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1

Building Materials

1.1. The rocks formed from molten magma, are called
(a) sedimentary rocks (b) igneous rocks
(c) metamorphic rocks (d) none of these.

1.2. The rocks formed by gradual deposition, are called
(a) sedimentary rocks (b) igneous rocks
(c) metamorphic rocks (d) none of these.

1.3. Rocks formed due to alteration of original structure due to heat and excessive pressure, are called
(a) sedimentary rocks (b) igneous rocks
(c) metamorphic rocks (d) none of these.

1.4. Lime stones are generally known as
(a) aqueous rocks (b) sedimentary rocks
(c) stratified rocks (d) all the above.

1.5. Geologically, marble is known as
(a) sedimentary rock (b) igneous rock
(c) metamorphic rock (d) stratified rock.

1.6. Chemically, marble is known as
(a) metamorphic rock (b) argillaceous rock
(c) calcareous rock (d) silicious rock.

1.7. Kaolin is chemically classified as
(a) metamorphic rock (b) argillaceous rock
(c) calcareous rock (d) silicious rock.

1.8. Quartzite is a
(a) metamorphic rock (b) argillaceous rock
(c) calcareous rock (d) silicious rock.

1.9. Basalt is
(a) sedimentary rock (b) metamorphic rock
(c) extrusive igneous rock (d) intrusive igneous rock.

1.10. Sand stone is
(a) sedimentary rock (b) metamorphic rock
(c) igneous rock (d) volcanic rock.

1.11. Lime stone is not a
(a) sedimentary rock (b) stratified rock
(c) aqueous rock (d) metamorphic rock.

1.12. Pegmatite is a/an
(a) intrusive igneous rock (b) extrusive igneous rock
(c) sedimentary rock (d) metamorphic rock.

1.13. Laterite is a/an
(a) volcanic rock (b) argillaceous rock
(c) calcareous rock (d) silicious rock.

1.14. Granite mainly composed of quartz and felsper particles, is obtained from
(a) sedimentary rocks (b) metamorphic rocks
(c) igneous rocks (d) all the above.

1.15. Gniess is obtained from
(a) igneous rocks
(b) metamorphic rocks
(c) sedimentary rocks
(d) sedimentary-metamorphic rocks.

1.16. Dolomite is a lime stone which contains carbonate of magnesia upto
(a) 15% (b) 20%
(c) 25% (d) 35%
(e) 45%.

1.17. The colour of statuary marble used for sculptor's work, is
(a) red (b) blue
(c) white (d) green
(e) yellow.

1.18. Black marble is generally found in the district of
(a) Jodhpur (b) Jaipur
(c) Jabalpur (d) Jaisalmer
(e) Pune.

1.19. The rocks having alumina or clay as their major constituents, are known as
(a) siliceous rocks (b) argillaceous rocks
(c) calcareous rocks (d) sedimentary rocks
(e) igneous rocks.

1.20. The hardest rock is
(a) marble (b) diamond
(c) talc (d) quartz.

1.21. The softest rock is
(a) marble (b) diamond
(c) talc (d) quartz.

1.22. The specific gravity of marble, is
(a) 2.50 (b) 2.60
(c) 2.66 (d) 2.72
(e) 3.00.

1.23. Shingle is
(a) decomposed laterite (b) crushed granite
(c) water bound pebbles (d) air weathered rock.

1.24. The rock generally used for roofing, is
(a) granite (b) basalt
(c) slate (d) pumice.

1.25. Laterite is found in
(a) U.P. (b) Punjab
(c) West Bengal (d) Kerala.

1.26. Good quality stones must
(a) be durable (b) be free from clay
(c) resist action of acids (d) all the above.

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1.27. A good quality stone absorbs water less than
(a) 5% (b) 10%
(c) 15% (d) 20%
(e) 25%.

1.28. A stone is rejected if it absorbs water more than
(a) 5% (b) 10%
(c) 15% (d) 20%
(e) 25%.

1.29. Stones used for ornamental work must be
(a) soft (b) hard
(c) light (d) heavy.

1.30. Stones used for rubble masonry must be
(a) soft (b) hard
(c) light (d) heavy.

1.31. Stones used for the construction of retaining walls must be
(a) soft (b) hard
(c) light (d) heavy.

1.32. In stone masonry, stones (stratified rocks) are so placed that the direction of pressure to the plane of bedding is
(a) right angles (b) 45°
(c) 60° (d) parallel
(e) None of these.

1.33. In stone masonry, if stones are so placed that their layers are parallel to the direction of load, they
(a) split easily (b) are affected by moisture
(c) both (a) and (b) (d) none of these.

1.34. In arches, stratified stones are placed so that their planes are
(a) parallel (b) perpendicular
(c) radial (d) none of these.

1.35. The tendency of a stone is, to split along :
(a) texture (b) fracture
(c) cleavage (d) structure
(e) all the above.

1.36. The standard size of masonry bricks, is
(a) 18 cm × 8 cm × 8 cm
(b) 19 cm × 9 cm × 9 cm
(c) 20 cm × 10 cm × 10 cm
(d) 21 cm × 11 cm × 11 cm
(e) none of these.

1.37. The size of modular bricks, is
(a) 10 × 10 × 9 cm (b) 19 × 9 × 9 cm
(c) 22.5 × 10 × 8.5 cm (d) 22.5 × 8.0 × 9 cm.

1.38. The term frog means
(a) an apparatus to lift the stone
(b) a depression on a face of brick
(c) vertical joint in a brick work
(d) soaking brick in water.

1.39. The frog of a brick is normally made on its
(a) top face (b) bottom face
(c) longer face (d) shorter side.

1.40. The size of mould for bricks, is generally kept
(a) a little large to specified size
(b) a little small to specified size
(c) equal to specified size
(d) 10% larger than specified size
(e) 20% larger than specified size.

1.41. For one cubic metre of brick masonry, number of bric required, is
(a) 400 (b) 425
(c) 450 (d) 500
(e) 550.

1.42. The minimum compressive strength of 1st class bric should be
(a) 75 kg/cm^2 (b) 90 kg/cm^2
(c) 100 kg/cm^2 (d) 120 kg/cm^2
(e) 130 kg/cm^2.

1.43. The minimum compressive strength of IInd class bric should be
(a) 75 kg/cm^2 (b) 90 kg/cm^2
(c) 100 kg/cm^2 (d) 120 kg/cm^2
(e) 150 kg/cm^2.

1.44. A 1st class brick immersed in water for 24 hours, shou not absorb water (by weight) more than
(a) 10% (b) 15%
(c) 20% (d) 25%
(e) 5%.

1.45. The main ingredient of a good quality brick earth, is
(a) magnesia (b) lime
(c) silica (d) alumina.

1.46. Clay and silt content in a good brick earth must be least
(a) 50% (b) 40%
(c) 30% (d) 25%
(e) 20%.

1.47. A bull nose brick is not used for
(a) rounding off sharp corners (b) pillars
(c) decoration purpose (d) arches.

1.48. Second class bricks
(a) are of dark brown colour
(b) produce a metallic sound when struck
(c) are well burnt
(d) are under burnt.

1.49. Jhumb bricks are
(a) under burnt (b) over burnt
(c) kutcha (d) none of these.

1.50. The portion of the brick cut across its width and havi its length equal to that of a full brick, is known as
(a) closer (b) queen closer
(c) king closer (d) prince closer
(e) none of these.

1.51. The portion of the brick without a triangular corn equal to half the width and half the length, is called
(a) closer (b) queen closer
(c) king closer (d) squint brick.

1.52. The portion of a brick cut to form angles other than rig angles in plan, is known as
(a) queen closer (b) king closer
(c) closer (d) squint brick.

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1.53. Refractory bricks resist
(a) high temperature (b) chemical action
(c) dampness (d) all the above.

1.54. Refractory bricks are used for
(a) retaining walls (b) columns
(c) piers (d) combustion chambers.

1.55. The fire clay contains pure
(a) lime (b) oxide of iron
(c) hydrated aluminium silicate
(d) magnesium.

1.56. Refractory bricks are
(a) neutral refractory bricks (b) acid refractory bricks
(c) basic refractory bricks (d) all the above.

1.57. Sewer pipes are made of
(a) earthen ware (b) stone ware
(c) refractory clay (d) terracota
(e) all the above.

1.58. Glazing of clay products, is done
(a) to improve their appearance
(b) to protect them from atmospheric effect
(c) to protect them from corrosive action
(d) all the above.

1.59. A pug mill is used for
(a) softening brick earth (b) moulding brick earth
(c) tempering brick earth (d) providing brick earth
(e) all the above.

1.60. Generally wooden moulds are made from
(a) ply wood (b) shisham wood
(c) deodar wood (d) teak wood
(e) hard wood.

1.61. The kiln which may work throughout the year, is
(a) Clamp (b) Bull's kiln
(c) Hoffman's kiln (d) none of these.

1.62. Pick up the correct statement from the following :
(a) Lime is available in free state
(b) Lime is available by dissolving calcium carbonate in water
(c) Lime is available by calcining calcium carbonate at 900°C
(d) Lime is nothing but calcium chloride
(e) None of these.

1.63. The lime which contains mainly calcium oxide and slacks with water, is
(a) fat lime (b) quick lime
(c) hydraulic lime (d) poor lime
(e) none of these.

1.64. The lime which contains high percentage of calcium oxide, is generally called
(a) fat lime (b) rich lime
(c) white lime (d) none of these.

1.65. The property by virtue of which lime sets under water, is known as
(a) slacking (b) setting
(c) hydraulicity (d) calcining.

1.66. For construction of structures under water, the type of lime used, is
(a) hydraulic lime (b) fat lime
(c) quick lime (d) pure lime
(e) none of these.

1.67. Pozzolana (or *surkhi*) is used in lime
(a) to impart hydraulicity
(b) to prevent shrinkage
(c) to decrease the cost of construction
(d) to decrease the setting time.

1.68. Pick up the correct statement from the following :
(a) Quick lime is obtained by burning pure lime stone :
(b) Hydraulic lime is obtained by burning lime stone containing clay 5% to 30%
(c) Poor lime is obtained by burning lime stone containing impurities more than 5%.
(d) All the above.

1.69. Slacking of lime is affected by
(a) keeping it exposed to air
(b) immersing the lime in water
(c) crushing the lime lumps
(d) none of these.

1.70. Lime mortar is generally made with
(a) quick lime (b) fat lime
(c) hydraulic lime (d) plain lime
(e) none of these.

1.71. The commonly used lime in white-washing, is
(a) white lime (b) fat lime
(c) hydraulic lime (d) lime
(e) quick lime.

1.72. Lime concrete is generally used for
(a) wall foundations (b) flooring at ground level
(c) both (a) and (b) (d) neither (a) nor (b).

1.73. Lime putty
(a) is made from hydraulic lime
(b) is made by adding lime to water
(c) can be used only upto three days
(d) may be obtained from drying lime water mix passing through IS sieve No. 300
(e) all of above.

1.74. Pick up the correct statement from the following :
(a) Slaked lime contains calcium hydroxide
(b) Quick lime contains calcium oxide
(c) Slaked lime may be obtained from quick lime
(d) Slaked lime is obtained by adding water to quick lime
(e) All the above.

1.75. Quick lime
(a) generates heat when added to water
(b) reacts with carbon dioxide
(c) may be used for white-washing
(d) when mixed with water forms slaked lime
(e) all the above.

1.76. Pick up the incorrect statement from the following :
(a) Hydraulic lime is generally obtained by burning kankar
(b) Hydraulic lime sets slowly as compared to fat lime
(c) Hydraulic lime is generally used in lime mortar
(d) None of these.

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1.77. The minimum percentage of silica, alumina and ferric oxide in lime for white washing, is
(a) 20 (b) 15
(c) 10 (d) 5
(e) 0.

1.78. The initial setting time of hydraulic lime, is
(a) 30 minutes (b) 60 minutes
(c) 90 minutes (d) 120 minutes
(e) 150 minutes.

1.79. The initial setting time of lime-pozzolona, is
(a) 30 minutes (b) 60 minutes
(c) 90 minutes (d) 120 minutes.

1.80. The normal curing period for lime mortar, is :
(a) one day (b) 3 days
(c) 7 days (d) 10 days
(e) 14 days.

1.81. For lime concrete,
(a) slump is 50 to 75 mm
(b) flexural strength at 90 days is 0.2 N/mm^2
(c) compressive strength at 90 days is 1.5 N/mm^2
(d) compressive strength at 26 days is 1.2 N/mm^2
(e) all the above.

1.82. Plaster of Paris is obtained by calcining
(a) bauxite (b) gypsum
(c) kankar (d) lime stone
(e) none of these.

1.83. For the manufacture of Portland cement, the proportions of raw materials used, are
(a) lime 63% ; silica 22% ; other ingredients 15%
(b) silica 22% ; lime 63% ; other ingredients 15%
(c) silica 40% ; lime 40% ; other ingredients 20%
(d) silica 70% ; lime 20% ; other ingredients 10%.

1.84. Good quality cement contains higher percentage of
(a) Tricalcium silicate (b) Di-calcium silicate
(c) Tri-calcium aluminate
(d) Tetra calcium alumino ferrite
(e) all the above.

1.85. Initial setting of cement is caused due to
(a) Tri-calcium silicate (b) Di-calcium silicate
(c) Tri-calcium aluminate
(d) Tetra calcium alumino ferrite.

1.86. Ultimate strength to cement is provided by
(a) Tricalcium silicate (b) Di-calcium silicate
(c) Tri-calcium aluminate
(d) Tetra calcium alumino ferrite.

1.87. To retard the initial setting time of cement, the compound responsible, is
(a) Tricalcium silicate (b) Gypsum
(c) Di-calcium silicate (d) Tri calcium aluminate.

1.88. The compound of Portland cement which reacts immediately with water and also sets first is
(a) Tri-calcium silicate (b) Di-calcium silicate
(c) Tri-calcium aluminate
(d) Tetra calcium alumino ferrite.

1.89. The commonly used raw material in the manufacture of cement, is
(a) slate (b) sand stone
(c) lime stone (d) basalt.

1.90. The compound of Portland cement which contributes t the strength after two to three years is
(a) Tricalcium silicate (b) Di-calcium silicate
(c) Tricalcium aluminate
(d) Tetracalcium alumino ferrite.

1.91. Rapid hardening cement attains early strength due to
(a) larger proportion of lime grounded finer than norma cement
(b) lesser proportion of lime grounded coarser than norma cement
(c) lesser proportion of lime grounded finer than norma cement
(d) larger proportion of lime grounded coarser than norma cement
(e) excess percentage of gypsum.

1.92. Quick setting cement is produced by adding
(a) less amount of gypsum in very fine powdered form
(b) more amount of gypsum in very fine powdered form
(c) aluminium sulphate in very fine powdered form
(d) pozzolana in very fine powdered form
(e) none of these.

1.93. Portland cement manufactured from pure white chal and clay but free from iron-oxide, is known as
(a) quick setting cement (b) rapid hardening cemen
(c) white cement
(d) low heat Portland cement.

1.94. Portland pozzolana cement possesses
(a) higher resistance to chemical attack
(b) lower heat of hydration
(c) lower shrinkage on drying
(d) water tightness
(e) all the above.

1.95. The percentage of water for normal consistency, is
(a) 5% to 15% (b) 10% to 25%
(c) 15% to 25% (d) 20% to 30%
(e) 25% to 35%.

1.96. If P is the percentage of water required for norma consistency, water to be added for determination of initi setting time, is
(a) 0.70 P (b) 0.75 P
(c) 0.80 P (d) 0.85 P
(e) 0.90 P.

1.97. Soundness of cement is tested by
(a) Vicat's apparatus (b) Le-chatelier apparatus
(c) compressive strength testing apparatus
(d) none of the these.

1.98. Soundness test of cement determines
(a) quality of free lime (b) ultimate strength
(c) durability (d) initial setting
(e) all the above.

1.99. Cement is said to be of good quality if
(a) its colour is not greenish grey
(b) one feels cool by thrusting one's hand in the cement ba

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(c) it is not smooth when rubbed in between fingers
(d) a handful of cement thrown into a bucket of water does not float
(e) none of these.

1.100. With storage, strength of cement
(a) increases (b) decreases
(c) remains the same (d) none to these.

1.101. In a mortar, the binding material is
(a) cement (b) sand
(c) surkhi (d) cinder.

1.102. Good quality sand is never obtained from
(a) river (b) nala
(c) sea (d) gravel powder.

1.103. Index number expressing the relative sizes of both coarse and fine aggregates, is called
(a) proportioning of aggregates
(b) fineness modulus
(c) grading of aggregates
(d) none of these.

1.104. Bulking of sand is caused due to
(a) surface moisture (b) air voids
(c) viscosity (d) clay contents
(e) all the above.

1.105. Pick up the correct statement from the following :
(a) Adding 5% to 6% of moisture content by weight, increases the volume of dry sand from 18% to 38%
(b) The bulking of fine sand is more than that of coarse sand
(c) If the percentage content of moisture exceeds 10%, increase in bulk of sand starts increasing
(d) The volume of fully saturated sand equals that of dry sand
(e) All the above.

1.106. Strength of cement concrete primarily depends upon
(a) quality of water (b) quantity of aggregate
(c) quantity of cement (d) water-cement ratio.

1.107. Slump test for concrete is carried out, to determine
(a) strength (b) durability
(c) workability (d) water content.

1.108. A badly mixed cement concrete results in
(a) segregation (b) bleeding
(c) honey combing (d) none to these.

1.109. For a 50 kg cement bag water required, is
(a) 16.5 litres (b) 18.5 litres
(c) 20.5 litres (d) 22.5 litres
(e) 25 litres.

1.110. Minimum required water cement ratio for a workable concrete, is
(a) 0.30 (b) 0.40
(c) 0.50 (d) 0.60
(e) 1.0.

1.111. Inner part of a timber log surrounding the pitch, is called
(a) sapwood (b) cambium layer
(c) heart wood (d) none to these.

1.112. Age of a tree may be ascertained by
(a) radius of its stem
(b) circumference of its stem
(c) number of branches
(d) number of annual rings.

1.113. Pick up the correct statement from the following :
Method of sawing timber
(a) tangentially to annual rings, is known as tangential method.
(b) in four quarters such that each board cuts annual rings at angles not less than 45°, is known as quarter sawing method.
(c) cut out of quarter logs, parallel to the medullary rays and perpendicular to annual rings, is known as radial sawing.
(d) all the above.

1.114. Seasoning of timber is essential to remove
(a) knots from timber
(b) sap from timber
(c) twisted fibre from timber
(d) roughness of timber.

1.115. A piece of sawn timber whose cross-sectional dimensions exceed 5 cm, in one direction and 20 cm in the other direction, is called a
(a) cant (b) deal
(c) baulk (d) strip.

1.116. A piece of timber whose thickness and width are respectively 5 cm and 10 cm is called
(a) slate (b) plank
(c) board (d) strip.

1.117. Seasoning of timber is done
(a) to make it water proof (b) to paint its surface
(c) to increase its temperature (d) to remove water.

1.118. Based on its dry weight, a freshly felled tree may contain water
(a) 25% (b) 50%
(c) 75% (d) 100%.

1.119. A well seasoned timber may contain moisture up to
(a) 4 to 6% (b) 6 to 8%
(c) 8 to 10% (d) 10 to 12%.

1.120. The curved swellings from the growth of layers or wounds left after branches are cut off in an irregular manner, are known as
(a) knots (b) rindgalls
(c) burls (d) none of these.

1.121. For the manufacture of plywood, veneers are placed so that grains of adjacent veneers
(a) run at right angles (b) parallel
(c) inclined at 45° (d) inclined at 60°.

1.122. The most valuable timber may be obtained from
(a) chir (b) shisham
(c) sal (d) teak.

1.123. The timber having maximum resistance against white ants, is obtained from
(a) chir (b) shisham
(c) sal (d) teak.

1.124. Due to attack of dry rot, the timber

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(a) cracks (b) shrinks
(c) reduces to powder (d) none of these.

1.125. Teak wood is suitable for
(a) sports articles (b) furnitures
(c) railway sleepers (d) all the above.

1.126. Seasoning of timber is done for
(a) increasing moisture content
(b) decreasing moisture content
(c) increasing strength of timber
(d) none to these.

1.127. Veneering means
(a) carving out designs on timber planks
(b) chemically treating timber planks
(c) thick layer of superior wood glued to inferior wood
(d) thin layer of superior wood glued to inferior wood.

1.128. According to IS 399—1963, the weight of the timber is specified at
(a) 8% moisture content (b) 10% moisture content
(c) 12% moisture content (d) 14% moisture content.

1.129. Knots in timber are
(a) defects caused by crushing fibres
(b) splits radiating from the centre
(c) speckled strains
(d) signs of branches cut off.

1.130. Seasoning is
(a) a process of removing sap (b) creosoting
(c) painting with sodium silicate
(d) coating with tar.

1.131. Plywood is obtained by gluing wooden sheets at a pressure of
(a) 100 to 150 N/cm^2 (b) 100 to 130°C
(c) both (a) and (b) (d) Neither (a) nor (b).

1.132. Plywood is normally available
(a) 1 mm thick (b) 2 mm thick
(c) 2 to 3 mm thick (d) 3 mm to 4 mm thick.

1.133. Plywood is made from
(a) common timber (b) bamboo fibre
(c) teak wood only (d) asbestos sheets.

1.134. Fibre boards can be
(a) distempered (b) painted
(c) painted and distempered (d) used for furniture.

1.135. Pick up correct statement from the following :
(a) Fibre boards are used for thermal and acoustic control
(b) Fibre boards are used for light weight standing members
(c) Fibre boards are obtained by impregnating a resin product on fibres
(d) all the above.

1.136. The most commonly used base for timber painting, is
(a) red lead (b) zinc white
(c) white lead (d) titanium white.

1.137. The commonly used base for iron and steel work, is
(a) red lead (b) zinc white
(c) white lead (d) titanium white.

1.138. A volatile substance added to a paint to make its application easy and smooth, is known as
(a) base (b) solvent
(c) vehicle (d) none to these.

1.139. Most commonly used solvent in oil paints, is
(a) petroleum (b) spirit
(c) coaltar (d) turpentine.

1.140. Turpentine oil is used in paints as
(a) thinner (b) vehicle
(c) base (d) drier.

1.141. Linseed oil is used in paints as
(a) thinner (b) vehicle
(c) base (d) drier.

1.142. Duco is one of the patent forms of
(a) emulsion paints (b) plastic paints
(c) bituminous paints (d) aluminium paints
(e) cellulose paints.

1.143. Varnish is a transparent or semi-transparent solution of resinuous substances in
(a) alcohol (b) linseed
(c) turpentine (d) all the above.

1.144. The most important constituent of an oil paint, is
(a) thinner (b) vehicle
(c) pigment (d) base
(e) all the above.

1.145. The most important constituent of varnish, is
(a) drier (b) solvent
(c) resin (d) all the above.

1.146. A prime coat is given to steel work with
(a) an oxide of iron paint
(b) a mixture of white lead and lead paint
(c) a special paint
(d) cement paint.

1.147. The base material for distemper, is
(a) chalk (b) lime
(c) lime putty (d) cement wash.

1.148. The commonly used drying oil for oil paints, is
(a) olive oil (b) linseed oil
(c) kerosine oil (d) accetate of lead.

1.149. Distemper is
(a) a paint consisting of powdered chalk, pigments, and water
(b) a water proofing agent
(c) a paint consisting of coloured cement and water
(d) a drying agent.

1.150. Plastic asphalt is
(a) used as a water proofing layer over roof
(b) a mixture of cement and asphalt
(c) a natural asphalt (d) a refinery product.

1.151. French polish is
(a) oil paint (b) distemper
(c) spirit varnish (d) none to these.

1.152. Duco paints are
(a) plastic paints (b) cellulose paints
(c) emulsion paints (d) bituminous paints
(e) oil paints.

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1.153. Asbestos is
(a) corrugated sheet used for roofing
(b) an incombustible fire proof material
(c) an organic substance
(d) a bad insulator for sound and heat
(e) all the above.

1.154. Fibre glass
(a) retains heat-longer
(b) has a higher strength to weight ratio
(c) is shock proof and fire retardent
(d) does not decay
(e) all the above.

1.155. Bituminous fells are used for
(a) covering A.C. sheets (b) covering sloping roofs
(c) D.P.C. (d) none to these.

1.156. Formula for quick lime, is
(a) $CaCO_3$ (b) $Ca(OH)_2$
(c) CO_3CO_2 (d) none to these.

1.157. Dry rot
(a) cracks the timber
(b) reduces the strength of timber
(c) reduces the timber to powder
(d) shrinks the timber
(e) spoils the appearance of timber.

1.158. In paints, the pigment is responsible for
(a) durability (b) colour
(c) smoothness (d) glassy face
(e) none of these.

1.159. The pigment used in paints for corrosive resistance, is
(a) white lead (b) ferrous oxide
(c) zinc white (d) red lead
(e) gypsum.

1.160. The material generally not used as extender in paints, is
(a) powdered silica (b) gypsum
(c) talc (d) zinc white.

1.161. The commonly used colour pigment in paints, is
(a) ambers (b) carbon black
(c) iron oxide (d) lamp black
(e) all the above.

1.162. The commonly used thinner in oil paints, is
(a) naptha (b) turpentine
(c) both (a) and (b) (d) neither (a) nor (b)
(e) none the these.

1.163. Commonly used thinner in
(a) lacquer paints, is alcohol
(b) cellulose paints is ethyle acetate
(c) oil paints, is naptha
(d) distemper, is water
(e) all the above.

1.164. Lacquer paints
(a) are generally applied on structural steel
(b) are more durable as compared to enamel paints
(c) consist of resin and nitro-cellulose
(d) contain alcohol as thinner
(e) all the above.

1.165. Spirit varnish generally consists of
(a) oil, wax and resin
(b) alcohol, wax and turpentine
(c) pigment and synthetic resin
(d) spirit and shellac
(e) none of these.

1.166. Oil varnish generally consists of
(a) synthetic resin and spirit (b) oil, wax and resin
(c) resin, oil and turpentine (d) spirit, oil and wax.

1.167. Bitumen paints offer
(a) pleasing surface (b) hard surface
(c) smooth surface (d) protective surface
(e) rough surface.

1.168. Cement paints usually
(a) contain hydrated lime
(b) contain 5% to 10% colour pigments
(c) are prepared with white cement
(d) contain 5% sodium chloride
(e) all the above.

1.169. Stuco paints are suitable for
(a) stone masonry (b) brick walls
(c) both (a) and (b) (d) neither (a) nor (b).

1.170. Snowcrete is one of the patent forms of
(a) distempers
(b) water proof cement paints
(c) enamel paints
(d) cellulose paints.

1.171. The most fire resistant paints are :
(a) enamel paints (b) aluminium paints
(c) asbestos paints (d) cement paints.

1.172. Priming consists of
(a) one part of white lead, 8 parts of chalk and four parts of twice boiled linseed oil
(b) 8 parts of white lead, one part of chalk and four parts of twice boiled linseed oil
(c) one part of white lead, 8 parts of chalk and one part of linseed oil
(d) none to these.

1.173. Water paint is a
(a) white wash (b) colour wash
(c) whiting (d) distemper
(e) all the above.

1.174. Pick up the correct statement from the following :
(a) Blistering may be cured by applying water paint finished with oil paint dried with a little copal varnish
(b) Cracked paints may be cured by removing paint and giving a fresh coat of paint
(c) Crawling paints may be cured by sand preparing the surface and giving a fresh coat with plenty of turps
(d) All the above.

1.175. Resins are
(a) not soluble in water (b) soluble in spirit
(c) used in varnishes
(d) left behind on evaporation of oil
(e) all the above.

1.176. To give a brilliant finish, the type of varnish used, is

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(a) water varnish (b) spirit varnish
(c) turpentine varnish (d) oil varnish
(e) none of these.

1.177. The most durable varnish is
(a) water varnish (b) spirit varnish
(c) turpentine varnish (d) oil varnish
(e) none of these.

1.178. Lacquer is
(a) oil paint (b) distemper
(c) spirit varnish (d) none to these.

1.179. Percentage content of silica in window glass, is
(a) 40 to 45 (b) 50 to 55
(c) 60 to 65 (d) 70 to 75.

1.180. Ground glass
(a) is made by grinding its one side
(b) is made by melting powdered glass paints surface
(c) is used for getting light without transparency
(d) all the above.

1.181. Bullet proof glass is made of thick glass sheet sandwiched by a layer of
(a) steel (b) stainless steel
(c) high test plastic (d) chromium plate.

1.182. Dextrine is
(a) animal glue (b) starch glue
(c) albumin glue (d) rubber based adhesive
(e) none to these.

1.183. Putty is
(a) made with finely powdered chalk and linseed oil
(b) used for fixing glass panes
(c) softened by a solution of pearl ash and quick-lime soaked in water
(d) all the above.

1.184. Bitumen in
(a) solid state, is called asphalt
(b) semi fluid state, is called mineral tar
(c) fluid state, is called petroleum
(d) all the above.

1.185. Mastic asphalt is
(a) water proof (b) fire proof
(c) elastic (d) all the above.

1.186. Mastic asphalt is generally used for
(a) damp proof course (b) water proof layer
(c) partition walls (d) both (a) and (b).

1.187. According to ISI, bitumen is classified into
(a) 2 grades (b) 4 grades
(c) 6 grades (d) 8 grades.
(e) 10 grades.

1.188. Bitumen is generally obtained from
(a) organic material (b) synthetic material
(c) petroleum product (d) coal.

1.189. Bitumen may be dissolved in
(a) carbondioxide (b) water
(c) sodium chloride (d) carbon disulphide
(e) none of these.

1.190. Plastic bitumen is generally used for
(a) road pavements (b) expansion joints
(c) crack fillings (d) none to these.

1.191. Bitumen emulsion is
(a) a liquid containing bitumen in suspension
(b) a paint
(c) used as anti-corrosive paint
(d) all the above.

1.192. Bitumen felt
(a) is used as water proofing material
(b) is used as damp proofing material
(c) is made from bitumen and hessian fibres
(d) all the above.

1.193. Asphalt is obtained from
(a) petroleum distillation (b) bitumen distillation
(c) plastic distillation (d) none of these.

1.194. Mastic asphalt is normally used for
(a) sound insulation (b) water proofing
(c) fire proofing (d) none to these.

1.195. Mastic asphalt is
(a) acid resisting material (b) non-corrosive material
(c) corrosive material
(d) heating-resisting material.

1.196. The filler used in plastic bitumen, is
(a) shale powder (b) talc powder
(c) asbestos powder (d) plastic powder
(e) none of these.

1.197. Bitumen felt is used for
(a) water proofing (b) damp proofing
(c) both (a) and (b) (d) neither (a) nor (b).

1.198. A ferrous metal is
(a) cast iron (b) wrought iron
(c) steel (d) all the above.

1.199. Depending on the chemical composition and mechanical properties, iron may be classified as
(a) cast iron (b) wrought iron
(c) steel (d) all the above.

1.200. Iron ore may contain
(a) carbon (b) silicon
(c) sulphur (d) phosphorus & maganes
(e) all the above.

1.201. Pig iron is manufactured from the ores by
(a) dressing (b) calcination and roastin
(c) smelting (d) all the above.

1.202. The operation of removal of impurities or clay adherin to iron ores, is known as
(a) dressing (b) calcination
(c) roasting (d) smelting.

1.203. Calcination of iron ores is done
(a) to remove moisture (b) to remove carbonic acic
(c) by roasting in heaps (d) after dressing
(e) all the above.

1.204. The slag which floats on the surface of the molten iro generally contains

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(a) Lime (CaO) 45%
(b) Silica (SiO_2) 35%
(c) Alumina (Al_2O_3) 12%
(d) MgO, $CaSO_4$, $KMnO_2$ and FeO 8%
(e) all the above.

1.205. Pick up the correct statement from the following :
(a) Roasting is not necessary if iron ore is an oxide
(b) Impurities float on the molten iron as slag
(c) The slag contains lime about 45%
(d) The molten iron is made to run, in a long channel formed in sand called 'sow'
(e) All the above.

1.206. If the iron ore contains clay as an impurity, the flux added during calcination, is
(a) clay (b) lime stone
(c) argillaceous iron ore (d) all the above.

1.207. If the ore impurities is
(a) clay, lime stone is used as flux
(b) lime stone, clay is used as flux
(c) quartz, lime stone and argallaceous iron ores are used as flux
(d) All the above.

1.208. During smelting process, the combination of fuel in the furnace
(a) forms carbon dioxide
(b) carbon dioxide with carbon forms carbon mono-oxide
(c) carbon mono-oxide reacts with Fe_2O_3 to form iron and liberates CO_2
(d) all the above.

1.209. Pig iron made from heamatite ores free from sulphur, phosphorus and copper, is known as
(a) Bessemer pig (b) Grey or foundry pig
(c) White or forge pig (d) Mottled pig
(e) All the above.

1.210. Pig iron obtained from the furnance which is properly provided with fuel at a very high temperature, is called
(a) Bessemer pig (b) Grey or foundry pig
(c) White or forge pig (d) Mottled pig
(e) None of the above.

1.211. If the furnace is provided with insufficient fuel at low temperatures, the type of pig iron produced, is called
(a) Bessemer pig (b) Grey or foundry pig
(c) White or forge pig (d) Mottled pig.

1.212. The variety of pig iron used for the manufacture of steel by Bessemer process, is
(a) Bessemer pig (b) Grey pig
(c) White forge pig (d) Mottled pig.

1.213. The variety of pig iron used for manufacture of wrought iron, is
(a) Bessemer pig (b) Grey or foundry pig
(c) White forge pig (d) Mottled pig.

1.214. For light and ornamental casting, the most unsuitable pig iron, is
(a) Bessemer pig (b) Grey or foundry pig
(c) White or forge pig (d) Mottled pig.

1.215. Upto a maximum of 72% of iron, is available in
(a) Magnetite (b) Red haemetite
(c) Limonite (d) Siderite
(e) Iron pyrites.

1.216. Minimum of 40% of iron, is available in
(a) Magnetite (b) Red haemetite
(c) Limonite (d) Siderite
(e) Black band.

1.217. Cast iron
(a) is obtained by purifying pig iron
(b) is manufactured in required shapes
(c) may contain 2 to 5 per cent of carbon with other impurities
(d) is remelted in a cupola furnace
(e) all the above.

1.218. For melting one tonne of cast iron
(a) 700 m^3 air is required
(b) 20 kg limestone is required
(c) one quintal coke is required
(d) all the above.

1.219. The cast iron when heated to red heat with powdered red haemetite in an oven for increasing its toughness, is converted to
(a) grey cast iron (b) white cast iron
(c) mottled cast iron (d) toughed cast iron.

1.220. Wrought iron contains carbon upto
(a) 0.15% (b) 1.0%
(c) 1.5% (d) 2%.

1.221. Wrought iron is manufactured from pig iron by
(a) refining (b) pudding
(c) shingling (d) rolling
(e) all the above.

1.222. Forge pig may be converted to wrought iron by
(a) rolling (b) pudding
(c) shingling (d) refining.

1.223. During pudding
(a) molten metal is kept clear of the fuel
(b) carbon is converted into carbonic acid gas
(c) silicon forms a slag
(d) metal is heated by the burning of gases
(e) all the above.

1.224. Brittleness of cold is due to an excess of
(a) sulphur (b) carbon
(c) phosphorus (d) silicon.

1.225. Red short iron cracks when bent due to the presence of
(a) sulphur (b) carbon
(c) phosphorus (d) silicon.

1.226. Pick up the correct statement from the following :
(a) Air bubbles in casting produce a dull sound by tapping their surfaces lightly with a hammer
(b) Cupola furnace is used for the manufacture of cast iron
(c) Red short iron is of no value for welding purpose
(d) All the above.

1.227. Pick up the correct statement from the following :
(a) Blisters in the finished wrought iron, are caused due to the reaction between oxide of iron and carbon

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(b) The edges of a finished wrought iron, are rough due to red shortage
(c) Pig iron (charcoal) is manufactured from magnetic ore (Fe_3O_4)
(d) For the manufacture of wrought iron, non-sulphurous fuel is not necessary
(e) All the above.

1.228. The process of decarbonising the pig iron completely and then adding proper percentage of carbon for manufacturing steel, is called
(a) Cementation process (b) crucible process
(c) Bessemer process (d) Open hearth process.

1.229. The process of manufacturing steel by heating short lengths of wrought iron bars mixed with charcoal in fire clay crucibles and collecting the molten iron into moulds, is known as
(a) Cementation process (b) Crucible process
(c) Bessemer process (d) Open hearth process.

1.230. Bessemer process is used for the manufacture of
(a) Pig iron (b) cast iron
(c) Wrought iron (d) Steel.

1.231. Softer variety of steel may be obtained by
(a) Cementation process (b) crucible process
(c) Bessemer process (d) Open hearth process.

1.232. The steel which contains fissures and cavities, is manufactured by
(a) Cementation process (b) Crucible process
(c) Bessemer process (d) Open hearth process.

1.233. Cast steel is manufactured by
(a) Cementation process (b) Crucible process
(c) Bessemer process (d) Open hearth process.

1.234. Pick up the correct statement from the following :
(a) In basic Bessemer process, the steel heats the converter
(b) In open-hearth process, the furnace heats the steel
(c) In siemens process, the impurities of pig iron are oxidised by the oxygen of the ore
(d) all the above.

1.235. Pick up the correct statement from the following :
(a) Steel produced by open hearth process is milder than that obtained by the bessemer process
(b) Engineers prefer open hearth steel for structural purpose as it is more homogenous
(c) Basic Bessemer process is suitable for converting poor ore containing a large proportion of sulphur and phosphorus into steel
(d) all the above.

1.236. Blister steel
(a) is obtained by cementation process
(b) is full of fissures and cavities
(c) can not be forged
(d) can be easily welded
(e) all the above.

1.237. For high grade instruments the steel preferred to, is
(a) cast steel (b) bessemer steel
(c) mild steel
(d) whitworth compressed steel.

1.238. The steel used in R.C.C. work is
(a) stainless steel (b) mild steel
(c) high carbon steel (d) wrought iron.

1.239. The steel used for the manufacture of rails, is
(a) Bessemer steel (b) mild steel
(c) cast steel (d) stainless steel.

1.240. Whitworth compressed steel is obtained when molten steel is subjected to a pressure of
(a) 5 kg/mm^2 (b) 9 kg/mm^2
(c) 13 kg/mm^2 (d) 15 kg/mm^2
(e) 10 kg/mm^2.

1.241. The steel used for rails under heavy traffic and on sharp curves, is
(a) Nickel steel (b) Chrome steel
(c) Magnese steel (d) Vanadium steel.

1.242. Vanadium steel is generally used for
(a) railway switches and crossing
(b) bearing balls
(c) magnets
(d) axles and springs.

1.243. The type of steel used for precision levelling staff, is
(a) Titanium steel (b) Carbon steel
(c) Invar (d) Stainless steel.

1.244. Invar contains
(a) 12% of nickel (b) 24% of nickel
(c) 30% to nickel (d) 36% of nickel.

1.245. Stainless steel contains
(a) 18% of chromuim and 8% nickel
(b) 8% of chromium and 18% of nickel
(c) 12% of chromium and 36% of nickel
(d) 36% of chromium and 12% of nickel.

1.246. Permanent magnets are made of high carbon steel and
(a) 15% of cobalt (b) 20% of cobalt
(c) 35% of cobalt (d) 45% of cobalt.

1.247. Cast iron contains carbon approximately
(a) 15% to 5.5% (b) 0.05% to 1.75%
(c) 0.250% (d) none to these.

1.248. Steel contains carbon approximately
(a) 1.50% to 5.6% (b) 0.05% to 1.75%
(c) 0.25% (d) none to these.

1.249. Wrought iron contains carbon about
(a) 1.5% to 5.5% (b) 0.5% to 1.75%
(c) 0.25% (d) none to these.

1.250. Pick up the correct statement from the following :
(a) Solder material is an alloy which melts at a temperature above 400°C
(b) Brazing is done at temperature above 600°C to 1100°C
(c) Brazing joint is stronger than the solder joint
(d) all the above.

1.251. Pick up the correct statement from the following :
(a) Corrugated sheet iron is made by passing plain sheets between grooved rollers
(b) Strength and stiffness of corrugated sheets are considerably increased
(c) Corrugated sheets are generally galvenised to protect

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iron from corrosion by rust
(d) Corrugated sheets are generally used on slanting roofs
(e) all the above.

1.252. Expanded metal is
(a) manufactured from steel sheets
(b) used for reinforced concrete in road pavements
(c) measured in term of SWM (shortway mesh) and LWM (long way mesh)
(d) all the above.

1.253. Mild steel is used for
(a) structural works in beams, joints and girders
(b) small sized water pipes
(c) columns and struts
(d) none of these.

1.254. Wrought iron is used for
(a) structural works in beams
(b) small sized water pipes
(c) columns and struts
(d) none to these.

1.255. Cast iron is used for
(a) structural works in beams
(b) small sized water pipes
(c) columns and struts
(d) none to these.

1.256. Pick up the correct statement from the following :
(a) Rust is due to formation of oxides
(b) Cast iron oxidises less
(c) Steel oxidises most
(d) Wrought iron oxidises moderately
(e) All the above.

1.257. Galvanising means covering iron with a thin coat of
(a) tin (b) zinc
(c) glaze (d) coal tar.

1.258. Magnese steels
(a) are non-magnetic
(b) possess high electrical resistance
(c) possess low coefficient of expansion
(d) are used for the manufacture of rails
(e) all the above.

1.259. For the manufacture of stainless steel, steel is mixed with
(a) chromium (b) nickel
(c) tungsten (d) none of these.

1.260. The yield strength and tensile strength of low carbon steel may be improved by the addition of
(a) manganese (b) chromium
(c) nickel (d) venadium
(e) tungsten.

1.261. Pick up the correct statement from the following :
(a) Rusting is caused due to combined action of air, moisture and carbon dioxide
(b) During rusting, first ferrous bicarbonates are formed
(c) On further oxidation ferrous bicarbonates get converted to ferric bicarbonates
(d) Ultimately hydrated ferric oxide is formed during rusting and carbon dioxide gets liberated
(e) All the above.

1.262. German silver is an alloy of
(a) zinc, lead and nickel (b) silver, gold and lead
(c) copper, nickel and zinc (d) copper, nickel and zinc
(e) brass, silver and zinc.

1.263. PVC stands for
(a) plastic very compact (b) polythene vinyl chloride
(c) polythene vinyl carbon
(d) polythene vanadium carbide.

1.264. Stainless steel resists corrosion due to
(a) carbon (b) sulphur
(c) vanadium (d) chromium
(e) maganese.

1.265. Brass is an alloy of
(a) copper and zinc (b) zinc and lead
(c) tin and silver (d) zinc and nickel
(e) tin and lead.

1.266. The rocks which are formed due to cooling of magma at a considerable depth from earth's surface are called
(a) Plutonic rocks (b) Hypabyssal rocks
(c) Volcanic rocks (d) Igneous rocks.

1.267. The rocks which are formed due to cooling of magma at a relatively shallow depth from the earth's surface are called
(a) Plutonic rocks (b) Hypabyssal rocks
(c) Volcanic rocks (d) Ignoeous rocks.

1.268. The rocks which are formed due to pouring of magma at the earth's surface are called
(a) Plutonic rocks (b) Hypabyssal rocks
(c) Volcanic rocks (d) Igneous rocks

1.269. Pick up the plutonic rock from the following :
(a) Granite (b) Dolerite
(c) Basalt (d) All the above.

1.270. Pick up the hypabyssal rock from the following :
(a) Granite (b) Dolerite
(c) Basalt (d) All the above.

1.271. Pick up the volcanic rock from the following :
(a) Granite (b) Dolerite
(c) Basalt (d) All the above.

1.272. Match List I and List II and select the correct answer by using the codes given below the lists.

List I (Rock)	*List II (Structure)*
A. Plunotic	1. extremely fine grained
B. Hypabyssal	2. coarsely grained crystalline
C. Volcanic	3. finely grained crystalline.

Codes :

	A	B	C
(a)	1	2	3
(b)	2	3	1
(c)	3	1	2
(d)	2	1	3.

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1.273. Pick up the rock which is not a sedimentary rock from the following :
(a) gravel (b) sand stone
(c) gypsum (d) dolerite
(e) lignite.

1.274. The foliated structure is very common in
(a) sedimentary rocks (b) igneous rocks
(c) metamorphic rocks (d) none of these.

1.275. The rocks in which argil (or clay) pre- dominates, are called
(a) sillicious rocks (b) argillaceous rocks
(c) calcareous rocks (d) igneous rocks.

1.276. In a rock calcium carbonate pre-dominates. State whether it is :
(a) Sillicious rock (b) Argillaceous rock
(c) Calcareous rock (d) None of these.

1.277. A rock contains only one mineral. It is called
(a) homogeneous (b) non-homogeneous
(c) monomineralic (d) polymineralic.

1.278. Pick up the monomineralic rock from the following :
(a) Quartz sand (b) Pure gypsum
(c) Magnesite (d) Granite
(e) None of these.

1.279. Pick up the correct characteristic of Pyroxene from the following :
(a) It forms octagonal crystals
(b) It converts to chlorine by hydration
(c) Its density is 2.3 to 3.6 g/cm^2
(d) Its hardness is 5 to 6
(e) All the above.

1.280. Chlorite, a green colour mineral is mainly derived from the decomposition of
(a) augite (b) biotite
(c) horn blende (d) All of these.

1.281. Pick up the correct statement from the following :
(a) Horn blende mineral is brittle
(b) Muscovite is also known as white mica and potashmica
(c) Biotite is also known as blackmica
(d) All the above.

1.282. Match List I with List II and choose the correct answer by using the codes given below the lists :

List I (Mineral)	*List II (Chemical formula)*
A. Calcite	1. $MgCO_3$
B. Magnesite	2. $MgCO_3.CaCO_3$
C. Dolomite	3. $CaSO_3.2H_2O$
D. Gypsum	4. $CaCO_3$

Codes :

	A	B	C	D
(a)	4	1	2	4
(b)	1	2	3	4
(c)	3	4	1	2
(d)	2	3	4	1.

1.283. Pick up the correct statement from the following :
(a) The distinct plane of division along which a stone can easily be split, is called natural bed of stone
(b) The natural bed of sedimentary rocks is along the planes of stratification
(c) The natural bed of igneous rocks is not defined
(d) All the above.

1.284. Pick up the correct statement from the following :
(a) In stone arches, the stones are placed with their natural beds radial
(b) In cornices, the stones are placed with their natural beds as vertical
(c) In stone walls, the stones are placed with their natural beds as horizontal
(d) All the above.

1.285. Pick up the correct statement from the following :
(a) Acid test is done to find out the weathering quality of stones
(b) Attrition test is done to find out the rate of wear of stones which are used in road construction
(c) Crushing test is done to find out the compressive strength of the stone
(d) Impact test is done to determine toughness of a stone
(e) All the above.

1.286. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Stone test)	*List II (Characteristics)*
A. Acid test	1. compressive strength
B. Attrition	2. weathering quality
C. Crushing test	3. toughness
D. Impact test	4. rate of wear

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	4	2
(c)	2	4	1	3
(d)	4	3	2	1.

1.287. Smith's test of stones is performed to find out
(a) the presence of soluble matter of stone
(b) the compressive strength of the stone
(c) the hardness of the stone
(d) the toughness of the stone.

1.288. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Rock)	*List II (Crushing strength)*
A. Laterite	1. 5 kg/cm^2
B. Lime stone	2. 25 kg/cm^2

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C. Sand stone ——— 3. 650 kg/cm^2

D. Slate 4. 550 kg/cm^2

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	3	1	2	4
(d)	1	4	3	2

1.289. Durability of building stone is affected by its
(a) chemical composition (b) texture
(c) resistance to atmosphere (d) location in structure
(e) all the above.

1.290. Dorry's testing machine is used for
(a) crushing test of stone (b) hardness test of stone
(c) impact test of stone (d) water absorption test.

1.291. The coefficient of hardness of stones used in road work should be greater than
(a) 10 (b) 12
(c) 15 (d) 17.

1.292. Pick up the correct statement from the following :
(a) The free quartz suddenly expands at a temperature lower than 600°C
(b) The lime stone resists fire upto about 800°C and at higher temperature it splits into CaO and CO_2
(c) The sand stone with silicates resist a fire in a better way
(d) The argillaceous stone though poor in strength can resist fire quite weak
(e) All the above.

1.293. For a good building stone, its specific gravity should the greater than
(a) 1.5 (b) 1.7
(c) 2.2 (d) 2.7.

1.294. Pick up the correct statement from the following :
(a) soft stones are required for carving
(b) light stones are required for arches
(c) hard stones are required to stand high pressure
(d) All the above.

1.295. The wedging is adopted for quarrying costly stratified rock such as
(a) laterite (b) marble
(c) limestone (d) sandstone
(e) All the above.

1.296. The stones obtained by blasting are used as
(a) ballast in railways
(b) aggregates for concrete
(c) roadmetal
(d) All the above.

1.297. The proportions of charcoal, saltpetre and sulphur in gun pow der by weight, are respectively :
(a) 15, 75, 10 (b) 75, 10, 15
(c) 10, 15, 75 (d) 10, 75, 15.

1.298. Pick up the correct statement from the following :
(a) The baked earth is called terra-cotta
(b) The articles prepared from clay which is burnt at low temperature and cooled down slowly, are called earthen-ware
(c) The articles prepared from refractory clays which as mixed with stone and crushed pottery, are called stone ware
(d) The articles prepared from fine earthen ware which is white, thin and semi-transparent, are called procelain
(e) All the above.

1.299. For sanitary pipes and chemical stonewares,
(a) salt glazing is used (b) lead glazing is used
(c) opaque glazing is used (d) None of these.

1.300. Quartzite, a metamorphic stone is
(a) hard (b) brittle
(c) crystalline (d) compact
(e) All the above.

1.301. The melting point of silica is :
(a) 1570°C (b) 1630°C
(c) 1730°C (d) 1850°C.

1.302. The silica is used for preparing
(a) silica bricks (b) coke oven
(c) lining for glass furnaces (d) all of these.

1.303. The sequence of refractory materials according to increasing melting points is :
(a) Dolomite, Magnesia, Bauxite, Chromite
(b) Bauxite, Chromite, Dolomite, Magnesia
(c) Magnesia, Bauxite, Dolomite, Chromite.

1.304. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I (*Neutral refractory materials*)	*List II* (*Melting points*)
A. Bauxite	1. 1890°C
B. Carbon	2. 2180°C
C. Forsterite	3. 3500°C
D. Chromite	4. 1200°C

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	1	3
(c)	4	3	1	2
(d)	3	1	4	2.

1.305. The high quality refractory materials which contain pure clay are oxides of
(a) pure alumina oxide (b) pure magnesia oxide
(c) pure carbides (d) all of these.

1.306. Pick up the metal refractory from the following :
(a) Molyblendum (b) Tungsten
(c) Zicronium (d) All of these.

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1.307. The usual percentages of clay and metal in cermet are:
(a) 50%, 50% (b) 60%, 40%
(c) 70%, 30% (d) 80%, 20%.

1.308. Pick up the constituent of good brick earth whose excess causes the raw bricks shrink and warp during drying and burning, from the following :
(a) Alumina (b) Lime
(c) Ironoxide (d) Magnesia.

1.309. A good brick earth should contain :
(a) about 20% to 30% of alumina
(b) about 50% to 60% of silica
(c) not more than 5% of lime
(d) about 5 to 6% of oxide of lime
(e) All the above.

1.310. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Porcelain)	*List II (Use)*
A. Carbon brick	1. Manufacture of spark plugs
B. Zircon porcelain	2. Lining of electric furnace
C. Carbon and graphite	3. Construction of atomic reactor rockets
D. Cordierite porcelain	4. In electric furnace

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	4	3	1	2
(d)	2	1	3	4.

1.311. For preparing porcelains, the clay should be
(a) sufficiently pure (b) of high degree of tanacity
(c) of good plasticity (d) All the above.

1.312. Which one of the following is used for preparing porcelain
(a) clay (b) feldspar
(c) quartz (d) minerals
(e) All of these.

1.313. Porcelain is used as :
(a) sanitary wares (b) electric insulators
(c) storage vessels (d) reactor chambers
(e) All of the above.

1.314. Pick up the correct statement from the following :
(a) The low voltage porcelain is prepared by wet process
(b) The high voltage porcelain is prepared by dry process
(c) The low voltage porcelain is prepared by dry process
(d) None of the above.

1.315. The low voltage porcelain is mainly used for
(a) switch block (b) insulating tubes
(c) lamp sockets (d) All of these.

1.316. The presence of sand in brick earth prevents :
(a) cracking of bricks (b) shrinkage of bricks
(c) warping of bricks (d) none of these.

1.317. In order of increasing percentage of silica, the correct sequence is
(a) sandy clay, calcareous clay, pure clay
(b) calcareous clay, pure clay, sandy clay
(c) pure clay, sandy clay, calcareous clay
(d) None of these.

1.318. The clay to be used for manufacturing bricks for a large project, is dugout and allowed to weather throughout
(a) the monsoon (b) the winter
(c) the summer (d) none of these.

1.319. The harmonious mixing of the clay ingredients, is known as
(a) weathering (b) blending
(c) tempering (d) None of these.

1.320. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Operation)	*List II (Process)*
A. Weathering	1. To achieve proper degree of hardness
B. Pugging	2. Harmonious mixing of ingredients
C. Blending	3. Softening or mellowing
D. Tempering	4. Grinding clay with water to make plastic

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	4	2	3	1
(d)	1	3	2	4

1.321. Pick up the correct statement from the following :
(a) Bull's trench kiln a trench excavated in ground
(b) Hoffman's kiln is constructed overground
(c) Tunnel Kiln is constructed as a tunnel
(d) All the above.

1.322. Pick up the correct statement from the following :
(a) The average crushing strength of hand moulded bricks is 6000 t/m^2
(b) The average tensile strength of hand moulded brick is 200 t/m^2
(c) The average shearing strength of hand moulded brick is 600 t/m^2
(d) All the above.

1.323. The weight of a good quality brick when immersed in water for a period of 16 hours should not exceed the weight of dry brick
(a) 20% (b) 15%
(c) 10% (d) None of these.

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1.324. When a brick is immersed in water for 24 hours and then dried, if
(*a*) no grey or white deposits appear on the surface, the brick is free from soluble salts
(*b*) 10 per cent surface is covered with grey or white deposits, the brick has slight efflorescence
(*c*) 50 per cent surface is covered with grey or white deposits, the brick has serious efflorescence
(*d*) All the above.

1.325. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Colour of brick)	*List II (Constituent of clay)*
A. Black	1. Lime in excess
B. Bluish green	2. Iron in excess
C. Red	3. Alkalies burnt at high temperature
D. Brown	4. Manganese and iron

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	1	2	3	4
(*c*)	3	1	4	2
(*d*)	2	4	1	3.

1.326. The weight of 1 m^3 of brick earth, is about
(*a*) 1200 kg (*b*) 1500 kg
(*c*) 1800 kg (*d*) 2000 kg.

1.327. The percentage of alumina and silica in good fire clay vary respectively is
(*a*) 25, 75 (*b*) 30, 70
(*c*) 35, 65 (*d*) All of these.

1.328. Pick up the correct statement from the following :
(*a*) The percentage of absorption for fire-bricks varies from 5 to 10
(*b*) The percentage of silica in silica bricks is to the extent of about 95 to 97 percent
(*c*) Roughly 1 to 2 percent of lime in silica bricks is added to act as binding material
(*d*) The compressive strength of silica bricks is about 150 kg/cm^2
(*e*) All the above.

1.329. Match List I with List II and select a correct answer using the codes given below the lists :

List I (Colour of sand lime bricks)	*List II (Pigments)*
A. Green	1. Carbon black
B. Grey	2. Ochra
C. Red	3. Chromium oxide
D. Yellow	4. Iron oxide

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	3	1	4	2
(*c*)	2	3	1	3
(*d*)	4	3	2	1.

1.330. Pick up the correct statement from the following :
(*a*) The heating of a material to redness in contact with air, is known as calcination
(*b*) The property of lime by which it sets or hardens in damp places having no free circulation of air is called setting
(*c*) The product that remains after calcination of limestone, is called lime
(*d*) All the above.

1.331. Quick lime (or caustic lime)
(*a*) is obtained by the calcination of pure lime stone
(*b*) has great affinity to moisture
(*c*) is amorphous
(*d*) All the above.

1.332. For slaking of 10 kg of CaO, the theoretical amount of water is
(*a*) 2.2 kg (*b*) 1.5 kg
(*c*) 3.2 kg (*d*) None of these.

1.333. Which one of the following is an air binding material ?
(*a*) Gypsum (*b*) Acid-resistant cement
(*c*) Quick lime (*d*) All of these.

1.334. Pick up the correct statement from the following :
(*a*) The lime in excess makes the cement unsound and causes the cement to expand and disintegrate
(*b*) The silica in excess makes the cement stronger but its setting time also increases
(*c*) The excess amount of alumina weakens the cement
(*d*) The addition of gypsum increases the initial setting time of cement
(*e*) All the above.

1.335. The cement becomes unsound by the presence of excess
(*a*) sulphur (*b*) magnesia
(*c*) lime (*d*) All of these.

1.336. Pick up the compound responsible for early strength of cement from the following :
(*a*) Tetra-calcium alumino-ferrite
(*b*) Tricalcium silicate
(*c*) Tricalcium aluminate
(*d*) Dicalcium silicate.

1.337. In the cement the compound quickest to react with water, is
(*a*) Tricalcium aluminate
(*b*) Tetra-calcium alumino-ferrite
(*c*) Tricalcium silicate
(*d*) Dicalcium silicate.

1.338. Pick up the correct statement regarding low heat cement from the following :

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(a) It possesses less compressive strength
(b) Its initial setting time is about one hour
(c) Its final setting time is about 10 hours
(d) Its mainly used for mass concrete work
(e) All the above.

1.339. Rapid hardening cement contains
(a) Tri-calcium silicate
(b) Tri-calcium aluminate
(c) Tetra-calcium alumino-ferrite
(d) Dicalcium silicate.

1.340. Name the type of cement from the following for canal linings :
(a) sulphate resisting cement (b) rapid hardening cement
(c) quick setting cement (d) pozzuolana cement.

1.341. Sea sand used in structures causes
(a) dampness (b) efflorescence
(c) disintegration (d) All of these.

1.342. If water required for 1 bag of cement is 30 litres, the water cement ratio is :
(a) 0.40 (b) 0.50
(c) 0.60 (d) None of these.

1.343. Pick up the correct statement from the following :
(a) For thin structures subjected to wetting and drying, the water cement ratio should be 0.45
(b) For mass concrete structures subjected to wetting and drying, the water ratio should be 0.55
(c) For thin structures which remain continuously under water, the water-cement ratio by weight should be 0.55
(d) For massive concrete structures which remain continuously under water, the water cement ratio by weight should be 0.65
(e) All the above.

1.344. Pick up the correct statement from the following :
(a) The theory of formation of concrete is based on the phenomena of formation of voids
(b) The bulking of sand is taken into account while volumetric proportioning of the aggregates
(c) The dry sand and the sand completely flooded with water, have practically the same volume
(d) The expansion and contraction joints are provided if concrete structures exceed 12 m in length
(e) All the above.

1.345. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Pith	1. Inner annual rings surrounding the pith
B. Heart wood	2. The thin layer of sap between sap wood and inner back
C. Sap wood	3. Inner most control portion
D. Cambium	4. The outer annual rings between heart wood and cambium layer

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	2	3	1	3
(d)	4	3	2	1.

1.346. The presence of original rounded surface on the manufactured piece of timber, is called
(a) Wane (b) Torn grain
(c) Diagonal grain (d) Chipmark.

1.347. Pick up the most favourable condition for the rapid growth of fungus for dry rot from the following :
(a) absence of sun light (b) dampness
(c) presence of sap (d) stagnant air
(e) All the above.

1.348. The cracks which extend from bark towards the sap wood in the cross section of a tree, are called
(a) radial shakes (b) star shakes
(c) heart shakes (d) cup shakes.

1.349. The cracks caused by shrinkage of the exterior surface of the wood exposed to atmosphere, are called :
(a) radial shakes (b) heart shakes
(c) wind cracks (d) twisted fibres.

1.350. Pick up the correct statement from the following :
(a) The plywoods do not split or crack due to changes in atmosphere
(b) The commercial plywoods are available upto 150 cm wide and upto 300 cm long
(c) The plywoods possess uniform tensile strength in all directions
(d) The plywoods are light in weight
(e) All the above.

1.351. Pick up the correct statement from the following :
(a) Alexander Parkes, a Scottish chemist prepared a hard material by mixing camphor and alcohol with nitro cellulose and called it, as *Parkesite*
(b) Dr. L. Bakeland, a Belgian scientist prepared a product known as Bakelite
(c) Pollark, an Austrian scientist prepared a substance from urea and formaldehyde and called it *Plastic*
(d) All the above.

1.352. Plastics are compounds of carbon with element
(a) hydrogen (b) nitrogen
(c) oxygen (d) All of these.

1.353. Plastic
(a) is an organic substance
(b) consists of natural or synthetic binders
(c) finished products are rigid and stable at normal temperature
(d) is capable of flow when necessary heat and pressure ar

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applied
(e) All the above.

1.354. Pick up the correct statement from the following :
(a) The substance which consists of one primary chemical, is known as monomer
(b) The polymer consists of thousands of monomers joined together
(c) The polymer molecule is called macromolecule
(d) A polymetric material consists of a large number of long-chain molecules
(e) All the above.

1.355. Polymerization helps to improve the property of
(a) strength (b) rigidity
(c) elasticity (d) all of these.

1.356. The method of addition polymerization is used for obtaining :
(a) polythylene (b) polypropylene
(c) polyvinylchloride (d) polystyrene
(e) All of these.

1.357. In the method of condensation polymerization,
(a) low-molecular substances are removed from the high molecular substance
(b) the reaction proceeds with an evolution of ammonia
(c) the reaction proceeds with an evolution of hydrogen chloride
(d) all the above.

1.358. Which one of the following polymers is obtained from condensation polymerization ?
(a) phenol formaldehyde (b) carbamide
(c) melamine-formaldehyde (d) all of these.

1.359. For obtaining vinyl chloride acetate, the method used, is
(a) addition polymerization
(b) condensation polymerization
(c) co-polymerization
(d) none of these.

1.360. The thermosetting plastic
(a) becomes rigid when moulded at suitable pressure and temperature
(b) at 127°C to 177°C permanently set and further application of heat does not soften it
(c) charrs at 343°C
(d) All the above.

1.361. Elastomers can extend upto
(a) five times their original dimensions
(b) seven times their original dimensions
(c) ten times their original dimensions
(d) three times their original dimensions.

1.362. The plastics made from cellulose resin
(a) are as clear as glass
(b) are tough and strong
(c) possess excellent electrical properties
(d) All the above.

1.363. Acrylic is the name of
(a) cellulose resin (b) alkyd resin
(c) methyl metha crylate (d) cumarone-indene.

1.364. Acrylic sheets
(a) possess 10 to 17 times greater breakage resistance than that of glass of equivalent thickness
(b) are generally unaffected by most house-hold detergents
(c) possess the light transmission rate of 93%
(d) are available in various shapes
(e) all the above.

1.365. Pick up the correct statement from the following :
(a) Styrene resin is produced from ethylene which is made from petroleum
(b) Styrene resin is light in weight
(c) Styrene resin transmits ultraviolet waves of light
(d) Styrene resin is used to manufacture utensils which are unaffected by chemicals
(e) All the above.

1.366. The plastics prepared from Vinyl resin are
(a) odourless (b) non-toxic
(c) transparent (d) colourless
(e) all of these.

1.367. Pick up the correct statement from the following :
(a) Melamine is obtained from calcium carbide
(b) Formaldehyde is prepared synthetically from methane
(c) The melamine when reacted with formaldehyde forms the melamine-formaldehyde resin
(d) The plastics made from melamine formaldehyde resin, are used for electrical insulators
(e) All the above.

1.368. Pick up the correct statement from the following :
(a) The phenol is carbolic acid
(b) The phenol is either extracted from coaltar or prepared from benzene
(c) Phenol reacts with formaldehyde, to form phenol formaldehyde resin
(d) The plastics prepared from phenol-formaldehyde are used for paints, varnishes, w.c. seats
(e) All the above.

1.369. Pick up the correct statement from the following :
(a) Catalysts are added to assist and accelerate the hardening of resin,
(b) The fillers are inert materials and they impart strength and hardness
(c) Fibrous fillers increase thermal resistance
(d) All the above.

1.370. Pick up the correct statement from the following :
(a) The plastic bottles are made by the process of blowing
(b) The plastic sheets are made by the calendering process in which the plastic material is allowed to pass between cylindrical rollers
(c) The application of thermo-setting resins on sheets of paper, is called laminating process

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(*d*) The plastic articles made by placing raw material in the desired moulds, is known as moulding process
(*e*) All the above.

1.371. Pick up the incorrect statement from the following :
(*a*) Plastics are chemical resistant
(*b*) Plastics are durable
(*c*) Plastics are ductile
(*d*) Plastics are excellent electric insulators.

1.372. Pick up the non-inflammable plastic from the following:
(*a*) Cellulose acetate plastics
(*b*) Polyvinyl chloride plastics
(*c*) Phenol formaldehyde plastic
(*d*) Urea formaldehyde plastic.

1.373. Pick up the correct statement from the following :
(*a*) Plastics have generally low melting point
(*b*) The coefficient of thermal expansion of plastics is about three times than that of steel
(*c*) The acoustical boards prepared by impregnating fibre-glass with phenolic resins has absorption coefficient of about 0.67
(*d*) All the above.

1.374. The PVC doors and windows are preferred as they are
(*a*) rust proof (*b*) rot proof
(*c*) termile proof (*d*) water proof
(*e*) all of these.

1.375. Based on flow quality, the sequence of pipes is
(*a*) A.C. pipes, G.I. pipes, C.I. pipes, PVC pipes
(*b*) C.I. pipes, G.I. pipes, A.C. pipes, PVC pipes
(*c*) C.I. pipes, G.I. pipes, PVC pipes, A.C. pipes
(*d*) None of these.

1.376. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Abrasive)	*List II (Use)*
A. Diamond	1. Polishing glass
B. Garnet	2. Polishing precious stone
C. Corundum	3. Rock drills
D. Emery	4. Grinding stone

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	1	3	4
(*c*)	4	3	1	2
(*d*)	1	4	2	3.

1.377. The most commonly used synthetic abrasive is
(*a*) aluminium carbide (*b*) boric acid
(*c*) silicon (*d*) All of these.

1.378. Pick up the synthetic resin from the following :
(*a*) Malamine resin (*b*) Phenolic resin
(*c*) Resorcinol resin (*d*) Urea resin
(*e*) All of these.

1.379. Asbestos
(*a*) is a natural fibrous mineral substance
(*b*) is composed of hydrous silicates of calcium and magnesium ($CaSiO_3$, $3MgSiO_3$)
(*c*) contains iron oxide and alumina
(*d*) all the above.

1.380. Which one of the following is acid resistant asbestos:
(*a*) actinolite asbestos (*b*) amosite asbestos
(*c*) anthophylite asbestos (*d*) crocidolite asbestos
(*e*) All the above.

1.381. Non acid-resistant asbestos is :
(*a*) tremolite asbestos (*b*) chrysolite abestos
(*c*) amosite absestos (*d*) none of these.

1.382. Asbestos
(*a*) is an excellant insulator for heat and electricity
(*b*) is fire-proof and acid proof
(*c*) has sp. gravity equal to 3.10
(*d*) is smooth like glass and silk
(*e*) All the above.

1.383. Initial setting time of cement for asbestos cemer products should be not less than
(*a*) 30 minutes (*b*) 50 minutes
(*c*) 75 minutes (*d*) 90 minutes.

1.384. Asbestos cement
(*a*) is brittle
(*b*) warps due to changes in humidity
(*c*) strength is lowered when saturated by water
(*d*) all the above.

1.385. Bitumen completely dissolves in
(*a*) carbon bisulphide (*b*) chloroform
(*c*) benzol (*d*) coaltar
(*e*) All of these.

1.386. Pick up the correct composition of bitumen from tl following :

	Carbon	Hydrogen	Oxygen
(*a*)	87%	11%	2%
(*b*)	80%	16%	4%
(*c*)	75%	20%	5%

(*d*) None of these.

1.387. For filling cracks in masonry structures, the type bitumen used, is
(*a*) cut-back bitumen (*b*) bitumen-emulsion
(*c*) blown bitumen (*d*) plastic bitumen.

1.388. The main constituent of fly-ash, is
(*a*) aluminium oxide (*b*) silica
(*c*) ferrous oxide (*d*) All of these.

1.389. Inhaling of fly-ash over a long period causes
(*a*) silicosis (*b*) fibrosis of lungs
(*c*) bronchitis (*d*) pneumonitis
(*e*) All of these.

1.390. For making fly-ash building bricks, the following r of fly-ash, sand and lime, is
(*a*) 80 : 13 : 7 (*b*) 70 : 20 : 10
(*c*) 60 : 35 : 5 (*d*) none of these.

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The following 17 items, consist of two statements one labelled the 'Assertion A' and other labelled the 'Reason R'. You are to examine these two statements and decide if the Assertion A and the Reason R are individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answers to these items using the codes given below and mark your answers sheet accordingly.

Codes :

(*a*) Both A and R are true and R is the correct explanation of A

(*b*) Both A and R are true but R is not a correct explanation of A

(*c*) A is true but R is false

(*d*) A is false but R is true.

1.391. Assertion : Porous stones should not be recommended for places subjected to frost, rain or moisture.

Reason : The rain water while falling through atmosphere absorbs some acidic gases. Such rain water if absorbed by porous stones causes the constituents of stones crumble.

1.392. Assertion : Lime should be present in good brick earth in a very finely powdered state.

Reason : Even small particles of the size of pin-head cause flaking of the bricks.

1.393. Assertion : Fourth class bricks are used for concrete in foundations.

Reason : The over burnt bricks have a compact structure and are stronger than even the first class bricks.

1.394. Assertion : The slaked lime should always be used as fresh as possible.

Reason : It has the tendency to absorb carbonic acid from the atmosphere in the presence of moisture.

1.395. Assertion : In initial stage, the gain in strength in hydrophobic cement is less.

Reason : The hydrophobic films on cement grains prevent the interaction with water.

1.396. Assertion : The presence of moisture in sand increases the volume of sand.

Reason : The moisture causes film of water around sand particles which increase.

1.397. Assertion : The mortar with surkhi should not be used for external plaster.

Reason : It disintegrates under the action of air and humidity.

1.398. Assertion : For strong and durable concrete, minimum quantity of water should be used to have reasonable degree of workability.

Reason : The excess water occupies space in concrete and on evaporation, the voids are created in concrete.

1.399. Assertion. The intermittant spraying of water on the dried surface of concrete has harmful effects as compared to the advantages of curing.

Reason : The green young concrete which is constantly subjected to multiple wetting and drying leads to early deterioration.

1.400. Assertion : Teak and sal resist the attack of white ants.

Reason : Such timbers contain certain chemicals in their composition. The smell of these chemicals, is not favourable for termites.

1.401. Assertion : If we remove the bark of a tree, it causes the death of tree.

Reason : The cambium layer gets exposed and the cells cease to be active.

1.402. Assertion : The fungi do not attack timber if the moisture contant of timber is above 20 percent and there is presence of air and warmth.

Reason : The fungi grow if the moisture content of timber is above 20 per cent and there is presence of air and warmth.

1.403. Assertion : The plywoods do not split when nailed near edges.

Reason : They possess cross grained nature.

1.404. Assertion : The thermosetting plastics are used for making paints and varnishes.

Reason : The thermosetting plastics are soluble in alcohol and certain organic solvents.

1.405. Assertion : It is necessary to make adequate provisions for expansion and contraction of the acrylic sheets of large dimensions.

Reason : The coefficient of thermal expansion of acrylic sheets is too large.

1.406. Assertion : The lubricants are applied on the surface of the moulds.

Reason : The application of lubricants on the surface of moulds allows easy removal of finished plastic article from the moulds.

1.407. Assertion : A five minute inhalation of blue asbestos dust can produce cancer upto 20 years afterwards.

Reason : Asbestos fibres are capable of being separated to extreme fineness and into dust.

1.408. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Granite	1. Water worn pebble
B. Sand Stone	2. Igneous rock
C. Gneiss	3. Sedimentary rock
D. Gravel	4. Metamorphic rock

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	3	4	1
(*c*)	3	4	1	2
(*d*)	4	3	2	1

1.409. Match List I with List II and select the correct answer by using the codes given below the lists :

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List I	List II
A. seipentine	1. marine works
B. Quartzite	2. flooring
C. Slate	3. Indoor decoration
D. Granite	4. road metal

Codes :

	A	B	C	D
(a)	1	4	3	2
(b)	2	4	3	1
(c)	1	2	3	4
(d)	3	4	2	1

1.410. Match List I with List II and select the correct answer by using the codes given below the lists :

List I (Rock)	*List II (Weight)*
A. Sand stone	1. 8880 kg/m^3
B. Slate	2. 9300 kg/m^3
C. Marble	3. 7200 kg/m^3
D. Granite	4. 8725 kg/m^3

Codes :

	A	B	C	D
(a)	3	2	4	1
(b)	1	3	4	2
(c)	2	1	4	3
(d)	1	2	3	4

1.411. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Granites	1. Uttar Pradesh
B. Basalts	2. Gujarat
C. Slates	3. Deccan Traps
D. Sand stones	4. Rajasthan

Codes :

	A	B	C	D
(a)	1	3	2	4
(b)	2	3	4	1
(c)	2	3	1	4
(d)	4	3	1	2

1.412. Match List I with List II and select the correct answer using the codes given below the lists :

List I	*List II*
A. Blasting powder	1. 93% nitroglycerine and 7% gun cotton
B. Dynamite	2. 65% saltpetre, 20% sulphur and 15% char-coal
C. Nitrocellulose	3. 75% nitro-glycerine and 25% sandy earth
D. Blasting gelatine	4. Saturated cotton with nitric acid

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	2	3	4	1
(d)	1	3	2	4

1.413. Match List I with List II and select the correct answer by using the codes given below (he lists :

List I	*List II*
A. Rubber masonry	1. hammer-dressed
B. Ashlar masonry	2. true faced
C. Freshly quarried blocks	3. rock faced
D. Fine ashlar	4. quarry sap

Codes :

	A	B	C	D
(a)	1	3	4	2
(b)	2	4	1	3
(c)	3	2	1	4
(d)	1	4	2	3

1.414. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Lime stones	1. Not affected
B. Porous & soft stones	2. Boring worms
C. Soft sand stones	3. Mechanical agents
D. Granite	4. Chemical agents

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	1	3	4	2
(c)	2	4	3	1
(d)	1	2	4	3

1.415. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Granite	1. Meghalaya
B. Rajmahal traps	2. West Bengal
C. Sandstone	3. Orissa
D. Limestone	4. Bihar

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Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	4	2	1
(d)	1	3	4	2

1.416. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Granite	1. Haryana
B. Basalt	2. Himachal Pradesh
C. Slate	3. Punjab
D. Limestone	4. Uttar Pradesh

Codes :

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	3	4	2

1.417. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Ancient Indian temples	1. White marble
B. Taj Mahal, Agra	2. Granite
C. Red Fort, Delhi	3. Pink and stone
D. Rashtrapati Bhawan, Delhi	4. Red and stone

Codes :

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	3	4
(c)	2	3	1	4
(d)	1	2	4	3

1.418. Match List I with List II and select the correct answer in respect of brick earth by using the codes given below the lists:

List I	*List II*
A. Silica	1. provides red colour
B. Alumina	2. provides bondage to clay particles
C. Lime	3. provides hardness
D. Oxide of iron	4. prevents shrinkage

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	1	3	4	2
(c)	2	3	1	4
(d)	4	1	2	3

1.419. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Bull-nosed brick	1. for arches over doors and windows
B. Plinth bricks	2. on top of parapet wall
C. Coping bricks	3. for use in plinths
D. Voussoirs	4. for rounding off sharp corners

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4
(c)	4	2	1	3
(d)	1	3	4	2

1.420. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Earthenware	1. burnt at high temperature
B. Stoneware	2. burnt at low temperature
C. Terracotta	3. means baked earth
D. Faience	4. means glazed terracotta

Codes :

	A	B	C	D
(a)	2	1	3	4
(b)	1	3	4	2
(c)	2	1	3	4
(d)	1	2	3	4

1.421. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Biscuiting of faience	1. made with dry mixture and fireclay and crushed stone
B. Glazing of biscuited material	2. throwing salt during burning operation
C. Salt glazing	3. burnt at 12000°C
D. Sanitary tiles	4. burnt at 7000°C

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4

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(c) 1 3 4 2
(d) 4 2 3 1

1.422. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Granite	1. Quartzile
B. Sandstone	2. Slate
C. Lime stone	3. Marble
D. Shale	4. Gneiss

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	4	1	3	2
(d)	3	2	1	4

1.423. Consider the following statements :
A. Granite, Basalt and trap are unstratified rocks
R. These rocks do not show any sign of stratification.
Of these statements:
(a) both A and R are true and R is the correct explanation of A.
(b) both A and R true, but R is not a correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

1.424. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Argillaceous	1. Sand (silica SiO_2)
B. Silicious	2. Lime(CaO)
C. Calcareous	3. Clay (alumina Al_2O_3)

Codes :

	A	B	C
(a)	1	2	3
(b)	3	2	1
(c)	2	1	3
(d)	3	1	2

1.425. Consider the following statements :
A. Stones disintegrate in cold region
R. Volume of water driven in the pores of stones increases on freezing. Of these statements :
(a) Both A and R are true.
(b) A is true but R is false,
(c) A is false but R is true
(d) both A and R are false.

1.426. Consider the following statements :
A. Porous stones are used at places where they are not to encounter moisture
R. Porous stones are generally strong.
Of these statements :
(a) Both A and R are true.
(b) Both A and R are false.
(c) A is true but R is false.
(d) A is false but R is true.

1.427. Match List I with List II and select the correct answer for quarrying stones by using the codes given below the lists:

List I	*List II*
A. Blasting method	1. Rocks bedded in horizontal layers
B. Heating method	2. Soft stratified rocks
C. Wedging method	3. Stones burried in earth
D. Excavating	4. For tunneling

Codes:

	A	B
(a)	1	2
(b)	4	1
(c)	1	3
(d)	1	3

1.428. Consider the following statements :
A. Stones should be placed in such a manner that its natural bed is at right angles to the expected pressure.
R. In doing so the stones offer maximum resistance to crushing and also maximum resistance to disintegration by rain water Of these statements:
(a) Both A and R are true.
(b) A is true but R is false,
(c) A is false but R is true.
(d) Both A and R are false.

1.429. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. For carved and ornamental work	1. Quartzite
B. For structures facing sea	2. Granite
C. For construction industrial towns	3. Marble
D. For railway ballast	4. Fine grained sand stone

Codes :

	A	B	C
(a)	1	2	3
(b)	3	4	2
(c)	4	2	3
(d)	1	3	4

1.430. Match List I with List II and select the correct answer

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by using the codes given below the lists :

List I	*List II*
A. Hardest rock	1. Slate
B. Shingle	2. Marble
C. Ornamental work	3. Granite
D. Metamorphic rock	4. Water worn pebbles

Codes :

	A	B	C	D
(a)	1	3	2	4
(b)	4	2	3	1
(c)	3	4	2	1
(d)	1	4	2	3

1.431. Match List I with List II and select the correct functions of the ingredients of brick earth by using codes given below the lists :

List I	*List II*
A. Silica	1. In the presence of silica and alumina
B. Alumina	2. reduces shrinkage of bricks and acts as a flux.
C. Lime	3. a tenacious finely grained mineral compounds.
D. Magnesia	4. in the presence of iron, it gives yellowish tint
E. Iron oxide	5. fuses in the presence of alumina at low temperature.

Codes :

	A	B	C	D	E
(a)	4	2	3	5	1
(b)	1	4	3	2	5
(c)	3	2	4	1	5
(d)	5	3	2	4	1
(e)	1	4	3	5	2

1.432. Match List I with List II regarding effects the codes given below the lists : of ingredients in earth and select the correct answer by using

List I	*List II*
A. Excess lime	1. causes deformation of bricks
B. Iron pyrites	2. weak and porous bricks are obtained
C. Pebbles of stones	3. causes efflorescene
D. Salt	4. crystalize and split the brick.

Codes :

	A	B	C	D
(a)	1	4	2	3
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	2	3	4

1.433. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Allahabad tiles	1. square, hexagonal or other geometrical pattern
B. Maggalore tiles	2. consist of two sets of tiles
C. Pot tiles	3. flat tiles with a suitable key projection
D. Flooring tiles	4. semi-circular in section and tapers along the length.

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	2	3	4	1
(d)	4	1	3	2

1.434. What is the correct sequence of operations involved in the manufacture of tiles ?

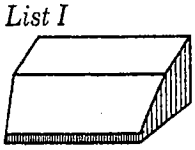
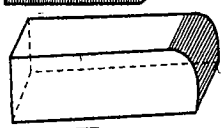
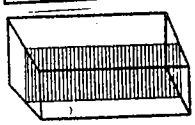
1. moulding
2. Preparation of clay
3. Burning
4. Drying

Choose the answer from the codes given below:

Codes :

(a) 1, 2, 3, 4
(b) 4, 3, 2, 1
(c) 1, 3, 4, 2
(d) 2, 1, 4, 3

1.435. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. 	1. King closer
B. 	2. Plinth brick
C. 	3. Bullnosed brick

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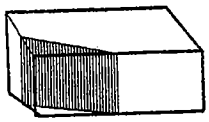
D.  4. Queen brick

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	1	3	4	2
(d)	2	1	4	3

1.436. Match List I with List II and select the correct answer by using the codes given under lists :

List I	*List II*
A. Stoneware	1. good in appearance
B. Porcelain	2. hygienic consumer goods
C. Glazed earthen ware	3. gets sanitary ware
D. Enamelled articles	4. attacked by hydrofluoric acid

Codes :

	A	B	C	D
(a)	3	3	2	1
(b)	1	2	3	4
(c)	1	1	2	3
(d)	3	4	1	4

1.437. Regarding the composition of raw material used for manufacturing ordinary Portland cement, match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Calcium oxide (CaO)	1. 2%
B. Silica (SiO_2)	2. 3%
C. Aluminium oxide (*roman*Al_2O_3)	3. 5%
D. Ferrous oxide,(Fe_2O_3)	4. 65%
E. Magnesium oxide (MgO)	5. 25%

Codes :

	A	B	C	D	E
(a)	4	5	3	2	1
(b)	1	2	3	4	5
(c)	3	4	5	1	2
(d)	2	1	3	5	4

1.438. Consider the following statements :

A. A cement having lesser aluminate shall have lesser initial strength

B. The aluminate is the first to set and harden.

Of these statements:

(a) Both A and R are false.
(b) Both A and R are true.
(c) A is true but R is false.
(d) A is false but R is true.

1.439. Match List I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Water and cement	1. fast in reaction
B. Tricalcium silicate	2. slow in reaction
C. Di-calcium silicate	3. slowest in reaction
D. Tri-calcium aluminate	4. hydrates.

Codes :

	A	B	C	D
(a)	4	2	3	1
(b)	1	3	2	4
(c)	4	1	2	3
(d)	3	2	1	4

1.440. Match List I with List II and select the correct answe by using the codes given below the lists :

List I	*List II*
A. Soundness of cement	1. Le Chatelier's apparatus
B. Initial setting time of cement	2. ViCat's apparatus
C. fineness of cement	3. Sieve analysis
D. consistency of cement	

Codes :

	A	B	C	D
(a)	1	2	3	2
(b)	2	1	3	3
(c)	1	3	3	2
(d)	3	1	2	2

1.441. Match List I with List II and select the correct answ by using codes given under lists :

List I	*List II*
A. P.V.C.N. 25 to 40	1. Paint for prime coa on wood
B. P.V.C.N. 28 to 40	2. Semi-gloss paint
C. P.V.C.N. 35 to 40	3. Paint for prime coa on metal
D. P.V.C.N. 35 to 45	4. Paint for exterior su face of house

Codes :

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	3	4

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(c) 2 3 4 1
(d) 1 2 4 3

1.442. Match List I with List II and select the correct answer by using codes given under lists :

List I	*List II*
A. White lead	1. Priming coat to iron surfaces
B. Red lead	2. Resists sulphur vapour
C. Zinc white	3. Priming coat to wood surfaces
D. Iron oxide	4. Does not resist sulphur vapours

Codes :

	A	B	C	D
(a)	1	3	2	4
(b)	4	3	2	1
(c)	3	4	1	2
(d)	2	1	3	4

1.443. Match List I with List II and select correct answer by using codes given below the lists :

List I	*List II*
A. Tung oil	1. odour less vehicle for paints
B. Nut oil	2. used for delicate colours
C. Linseed oil	3. cheap vehicle for paints
D. Poppy oil	4. used for superior paint

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	2	3	1
(c)	4	3	1	2
(d)	1	2	4	3

1.444. Match List I with List II and select correct answer by using the codes given below the lists :

List I (Tint)	*List II (Pigment of print)*
A. Green	1. Indigo
B. Black	2. Zinc chrome
C. Blue	3. Copper sulphate
D. Yellow	4. Graphite

Codes :

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	3	4
(c)	3	2	1	4
(d)	4	3	2	1

1.445. Match List I with List II and select correct answer by using codes given below the lists :

List I (Paint)	*List II (Uses)*
A. Aluminium paint	1. for resisting corossive reaction
B. Anti-corossive paint	2. for painting iron work under water
C. Bituminous paint	3. for painting surfaces exposed to high temperature
D. Cellulose paint	4. for painting oil storage tank

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	4	1
(c)	4	1	2	3
(d)	1	3	2	4

1.446. Match List I with List II and select correct answer by using codes given below the lists :

List I (Defect)	*List II (Cause)*
A. Cracking of paint	1. Paint film becomes powdery
B. Efflorscene	2. Bleaching or fading of colours
C. Chalking of surfaces	3. Highly saline atmospheric conditions
D. Fleeting	4. Insufficinet flexibility of the film of paint

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	4	2	1	3
(d)	4	3	1	2

1.447. Match List I with List II and select correct answer by using codes given below the lists :

List I	*List II*
A. Enamel paint	1. excellent alkali resistant
B. Emulsion paint	2. requires a coat of titanium white in pale linseed oil
C. Graphite paint	3. mostly used in show rooms
D. Plastic paint	4. most suitable for underground railways

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Codes:

(a)	1	2	3	4
(b)	2	1	4	3
(c)	2	1	3	4
(d)	4	3	2	1

1.448. Match List I with List II and select correct answer by using codes given below the lists :

List I (Defect in painting)	*List II (Causes)*
A. Blistering	1. due to bad ventilation
B. Bloom	2. due to poor adhesion of paint
C. Flaking	3. due to insufficient opacity
D. Grinning	4. due to entrapped water vapours in the painted surface

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	3	4	2	1
(d)	1	3	4	2

1.449. Match List I with List II and select correct answer by using codes given below the lists :

List I (Defects in paint)	*List II (Causes of defect)*
A. Running	1. due to thickly painted vertical surfaces
B. Saponificalion	2. due to chemical action of alkalies
C. Sagging	3. due to too smooth surface
D. Wrinkling	4. due to thickly painted horizontal surface

Codes :

	A	B	C	D
(a)	3	2	1	4
(b)	1	2	3	4
(c)	3	2	4	1
(d)	1	2	4	3

1.450. Plasticizers are added to cellulose paints to improve the film for :

(a) adhesion (b) flexibility
(c) toughness (d) smoothness
(e) All of these

1.451. Match List I with List IIand select thecorrect answer by using codes given below the lists :

List I (Varnish)	*List II (Solvent)*
A. Oil varnish	1. Methylated spirit
B. Spirit varnish	2. hot water
C. Turpentine varnish	3. Linseed oil
D. Water varnish	4. Turpentine

Codes :

	A	B	C	D
(a)	3	1	4	2
(b)	1	4	3	2
(c)	2	3	4	1
(d)	1	2	3	4

1.452. What is the correct sequence of operations involved in the process of varnishing ?

Choose the correct answer from the codes given below :

Codes:

1. Slopping
2. knotting
3. preparation of surface
4. application of varnish coats

(a)	1	2	3	4
(b)	2	4	3	1
(c)	3	2	1	4
(d)	4	3	2	1

1.453. Consider the following statements :

A. The white washing is extensively used for ceilings of houses

R. The lime kills the germs and reflects light and thus increases the brightness of the surface.

Of these statements:

(a) Both A and R are false. (b) A is true but R is false.
(c) A is false but R is true. (d) Both A and R are true.

1.454. Consider the following statements :

A. The oil painted walls receive the oil bound distemper.

B. If such surfaces are given a priming coat of kerosene.

Of these statements:

(a) Both A and B are true (b) Both A and B are false
(c) A is true and B is false (d) A is false and B is true

1.455. Consider the following statements :

A. The distempers arc available both in powder and paste

B. The distempers are mixed with linseed oil before use.

Of these statements:

(a) Both A and B are true. (b) Both A and B are false.
(c) A is true and B is false (d) A is false and B is true.

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1.456. Consider the following statements :
A. The painted surfaces develop efflorescence or crystalline deposits.
B. The defect is caused by highly saline atmosphere.
Of these statements:
(*a*) Both A and B are false (*b*) Both A and B are true
(*c*) A is true and B is false (*d*) A is false and B is true.

1.457. Consider the following statements :
A. The oil paint should be applied during humid and damp weather
B. The presence of dampness on wall surface considerably increases the life of oil paint coating
Of these statements :
(*a*) Both A and B are true (*b*) A is true and B is false
(*c*) A is false and B is true (*d*) Both A and B are false.

1.458. Consider the following statements :
A. The white lead is used for painting iron surface
B. It affords protection against rusting.
Of these statements:
(*a*) Both A and B are true (*b*) Both A and B are false
(*c*) A is true and B is false (*d*) A is false and B is true.

1.459. Match List I with List II and choose a correct answer by using the codes given below the lists:

List I (Material)	*List II (Volume immediately after excavation)*	*(Volume after compaction)*
A. Gravel	1. 0.95	0.89
B. Clay	2. 1.2	0.90
C. Chalk	3. 1.0	0.92
D. Sandy soil	4. 1.8	1.4

Codes :

	A	B	C	D
(*a*)	1	4	3	2
(*b*)	3	2	4	1
(*c*)	4	3	2	1
(*d*)	2	1	3	4

1.460. Dolomite, a rock forming mineral
(*a*) contains brittle crystals
(*b*) is heavier than calcite
(*c*) is a chemical composition of bicarbonate of magnesium and calcium
(*d*) Possesses the ratio of magnesium bicarbonate and calcium bicarbonate as 46 : 54
(*e*) All the above.

1.461. Pick up the correct statement from the following :
(*a*) Calcite is a calcium carbonate ($CaCO_3$)
(*b*) Dolomite is chemical composition of magnesium bicarbonate and calcium bicarbonate
(*c*) Gypsum is the hydrated sulphate of calcium ($CaSO_4.2H_2O$)
(*d*) All the above.

1.462. The Smith's test of a stone sample is performed to determine :
(*a*) the presence of soluble matter
(*b*) the hardness of the stone
(*c*) the toughness of the stone
(*d*) the compressive strength of the stone.

1.463. Pick up the correct statement regarding Deval's attrition test machine from the following :
(*a*) The diameter and length of cylinder are respectively 20 cm and 34 cm
(*b*) The axes of cylinders make an angle of 30° with the horizontal
(*c*) The cylinders the rotated about horizontal axis for 5 hours at the rate of 30 R.P.M.
(*d*) The contents of the cylinders are passed through a sieve of 1.50 mm mesh.
(*a*) All the above.

1.464. Match the List I with List II and select a suitable answer by using the codes given below the lists :

List I (Stone test)	*List II (Purpose)*
A. Acid test	1. rate of wear
B. Attrition test	2. hardness
C. Hardness test	3. wearthering quality
D. Impact test	4. toughness.

Codes :

	A	B	C	D
(*a*)	1	4	3	2
(*b*)	3	1	2	4
(*c*)	4	3	1	2
(*d*)	2	3	4	1

1.465. Pick up the correct statement from the following :
(*a*) The coefficient of hardness of stone used in road work should be greater than 17
(*b*) For a good building stone, percentage wear should be equal to or less than 3 percent
(*c*) The free quartz suddenly expands at a temperature lower than 600°C
(*d*) The argillaceous stones are poor in strength, but resist fire quite well
(*e*) All the above.

1.466. The stone whose margin of about 20 mm width is sunk on all the edges and whose central portion is made to project about 15 mm, is called
(*a*) reticulated finish (*b*) tooled finish
(*c*) furrowed finish (*d*) sunk finish

1.467. Which one of the following statements is incorrect ?
(*a*) The pre-cast concrete tiles with marble chips at top surface, are known as **mosaic tiles**
(*b*) A mixture of marble chips and cement is called **Terrazo**
(*c*) The calcium hydroxide [$Ca(OH)_2$] absorbs carbon dioxide from atmosphere and forms calcium carbonate

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($CaCO_3$) which increases the strength of stone

(*d*) The tiles used for decorative purposes in floors, walls, ceiling and roofs are called encaustic tiles

(*e*) None of the above.

1.468. Match List I with List II and select a current answer by using the codes given below the lists :

List I	*List II*
A. Calcination	1. Lime obtained by calcination of pure lime
B. Lime	2. Slaked quick lime
C. Setting	3. Heating to redness in air
D. Slaked lime	4. Hardening of lime.

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	3	1	4	2
(*c*)	3	1	4	2
(*d*)	4	2	3	1

1.469. Pick up the incorrect statement from the following :

(*a*) The slaked lime should be used as fresh as possible to avoid formation of carbonate of lime

(*b*) The slaked lime after conversion to carbonate of lime attains a good setting property

(*c*) By adding sufficient quantity of water to quick lime hydrated lime is obtained

(*d*) Cracking, swelling and becoming powder of quick lime due to mixing of sufficient quality of water, is the process of slaking

(*e*) All the above.

1.470. Pick up the correct statement from the following :

(*a*) Clay in lime stones provides hydraulicity in lime

(*b*) Clay in lime stone makes lime soluble in water

(*c*) Excess clay in lime stone retards slaking of lime

(*d*) Small quantity of clay in lime stone assests slaking

(*a*) None of the above.

1.471. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Medullary rays	1. A thin layer of sap between sap wood and inner back
B. Cambium layer	2. Inner annual rings surroundings the path
C. Pith	3. Inner most central core of the tree
D. Heartwood	4. Thin radial fibres in the stem cross section

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	4	3	1
(*c*)	4	1	3	2
(*d*)	3	4	2	1

1.472. Match List I with List II and select a correct answer by using the codes gives below the lists :

List I (Defect)	*List II (Causes)*
A. Dry rot	1. Conversion of wood into dry powder form
B. Heart rot	2. Growth of a branch
C. Wet rot	3. Conversion of wood into greyish brown colour
D. Brown rot	4. Conversion of tree colour brown.

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	1	2	3	4
(*c*)	4	2	3	1
(*d*)	2	4	1	3

1.473. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Coarse grain	1. Bases of cut off branches of trees
B. Dead wood	2. Tree grown
C. Foxiness	3. Light weight and reddish colour
D. Knots	4. Rapid growth of tree.

Codes :

	A	B	C	D
(*a*)	3	1	4	2
(*b*)	1	2	3	4
(*c*)	4	3	2	1
(*d*)	2	4	1	3

1.474. The peculiar curved swellings found on the body of a tree, are called

(*a*) knots (*b*) hearts rots

(*c*) rindgalls (*d*) None of these.

1.475. Match List I with List II and select a suitable answer by using the codes given below the lists :

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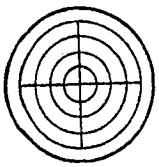
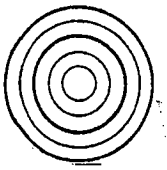
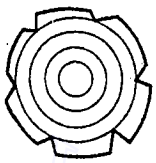
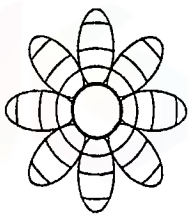
List I		*List II*
A.		1. Cup shakes
B.		2. Heart shakes
C.		3. Star shakes
D.		4. Ring shakes

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	2	4	1	3
(d)	4	3	1	2

1.476. The figure indicates



(a) Star shakes (b) Wind cracks
(c) Heart shakes (d) None of these.

1.477. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Bethel's method of preservation of timber	1. Preservation of timber from white ants
B. Sodinum paints	2. Fire resistant
C. Sir Abel's process of timber preservation	3. Odourless
D. Ascu solution	4. Creosote oil

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	4	3	1	2
(d)	3	4	2	1

1.478. Pick up the most valuable timber from the following :
(a) Deodar (b) Mahagany
(c) Pine (d) Teak
(e) toon.

1.479. Arrange the following timbers in order of their decreasing weight at 12 percent moisture :
1. Mahagany 2. Shisham
3. Teak 4. Toon

(a)	1	2	3	4
(b)	2	4	3	1
(c)	2	1	3	4
(d)	4	3	2	1

1.480. Toon is abundantly found in
(a) Madhya Pradesh (b) Andhra Pradesh
(c) Assam (d) Punjab.

1.481. Pick up the correct statement from the following :
(a) The planks obtained by tangetial sawing generally warp too much
(b) The solignum paints preserve timber from white ants
(c) The falling of trees in autumn and spring should be avoided
(d) The cost of radial sawing is always high
(a) All the above.

1.482. Pick up the timber from the followings which is used for railway sleepers :
(a) Sal (b) Mahagany
(c) Deodar (d) Teak.

1.483. Match List I with List II and select a correct answer by using the codes given below the lists

List I (Fuel)	*List II (Calorific value)*
A. Hydrogen	1. 2400 gm calories
B. Carbon monoxide	2. 34460 gm calories
C. Methane	3. 8080 gm calories
D. Carbon	4. 13060 gm calories

Codes :

	A	B	C	D
(a)	1	4	2	3
(b)	2	1	4	3
(c)	4	3	1	2
(d)	3	2	3	4

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2 Building Construction

2.1. The maximum bearing capacity of soil is that of
(a) black cotton soil (b) loose fine sandy soil
(c) dry coarse sandy soil (d) hard rocks
(e) soft clay soil.

2.2. The least bearing capacity of soil is that of
(a) hard rock (b) moist clay
(c) soft rock (d) laminated
(e) coarse sandy soil.

2.3. The bearing capacity of granite is generally
(a) 5 to 10 kg/cm^2 (b) 15 to 20 kg/cm^2
(c) 30 to 35 kg/cm^2 (d) 40 to 45 kg/cm^2.

2.4. Bearing capacity of soils cannot be improved by
(a) draining sub-soil water
(b) ramming crushed stone in soil
(c) driving sand piles
(d) watering surface of soil
(e) none of these.

2.5. Depth of lean concrete bed placed at the bottom of a wall footing, is kept
(a) 10 cm
(b) 15 cm
(c) equal to its projection beyond wall base
(d) less than its projection beyond wall base.

2.6. For a wall carrying heavy load on low bearing capacity soil,
(a) lean concrete bed is provided
(b) thick concrete bed is provided
(c) reinforced concrete bed is provided
(d) (a) and (c) of the above
(e) (b) and (c) of the above.

2.7. In grillage foundations, distance between flanges of grillage beams, is kept
(a) 40 cm (b) equal to flange width
(c) twice the flange width
(d) maximum of (a), (b) and (c).

2.8. In grillage foundations a minimum 15 cm cover is provided on
(a) upper flange of top tier (b) lower beam of lower tier
(c) ends of external beams (d) none to these.

2.9. To ensure that supporting area of an offset footing of a boundary wall is fully compressive, the C.G. of load must act
(a) at the centre of the base
(b) within the middle third of the base
(c) within the middle fifth of the base
(d) neither (a), (b) nor (c).

2.10. The foundation in which a cantilever beam is provided to join two footings, is known as
(a) strip footing (b) strap footing
(c) combined footing (d) raft footing
(e) none of these.

2.11. For a rectangular foundation of width b, eccentricity of load should not exceed
(a) $\frac{b}{2}$ (b) $\frac{b}{3}$
(c) $\frac{b}{4}$ (d) $\frac{b}{5}$
(e) $\frac{b}{6}$.

2.12. Pick up the correct statement from the following :
(a) A combined footing is so proportioned that centre of gravity of supporting area coincides with centre of gravity of two column loads
(b) A combined footing may be either rectangular or trapezoidal in shape
(c) Rectangular footings are provided if two column loads are equal or interior column carries relatively greater load
(d) Trapezoidal shaped footings may be provided under any loading
(e) All the above.

2.13. The foundation which consists of a thick reinforced cement slab covering whole area to support heavy concentrated structural loads, is known as
(a) combined footing (b) strap footing
(c) raft footing (d) none of these.

2.14. The black cotton soil
(a) undergoes volumetric changes
(b) swells excessively when wet
(c) shrinks excessively when dry
(d) has a tendency of swelling and shrinking due to clay particles
(e) all the above.

2.15. Black cotton soil is unsuitable for foundations because its
(a) bearing capacity is low
(b) permeability is uncertain
(c) particles are cohesive
(d) property to undergo a volumetric change due to variation of moisture content.

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2.16. Raft foundation are generally preferred to when the area required for individual footing, is more than
(a) 25% to total area (b) 30% of total area
(c) 40% to total area (d) 50% of total area.

2.17. To support a heavy structure in sandy soil, the type of foundation generally used, is
(a) combined footing (b) raft footing
(c) peir footing (d) strap footing
(e) none of these.

2.18. Pile foundation is generally provided if soil is
(a) compressible (b) water logged
(c) made up (d) all the above.

2.19. Suitable spacing of timber piles, is
(a) 50 cm (b) 60 cm
(c) 70 cm (d) 80 cm
(e) 90 cm.

2.20. Best type of piles for soft soil having little resistance to the flow of concrete, is
(a) Simplex pile (b) Vibro pile
(c) Raymond pile (d) Franki pile.

2.21. In case of Raymond pile
(a) lengths vary from 6 m to 12 m
(b) diameter of top of piles varies from 40 cm to 60 cm
(c) diameter of pile at bottom varies from 20 cm to 28 cm
(d) thickness of outer shell depends upon pile diameter
(e) all the above.

2.22. The pile which is provided with a bulb filled with concrete at its lower end, is known as
(a) Simplex pile (b) Mac-Arthur pile
(c) Raymond pile (d) Franki pile
(e) none of these.

2.23. A pre-stressed concrete pile is
(a) easy to handle (b) lighter in weight
(c) extremely durable (d) suitable for heavy load
(e) all the above.

2.24. The pile which supports the load due to friction between pile face and surrounding soil, is generally known as
(a) bearing pile (b) friction pile
(c) sheet pile (d) battered pile.

2.25. The pile which supports the load partly by friction and partly by resting on hard stratum, is called
(a) friction pile (b) bearing pile
(c) friction bearing pile (d) rough pile.

2.26. The steel pile which is generally sunk in soft clay or loose sand of low bearing capacity, is
(a) H-pile (b) pipe pile
(c) screw pile (d) disc pile
(e) none of these.

2.27. The depth of excavation of foundations, is generally measured with a
(a) ranging rod (b) steel tape
(c) levelling staff (d) bonning rod.

2.28. The bearing capacity of a water logged soil, may be improved by
(a) grouting (b) chemical action
(c) drainage (d) compaction.

2.29. Safe bearing capacity of black cotton soil varies from
(a) 2 to 3 t/m^2 (b) 5 to 7.5 t/m^2
(c) 8 to 10 t/m^2 (d) 10 to 12 t/m^2.

2.30. The foundations are placed below ground level, to increase
(a) strength (b) workability
(c) stability of structure (d) all the above.

2.31. According to Rankine's formula, minimum depth of foundations, is

(a) $\frac{P}{w} \times \left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2$ (b) $\frac{P}{w} \times \left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$

(c) $\frac{P}{2w} \times \left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$ (d) $\frac{P}{w} \times \left(\frac{1+\sin\phi}{1-\sin\phi}\right)$.

2.32. The single stage well point system of dewatering an excavation can be used if the depth of excavation does not exceed
(a) 5 m (b) 10 m
(c) 15 m (d) 20 m
(e) 25 m.

2.33. If the depth of an excavation is 20 metres, number of single stage well points to be installed at various levels, is
(a) 5 (b) 4
(c) 3 (d) 2
(e) 6.

2.34. In case of foundations on sandy soil, maximum permissible differential settlement, is usually limited to
(a) 15 mm (b) 25 mm
(c) 35 mm (d) 45 mm
(e) 55 mm.

2.35. The maximum permissible differential settlement, in case of foundations in clayey soil, is usually limited to
(a) 10 mm (b) 20 mm
(c) 30 mm (d) 40 mm
(e) 50 mm.

2.36. Pick up the incorrect statement from the following :
(a) The function of foundation is to distribute the load of super structure over a large bearing area
(b) No timbering is required for shallow trenches
(c) Shallow foundations can be constructed on made-up soil
(d) Grillage foundation is classified as a shallow foundation
(e) Black cotton soil is very good for foundation bed.

2.37. Stability of an existing structure may be disturbed by
(a) rising of water table
(b) vibrations caused by traffic movements
(c) mining in the neighbourhood
(d) excavation in the neighbourhood
(e) all the above.

2.38. In soils possessing low bearing capacity, the type of foundation generally provided, is
(a) column footing (b) grillage footing
(c) raft footing (d) mat footing
(e) all the above.

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2.39. Pile foundations are suitable for
(a) water logged soils
(b) soft rocks
(c) compact soils
(d) multistoreyed buildings
(e) none of these.

2.40. For the construction of flyovers in sandy soils, the type of foundation provided, is
(a) strap footing (b) raft footing
(c) combined footing (d) pier footing
(e) none of these.

2.41. In soft clay of low bearing capacity, the type of steel pile generally used, is
(a) H-pile (b) screw pile
(d) disc pile (d) pipe pile
(e) raking pile.

2.42. The additional piles which are driven to increase the capacity of supporting loads on vertical piles, are known
(a) construction piles (b) raking piles
(c) eccentric piles (d) sinking piles
(e) none of these.

2.43. Dampness causes
(a) efflorescence (b) bleaching of paints
(c) crumbling of plaster (d) growth of termites
(e) none of these.

2.44. Pick up the correct statement from the following :
(a) D.P.C. should be continuous
(b) D.P.C. should be of good impervious material
(c) D.P.C. may be horizontal or vertical
(d) All the above.

2.45. In ordinary residential and public buildings, the damp proof course is generally provided at
(a) ground level (b) plinth level
(c) water table level
(d) midway ground level and watertable level.

2.46. In horizontal D.P.C., thickness of cement concrete (1 : 2 : 4) is
(a) 2 cm (b) 4 cm
(c) 6 cm (d) 8 cm
(e) 10 cm.

2.47. Pick up the incorrect statement from the following :
(a) Horizontal D.P.C. is provided at plinth level in internal walls
(b) D.P.C. is provided under door and verandah openings
(c) Vertical D.P.C. is not provided in internal walls
(d) Cement concrete is a rigid damp-proofing material.

2.48. The inner section of a cavity wall, is generally known as
(a) butress (b) leaf wall
(c) pillaster (d) pillar.

2.49. Pick up the correct statement from the following :
(a) Cavity of a cavity wall should start near ground level
(b) Cavity of a cavity wall should terminate near eaves level of sloping roof
(c) Cavity of a cavity wall should terminate near coping of flat roof with parapet wall
(d) Damp proof course for two leaves of a cavity wall, is laid separately but at the same level
(e) All the above.

2.50. The brick laid with its length parallel to the face of a wall, is a known as
(a) header (b) stretcher
(c) closer (d) none of these.

2.51. The brick laid with its breadth parallel to the face of a wall, is known as
(a) header (b) stretcher
(c) closer (d) none of these.

2.52. The position of a brick when laid on its side 9 cm × 9 cm with its frog in the vertical plane, is called
(a) brick on edge (b) brick on end
(c) brick on bed (d) brick held vertically.

2.53. The 9 cm × 9 cm side of a brick as seen in the wall face, is generally known as
(a) stretcher (b) face
(c) front (d) header
(e) side.

2.54. The 19 cm × 9 cm side of a brick as seen in the wall face, is generally known as
(a) stretcher (b) face
(c) front (d) header
(e) side.

2.55. The portion of a brick cut across the width, is called
(a) closer (b) half brick
(c) bed (d) bat.

2.56. Queen closer may be placed
(a) in header course (b) in stretcher course
(c) in header course next to first brick
(d) in stretcher course next to first brick
(e) in any position.

2.57. To obtain good bonding in brick masonry
(a) first class bricks are used
(b) vertical joints in alternate courses are kept in plumb line
(c) bats are used where necessary
(d) all the above.

2.58. A temporary rigid structure having platforms to enable masons to work at different stages of a building, is known as
(a) scaffolding (b) dead shore
(c) raking shore (d) under pinning.

2.59. The arrangement made to support an unsafe structure temporarily, is known as
(a) shoring (b) scaffolding
(c) underpinning (d) jacking
(e) none of these.

2.60. The arrangement of supporting an existing structure by providing supports underneath, is known as
(a) shoring (b) underpinning
(c) jacking (d) piling

2.61. Cavity wall is generally provided for
(a) heat insulation (b) sound insulation

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(c) prevention of dampness (d) all the above.

2.62. The piece of a brick cut along the centre of width in such a way that its length is equal to that of full brick, is called
(a) half brick (b) queen closer
(c) king closer (d) bevelled closer.

2.63. The dimensions of a half queen closer, are
(a) 9 cm × 9 cm × 9 cm (b) 9 cm × 9 cm × 4.5 cm
(c) 9 cm × 4.5 cm × 9 cm (d) 1.8 cm × 4.5 cm × 9 cm.

2.64. The piece of a brick cut with its one corner equivalent to half the length and half the width of a full brick, is known as
(a) queen closer (b) bevelled closer
(c) king closer (d) half king closer.

2.65. The vertical sides of a door and window openings provided in a wall, are known as
(a) verticals (b) reveals
(c) jambs (d) none of these.

2.66. Exposed portions of vertical surface at right angles to the door or window frame, are known as
(a) jambs (b) lintels
(c) reveals (d) soffits.

2.67. To stagger vertical joints in successive courses of a wall, a piece of brick is generally used at the end of the course, which is known as
(a) bat (b) header
(c) stretcher (d) closer.

2.68. The type of bond in which every course contains both headers and stretchers, is called
(a) English bond (b) Flemish bond
(c) Russian band (d) Mixed bond.

2.69. The type of bond in a brick masonry containing alternate courses of stretchers and headers, is called
(a) Flemish bond (b) English bond
(c) Stretcher bond (d) Header bond.

2.70. Pick up the incorrect statement from the following :
(a) In Flemish bond, headers and stretchers are laid alternately in the same course
(b) In Flemish bond every header in each course lies centrally over every stretcher of the underlying course
(c) In English bond, stretchers are laid in every course
(d) In English bond, headers and stretchers are laid in alternate courses
(e) None of these.

2.71. To construct a 10 cm thick partition wall, you will prefer
(a) English bond (b) Flemish bond
(c) Header bond (d) Stretcher bond.

2.72. The alignment of a cross joint along the plumb line is
(a) bed block (b) perpend
(c) lintel (d) vertical line.

2.73. Herringbone bond is used for
(a) walls having thickness more than 4 bricks
(b) architectural finish to the face work
(c) ornamental panels in brick flooring
(d) all the above.

2.74. The bond in which headers and stretchers are laid in alternate courses and every stretcher course is started with a three fourth brick bat, is known as
(a) English cross bond (b) Dutch bond
(c) Monk bond (d) Rat-trap bond

2.75. The header bond is generally used for
(a) half brick wall (b) simple brick wall
(c) $1\frac{1}{2}$ bricks wall (d) arches.

2.76. The stretcher bond is generally used for
(a) half brick wall (b) simple brick wall
(c) $1\frac{1}{2}$ bricks wall (d) arches.

2.77. Pick up the correct statement from the following :
(a) English bond is used for brick masonry to support heavy loads
(b) Double-flemish bond is suitable for brick masonry to give uniform face appearance
(c) The double-flemish bond is used for the construction of single brick residential building
(d) The stretcher bond is used for the construction of half brick masonry brick
(e) all the above.

2.78. The method of moving each brick through a small horizontal distance before it is finally laid in any brick wall and pressing it by means of brick hammer, is known as
(a) trowelling (b) laying
(c) grouting (d) placing.

2.79. A covering of concrete placed on the exposed top of an external wall, is known as
(a) cornice (b) coping
(c) frieze (d) lintal.

2.80. Ornamental moulded course placed on the top of a wall, is
(a) cornice (b) coping
(c) frieze (d) lintel.

2.81. A projecting piece usually provided to support a truss, is
(a) cornice (b) coping
(c) frieze (d) lintal.

2.82. The stepped structure provided for lateral support of a structure, is
(a) retaining wall (b) breast wall
(c) buttress (d) parapet wall.

2.83. The type of stone masonry in which stones of same height are laid in layers, is called
(a) random rubble masonry (b) course rubble masonry
(c) uncoursed rubble masonry (d) ashlar masonry.

2.84. The exterior angle between outer faces of a wall, is known as
(a) turn (b) junction
(c) quion (d) all the above.

2.85. The stone masonry of finely dressed stones laid in cement or lime, is
(a) random rubble masonry (b) coursed rubble masonry
(c) dry rubble masonry (d) ashlar masonry.

2.86. The stone whose crushing strength is least, is

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(a) granite (b) chalk
(c) marble (d) slate
(e) sand stone.

2.87. The stone whose crushing strength is maximum, is
(a) granite (b) chalk
(c) slate (d) sand stone
(e) marble.

2.88. The type of ashlar masonry in which stones are finely chisel dressed and thickness of joints does not exceed 3 mm, is
(a) chamfered ashlar masonry
(b) ashlar facing masonry
(c) random coursed ashlar masonry
(d) coursed ashlar masonry.

2.89. A wall constructed to resist the pressure of an earth filling, is called
(a) retaining wall (b) breast wall
(c) buttress (d) parapet wall.

2.90. A wall constructed with stones to protect slopes of cuttings in natural ground from the action of weathering agents, is called
(a) retaining wall (b) breast wall
(c) buttress (d) parapet wall.

2.91. Weep holes are provided in retaining and breast walls
(a) to drain off the water from the filling
(b) to ventilate the stone masonry
(c) to add architectural beauty
(d) to reduce the weight of the earth retained
(e) to increase compaction of the earth retained.

2.92. If (ϕ) is the angle of repose of soil of weight w kg/m^3, the horizontal pressure p at a depth of h metres per metre length of wall, is
(a) $wh \times \frac{1-\sin\phi}{1+\sin\phi}$ (b) $\frac{wh}{2} \times \frac{1-\sin\phi}{1+\sin\phi}$
(c) $wh \times \sqrt{\frac{1-\sin\phi}{1+\sin\phi}}$ (d) $wh \times \sqrt{\frac{1+\sin\phi}{1-\sin\phi}}$

2.93. Pick up the incorrect statement from the following :
(a) The retaining wall should be structurally capable to resist the applied earth pressure
(b) The section of the retaining wall should be so proportioned that it may not overturn by the lateral pressure
(c) The retaining wall should be safe against sliding
(d) The foundation of the retaining wall should not be stressed beyond safe bearing capacity ; due to its weight and the force resulting from the earth pressure
(e) to drain off water from the earth retained, weep holes are provided near the top of the retaining wall.

2.94. Brick nogging type of partition wall, is constructed by
(a) laying bricks as stretchers in cement mortar
(b) laying bricks as headers in cement mortar
(c) reinforcing brick wall with iron straps
(d) constructing brick work within a wooden framework.

2.95. Stud(s) of a common wooden partition
(a) are vertical wooden members
(b) is the upper horizontal wooden member
(c) is the lower horizontal wooden member
(d) are the intermediate horizontal wooden members.

2.96. The sill of a common wooden partition is
(a) vertical wooden member on either end
(b) lower horizontal wooden member
(c) upper horizontal wooden member
(d) intermediate horizontal wooden member.

2.97. Nogging of a common wooden partition is
(a) upper horizontal wooden member
(b) lower horizontal wooden member
(c) intermediate horizontal wooden member
(d) vertical wooden member.

2.98. The thickness of a reinforced brick partition wall, is generally kept
(a) 5 cm (b) 10 cm
(c) 15 cm (d) 20 cm
(e) 25 cm.

2.99. The process of keeping concrete moist for a certain period after its finishing, is known as
(a) finishing of concrete (b) curing of concrete
(c) placing of concrete (d) compaction of concrete
(e) none of these.

2.100. The mortar in which both cement and lime are used as binding materials, is called
(a) cement mortar (b) lime mortar
(c) fire resistant mortar (d) gauged mortar
(e) light weight mortar.

2.101. The strength of brick masonry in 1 : 6 cement mortar is
(a) 20 tonnes/m^2 (b) 40 tonnes/m^2
(c) 50 tonnes/m^2 (d) 60 tonnes/m^2.
(e) 75 tonnes/m^2.

2.102. The entrained concrete is used in lining walls and roof for making
(a) heat insulated (b) sound insulated
(c) neither (a) nor (b) (d) both (a) and (b).

2.103. Pick up the incorrect statement from the following :
(a) Cement is added to lime mortar to increase its hydraul properties only
(b) Lime surkhi mortar is used for pointing the walls
(c) Lime should be slaked before preparing lime mortar
(d) High early strength concrete is generally used in col weather.

2.104. Pick up the correct statement from the following :
(a) Plain cement concrete is equally strong in compressic as well as in tension
(b) Slump test is performed to check concrete strength
(c) Curing of concrete is done for proper compaction cement
(d) Fineness modulus is the index number expressing th relative sizes of both coarse and fine aggregates
(e) Concrete is a mixture of binding material, coarse a gregate and water.

2.105. The concrete slump recommended for beams and slab is

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(a) 25 to 50 mm (b) 25 to 75 mm
(c) 30 to 125 mm (d) 50 to 100 mm
(e) none of these.

2.106. The concrete slump recommended for columns, is
(a) 25 to 50 mm (b) 25 to 75 mm
(c) 75 to 125 mm (d) 50 to 100 mm.

2.107. The concrete slump recommended for foundations, is
(a) 25 to 50 mm (b) 30 to 125 mm
(c) 50 to 100 mm (d) 75 to 125 mm
(e) none of these.

2.108. The minimum thickness of walls built in cement mortar (1 : 6) for a single storey building, is
(a) 10 cm (b) 15 cm
(c) 20 cm (d) 25 cm
(e) 30 cm.

2.109. The wedge shaped bricks forming an arch ring, are called
(a) Soffits (b) voussoirs
(c) haunchs (d) spandrils.

2.110. Crown is located at
(a) highest point on the extrados of the arch
(b) highest point on the intrados of the arch
(c) skew-back of the arch
(d) none of these.

2.111. An arch may fail due to
(a) uneven settlement of abutments
(b) sliding of voussoirs
(c) crushing of the material
(d) all the above.

2.112. A pointed arch which forms isosceles or equilateral triangle, is generally known as
(a) three centred arch (b) two centred arch
(c) Lancet arch (d) Bull's eye arch.

2.113. The triangular portion between any two adjacent arches and the tangent to their crowns, is
(a) haunch (b) spandril
(c) soffit (d) rise.

2.114. The inclined surface of an abutment to receive the arch, is known as
(a) skew back (b) soffit
(c) spandril (d) haunch.

2.115. The lower half portion between crown and skew back of the arch, is called
(a) spandril (b) haunch
(c) springing (d) soffit.

2.116. The under surface of an arch, is called
(a) soffit (b) intrados
(c) haunch (d) back.

2.117. The voussoir placed at crown of an arch, is known as a
(a) key (b) soffit
(c) springer (d) haunch.

2.118. An arch constructed with finely dressed stones, is known
(a) ashlar arch (b) rubble arch
(c) gauged arch (d) axed arch.

2.119. The type of arch used for high class buildings where appearance is of prime importance, is known as
(a) ashlar arch (b) rubble arch
(c) gauged brick arch (d) axed brick arch.

2.120. The angle between skew back of a flat arch and the horizontal, is kept approximately equal to
(a) 0° (b) 30°
(c) 60° (d) 90°
(e) 120°.

2.121. Arches in the form of masonry arcs struck from more than four centres, are called
(a) two curved arches (b) gothic arches
(c) ogee arches (d) drop gothic arches.

2.122. The depth of an arch is the distance between
(a) ground level and springing line
(b) crown and springing line
(c) crown and ground level
(d) intrados and extrados.

2.123. The vertical side member of a shutter frame, is known
(a) style (b) reveal
(c) mullion (d) post.

2.124. The vertical member running through middle of a shutter frame, is
(a) style (b) reveal
(c) mullion (d) post.

2.125. The projections of head or sill of a door or window frame, are
(a) transoms (b) horns
(c) stops (d) chocks.

2.126. A cut in frame of a door to receive the shutter, is called
(a) louver (b) stop
(c) horn (d) rebate.

2.127. The vertical faces of a door opening which support frame of the door, are
(a) jambs (b) posts
(c) reveals (d) styles.

2.128. A wooden block fixed on back side of a door frame on its post, is known as
(a) cleat (b stop
(c) horn (d) none of these.

2.129. A wooden block hinged on post outside a door, is known
(a) cleat (b stop
(c) horn (d) none of these.

2.130. The window which projects outside a room of a building for admitting more light and air, is known
(a) bay window (b) casement window
(c) lantern window (d) dormer window.

2.131. The window which is provided on a sloping roof of a building, is called
(a) lantern window (b) dormer window
(c) louvered window (d) rash window
(e) air window.

2.132. The window which is provided in flat roof of a room, is known

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(a) dormer window (b) lantern window
(c) louvered window (d) sky window.

2.133. The opening provided in sloping roof with its top parallel to the roof surface, is called
(a) dormer window (b) sky light window
(c) lantern window (d) louvered window.

2.134. Pick up the correct statement from the following :
(a) Louvered door is generally provided in bath rooms
(b) Flush door is generally provided in dinning room
(c) Revolving door is generally provided in cinema halls
(d) Sliding door is generally provided in show rooms
(e) All the above.

2.135. The platform at the end of a series of steps, is known as
(a) platform (b) relief
(c) rest (d) landing
(e) stop.

2.136. The inclined support at the ends of treads and rises of a stair, is known as
(a) baluster (b) header
(c) string (d) beam.

2.137. The vertical members fixed between steps and hand rail, are known
(a) balusters (b) strings
(c) newel posts (d) soffits.

2.138. Pick up the incorrect statement from the following :
(a) In dog-legged stairs, no space between its flights is provided
(b) In open newel stair, a rectangular well is provided
(c) In geometric stair, a curved shaped well between forward and backward flights, is provided
(d) In geometrical stair, two quarter space landing is provided.

2.139. The minimum width of a stair in residential buildings, is
(a) 55 cm (b) 70 cm
(c) 85 cm (d) 100 cm
(e) 120 cm.

2.140. If height of the first storey of a building is 3.2 m and riser is 13 cm, the number of treads required, is
(a) 12 (b) 18
(c) 24 (d) 25
(e) 30.

2.141. While designing a stair, the product of rise and going is approximately kept equal to
(a) 350 (b) 420
(c) 450 (d) 500
(e) 600.

2.142. A stair should not have pitch more than
(a) 25° (b) 30°
(c) 40° (d) 50°
(e) 60°.

2.143. The stone blocks approximately triangular in shape, used as steps, are known
(a) stone steps (b) built up steps
(c) spandril steps (d) none of these.

2.144. The angular steps used for changing direction of the stairs, are called
(a) round steps (b) angular steps
(c) winders (d) radial steps
(e) circular steps.

2.145. A roof which slopes in four directions, is called
(a) shed roof (b) gable end roof
(c) hipped roof (d) gambrel roof.

2.146. In high mountaneous region, the type of roof generally recommended for buildings, is
(a) shed type (b) gable type
(c) gambrel type (d) mansord type.

2.147. The line of intersection of the surfaces of a sloping roof forming an external angle exceeding 180°, is
(a) ridge (b) hip
(c) valley (d) none of these.

2.148. The line of intersection of two surfaces of a sloping roof forming an internal angle less than 180°, is known as
(a) ridge (b) hip
(c) valley (d) none of these.

2.149. The highest line of sloping roof, where two opposite slopes meet, is known as
(a) rafter (b) ridge
(c) crown (d) eave.

2.150. The members which support covering material of sloping roof, are
(a) rafters (b) purlins
(c) battens (d) struts.

2.151. The member which is placed horizontally to support common rafter of a sloping roof, is
(a) purlin (b) cleat
(c) batten (d) strut.

2.152. Couple roof is used for spans
(a) 3.5 m or less
(b) 3.5 m but less than 5 m
(c) 5 m but less than 6.5 m
(d) 6.5 m but less than 8 m.

2.153. You are asked to design and supervise a truss for factory to have spans 6 m to 9 m. The type of the truss you will use, is
(a) mansored truss (b) queen post truss
(c) king post truss (d) collar truss
(e) none of these.

2.154. Pick up the correct statement from the following :
(a) In a king post truss, principal rafter and tie beams are jointed together with a bridle joint.
(b) Joint between the principal rafter and the king post made by making tenon and mortice respectively
(c) Joint between strut and king post, is generally of mortice and tenon type
(d) All the above.

2.155. Pick up the incorrect statement from the following
(a) In king post truss, one vertical post is used
(b) In a queen post truss, one vertical post is used

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(c) In a queen post truss, two vertical posts are used
(d) None of these.

2.156. In flat roof of reinforced cement concrete, the recommended angle of slope, is
(a) zero (b) a few degrees
(c) 10° (d) 200°.

2.157. The art of bringing the floor to a true level surface by means of screads, is called
(a) topping (b) bedding
(c) screading (d) none of these.

2.158. The size of a floor tile commonly used, is
(a) 15 cm × 15 cm × 1.8 cm (b) 20 cm × 20 cm × 2 cm
(c) 22.5 × 22.5 cm × 2.2 cm (d) all the above.

2.159. A floor constructed with the 4 to 6 mm marble chips, is known
(a) reinforced marble floor (b) terrazo floor
(c) marble floor (d) chip floor
(e) mosaic floor.

2.160. For different layers of cement concrete floor. Pick up the incorrect statement from the following :
(a) The lowest layer consists of consolidated ground
(b) A 10 cm thick clean sand is laid on consolidated ground
(c) A 10 cm lime concrete (1 : 4 : 8) is laid on clean sand
(d) A 10 cm thick cement concrete (1 : 2 : 4) is laid on top layer.

2.161. A floor constructed with 3 mm marble chips, is known
(a) mosaic floor (b) terrazo floor
(c) chips floor (d) marble floor.

2.162. The floor is rubbed with oxalic acid, for making its surface
(a) free from voids (b) glossy
(c) durable (d) uniform.

2.163. For constructing a terrazo floor. Pick up the incorrect statement from the following :
(a) a base course is prepared as in cement concrete flooring
(b) a 32 mm thick layer of cement concrete (1 : 2 : 4) is laid on the base course and the surface is made smooth by trowelling
(c) glass strips are driven into the layer according to the pattern required
(d) after final grinding is over, oxalic acid mixed with water is spread over and rubbed hard with soft material
(e) none of these.

2.164. In jack arch floor, the rise is kept
(a) 1/6th of the span (b) 1/8th of the span
(c) 1/10th of the span (d) 1/12th of the span
(e) 1/15th of the span.

2.165. In verandah floors outward slope is
(a) 1 in 40 (b) 1 in 50
(c) 1 in 60 (d) 1 in 70
(e) 1 in 100.

2.166. The process of filling hollow spaces of walls before plastering, is known
(a) hacking (b) dubbing out
(c) blishering (d) peeling
(e) all the above.

2.167. The process of making the back ground rough, before plastering, is
(a) dubbing (b) hacking
(c) blistering (d) peeling.

2.168. The local swelling of a finished plaster, is termed
(a) cracking (b) dubbing
(c) blistering (d) hacking.

2.169. Dado is usually provided in
(a) dinning halls (b) bath rooms
(c) living rooms (d) verandah
(e) roofs.

2.170. The type of pointing in which upper side of mortar joints is kept about 12 mm inside the face of the masonry and bottom is kept flushed with face of wall, is
(a) truck pointing (b) recessed pointing
(c) struck pointing (d) grooved pointing.

2.171. The type of pointing in which a V-shaped projection outside the wall surface, is provided, is called
(a) recessed pointing (b) weather pointing
(c) V-pointing (d) tuck pointing.

2.172. The process of working a flat for the finishing coat, is known
(a) dubbing out (b) floating
(c) knetting (d) blistering.

2.173. The sound which continues even after its source is cut off, is called
(a) reverberation (b) echo
(c) intensity of sound (d) interference.

2.174. The maximum permissible deflection of a timber beam supporting a roof, is
(a) $L/100$ (b) $L/150$
(c) $L/260$ (d) $L/360$
(e) none of these.

2.175. The skirting/dado in a bath roof should be upto
(a) ceiling (b) 15 cm above floor level
(c) 200 cm (d) level of the tap.

2.176. For effective drainage, the finished surface of flat roof should have a minimum slope of
(a) 1 in 20 (b) 1 to 50
(c) 1 in 10 (d) 1 in 5.

2.177. The range of spread from the wall base to outer edge of a brick work foundation does not exceed
(a) 1/2 horizontal to 1 vertical
(b) 2/3 horizontal to 1 vertical
(c) 1 horizontal to 1 vertical
(d) 2 horizontals to 1 vertical.

2.178. The ceiling height of a building is
(a) between ceiling and ground level
(b) between ceiling and floor level
(c) upto roof above ground level
(d) upto ceiling from the ground level.

2.179. The nominal thickness of an expansion joint in brick walls, is kept more than
(a) 5 mm (b) 10 mm

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(c) 15 mm (d) 20 mm
(e) 40 mm.

2.180. Expansion joints in masonry walls are provided if length exceeds
(a) 10 m (b) 20 m
(c) 30 m (d) 40 m
(e) 50 m.

2.181. The nominal thickness of one brick wall in mm, is
(a) 90 mm (b) 150 mm
(c) 190 mm (d) 200 mm.

2.182. The minimum strength of the mortar used in load bearing brick masonry, is
(a) 50 N/cm^2 (b) 100 N/cm^2
(c) 150 N/cm^2 (d) 200 N/cm^2.

2.183. For plastering the exposed brick walls, the cement sand mortar should be
(a) 1 : 2 (b) 1 : 3
(c) 1 : 4 (d) 1 : 6
(e) 1 : 8.

2.184. For brick construction, the lime-sand mortar, is
(a) 1 : 1 (b) 1 : 2
(c) 1 : 3 (d) 1 : 4
(e) 1 : 5.

2.185. Pick up the correct statement from the following :
(a) A mortar joint having a concave finishing in brick masonry, is called keyed joint
(b) A mortar joint projecting beyond the face of a masonry wall, is called tucked joint
(c) A mortar joint having an inward-upward slope in brick masonry, is called weathered joint.
(d) A mortar joint having a recess in it, is called ruled joint.
(e) All the above.

2.186. The form work from the sides of beams can be removed only after
(a) 1 day (b) 4 days
(c) 7 days (d) 14 days.

2.187. The form work from the underside of slabs, can be removed only after
(a) 1 day (b) 4 days
(c) 7 days (d) 14 days.

2.188. The form work from the slabs excluding props, can be removed only after
(a) 1 day (b) 4 days
(c) 7 days (d) 14 days

2.189. The formwork including the props can be removed from beams, only after
(a) 3 day (b) 7 days
(c) 14 days (d) 21 days.

2.190. The construction joints in buildings are provided after
(a) 10 m (b) 15 m
(c) 20 m (d) 40 m
(e) 60 m.

2.191. The maximum spacing of expansion joints in R.C.C. roof slabs covered by insulating layer, is
(a) 10 to 12 m (b) 15 to 18 m
(c) 20 to 30 m (d) 30 to 35
(e) 40 m.

2.192. Pick up the correct statement from the following :
(a) The bearing capacity of a pile is defined as the load which can be sustained by the pile without producing excessive settlement
(b) The ultimate bearing capacity of a pile is defined as the maximum load which the pile carries and continues to sink without any further increases of load
(c) The safe bearing capacity of a pile is obtained by dividing the ultimate bearing capacity with a suitable factor of safety
(d) The factor of safety for piles is taken as 6
(e) All the above.

2.193. The bearing capacity of piles is determined by
(a) dynamic formula (b) static formula
(c) pile load tests (d) all the above.

2.194. Engineering news formula for obtaining safe bearing capacity of pile for drop hammer, is,
(a) $Q = \dfrac{W \cdot h}{6(S + 2.5)}$ (b) $Q = \dfrac{W \cdot h}{2.5\,(S + 6)}$
(c) $Q = \dfrac{W \cdot 6}{h(S + 2.5)}$ (d) $\dfrac{W \times 2.5}{6(S + h)}$.
(e) none of these.

2.195. I.S.I formula for determination of safe bearing capacity of piles, is
(a) $Q = \dfrac{\eta h\, W \cdot h \cdot \eta b}{S + \frac{1}{2} C}$ (b) $Q = \dfrac{\eta h\, W \cdot h \cdot \eta b}{\frac{1}{2} S + C}$
(c) $Q = \dfrac{\eta h\, W \cdot h \cdot \eta b}{S + C}$ (d) none of these
where W = weight of hammer in kg
h = height of drop of hammer in cm
S = penetration in cm
C = elastic compression.

2.196. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Detached house	1. The two identical houses attached by a common entrance and staircase
B. Semi-detached house	2. A living space at two or more levels
C. Flat	3. The house that stands on its own landscape setting aloof from the other building
D. Duplex apartment	4. A dwelling divided horizontally from an other.

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Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	4	2
(c)	4	3	1	2
(d)	2	4	2	3.

2.197. The service area in a building means the area occupied by
(a) stairs (b) toilets
(c) light and shafts (d) all the above.

2.198. Pick up the consideration to the taken while designing a hospital from the following :
(a) the operation theatre unit to be detached as it requires sterlized zone but near the ward for the patients and doctor
(b) the mortuary should be detached from the main circulation with a postmortem room
(c) causalty unit should be provided a separate entrance
(d) all the above.

2.199. Which one of the following factors is considered for the orientation of buildings :
(a) the direction of the prevailing winds in the area
(b) the exposure of the walls and roof of the buildings to the rays of sun
(c) the extent up to which the sunrays penetrate with the verandah.
(d) all the above.

2.200. Pick up the correct specification of one-room quarters generally adopted from the following :
(a) six quarters in a row
(b) the size of room is either 3.5 m × 3 m or 4.2 m × 2.5 m
(c) the front verandah is kept 2 m wide.
(d) all the above.

2.201. Pick up the correct statement from the following :
(a) the cost of square rooms is less
(b) the expenditure on the foundation and roof for the double storeyed building is nearly half of that for the ground storeyed building.
(c) the cost of construction of a house may be minimised by restricting the height floors
(d) all the above.

2.202. Pick up the correct statement from the following :
(a) lime mortar with cement in the ratio of in 10 is cheaper and better for outside plaster.
(b) the lime with surkhi used as mortor for construction reduces the cost and provides equal strength to wall
(c) for very cold or very hot climate, a compact and closed plan should be provided
(d) on the sea coast, an exposed and open house is generally preferred
(e) all the above.

2.203. The rock formed from the solidification of molten matter (magma) is called :
(a) sedimentary rock (b) metamorphic rock
(c) igneous rock (d) none of the above.

2.204. Gravels
(a) are cohesionless aggregates
(b) vary in size between 2 to 20 mm
(c) never swell when they come into contact with water
(d) seldom shrink when dried
(e) all the above.

2.205. Pick up the correct statement from the following :
(a) sand consists of coarse particles of silica formed due to the disintegration of rocks.
(b) the grains of sand are not affected by frost
(c) sand beds are permeable and do not allow water to rise up between pores due to capillary action
(d) all the above.

2.206. Pick up the correct statement about silt soil from the following :
(a) the silt soil has particle size from 0.02 mm to 0.06 mm.
(b) in organic fine grained silt soil possesses no plasticity.
(c) the least plastic type normally consists of more or less equi-dimensional grains of quartz
(d) all the above.

2.207. In clay soil
(a) swelling and shrinkage characteristics prevail
(b) consolidation continues even after several years of construction.
(c) differential settlement is generally prevalent
(d) all the above.

2.208. Pick up the correct statement from the following :
(a) inclined borings are made for taking samples under existing structures.
(b) inclined borings are occasionally used instead of vertical holes.
(c) the spacing of inclined borings is kept such that one bore hole is vertically above the bottom of an adjacent bore hole.
(d) all the above.

2.209. For each storey of a building, the depth of exploration should be
(a) 1 metre (b) 2 metres
(c) 3 metres (d) 4 metres.

2.210. For heavy embankments and dams, of height h, the depth of exploration of soil should not be less than
(a) $\frac{h}{4}$ (b) $\frac{1}{2}h$
(c) h (d) $2h$.

2.211. The depth of the ground water table may be ascertained by
(a) looking through the well in the vicinity
(b) standing on the well in the vicinity
(c) measuring the depth of water in the well
(d) none of the above.

2.212. Open test pit is only suitable upto a depth of
(a) 2 metres (b) 2.5 metres
(c) 3 metres (d) none of the above.

2.213. In the method of tube boring of soil investigation, the following is essential :

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(a) a tube of about 2 metres length and 20 cm diameter with a cutting edge
(b) a flap valve at the bottom of tube is provided to extract the soil sample
(c) the tube is raised and lowered by 4 thick rope moving over a pulley suspended on a tripod stand
(d) the tube is dropped to fall under gravity in side a metalic casing pipe which is driven as the depth of excavation proceeds.
(e) all the above.

2.214. Auger boring
(a) is the most primitive method for making a hole in the ground
(b) is generally employed in cohesive and other self soils above water table
(c) is most economical upto a depth of 5 metres
(d) is done by portable power driven helical augers those diameters range from 7.5 to 30 cm
(e) all the above.

2.215. The Auger borings are not common
(a) in soils that require lateral support
(b) in cohesive soils
(c) in soft soils
(d) none of the above.

2.216. The Auger boring method is not suitable for
(a) very hard soil (b) cemented soil
(c) vary soft soil
(d) fully saturated cohesionless soils
(e) all the above.

2.217. During percussion drilling
(a) ground water observations are hindered due to entry of the slurry in the soil below the bottom of the hole
(b) caving or mixing of strata are caused in soft soils or cohesionless soils
(c) the soil to a considerable depth below the bottom of the hole gets disturbed
(d) all the above.

2.218. A solid core of rock is formed in side the cylinder in the case of
(a) auger boring (b) percussion drilling
(c) diamond drilling (d) wash boring.

2.219. Rotary drilling is the fastest method in case of
(a) rocky soils (b) clay soils
(c) sandy soil (d) all of these.

2.220. Rotary drilling
(a) is not suitable for deposits containing very coarse gravel
(b) hinders the ground water observations and permeability test
(c) is not economical for holes of less than 10 cm.
(d) all the above.

2.221. Pick up the commonly adopted geophysical method in civil engineering from the following :
(a) the seisomic method
(b) electrical resistivity method
(c) gravitational method
(d) magnetic method
(e) both (a) and (b) of the above.

2.222. Pick up the incorrect statement from the following :
(a) the width of the wall is constructed thicker at the base in a stepped fashion
(b) a long vertical load transferring concrete structure is called a concrete pile
(c) in pile which transfers the load to the soil by the friction between the pile and the surrounding soil is called friction pile.
(d) the pile which transfers the load to a hard rock bed at certain depth is called load bearing
(e) none of the these.

2.223. The depth of concrete bed of the foundation depends upon
(a) the projection of the concrete block beyond the footing over it.
(b) the upward soil pressure
(c) the mix of the concrete
(d) all the above.

2.224. If a is the offset of concrete bed in cms, and d is the depth of concrete bed in cms, then
(a) $d = 0.445a$ (b) $0.557a$
(c) $d = 0.775a$ (d) none of these.

2.225. Pick up the correct statement from the following :
(a) Isolated footing is provided under column to transfer the load safely to soil bed
(b) column footings may have steps or projections in the concrete base
(c) heavily loaded column base must be provided steel reinforcement in both directions
(d) the concrete offset should be at least 15 cm on all sides
(e) all the above.

2.226. Two columns 50 cm × 50 cm and 60 cm × 60 cm carry 80 tonnes and 120 tonnes of loads respectively. The centre to centre distance between columns is 5.00 metres. The permissible bearing capacity of the soil is 20 t/m^2. If the footing is not to project more than 25 cm beyond the outside of the smaller column, pick up the correct design parameters of the footing from the following :
(a) distance of C.G. of the loads from the smaller column = 3.00 m
(b) the length of the foundation slab = 7.00 m
(c) area of footing slab = 11.00 m^2
(d) width of the footing = 1.57 m.
(e) all the above.

2.227. Grillage foundation
(a) is used to transfer heavy structural loads from steel columns to a soil having low bearing capacity
(b) is light and economical
(c) does not require deep cutting as the required base area with required pressure intensity is obtained at a shallow depth
(d) is constructed by rolled steel joists (R.S.J.) placed in

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(b) single or double tier
(c) all the above.

2.228. Raft foundations are used for :
(a) providing increased area of foundation over poor bearing capacity of soil
(b) spanning over small soft or loose pockets
(c) counter acting the hydrostatic effect
(d) all the above.

2.229. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I (Foundation)	*List II (Load)*
A. Inverted arch footing	1. to transfer the heavy structural loads from steel columns to a poor soil
B. Raft foundation	2. to transfer loads above an opening to the supporting walls
C. Stepped foundation	3. to transfer load to steep ground
D. Grillage foundation	4. to transfer the load to the soil by means of a continuous slab.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	3	1	4	2
(d)	4	3	1	3.

2.230. The loose pockets in soil mass can be bridged safely by providing a raft foundation provided the soft area is smaller than
(a) the column spacing
(b) one-third the column spacing
(c) half the column spacing
(d) three-fourth the column spacing
(e) none of these.

2.231. While investigating the site, a thick layer of fairly firm clay over a deep layer of soft clay is encountered. In such a situation, the following type of foundation is useful :
(a) pile formation (b) raft foundation
(c) grillage foundation (d) none of these.

2.232. The ultimate bearing capacity of a raft foundation of length L and width b on clay of unconfined compressive strength Q_u, is
(a) $2.85Q_u\left(1+0.3\frac{b}{L}\right)$ (b) $2.85Q_u\left(1+0.2\frac{b}{L}\right)$
(c) $2.85Q_u\left(1.0.1\frac{b}{L}\right)$ (d) $2.85Q_u\left(1+0.5\frac{b}{L}\right)$.

2.233. The raft slab is projected beyond the outer walls of the structure by
(a) 5 to 10 cm (b) 15 to 20 cm
(c) 25 to 30 cm (d) 30 to 45 cm
(e) 60 cm.

2.234. For providing a raft foundation, the following activities are involved
1. ramming the foundation bed
2. excavation of the soil upto required depth
3. laying the reinforcement over the foundation bed
4. curing the cement concrete placed over reinforcement
5. pouring the cement concrete over the reinforcement.

The correct sequence is
(a) 1, 2, 3, 4, 5 (b) 5, 4, 3, 2, 1
(c) 2, 1, 3, 5, 4 (d) 3, 2, 5, 1, 4.

2.235. The pile provided with one or more bulles in its vertical shaft, is generally known as
(a) under-ream pile (b) friction pile
(c) bearing pile (d) sheet pile.

2.236. Cast iron piles
(a) are suitable for works under sea water
(b) resist shocks or vibrations
(c) are suitable for use as batter piles
(d) are useful for heavy vertical loads.

2.237. The compaction of concrete in the drilled pile hole is done by compressed air in the case of
(a) simplex pile (b) Franki pile
(c) pressure pile (d) vibro pile.

2.238. In places where the soil is soft and has small resistance to the flow of concrete, which one of the following types of piles, is used
(a) vibro pile (b) pressure pile
(c) Franki pile (d) pedestal pile.

2.239. Which one of the following piles has a cast iron shoe even after removal of the hollow cylindrical steel casing
(a) simplex pile (b) pedastal pile
(c) Franki pile (d) vibro pile
(e) both (a) and (d) of the above.

2.240. Under reamed piles are generally used for
(a) machine foundations (b) factory buildings
(c) transmission linetowers (d) tall structures.
(e) All the above.

2.241. The minimum distance between the centres of bulb of diameter du, of a multi under reamed piles, is
(a) du (b) 1.25 du
(c) 1.5 du (d) 1.75 du
(e) 2 du.

2.242. The taper of precast concrete pile should not be more than
(a) 1 cm per metre length (b) 2 cm per metre length
(c) 4 cm per metre length (d) 5 cm per metre length.

2.243. Which one of the following specifications of precast concrete pile is incorrect ?
(a) the concrete mix 1 : 2 : 4 or 1 : $1\frac{1}{2}$: 3
(b) the size may be 25 to 60 cm
(c) the length may be for 3 metres to 30 metres
(d) the taper may not be more than 2 cm per metre length
(e) None of these.

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2.244. Pick up the correct statement from the following :
(a) the pile driven in sand is called sad pile
(b) the drilled hole filled with sand is called sand pile
(c) the sand piles are used for bearing purposes
(d) None of these.

2.245. Pick up the correct statement from the following :
(a) the sand in the sand pile is well compacted
(b) the sand is kept moist at the time of placing and tamping
(c) the top one metre of the pile is filled up with cement concrete to provide a cap for the filled up sand
(d) sand piles are generally used under column loads
(e) all of the above.

2.246. Negative skin friction
(a) is a downward drag acting on a pile due to downward movement of the surrounding compressible soil relative to the pile
(b) develops due to lowering of ground water
(c) both (a) and (b)
(d) neither (a) not (b).

2.247. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Frog	1. bottom surface of the brick when it is laid flat
B. Bed	2. the edges formed by the intersection of plane surface of brick
C. Bullnose	3. the depression provided in the face of the brick
D. Arrises	4. the brick with round edge.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	3	1	2	4
(d)	2	3	1	4.

2.248. Match List I with List II and select a suitable answer using the codes given below the lists :

List I	*List II*
A. Stretcher bond	1. the bond containing alternate course of stretchers and headers
B. Header bond	2. the bond containing alternately stretchers and headers in each course
C. English bond	3. the bond containing all stretchers
D. Double flemish bond	4. the bond containing all headers.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	3	1	4	2
(d)	4	3	2	1.

2.249. In English garden wall bond
(a) one course of headers to three or five course of stretchers
(b) queen closer in provided in each heading course
(c) the middle course of stretchers is started with a header to give proper vertical joints
(d) all the above.

2.250. Dutch bond is a modification of
(a) English bond (b) stretcher bond
(c) header bond (d) single Flemish bond.

2.251. Match List I with List II and select correct answer by using the codes given below the lists :

List I	*List II*
A. Herring bone bond	1. each course consists of one header to three or five stretchers
B. Diagonal bond	2. a modified form of English band
C. Dutch bond	3. bricks placed at an angle of 45° from the central line in both directions
D. Flemish garden wall band	4. bond is useful for walls which are 2 to 4 brick thick.

Codes :

	A	B	C	D
(a)	1	3	4	2
(b)	2	4	3	1
(c)	1	3	2	4
(d)	3	4	2	1.

2.252. Which one of the following activities is not correct as applicable to brick corbels
(a) the maximum projection of the corbel should not be more than the thickness of the wall
(b) the maximum projection of each corbel course should be limited to a quarter brick at a time
(c) the discontinuous corbels are used to carry heavy concentrated loads
(d) stretcher bond is generally used for the construction of brick corbel.

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2.253. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Granite	1. Metamorphic rock made from lime stone
B. Marble	2. Sedimentary rock and contains lime, silica, magnesia, alumina, etc.
C. Lime stone	3. very tough and hard stone
D. Sand stone	4. calcarious rock and contains carbonate of lime.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	4	2
(c)	2	3	1	4
(d)	4	2	2	1.

2.254. Which one of the following rocks is used for monumental buildings :
(a) granite (b) marble
(c) sand stone (d) slate.

2.255. Slate
(a) is a metamorphic rock
(b) splits into thin sheets along its bedding planes
(c) has a smooth surface and contains alumina and silica
(d) possesses good water absorption capacity
(e) is found in many colours.

2.256. Match List I with List II a select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Cracking	1. Making the background rough to have suitable key for plastering
B. Crazing	2. Appearance of one or more small local swellings in the finished plaster
C. Blistering	3. Development of fissures in the plaster
D. Hacking	4. Appearance of a series of haphazard hair cracks in the finished plaster

Codes :

	A	B	C	D
(a)	1	4	3	2
(b)	4	2	3	1
(c)	3	4	2	1
(d)	2	1	4	3.

2.257. Pick up the correct statement from the following :
(a) the first coat of stucco plaster is called scratch coat
(b) the second coat of stucco plaster is called brown coat
(c) the third coat of stucco plaster is called white coat
(d) all the above.

2.258. The X-ray rooms are plastered with
(a) Plaster of Paris (b) Barium plaster
(c) Martin's cement (d) Keen's cement.

2.259. Pick up the correct statements from the following :
(a) cracks appear on the plastered surface in the form of hair cracks
(b) in brick work, the efflorescence is removed by applying a solution of zinc sulphate and water
(c) excessive thermal variations in the backing or plaster causes the plaster to fall
(d) all the above.

2.260. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Pointing)	*List II (Surface of pointing)*
A. Flush pointig	1. a lime projection of mm in the 5 mm x 3 mm grove
B. Recessed pointing	2. top of the horizontal joints is pressed back by 3 to 6 mm
C. Struck pointing	3. the joint is made flash with the edges of bricks
D. Tuck pointing	4. the face of the pointing is vertical but pressed inside the wall.

Codes :

	A	B	C	D
(a)	2	3	1	4
(b)	3	4	2	1
(c)	4	1	3	2
(d)	1	2	4	3.

2.261. The width of the hollow space between two walls of a cavity wall should not exceed
(a) 5 cm (b) 7.5 cm
(c) 10 cm (d) 15 cm.

2.262. An ordinary concrete may be made water proof by adding
(a) pudlo (b) impermo
(c) snowcem (d) cico
(e) all of these.

2.263. Which of the following metal sheets is most effective in preventing dampness ?

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(a) Copper sheets (b) lead sheets
(c) aluminium sheets (d) all the above.

2.264. The columns of multi-storeyed buildings are designed to withstand the forces due to
(a) dead loads (b) live loads
(c) wind loads (d) earthquakes
(e) all of these.

2.265. Pick up the correct statement from the following :
(a) the roof slabs of multi-storeyed buildings are constructed monolithically to carry the various floor loads
(b) the beams of multi-storeyed buildings rest on girders and are the main load transferring members to the columns
(c) the slab is spanned across the secondary beams provided between the main beams
(d) All of these.

2.266. Vertical construction joints are provided where the shearing forces are minimum in the case of
(a) slabs (b) beams
(c) girders (d) all of these.

2.267. In case of multi-storeyed buildings, the forms to be removed first are
(a) sides of beams and girders
(b) column forms
(c) bottom of beams and girders
(d) all the above at the same time.

2.268. A concrete structure is set on fire and the temperature raises to 1000°C. The strength of concrete as compared to original strength reduces to
(a) 10% (b) 15%
(c) 20% (d) 25%.

2.269. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Sluice valves	1. are provided at all peaks in water supply
B. Air valves	2. help to repair the water mains
C. Wash out valves	3. is screwed into mains to provide supply of water to the building
D. Ferule	4. are provided at low points between peaks.

Codes :

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	3	4
(c)	1	4	3	2
(d)	4	3	1	2.

2.270. According to National Building Code, the hydrants in water mains is provided at minimum interval of
(a) 50 m (b) 60 m
(c) 75 m (d) 90 m.

2.271. Assertion : The most important aspect of planning one room single storey quarters, is their orientation.
Reason : The wrongly oriented small rooms with thin walls and low roofs become ovens for four months in a year.

2.272. Assertion : The height of the plinth, of the house should not be reduced to less than 0.6 metre.
Reason : A high plinth of the building contributes to preserve both sanitation and health of the family.

2.273. Assertion : The permeability of clay is very low.
Reason : Very limited spaces in between the particles does not allow water to pass through clay.

2.274. Assertion : For the foundation of important structure placed on a fairly homogeneous layer of clay, thorough soil testing must be done by experts.
Reason : The test results of soil investigations help to allow accurate prediction of time rate of settlement and total settlement.

2.275. Assertion : The size of the area occupied by the group does not matter.
Reason : Each building settles almost independently because the compressibility of sand strata decreases rapidly with increasing depth.

2.276. Assertion : The method of wash boring of site exploration does not obstruct ground water observations.
Reason : This method does not cause sealing of the bottom of the hole.

2.277. Assertion : The providing of a raft foundation is the only solution in highly compressible soils.
Reason : In highly compressible soils the settlements under individual footings are quite high.

2.278. Assertion. In black cotton soil and other expansive type of soils, buildings often crack due to relative ground movements.
Reason : The relative ground movement is caused by alternate swelling and shrinkage of the soil due to changes in its moisture content.

2.279. Assertion : The load distribution on thick walls constructed with facing bond is not uniform and unequal settlement of the wall causes.
Reason : The number of joints in the backing and facing differs considerably in facing bond.

2.280. Assertion : Construction of brick works with dry bricks and using cement mortar is dangerous.
Reason : Dry bricks absorb water from the mortar. Enough water required for setting of the cement mortar is not available.

2.281. Assertion : All the walls should be uniformly by raised and it should be ensured that the difference in level between two walls in the building is not more than one metre.
Reason : It is essential to avoid unequal settlement.

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2.282. Assertion : The Plaster of Paris should not be used in external works.

Reason : The Plaster of Paris is soluble in water.

2.283. Assertion : Windows are sometimes built into one side of tall column forms to allow the placing of concrete in the bottom half of the form.

Reason : It eliminates the chances to drop the concrete mix from the top which may otherwise cause segregation.

2.284. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Detached houses	1. Provides living spaces at two or more levels
B. Terrace houses	2. Dwelling divided horizontally from another dwelling
C. Flats	3. A house in a continuous row of three or more houses
D. Duplex appartments	4. A house setting aloof from the other buildings

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	1	4	3	2
(c)	4	3	1	2
(d)	4	3	2	1

2.285. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Boulder	1. Particle size varies between 2 to 20 mm
B. Gravel	2. Particle size varies between 0.06 to 2 mm
C. Sand	3. Particle size varies between 0.002 to 0.06 mm
D. Silt	4. Particle size is less than 0.002 mm
E. Clay	5. Rock pieces greater than 20 mm particle size.

Codes:

	A	B	C	D	E
(a)	5	1	2	3	4
(b)	1	2	3	4	5
(c)	3	2	5	4	1
(d)	1	4	3	2	5
(e)	2	5	1	4	3

2.286. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Isolated footing	1. For two or more columns in a row
B. Cantilever footing	2. For two or more than two columns
C. Combined footing	3. For eccentric footing and concentric footing of two columns
D. Continuous footing	4. For individual columns

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	4	3	2	1
(d)	1	2	4	3

2.287. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Bearing pile	1. An inclined pile
B. Battered pile	2. A timber pile
C. Sheet pile	3. Transfers superimposed loads to the hard strata
D. Under-ream pile	4. Pile contains one or two bulbs in its vertical shaft

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	4	2	3	1
(d)	3	2	1	4

2.288. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Simplex pile	1. contains corrugations on the vertical stem of the pile
B. Franki pile	2. suitable for machine foundations
C. Pedastal pile	3. contains a pedastal at the bottom end
D. Under-reamed pile	4. at the bottom end of hollow cylindrical steel casing one pointed cast iron shoe is attached.

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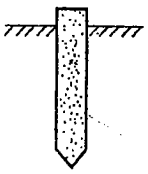
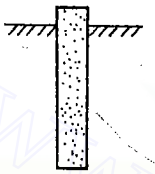
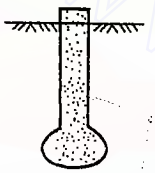
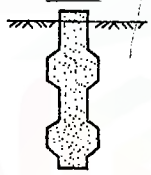
Codes.

	A	B	C	D
(a)	4	3	2	1
(b)	4	1	3	2
(c)	1	2	3	4
(d)	1	4	2	3

2.289. Match list I with *List II* and select the correct answer by using codes given below the lists :

List I	*List II*
A. 	1. Under reamed pile
B. 	2. simplex pile
C. 	3. pressure pile
D. 	4. pedastal pile

Codes :

	A	B	C	D
(a)	1	3	2	4
(b)	2	3	4	1
(c)	4	1	2	3
(d)	2	4	1	3

2.290. Consider the following statements :

A. In black cotton soils, buildings often crack due to relative ground movements

R. This is caused by alternate swelling and shrinkage of the soil due to change in temperature.

Of these statements :

(a) Both are false

(b) Both are true

(c) A is true and R is false

(d) A is false and R is true.

2.291. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Sand piles	1. get damaged during transformations
B. Precast concrete pile	2. unsuitable i earthquake region
C. Cast-in-situ concrete pile	3. deteriorate by the a tion of water
D. Timber piles	4. cannot be co structed unde water.

Codes :

	A	B	C	D
(a)	1	2	4	3
(b)	3	1	4	2
(c)	2	1	4	3
(d)	1	3	2	4

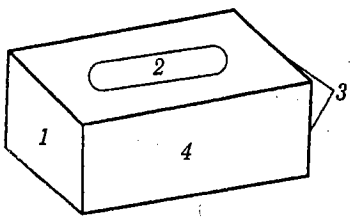
2.292. Match list I with List II and select the correct answ by using codes given below the lists :

List I	*List II*
A. Bed	1. Side surface of t brick
B. Header	2. End surface of t brick
C. Stretcher	3. Bottom surface of t brick
D. Frog	4. Depression provid in the top face of t brick

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	2	1	3	4
(d)	3	2	1	4

2.293. The various portions of a brick are shown in the fig and are marked as under :



1. Frog
2. Header
3. Arris
4. Stretcher

Choose the answer from the codes given below :

Codes:

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	2	3	4

2.294. Match list I with List II and select the correct ans by using codes given below the lists :

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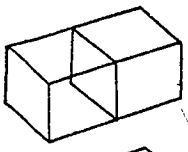
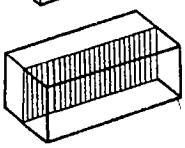
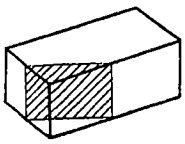
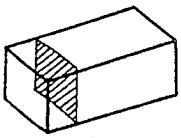
List I		*List II*
A.		1. King closer
B.		2. Half bat
C.		3. Queen closer
D.		4. Three quarter bat

Codes :

	A	B	C	D
(a)	2	3	1	4
(b)	1	2	3	4
(c)	3	1	4	2
(d)	2	4	3	1

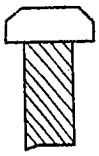
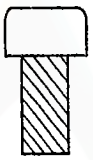
2.295. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Stretcher-bond	1. The bond containing bricks laid with towards the face of wall headers
B. Header bond	2. The bond containing alternate courses of stretchers and headers
C. English bond	3. The bond containing bricks laid with their length in the longitudinal direction of the wall.
D. Double Flemish bond	4. The bond containing alternatively stretchers and headers in each course.

Codes :

	A	B	C	D
(a)	3	1	2	4
(b)	1	3	2	4
(c)	4	3	2	1
(d)	1	2	4	3

2.296. Match list I with List II and select the correct answer by using codes given below the lists :

List I		*List II*
A.		1. Saddle back coping
B.		2. $\frac{1}{4}$ round coping
C.		3. Chamfered coping
D.		4. Bullnose coping

Codes

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	2	1	4	3
(d)	1	2	3	4

2.297. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Brick copings	1. In the bottom of windows opening projecting the external wall
B. Brick sills	2. Projecting bricks from a wall to support beams
C. Brick corbels	3. To spread mortar
D. Towels	4. On the top of parapet walls

Codes:

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	4	3
(c)	3	4	1	2
(d)	1	2	3	4

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2.298. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Defect in stone)	*List II (Appearances)*
A. Vents	1. very fine cracks
B. Mottle	2. small fossils
C. Shakes	3. chalky substances in stone
D. Shabby bars	4. smoke fissures in the stone

Codes.

	A	B	C	D
(a)	4	3	1	2
(b)	1	2	3	4
(c)	1	4	3	2
(d)	2	3	4	1

2.299. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Cramp	1. moulded course of stone placed at the top of wall
B. Cronice	2. stone piece projecting beyond wall to support beam
C. Crobel	3. metal connection used in stone masonry construction
D. Through stone	4. the stone extending through the entire thickness of wall

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	4	2	3	1
(d)	4	1	2	3

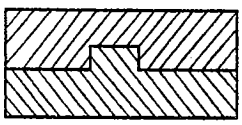
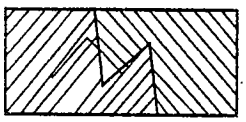
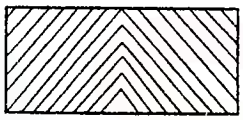
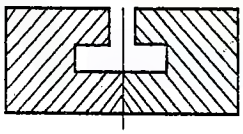
2.300. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Reveals	1. a cut provided in the underside of coping surface
B. Stoolings	2. The exposed vertical surface perpendicular to door or windows
C. Mullions	3. Horizontal seatings to receive jambs
D. Throating	4. Large vertical division of windows

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	4	2	3	1
(d)	4	1	2	3

2.301. Match list I with List II and select the correct answer by using codes given below the lists :

List I		*List II*
A.		1. Rebated joint
B.		2. Tabled joint
C.		3. Plugged joint
D.		4. Butt joint

Codes:

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	4	3	2

2.302. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Ashlar rough tooled masonry	1. The edges round the exposed face of stone are bevelled at 450
B. Ashlar quarry faced masonry	2. the stone blocks are finely dressed on all sides
C. Ashlar fine masonry	3. The exposed face of the facing stone between the chisel drafting all round are left undressed

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D. Ashlar chamfered masonry — 4. The bed and sides of the stone block are finely chisel dressed and exposed faces of stone have fine dressed chisel drafting.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	4	3	2	1
(d)	1	3	4	2

2.303. Match list I withList IIand select thecorrect answerby using codes given below the lists :

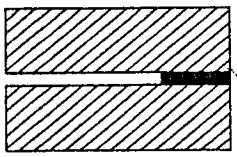
List I	*List II*
A. Cracking	1. Haphazard hair cracks in finished plaster surface
B. Blistering	2. Swellings on the finished plaster surface
C. Crazing	3. Patches created by falling of plaster
D. Flanking	4. Development of fissures in plaster

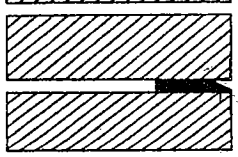
Codes :

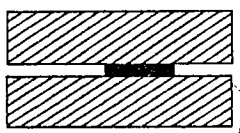
	A	B	C	D
(a)	4	2	1	3
(c)	1	2	3	4
(c)	3	2	4	1
(d)	1	3	4	2

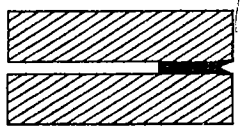
2.304. Match list I with List II and select the correct answer by using codes given below the lists :

List I — *List II*

A.  1. V-groov pointing

B.  2. Flush pointing

C.  3. Struck pointing

D.  4. Recessed pointing

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	4	2	1	3
(d)	3	1	4	2

2.305. Consider the following statements :

A. Small performations are made at the top and the bottom of the cavity wall

R. These enhance the bearing capacity of the cavity wall.

Of these statements:

(a) Both A and R are true
(b) Both A and R are false
(c) A is true and R is false
(d) A is false and R is true.

2.306. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Voussoirs	1. The topmost point of the arch
B. Crown	2. Inner surface of the arch
C. Soffit	3. Wedged shaped masonry units used in areches
D. Intrados	4. The inner curve of the arch

Codes :

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	4	3	1	2
(d)	2	1	3	4

2.307. Match list I withList II and select thecorrect answer by using codes given below the lists :

List I	*List II*
A. Springer	1. The triangular space between the extrados and the horizontal tangent line to crowns
B. Spandril	2. The vertical distance between highest part on intrados and springer
C. Rise	3. The first voussoir adjacent to the skew back of the arch
D. Extrados	4. The external curve of the arch

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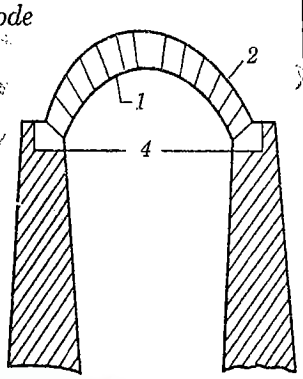
Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	2	1	4
(d)	4	1	3	2

2.308. The various parts of the arch are shown in the figure. Their coded descriptions are :

Part	*Code*
Span	1
Extrados	2
Intrados	3
Crown	4



Of these, the following are true.

Codes:
(a) 4, 3, 2, 1
(b) 1, 2, 3, 4
(c) 4, 2, 1, 3
(d) 3, 1, 2, 4

2.309. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Horse-shoe arch	1. semi-circular arch with two vertical members
B. Segmental arch	2. An arch of a part of a circle which
C. Blunt arch	3. An arch having a segment of a circle with its centre below the springing line
D. Stilted arch	4. A two centred arch

List I

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	1	3	4	2
(d)	3	2	1	4

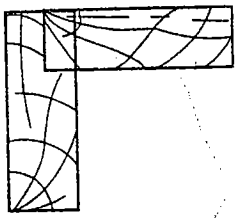
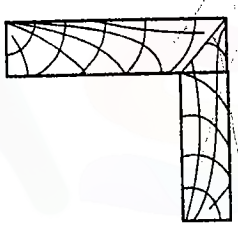
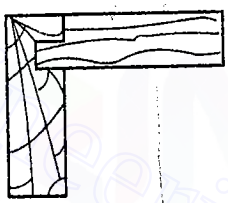
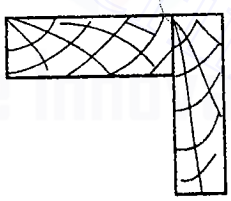
2.310. Match list I with List II and select the List I correct answer by using codes given below the lists :

List I	*List II*
A. Chamfer	1. Joining the two timber pieces at an angle
B. Mitring	2. A rectangular grove along the edge of a timber member
C. Rebate	3. A wooden penal provided on the masonry wall for a height of 60 cm above floor
D. Wain-scot	4. The edge of timber plained off at an angle of 450

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	3	2	1	4
(d)	4	1	3	2

2.311. Match list I with List II and select the correct answer by using codes given below the lists ;

List I	*List II*
A. 	1. Butt joint
B. 	2. Groove and tongued joint
C. 	3. Rebated joint
D. 	4. Mitre joint

Codes:

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	3	4
(c)	3	4	2	1
(d)	1	4	3	2

2.312. Match list I with List II and select the correct answe by using codes given below the lists :

List I	*List II*
A. Revolving doors	1. For air conditioned buildings
B. Sliding doors	2. For garges and workshops

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C. Swinging doors — 3. For residential buildings

D. Folding doors — 4. For covering large opening

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	1	3	2	4
(c)	1	2	3	4
(d)	2	1	3	4

2.313. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Mullion	1. One bottom most horizontal member of the door frame
B. Lower	2. The vertical member running through a frame
C. Horn	3. The horizontal projection of sill or head
D. Still	4. The vertical face of the door which supports the frame
E. Jamb	5. The timber piece attached in inclined position of the frame

Codes :

	A	B	C	D	E
(a)	2	5	3	1	4
(b)	1	2	3	4	5
(c)	5	1	2	3	4
(d)	4	3	2	1	5
(e)	5	2	3	4	1

2.314. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Collapsible doors	1. Suitable for hospitals
B. Revolving doors	2. Suitable for dressing rooms
C. Lowered doors	3. Suitable for big hotels
D. Sash doors	4. Suitable for godowns

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	1	4	2
(d)	2	4	1	3

2.315. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Dormer windows	1. The window provided in the gable ends of inclined roof building
B. Louvered windows	2. The window provided on the inclined roofs of the building
C. Clerestorey windows	3. The window provided near the main roof
D. Gable window	4. The window which provides both privacy and ventilation

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	2	4	3	1
(d)	1	4	2	3

2.316. Match list I with List II and select the correct answer by using codes given below the tables : *List II*

List I	*List II*
A. Mosaic	1. are rubbed by carborandum
B. Terrazo floors	2. stones are rubbed by pumic stones
C. Asphalt floors	3. Vermin and water proof
D. Cork floor covering	4. Used in churches

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	2	1	3	4
(d)	1	2	4	3

2.317. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Newel post	1. The outer projection of a tread
B. Nosing	2. The sloping member to support the ends of steps
C. String	3. Vertical member placed at the end of the flights to join the ends of string and hand rail

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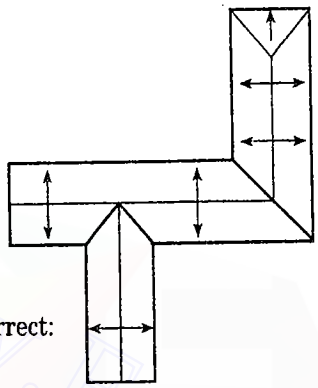
D. Baluster — 4. The vertical member placed between stringer and hand rail

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	2	1	4
(d)	3	2	4	3

2.318. The four portions of a roof (see figure) are listed below:



A. Hip 1

B. Valley..... 2

C. Gable end 3

D. Hipped end 4

Of these, the following are correct:

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	4	3	1	2
(d)	1	2	4	3

2.319. Match list I with List II and select the correct answer by using codes given below the lists :

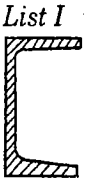
List I	*List II*
A. King post truss	1. Rise at the centre of the truss is not more than 1/8th of the span
B. Queen post truss	2. contains two vertical posts
C. Mansard truss	3. contains one vertical post
D. Bow string truss	4. A combination of king-post and queen-post trusses.

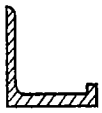
Codes :

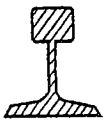
	A	B	C	D
(a)	3	2	4	1
(b)	1	2	3	4
(c)	3	4	1	2
(d)	1	2	4	3

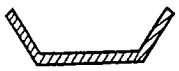
2.320. Match list I with List II and select the correct answer by using codes given below the lists :

List I — *List II*

A.  — 1. Bulb angle

B.  — 2. Channel section

C.  — 3. Trough section

D.  — 4. Rail section

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	1	4	3	2
(c)	2	1	4	3
(d)	3	4	1	2

2.321. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Underpinning	1. operation to prevent damaged structure due to foundation settlement
B. Scaffolding	2. providing platform for the convenience of workers
C. Shoring	3. Transverse piece which supports the wall at one end
D. Putlog	4. Operation of providing new permanent foundation

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	2	1	3
(c)	3	4	2	1
(d)	4	1	3	2

2.322. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Reverberation	1. The sound which remains in auditorium for prolonged time
B. Echo formation	2. The reflecting surfaces at a distance more than V.m produce

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C. Sound foci — 3. The interior concave surfaces produce this defect

D. Dead spot — 4. The place where sound intensity is least.

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	1	2	3	4
(d)	2	3	1	4

2.323. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Ferrules	1. used for 90° turn to the pipe
B. Elbows	2. used for water connection with municipal water mains
C. Hydrants	3. used for taking water for extinguishing fire
D. Sockets	4. used for lengthening the pipes

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	3	4
(c)	1	4	2	3
(d)	2	1	4	3

2.324. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. The minimum clear head room in any stair-case	1. 2.4 m
B. The height of basement	2. 2.2 m
C. The minimum height of loft from floorlevel to kitchen	3. 2.10 m
D. The minimum height of kitchen from floor level	4. 2.75m

Codes :

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	3	4
(c)	4	2	1	3
(d)	1	2	4	3

2.325. Rocks are generally classified :
(a) by geological consideration
(b) by physical consideration
(c) chemical consideration
(d) All the above considerations.

2.326. Plutonic rocks belong to :
(a) sedimentary rocks (b) metamorphic rocks
(c) igneous rocks (d) none of these.

2.327. Match List I with List II and select a correct answer by using the codes given below are lists.

List I	*List II (Formation)*
A. Plutonic rocks	1. By cooling of magma at shallow depth
B. Hypabyssal rocks	2. Weather soil at site
C. Volcanic rocks	3. By cooling of magma at considerable depth
D. Residual rocks	4. By cooling of magmat at earth's surface.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	3	1	4	2
(d)	4	3	2	1

2.328. Which one of the following agents is nor included in metamorphism
(a) heat (b) pressure
(c) weathering (d) chemicals.

2.329. The foliated structure is very common in the case of :
(a) sedimentary rocks (b) metamorphic rocks
(c) igneous rocks (d) all of the above.

2.330. Match List I with List II and select a suitable answer by using the codes given below the lists

List I (*Rocks*)	*List II* (*Chemical ingredient*)
A. Argillaceous	1. Calcium carbonate
B. Calcareous	2. Ferrous sulphate
C. Silicious	3. Silica
	4. Clay

Codes :

	A	B	C
(a)	1	2	3
(b)	4	1	3
(c)	3	4	2
(d)	2	3	1

2.331. Pick up the calcareous rock from the following :
(a) Slates (b) Granites
(c) Quartzites (d) Marbles.

2.332. Which one of the following rocks is a monomineralic

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rock :

(a) Quartz sand (b) Pure gypsum
(c) Magnesite (d) All the above.

2.333. The following rock forming minerals which are numbered can be arranged in decreasing order of hardness :

1. Hornblende (5–6)
2. Mica (2–3)
3. Quartz (7)
4. Calcite (3)
5. Gypsum (2)

	A	B	C	D	E
(a)	3	1	4	2	5
(b)	5	2	4	1	3
(c)	3	4	2	5	1
(d)	4	3	1	2	5

2.334. Pick up the correct statement from the following :

(a) The earthenware made from local clays and properly glazed with glazes containing galena, is called terra-cotta
(b) The articles prepared from clay which is brunt with required quantity of sand crushed pottery at low temperature and cooled down slowly, are called the earthen wares
(c) A fine earthenware which is white, thin and semi-transparent is called porcelain
(d) All the above.

2.335. Math List I with List II and select a correct answer by using the codes given below the lists :

List I (Earth constituent)	*List II (Property)*
A. Alumina	1. Prevents shrinkage of raw bricks
B. Silica	2. Imparts red colour
C. Lime	3. Plasticity
D. Oxide of iron	4. Prevents shrinkage
E. Magnesia	5. Prevents cracking.

Codes :

	A	B	C	D	E
(a)	1	2	3	4	5
(b)	3	5	1	2	4
(c)	3	1	4	3	2
(d)	4	3	2	1	3

2.336. The percentage of the ingredients of pure clay are :

(a) Alumina	10%
Silica	35%
Lime and magnesia	48%
Oxide of iron	3%
Alkalies	4%
(b) Alumina	27%
Silica	66%
Lime and magnesia	1%
Oxide of iron	1%
Organic matter	5%
(c) Alumina	34%
Silica	50%
Lime and magnesia	6%
Oxide of iron	8%
Organic matter	2%

(d) None of the above.

2.337. The following operations refer to the preparation clay:

1. Weathering
2. Tempering
3. Cleaning
4. Blending.

Their correct sequence is :

(a)	1	2	3	4
(b)	4	1	3	2
(c)	3	1	4	2
(d)	2	4	1	3

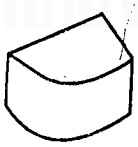
2.338. Match List I with List II and select a correct answer using the codes given below the lists :

List I (Shape) *List II (Name)*

A.
1. Half round brick

B.
2. Bull nose brick

C.
3. Chamberred brick

D. 
4. Saddle-back brick

Codes :

	A	B	C	D
(a)	1	3	4	2
(b)	4	2	3	4
(c)	3	4	1	2
(d)	2	1	3	4

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3

Surveying

3.1. The curvature of the earth's surface, is taken into account only if the extent of survey is more than
(a) 100 sq km (b) 160 sq km
(c) 200 sq km (d) 260 sq km.

3.2. The difference in the lengths of an arc and its subtended chord on the earth surface for a distance of 18.2 km, is only
(a) 1 cm (b) 5 cm
(c) 10 cm (d) 100 cm.

3.3. In geodetic surveys higher accuracy is achieved, if
(a) curvature of the earth surface is ignored
(b) curvature of the earth surface is taken into account
(c) angles between the curved lines are treated as plane angles
(d) none of these.

3.4. Hydrographic surveys deal with the mapping of
(a) large water bodies (b) heavenly bodies
(c) mountaineous region (d) canal system
(e) movement of clouds.

3.5. Surveys which are carried out to depict mountains, rivers, water bodies, wooded areas and other cultural details, are known as
(a) cadastral surveys (b) city surveys
(c) topographical surveys (d) guide map surveys
(e) plane surveys.

3.6. Surveys which are carried out to provide a national grid of control for preparation of accurate maps of large areas, are known
(a) plane surveys (b) geodetic surveys
(c) geographical surveys (d) topographical surveys.

3.7. The main principle of surveying is to work
(a) from part to the whole
(b) from whole to the part
(c) from higher level to the lower level
(d) from lower level to higher level.

3.8. Systematic errors are those errors
(a) which cannot be recognised
(b) whose character is understood
(c) whose effects are cumulative and can be eliminated
(d) none of these.

3.9. If the smallest division of a vernier is longer than the smallest division of its primary scale, the vernier is known as
(a) direct vernier (b) double vernier
(c) retrograde vernier (d) simple vernier.

3.10. The least count of a vernier scale is
(a) sum of the smallest divisions of main and vernier scales
(b) value of one division of the primary scale divided by total number of divisions of vernier scale
(c) value of one division of vernier scale divided by total number of divisions of primary scale
(d) none of these.

3.11. On a diagonal scale, it is possible to read up to
(a) one dimension (b) two dimensions
(c) three dimensions (d) four dimensions.

3.12. In case of a direct vernier scale
(a) graduations increase in opposite direction in which graduations of the main scale increase
(b) smallest division is longer than smallest division of the main scale
(c) graduations increase in the same direction in which graduations of the main scale increase
(d) none of these.

3.13. Short offsets are measured with
(a) an ordinary chain (b) an invar tape
(c) a metallic tape (d) a steel tape.

3.14. Greater accuracy in linear measurements, is obtained by
(a) tacheometry (b) direct chaining
(c) direct taping (d) all the above.

3.15. It is more difficult to obtain good results while measuring horizontal distance by stepping
(a) up-hill (b) down-hill
(c) in low undulations (d) in plane areas.

3.16. The distance between steps for measuring down hill to obtain better accuracy
(a) decreases with decrease of slope
(b) increases with increase of slope
(c) decreases with increase of slope
(d) decreases with decrease of weight of the chain.

3.17. The correction to be applied to each 30 metre chain length along $\theta°$ slope, is
(a) 30 (sec θ – 1) m (b) 30 (sin θ – 1) m
(c) 30 (cos θ – 1) m (d) 30 (tan θ – 1) m
(e) 30 (cot θ – 1) m.

3.18. The slope correction for a length of 30 m along a gradient of 1 in 20, is
(a) 3.75 cm (b) 0.375 cm
(c) 37.5 cm (d) 2.75 cm.

3.19. Correct distance obtained by an erroneous chain is :

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(a) $\frac{\text{Erroneous chain length}}{\text{Correct chain length}} \times \text{Observed distance}$

(b) $\frac{\text{Correct chain length}}{\text{Erroneous chain length}} \times \text{Observed distance}$

(c) $\frac{\text{Correct chain length}}{\text{Observed distance}} \times \text{Erroneous chain length}$

(d) none of these.

3.20. If a 30 m chain diverges through a perpendicular distance d from its correct alignment, the error in length, is

(a) $\frac{d^2}{60}$ m (b) $\frac{d^2}{30}$ m

(c) $\frac{d^2}{40}$ m (d) $\frac{d}{30}$ m

(e) $\frac{d}{20}$ m.

3.21. If h is the difference in height between end points of a chain of length l, the required slope correction is

(a) $\frac{h^2}{2l}$ (b) $\frac{h}{2l}$

(c) $\frac{h^2}{l}$ (d) $\frac{h^2}{2l}$.

3.22. If the length of a chain line along a slope of $\theta°$ is l, the required slope correction is

(a) $2l \cos^2 \theta/2$ (b) $2l \sin^2 \theta/2$

(c) $l \tan^2 \theta/2$ (d) $l \cos^2 \theta/2$.

3.23. A tape of length l and weight W kg/m is suspended at its ends with a pull of P kg, the sag correction is

(a) $\frac{l^3W^2}{24P^2}$ (b) $\frac{l^2W^3}{24P^2}$

(c) $\frac{l^2W^2}{24P^3}$ (d) $\frac{lW^2}{24P}$.

3.24. Correction per chain length of 100 links along a slope of $\alpha°$ is

(a) $\frac{1.5\alpha^2}{100}$ (b) $\frac{1.5\alpha}{100}$

(c) $\frac{1.5\alpha^3}{100}$ (d) $1.5\alpha^3$.

3.25. Correction per chain length of 100 links along a slope of α radians, is

(a) $100\ \alpha^2$ (b) $100\ \alpha$

(c) $100\ \alpha^3$ (d) $100\ \alpha^{-1}$.

3.26. Correction per chain length of 100 links along a slope having a rise of 1 unit in n horizontal units, is

(a) $\frac{100}{n^2}$ (b) $100\ n^2$

(c) $\frac{100}{n^3}$ (d) $\frac{100}{n}$.

3.27. Accidental or compensating errors of length L are proportional to

(a) L (b) $\sqrt{L}$

(c) $\sqrt[3]{L}$ (d) $\frac{1}{\sqrt{L}}$.

3.28. While measuring a chain line between two stations A and B intervened by a raised ground

(a) vision gets obstructed

(b) chaining gets obstructed

(c) both vision and chaining get obstructed

(d) all the above.

3.29. Prolongation of chain line across an obstruction in chain surveying, is done by

(a) making angular measurements

(b) drawing perpendiculars with a chain

(c) solution of triangles

(d) all the above.

3.30. In chain surveying tie lines are primarily provided

(a) to check the accuracy of the survey

(b) to take offsets for detail survey

(c) to avoid long offsets from chain lines

(d) to increase the number of chain lines.

3.31. In chain surveying field work is limited to

(a) linear measurements only

(b) angular measurements only

(c) both linear and angular measurements

(d) all the above.

3.32. Check lines (or proof lines) in Chain Surveying, are essentially required

(a) to plot the chain lines

(b) to plot the offsets

(c) to indicate the accuracy of the survey work

(d) to increase the out-turn

3.33. A well conditioned triangle has no angle less than

(a) 20° (b) 30°

(c) 45° (d) 60°.

3.34. The accuracy of measurement in chain surveying, does not depend upon

(a) length of the offset (b) scale of the plotting

(c) importance of the features

(d) general layout of the chain lines.

3.35. The limiting length of an offset does not depend upon

(a) accuracy of the work

(b) method of setting out perpendiculars

(c) scale of plotting

(d) indefinite features to be surveyed.

3.36. Chain surveying is well adopted for

(a) small areas in open ground

(b) small areas with crowded details

(c) large areas with simple details

(d) large areas with difficult details.

3.37. The angle between two plane mirrors of optical square, is

(a) 20° (b) 30°

(c) 45° (d) 60°

(e) 90°.

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3.38. An angles of 45° with a chain line may be set out with
(a) optical square (b) open cross staff
(c) Fench cross staff (d) prismatic square.

3.39. For taking offsets with an optical square on the right hand side of the chain line, it is held
(a) by right hand upside down (b) by left hand upright
(c) by right hand upright
(d) by left hand up side down.

3.40. If the chain line which runs along N-S direction is horizontal and the ground in E-W direction is sloping
(a) it is possible to set offsets correctly on east side
(b) it is possible to set offsets correctly on east side
(c) it is not possible to set offsets correctly on west side
(d) it is possible to set offsets correctly on both sides.

3.41. Perpendicularity of an offset may be judged by eye, if the length of the offset is
(a) 5 m (b) 10 m
(c) 15 m (d) 20 m.

3.42. The construction of optical square is based, on the principle of optical
(a) reflection (b) refraction
(c) double refraction (d) double reflection.

3.43. The conventional sign shown in Fig. 3.1 represents a
(a) road bridge
(b) railway bridge
(c) canal bridge
(d) aquaduct.

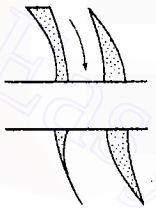
Fig. 3.1.

3.44. is the conventional sign of
(a) temple (b) mosque
(c) idgah (d) church
(e) fort.

3.45. The conventional sign shown in Fig. 3.2 represents a
(a) bridge carrying railway below road
(b) bridge carrying road below railway
(c) bridge carrying road and railway at the same level

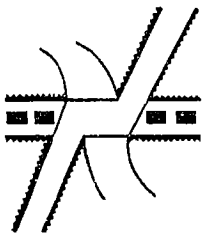
Fig. 3.2.

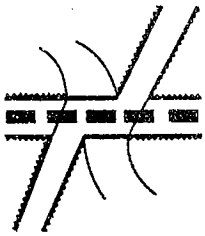
Fig. 3.3.

(d) a level crossing.

3.46. The conventional sign shown in Fig. 3.3 represents a
(a) bridge carrying railway below road
(b) bridge carrying road below railway
(c) bridge carrying road and railway at the same level
(d) a level crossing.

3.47. is a conventional sign of
(a) mosque (b) temple
(c) church (d) idgah.

3.48. The surface of zero elevation around the earth, which is slightly irregular and curved, is known as
(a) mean sea level (b) geoid surface
(c) level surface (d) horizontal surface.

3.49. Determining the difference in elevation between two points on the surface of the earth, is known as
(a) levelling (b) simple levelling
(c) differential levelling (d) longitudinal levelling.

3.50. When the bubble of the level tube of a level, remains central
(a) line of sight is horizontal
(b) axis of the telescope is horizontal
(c) line of collimation is horizontal
(d) geometrical axis of the telescope is horizontal.

3.51. In an adjusted level, when the bubble is central, the axis of the bubble tube becomes parallel to
(a) line of sight (b) line of collimation
(c) axis of the telescope (d) None of these.

3.52. The imaginary line passing through the intersection of cross hairs and the optical centre of the objective, is known as
(a) line of sight (b) line of collimation
(c) axis of the telescope (d) none of these.

3.53. Cross hairs in surveying telescopes, are fitted
(a) in the objective glass
(b) at the centre of the telescope
(c) at the optical centre of the eye piece
(d) in front of the eye piece.

3.54. The real image of an object formed by the objective, must lie
(a) in the plane of cross hairs
(b) at the centre of the telescope
(c) at the optical centre of the eye-piece
(d) anywhere inside the telescope.

3.55. An internal focussing type surveying telescope, may be focussed by the movement of
(a) objective glass of the telescope
(b) convex-lens in the telescope
(c) concave lens in the telescope
(d) plano-convex lens in the telescope.

3.56. The tangent to the liquid surface in a level tube, is parallel to the axis of the level tube at
(a) every point of the bubble
(b) either end of the bubble
(c) the mid-point of the bubble
(d) no where.

3.57. The sensitiveness of a level tube decreases if
(a) radius of curvature of its inner surface is increased
(b) diameter of the tube is increased
(c) length of the vapour bubble is increased
(d) both viscosity and surface tension are increased.

3.58. In a constant level tube, size of the bubble remains constant because upper wall is
(a) of relatively larger radius
(b) of relatively smaller radius

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(c) flat
(d) convex downwards.

3.59. The line normal to the plumb line is known as
(a) horizontal line (b) level line
(c) datum line (d) vertical line.

3.60. In levelling operation,
(a) The first sight on any change point is a back sight
(b) The second sight on any change point is a fore sight
(c) The line commences with a fore sight and closes with a back sight
(d) The line commences with a back sight and closes with a foresight.

3.61. A relatively fixed point of known elevation above datum, is called
(a) bench mark (b) datum point
(c) reduced level (d) reference point.

3.62. The rise and fall method of reduction of levels, provides a check on
(a) back sights (b) fore sights
(c) intermediate sights (d) all of these.

3.63. The line of collimation method of reduction of levels, does not provide a check on
(a) intermediate sights (b) fore sights
(c) back sights (d) reduced levels.

3.64. During levelling if back sight is more than foresight
(a) The forward staff is at lower point
(b) The back staff is at lower point
(c) The difference in level, cannot be ascertained.
(d) none of these.

3.65. The back staff reading on a B.M. of R.L. 500.000 m is 2.685 m. If foresight reading on a point is 1.345 m, the reduced level of the point, is
(a) 502.685 m (b) 501.345 m
(c) 501.340 m (d) 504.030 m
(e) 502.585 m.

3.66. In reciprocal levelling, the error which is not completely eliminated, is due to
(a) earth's curvature
(b) non-adjustment of line of collimation
(c) refraction
(d) non-adjustment of the bubble tube.

3.67. For true difference in elevations between two points A and B, the level must be set up
(a) at any point between A and B
(b) at the exact mid point of A and B
(c) near the point A
(d) near the point B.

3.68. Let angular value of one graduation of a tube of length x be ϕ seconds and R be the radius of its internal curved surface, then
(a) $\phi = \dfrac{x}{206265\,R}$ (b) $\phi = \dfrac{R}{206265\,x}$
(c) $\phi = \dfrac{206265}{x.R}$ (d) $\phi = \dfrac{x.R}{206265}$.

3.69. While viewing through a level telescope and moving the eye slightly, a relative movement occurs between the image of the levelling staff and the cross hairs. The instrument is
(a) correctly focussed
(b) not correctly focussed
(c) said to have parallax
(d) free from parallax.

3.70. Diaphragm of a surveying telescope is held inside
(a) eye-piece
(b) objective
(c) telescope tube at its mid point
(d) telescope at the end nearer the eye-piece
(e) telescope at its end nearer the objective.

3.71. A dumpy level is set up with its eye-piece vertically over a peg A. The height from the top of peg A to the centre of the eye-piece is 1.540 m and the reading on peg B is 0.705 m. The level is then setup over B. The height of the eye-piece above peg B is 1.490 m and a reading on A is 2.195 m. The difference in level between A and B is
(a) 2.900 m (b) 3.030 m
(c) 0.770 m (d) 0.785 m
(e) 1.770 m.

3.72. In levelling operation
(a) if second reading is more than first, it represents a rise
(b) if first reading is more than second, it represents a rise
(c) if first reading is less than second, it represents a fall
(d) if second reading is less than first, it represents a fall
(e) both (b) and (c).

3.73. For the construction of highway (or railway)
(a) longitudinal sections are required
(b) cross sections are required
(c) both longitudinal and cross sections are required
(d) none of these.

3.74. An imaginary line joining the points of equal elevation on the surface of the earth, represents
(a) contour surface (b) contour gradient
(c) contour line (d) level line
(e) none of these.

3.75. The boundary of water of a still lake, represents
(a) level surface (b) horizontal surface
(c) contour line (d) a concave surface.

3.76. The constant vertical distance between two adjacent contours, is called
(a) horizontal interval (b) horizontal equivalent
(c) vertical equivalent (d) contour interval
(e) contour gradient.

3.77. The contour interval is kept inversely proportional to
(a) time and expense of field work
(b) steepness of the configuration of the area
(c) scale of the map
(d) all the above.

3.78. The representation of general topography of a very flat terrain is possible only
(a) by drawing contours at large interval
(b) by drawing contours at small interval

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(c) by giving spot levels at large interval
(d) by giving spot levels to salient features at close interval.

3.79. Contour interval, within the limits of a map
(a) may be kept constant
(b) may not be kept constant
(c) must be kept constant
(d) may vary according to the configuration.

3.80. The direction of steepest slope on a contour, is
(a) along the contour
(b) at an angle of 45° to the contour
(c) at right angles to the contour
(d) none of these.

3.81. Straight, parallel and widely spaced contours represent
(a) a steep surface (b) a flat surface
(c) an inclined plane surface (c) curved surface.

3.82. Two contour lines, having the same elevation
(a) cannot cross each other (b) can cross each other
(c) cannot unite together (d) can unite together.

3.83. Contours of different elevations may cross each other only in the case of
(a) an over hanging cliff (b) a vertical cliff
(c) a saddle (d) an inclined plane.

3.84. Closed contours of decreasing values towards their centre, represent
(a) a hill (b) a depression
(c) a saddle or pass (d) a river bed.

3.85. The angle of intersection of a contour and a ridge line, is
(a) 30° (b) 45°
(c) 60° (d) 90°

3.86. In case of a double line river, contours are
(a) stopped at the banks of the river
(b) stopped at the edge of the river
(c) drawn across the water
(d) drawn by parabolic curves having their vertex at the centre of the water.

3.87. An imaginary line lying throughout on the surface of the earth and preserving a constant inclination to the horizontal, is called
(a) contour line (b) contour gradient
(c) level line (d) line of gentle scope.

3.88. From any point on the surface with a given inclination
(a) only one contour gradient is possible
(b) two contour gradients are possible
(c) indefinite contour gradients are possible
(d) all the above.

3.89. Location of contour gradient for a highway is best set out from
(a) ridge down the hill (b) saddle down the hill
(c) bottom to the ridge (d) bottom to the saddle.

3.90. Deviation of the actual road gradient from the proposed contour gradient up hill side, involves
(a) embankment on the centre line
(b) excavation on the centre line
(c) earth work on the centre line
(d) none of these.

3.91. Two hill tops A and B 20 km apart are intervened by a third top C. If the top most contour of the three hill tops are of the same value, state whether the line of sight AB
(a) passes clear of hill top C
(b) passes below the hill top C
(c) grazes the hill top C
(d) none of these.

3.92. The best method of interpolation of contours, is by
(a) estimation (b) graphical means
(c) computation (d) all of these.

3.93. For preparation of a contour plan for a route survey
(a) method of squares is used
(b) method of trace contour is used
(c) method of cross profile is used
(d) indirect method of contouring is used.

3.94. Accuracy of elevation of various points obtained from contour map is limited to
(a) $\frac{1}{2}$ of the contour interval
(b) $\frac{1}{4}$ th of the contour interval
(c) $\frac{1}{3}$ rd of the contour interval
(d) $\frac{1}{5}$ th of the contour interval.

3.95. While surveying a plot of land by plane tabling, the field observations
(a) and plotting proceed simultaneously
(b) and plotting do not proceed simultaneously
(c) and recorded in field books to be plotted later
(d) all the above.

3.96. The instrument which is used in plane tabling for obtaining horizontal and vertical distances directly without resorting to chaining, is known as
(a) Plane alidade (b) telescopic alidade
(c) clinometer (d) tacheometer.

3.97. The operation of revolving a plane table about its vertical axis so that all lines on the sheet become parallel to corresponding lines on the ground, is known
(a) levelling (b) centering
(c) orientation (d) setting.

3.98. In setting up a plane table at any station
(a) levelling is done first
(b) centering is done first
(c) both levelling and centering are done simultaneously
(d) orientation is done first.

3.99. Plotting of inaccessible points on a plane table, is done by
(a) intersection (b) traversing
(c) radiation (d) none of these.

3.100. Locating the position of a plane table station with reference to three known points, is known as
(a) intersection method (b) radiation method
(c) resection method (d) three point problem.

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3.101. The 'fix' of a plane table from three known points, is good, if
(a) middle station is nearest
(b) middle station is farthest
(c) either the right or left station is nearest
(d) none of these.

3.102. The 'fix' of a plane table station with three known points, is bad if the plane table station lies
(a) in the great triangle
(b) outside the great triangle
(c) on the circumference of the circumscribing circle
(d) none of these.

3.103. One of the Lehmann's rules of plane tabling, is
(a) location of the instrument station is always distant from each of the three rays from the known points in proportion to their distances
(b) when looking in the direction of each of the given points, the instrument station will be on the right side of one and left side of the other ray
(c) when the instrument station is outside the circumscribing circle its location is always on the opposite side of the ray to the most distant point as the inter-section of the other two rays
(d) none of these.

3.104. For orientation of a plane table with three points *A*, *B* and *C*, Bessel's drill is
(a) Align *b* through *a* and draw a ray towards *c*, align *a* through *b* and draw a ray towards *c*, finally align *c* through the point of intersection of the previously drawn rays
(b) Align *c* through *a* and draw a ray towards *b*, align *a* through *c* and draw a ray towards *b*, finally align *b* through the point of intersection of the previously drawn rays
(c) Align *c* through *b* and draw a ray towards *a*, align *b* through *c* and draw a ray towards *a*, finally align *a*, through the point of intersection of the previously, drawn rays
(d) In the first two steps any two of the points may be used and a ray drawn towards the third point, which is sighted through the point of intersection of previously drawn rays in the final step.

3.105. To orient a plane table at a point with two inaccessible points, the method generally adopted, is
(a) intersection (b) resection
(c) radiation (d) two point problem.

3.106. To orient a plane table at a point *P* roughly south of the mid-point of two inaccessible conical hill stations *A* and *B* in the plains, a point *C* is selected in line with *AB* and table is oriented at *C* by bringing *ab* in line with *AB*. *A* ray is then drawn towards *P* and at *P* the table is oriented by back ray method. The orientation so obtained, is
(a) unique and correct (b) incorrect
(c) manifold and correct (d) not reliable.

3.107. Orientation of a plane table by solving two point problem is only adopted when
(a) saving of time is a main factor
(b) better accuracy is a main factor
(c) given points are inaccessible
(d) none of these.

3.108. Accuracy of 'fix' by two point problem, is
(a) bad (b) good
(c) not reliable (d) unique.

3.109. While working on a plane table, the correct rule is :
(a) Draw continuous lines from all instrument stations
(b) Draw short rays sufficient to contain the points sought
(c) Intersection should be obtained by actually drawing second rays
(d) Take maximum number of sights as possible from each station to distant objects.

3.110. If the plane table is not horizontal in a direction at right angles to the alidade, the line of sight is parallel to the fiducial edge only for
(a) horizontal sights (b) inclined sights upward
(c) inclined sight downward (d) none of these.

3.111. The smaller horizontal angle between the true meridian and a survey line, is known
(a) declination (b) bearing
(c) azimuth (d) dip.

3.112. The vertical angle between longitudinal axis of a freely suspended magnetic needle and a horizontal line at its pivot, is known
(a) declination (b) azimuth
(c) dip (d) bearing.

3.113. Magnetic bearing of a survey line at any place
(a) remains constant
(b) changes systematically
(c) varies differently in different months of the year
(d) is always greater than true bearing.

3.114. Prismatic compass is considered more accurate than a surveyor's compass, because
(a) it is provided with a better magnetic needle
(b) it is provided with a sliding glass in the object vane
(c) its graduations are in whole circle bearings
(d) it is provided with a prism to facilitate reading of its graduated circle
(e) both (c) and (d).

3.115. If whole circle bearing of a line is 120°, its reduced bearing is
(a) S 20° E (b) S 60° E
(c) N 120° E (d) N 60° E.

3.116. The reduced bearing of a line is N 87° W. Its whole circle bearing is
(a) 87° (b) 273.°
(c) 93° (d) 3°

3.117. The magnetic meridian at any point, is the direction indicated by a freely suspended
(a) magnetic needle
(b) and properly balanced magnetic needle
(c) properly balanced and uninfluenced by local attractive

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force
(d) magnetic needle over an iron pivot.

3.118. The horizontal angle between true meridian and magnetic meridian, is known
(a) bearing (b) magnetic declination
(c) dip (d) convergence.

3.119. Imaginary line passing through points having equal magnetic declination is termed as
(a) isogon (b) agonic line
(c) isoclinic line (d) none of these.

3.120. Magnetic declination at any place
(a) remains constant (d) does'n remain constant
(c) fluctuates (d) changes abruptly.

3.121. The zero of the graduated circle of a prismatic compass is located at
(a) north end (b) east end
(c) south end (d) west end.

3.122. The true meridian of a place is the line in which earth's surface is intersected by a plane through
(a) east and west points
(b) zenith and nadir points
(c) north and south geographical poles
(d) north and south magnetic poles.

3.123. True meridian of different places
(a) converge from the south pole to the north pole
(b) converge from the north pole to the south pole
(c) converge from the equator to the poles
(d) run parallel to each other.

3.124. True meridians are generally preferred to magnetic meridians because
(a) these converge to a point
(b) these change due to change in time
(c) these remain constant.
(d) None of these.

3.125. During secular variation of magnetic meridian at different places
(a) range of oscillations is constant
(b) period of oscillation is constant
(c) range and period of oscillation both vary
(d) period of oscillation only varies.

3.126. Diurnal variation of magnetic declination is
(a) greater at equator than nearer the poles
(b) less at equator than nearer the poles
(c) less in summer than in winter
(d) same at all latitudes and during different months.

3.127. Grid lines are parallel to
(a) magnetic meridian of the central point of the grid
(b) line representing the central true meridian of the grid
(c) geographical equator
(d) none of these.

3.128. Whole circle bearing of a line is preferred to a quadrantal bearing merely because
(a) bearing is not completely specified by an angle
(b) bearing is completely specified by an angle
(c) Sign of the correction of magnetic declination is different in different quadrants
(d) its trigonometrical values may be extracted from ordinary tables easily.

3.129. In quadrantal bearing system, back bearing of a line may be obtained from its forward bearing, by
(a) adding 180°, if the given bearing is less than 180°
(b) subtracting 180°, if the given bearing, is more than 180°
(c) changing the cardinal points, *i.e.* substituting N for S and E for W and *vice-versa*
(d) none of these.

3.130. Reduced bearing of a line is an angle between
(a) north line and given line measured clockwise
(b) north line and given line measured anti-clockwise
(c) east or west and the given line
(d) given line and the part of the meridian whether N end or S end, lying adjacent to it.

3.131. If the whole circle bearing of a line is 270°, its reduced bearing is
(a) N 90° W (b) S 90° W
(c) W 90° (d) 90° W.

3.132. If the whole circle bearing of a line is 180°, its reduced bearing is
(a) S 0° E (b) S 0° W
(c) S (d) N.

3.133. The ratio of the linear displacement at the end of a line, subtended by an arc of one second to the length of the line, is
(a) 1 : 206 300 (b) 1 : 3440
(c) 1 : 57 (d) 1 : 100.

3.134. The line of sight is kept as high above ground surface as possible to minimise the error in the observed angles due to
(a) shimmering
(b) horizontal refraction
(c) vertical refraction
(d) both shimmering and horizontal refraction.

3.135. If a linear traverse follows a sharp curve round a large lake where it is difficult to have long legs, the accuracy of the traverse may be improved by
(a) taking short legs
(b) making repeated observations of angular and linear measurements
(c) making a subsidiary traverse to determine the length of a long leg
(d) all the above.

3.136. The distance between terminal points computed from a subsidiary traverse run between them, is generally known, as
(a) traverse leg (b) a base
(c) traverse base (d) all the above.

3.137. To avoid large centering error with very short legs, observations are generally made
(a) to chain pins
(b) by using optical system for centering the theodolite

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(c) to a target fixed on theodolite tripod on which theodolite may be fitted easily
(d) all the above.

3.138. A traverse deflection angle is
(a) less than 90°
(b) more than 90° but less than 180°
(c) the difference between the included angle and 180°
(d) the difference between 360° and the included angle.

3.139. In a precision traverse, included angles are measured by setting the vernier
(a) to read zero exactly on back station
(b) to read 5° exactly on back station
(c) some where near zero and reading both verniers on back station
(d) all the above.

3.140. The included angles of a theodolite traverse, are generally measured
(a) clockwise from the forward station
(b) anti-clockwise from the back station
(c) anti-clockwise from the forward station
(d) clockwise from the back station.

3.141. An angle of deflection right, may be directly obtained by setting the instrument to read
(a) zero on back station (b) 180° on back station
(c) 90° (d) 270° on back station.

3.142. You have to observe an included angle with better accuracy than what is achievable by a vernier, you will prefer the method of
(a) repetition (b) reiteration
(c) double observations (d) exactness.

3.143. Centering error of a theodolite produces an error
(a) in all angles equally
(b) which does not vary with the direction or pointing
(c) which varies with the direction of pointing and inversely with the length of sight
(d) none of these.

3.144. In horizontal angles, the error due to imperfect levelling of the plate bubble is
(a) large when sights are nearly level
(b) large for long sights
(c) less for steeply inclined sights
(d) large for steeply inclined sights.

3.145. Removal of parallax, may be achieved by focussing
(a) the objective
(b) the eye-piece
(c) the objective and the eye-piece
(d) none of these.

3.146. Accurate measurement of deflection angles with a transit not properly adjusted may be made by
(a) setting the vernier A at zero at back station and then plunging the telescope
(b) setting the vernier A at zero at back station and turning the instrument to the forward station
(c) taking two back sights one with the telescope normal and the other with telescope inverted
(d) none of these.

3.147. A transit is oriented by setting its vernier A to read the back azimuth of the preceding line. A back sight on the preceding transit station taken and transit is rotated about its vertical axis. The vernier A reads
(a) azimuth of the forward line
(b) bearing of the forward line
(c) back bearing of the forward line
(d) equal to 360°—azimuth of the forward line.

3.148. Under ordinary conditions, the precision of a theodolite traverse is affected by
(a) systematic angular errors
(b) accidental linear errors
(c) systematic linear errors
(d) accidental angular errors.

3.149. In precision theodolite traverse if included angles are read twice and the mean reading accepted using both verniers having a least count of 30″. Assuming the instrument to be in perfect adjustment, linear measurements correct to 6 mm per 30 metre tape duly corrected for temperature, slope and sag, the angular error of closure not to exceed
(a) $50'' \sqrt{n}$
(b) $30' \sqrt{n}$
(c) $60' \sqrt{n}$ where n is the number of traverse legs.

3.150. For locating a distant object visible from two transit stations, the method usually preferred to, is
(a) Angles and distances from transit stations
(b) Angles from two transit stations
(c) distance from two transit stations
(d) Angle from one transit station and distance from the other.

3.151. Angles to a given pivot station observed from a number of traverse stations when plotted, the lines to the pivot station intersect at a common point
(a) angular measurements are correct and not the linear measurements
(b) linear measurements are correct and not the angular measurements
(c) angular and linear measurements are correct and not the plotting of traverse
(d) angular and linear measurements and also plotting of the traverse are correct.

3.152. The most reliable method of plotting a theodolite traverse, is
(a) by consecutive co-ordinates of each station
(b) by independent co-ordinates of each station
(c) by plotting included angles and scaling off each traverse leg
(d) by the tangent method of plotting.

3.153. The orthographical projection of a traverse leg upon the reference meridian, is known as
(a) departure of leg (b) latitude to the leg
(c) co-ordinate of the leg (d) bearing of the leg.

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3.154. The co-ordinate of a point measured perpendicular to the parallel, is called
(a) total latitude (b) meridian distance
(c) total departure (d) consecutive co-ordinate.

3.155. Total latitude of a point is positive if it lies
(a) north of the reference parallel
(b) south of the reference parallel
(c) east of the reference parallel
(d) west of the reference parallel.

3.156. The latitude of a traverse leg is obtained by multiplying its length by
(a) tangent of its reduced bearing
(b) sign of its reduced bearing
(c) cosine of its reduced bearing
(d) cosecant of its reduced bearing.

3.157. In a closed traverse, sum of south latitudes exceeds the sum of north latitudes and the sum of east departures exceeds the sum of west departures, then, the closing line will lie in
(a) north-west quadrant (b) north east quadrant
(c) south-east quadrant (d) south-west quadrant.

3.158. The operation of making the algebraic sum of latitudes and departures of a closed traverse, each equal to zero, is known
(a) balancing the sights (b) balancing the departures
(c) balancing the latitudes (d) balancing the traverse.

3.159. If the angular measurements of a traverse are more precise than its linear measurements, balancing of the traverse, is done by
(a) Bowditch's rule (b) Transit rule
(c) Empirical rule (d) all of the above.

3.160. The length of a traverse leg may be obtained by multiplying the latitude and
(a) secant of its reduced bearing
(b) sine of its reduced bearing
(c) cosine of its reduced bearing
(d) tangent of its reduced bearing.

3.161. The branch of surveying in which both horizontal and vertical positions of a point, are determined by making instrumental observations, is known
(a) tacheometry (b) tachemetry
(c) telemetry (d) all the above.

3.162. The method generally preferred to for contouring an undulating area, is
(a) chain surveying (b) plane table surveying
(c) tacheometrical surveying (d) compass surveying.

3.163. Stadia techeometry was discovered by James Watt in the year.
(a) 1670 (b) 1770
(c) 1870 (d) 1900.

3.164. The diaphragm of a stadia theodolite is fitted with two additional
(a) horizontal hairs
(b) vertical hairs
(c) horizontal and two vertical hairs
(d) none of these.

3.165. The staff intercept will be
(a) greater farther off the staff is held
(b) smaller, farther off the staff is held
(c) smaller, nearer the staff is held
(d) same. wherever the staff is held.

3.166. One of the tacheometric constants is additive, the other constant, is
(a) subtractive constant (b) multiplying constant
(c) dividing constant (d) indicative constant.

3.167. If i is the stadia distance, f is the focal length and d is the distance between the objective and vertical axis of the techeometer, the multiplying constant, is
(a) $\frac{f}{i}$ (b) $\frac{i}{f}$
(c) $(f + d)$ (d) $\frac{f}{d}$.

3.168. Tacheometric formula for horizontal distances using horizontal sights can also suitable be employed for inclined sights through θ by multiplying
(a) the constants by $\sin^2 \theta$
(b) the constants by $\cos^2 \theta$
(c) the constants by $\cos \theta$
(d) the constants by $\sin \theta$
(e) the multiplying constant by $\cos^2 \theta$ and additive constant by $\cos \theta$.

3.169. The formula for the horizontal distances for inclined sights, on staff held normalis
$\frac{f}{i} s \cos \theta + (f + d) \cos \theta \pm h \sin \theta$
(a) minus sign is used for angle of depression
(b) plus sign is used for angle of depression
(c) minus sign is used for angle of elevation
(d) non of these.

3.170. If a tacheometer is fitted with an anallatic lens
(a) additive constant is 100, multiplying constant is zero
(b) multiplying constant is 100, additive constant is zero
(c) both multiplying and additive constants are 100
(d) both multiplying and additive constants are 50.

3.171. In tacheometrical observations, vertical staff holding is generally preferred to normal staffing, due to
(a) ease of reduction of observations
(b) facility of holding
(c) minimum effect of careless holding on the result
(d) none of these.

3.172. In tangential tacheometry, an ordinary level staff is used
(a) leaning towards the instrument for inclined sights upward
(b) leaning away from the instrument for inclined sights downwards
(c) vertical in all cases
(d) none of these.

3.173. Horizontal distances obtained tacheometerically are corrected for

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(a) slope correction
(b) temperature correction
(c) refraction and curvature correction
(d) all the above.

3.174. Tilt of the staff in stadia tacheometry increases the intercept if it is
(a) away from the telescope pointing down hill
(b) towards the telescope pointing up-hill
(c) away from the telescope pointing up-hill
(d) none of these.

3.175. If θ is the vertical angle of an inclined sight, δ is the angle of tilt of the staff, the error
(a) $E = 1 - \frac{\cos(\theta \pm \delta)}{\cos\theta}$ (b) $E = 1 - \frac{\sin(\theta \pm \delta)}{\sin\theta}$
(c) $E = 1 - \frac{\tan(\theta \pm \delta)}{\tan\theta}$ (d) none of these.

3.176. The intercept of a staff
(a) is maximum if the staff is held truly normal to the line of sight.
(b) is minimum if the staff is held truly normal to the line of sight.
(c) decreases if the staff is tilted away from normal
(d) increases if the staff is tilted towards normal.

3.177. If vertical angles of inclined sights do not exceed 10° and non-verticality of the staff remains within 1°, stadia system of tacheometric observations are made on
(a) staff normal
(b) staff vertical
(c) staff normal as well as vertical
(d) none of these.

3.178. θ_1 and θ_2 are the angles of elevation from A to the top and bottom of a vertically held rod of length S at B. The horizontal distance AB is
(a) $\frac{S}{\tan\theta_1 - \tan\theta_2}$ (b) $\frac{S}{\tan\theta_1 + \tan\theta_2}$
(c) $\frac{S}{\tan\theta_2 - \tan\theta_1}$ (d) $\frac{S}{\tan\theta_1 \times \tan\theta_2}$

3.179. Subtense tacheometry is generally preferred to if ground is
(a) flat (b) undulating
(c) mountaineous (d) deserts.

3.180. The theodolites used for making tacheometric observations by optical wedge system, are
(a) provided with stadia hairs in front of eye piece
(b) not provided with stadia hairs at all
(c) fitted with a glass wedge inside the telescope
(d) fitted with a glass wedge in front of telescope.

3.181. The curve composed of two arcs of different radii having their centres on the opposite side of the curve, is known
(a) a simple curve (b) a compound curve
(c) a reverse curve (d) a vertical curve.

3.182. Designation of a curve is made by :
(a) angle subtended by a chord of any length
(b) angle subtended by an arc of specified length
(c) radius of the curve
(d) curvature of the curve.

3.183. The radius of a simple circular curve is 300 m and length of its specified chord is 30 m. The degree of the curve is
(a) 5.73° (b) 5.37°
(c) 3.57° (d) 3.75°.

3.184. If D is the degree of the curve of radius R, the exact length of its specified chord, is
(a) radius of the curve × sine of half the degree
(b) diameter of the curve × sine of half the degree
(c) diameter of the curve × cosine of half the degree
(d) diameter of the curve × tangent of half the degree.

3.185. The angle of intersection of a curve is the angle between
(a) back tangent and forward tangent
(b) prolongation of back tangent and forward tangent
(c) forward tangent and long chord
(d) back tangent and long chord.

3.186. If Δ is the angle of deflection of a simple curve of radius R, the length of the curve is :
(a) $\frac{\pi R\,\Delta}{90°}$ (b) $\frac{\pi R\,\Delta}{180°}$
(c) $\frac{\pi R\,\Delta}{270°}$ (d) $\frac{\pi R\,\Delta}{360°}$.

3.187. If Δ is the angle of deflection of a simple curve of radius R, the length of its long chord, is
(a) $R\cos\frac{\Delta}{2}$ (b) $2R\cos\frac{\Delta}{2}$
(c) $R\sin\frac{\Delta}{2}$ (d) $2R\sin\frac{\Delta}{2}$.

3.188. If Δ is the angle of deflection of a simple curve of radius R, the distance between the mid-point of the curve and long chord, is
(a) $R\left(1 - \sin\frac{\Delta}{2}\right)$ (b) $R\left(1 + \sin\frac{\Delta}{2}\right)$
(c) $R\left(1 + \cos\frac{\Delta}{2}\right)$ (d) $R\left(1 - \cos\frac{\Delta}{2}\right)$.

3.189. The chord of a curve less than peg interval, is known as
(a) small chord (b) sub-chord
(c) normal chord (d) short chord.

3.190. The approximate formula for radial or perpendicular offsets from the tangent, is
(a) $\frac{x}{2R}$ (b) $\frac{x^2}{2R}$
(c) $\frac{x}{R}$ (d) $\frac{x^2}{R}$

3.191. Rankine's deflection angle in minutes is obtained by multiplying the length of the chord by
(a) degree of the curve
(b) square of the degree of the curve
(c) inverse of the degree of the curve
(d) none of these.

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3.192. Setting out a curve by two theodolite method, involves
(a) linear measurements only
(b) angular measurements only
(c) both linear and angular measurements
(d) none of these.

3.193. Transition curves are introduced at either end of a circular curve, to obtain
(a) gradually decrease of curvature from zero at the tangent point to the specified quantity at the junction of the transition curve with main curve
(b) gradual increase of super-elevation from zero at the tangent point to the specified amount at the junction of the transition curve with main curve
(c) gradual change of gradient from zero at the tangent point to the specified amount at the junction of the transition curve with main curve
(d) none of these.

3.194. If V is the speed of a locomotive in km per hour, g is the acceleration due to gravity, G is the distance between running faces of the rails and R is the radius of the circular curve, the required super elevation is
(a) $\frac{gv^2}{GR}$ (b) $\frac{Rg}{Gv^2}$
(c) $\frac{GR}{gv^2}$ (d) $\frac{GV^2}{gR}$.

3.195. If the rate of gain of radial acceleration is 0.3 m per sec^3 and full centrifugal ratio is developed. On the curve the ratio of the length of the transition curve of same radius on road and railway, is
(a) 2.828 (b) 3.828
(c) 1.828 (d) 0.828.

3.196. With usual notations, the expression $\frac{V^2}{gR}$ represents
(a) centrifugal force (b) centrifugal ratio
(c) super elevation (d) radial acceleration.

3.197. An ideal transition curve is
(a) cubic parabola (b) cubic spiral
(c) clothoid spiral (d) true spiral.

3.198. Shift of a curve, is
(a) $\frac{L^2}{6R}$ (b) $\frac{L}{24R}$
(c) $\frac{L^2}{24R}$ (d) $\frac{L^2}{6R}$

3.199. Perpendicular offset from a tangent to the junction of a transition curve and circular curve is equal to
(a) shift (b) twice the shift
(c) thrice the shift (d) four times the shift.

3.200. The properties of autogenous curve for automobiles are given by
(a) true spiral (b) cubic parabola
(c) Bernoulli's Lemniscate (d) clothoid spiral.

3.201. If the radius of a simple curve is R, the length of the chord for calculating offsets by the method of chords produced, should not exceed.
(a) $R/10$ (b) $R/15$
(c) $R/20$ (d) $R/25$.

3.202. If the radius of a simple curve is 600 m, the maximum length of the chord for calculating offsets, is taken
(a) 10 m (b) 15 m
(c) 20 m (d) 25 m
(e) 30 m.

3.203. If Δ is the angle of deflection of the curve, T_1 and T_2 are its points of tangencies, the angle between the tangent at T_1 and long chord $T_1\ T_2$ will be
(a) $\frac{\Delta}{4}$ (b) $\frac{\Delta}{3}$
(c) $\frac{\Delta}{2}$ (d) Δ
(e) 2Δ.

3.204. If S is the length of a subchord and R is the radius of simple curve, the angle of deflection between its tangent and sub-chord, in minutes, is equal to
(a) 573 S/R (b) 573 R/S
(c) 171.9 S/R (d) 1718.9 R/S
(e) 1718.9 S/R.

3.205. For a curve of radius 100 m and normal chord 10 m, the Rankine's deflection angle, is
(a) 0°25′.95 (b) 0°35′.95
(c) 1°25′.95 (d) 1°35′.95
(e) 1°45′.95.

3.206. For setting out a simple curve, using two theodolites.
(a) offsets from tangents are required
(b) offsets from chord produced are required
(c) offsets from long chord are required
(d) deflection angles from Rankine's formula are required
(e) none of these.

3.207. If R is the radius of the main curve, θ the angle of deflection, S the shift and L the length of the transition curve, then, total tangent length of the curve, is
(a) $(R - S)\tan\theta/2 - L/2$ (b) $(R + S)\tan\theta/2 - L/2$
(c) $(R + S)\tan\theta/2 + L/2$ (d) $(R - S)\tan\theta/2 + L/2$
(e) $(R - S)\cos\theta/2 + L/2$.

3.208. If the length of a transition curve to be introduced between a straight and a circular curve of radius 500 m is 90 m, the maximum perpendicular offset for the transition curve, is
(a) 0.70 m (b) 1.70 m
(c) 2.70 m (d) 3.70 m
(e) 4.70 m.

3.209. In question No. 3.208, the maximum deflection angle to locate its junction point, is
(a) 1°43′ 08″ (b) 1°43′ 18″
(c) 1°43′ 28″ (d) 1°43′ 38″.

3.210. An ideal vertical curve to join two gradients, is
(a) circular (b) parabolic
(c) elliptical (d) hyperbolic
(e) none of these.

3.211. If the sight distance (S) is equal to the length of the vertical curve ($2l$) joining two grades $g_1\%$ and $-g_2\%$, the height of the apex will be

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(a) $\frac{(S-l)}{400}(g_1-g_2)$ (b) $\frac{(g_1-g_2)}{400}$

(c) $\frac{(g_1-g_2)S^2}{1600\,l}$ (d) none of these.

3.212. If + 0.8% grade meets – 0.7% grade and the rate of change of grade for 30 m distance is 0.05, the length of the vertical curve will be

(a) 600 m (b) 700 m
(c) 800 m (d) 900 m
(e) 1000 m.

3.213. If α is the angle between the polar ray and the tangent at the point of commencement of a lemniscate curve, the equation of the curve, is

(a) $l = k\sqrt{\sin\alpha}$ (b) $l = k\sqrt{\sin 2\alpha}$
(c) $l = k\sqrt{\sin 3\alpha}$ (d) $l = k\sqrt{\tan 2\alpha}$
(e) $l = k\sqrt{\cos 2\alpha}$.

3.214. In a lemniscate curve the ratio of the angle between the tangent at the end of the polar ray and the straight, and the angle between the polar ray and the straight, is

(a) 2 (b) 3
(c) 4 (d) 5
(e) 3/2.

3.215. A lemniscate curve will not be transitional throughout, if its deflection angle, is

(a) 45° (b) 60°
(c) 90° (d) 120°
(e) 180°.

3.216. A lemniscate curve between the tangents will be transitional throughout if the polar deflection angle of its apex, is

(a) $\frac{\Delta}{2}$ (b) $\frac{\Delta}{3}$
(c) $\frac{\Delta}{4}$ (d) $\frac{\Delta}{5}$
(e) $\frac{\Delta}{6}$.

3.217. The area of any irregular figure of the plotted map is measured with

(a) pentagraph (b) sextant
(c) clinometer (d) planimeter
(e) optical square.

3.218. The area of a plane triangle ABC, having its base AC and perpendicular height h, is

(a) $\frac{1}{2}bh$ (b) $\frac{1}{2}ba\sin C$
(c) $\frac{1}{2}bc\sin A$ (d) $\sqrt{S(S-a)(S-b)(S-c)}$

where S is $\frac{a+b+c}{2}$

(e) all the above.

3.219. If the area calculated form the plan plotted with measurements by an erroneous chain, accurate area of the plan is

(a) measured area $\times \frac{\text{length of chain used}}{\text{nominal chain length}}$

(b) measured area $\times \frac{\text{nominal chain length}}{\text{length of chain used}}$

(c) measured area $\times \left(\frac{\text{nominal chain length}}{\text{length of chain used}}\right)^2$

(d) measured area $\times \left(\frac{\text{length of chain used}}{\text{nominal chain length}}\right)^2$

(e) none of the above.

3.220. Simpson's rule for calculating areas states that the area enclosed by a curvilinear figure divided into an even number of strips of equal width, is equal to

(a) half the width of a strip, multiplied by the sum of two extreme offsets, twice the sum of remaining odd offsets, and thrice the sum of the even offsets
(b) one third the width of a strip, multiplied by the sum of two extreme offsets, twice the sum of remaining odd offsets and four times the sum of the even offsets
(c) one third the width of a strip, multiplied by the sum of two extreme offsets, four times the sum of the remaining odd off-sets, and twice the sum of the even offsets
(d) one sixth the width of a strip, multiplied by the sum of the two extreme offsets, twice the sum of remaining odd offsets and four times the sum of the even offsets
(e) none of these.

3.221. If d is the distance between equidistant odd ordinates, the simpson's rule for the areas, is

(a) $\frac{d}{2}[h_1 + h_n + 2(h_3 + h_5 + \ldots + h_{n-2}) + 4(h_2 + h_4 + \ldots + h_{n-1})]$

(b) $\frac{d}{3}[h_1 + h_n + 2(h_3 + h_5 + \ldots + h_{n-2}) + 4(h_2 + h_4 + \ldots + h_{n-1})]$

(c) $\frac{d}{6}[h_1 + h_n \times 2(h_2 + h_4 + \ldots + h_{n-1}) + 4(h_3 + h_5 + \ldots + h_{n-2})]$

(d) $\frac{d}{6}[h_1 + h_n + 2(h_3 + h_5 + \ldots + h_{n-2}) + 4(h_2 + h_2 + \ldots + h_{n-1})]$

(e) none of these.

3.222. Volume of the earth work may be calculated by

(a) mean areas (b) end areas
(c) Prismoidal formula (d) Trapezoidal
(e) all the above.

3.223. The Trapezoidal rule of volumes V of an embankment divided into a number of sections equidistant D, is given by

(a) $V = D\left[\frac{A_1 + A_n}{2} + A_2 + A_3 + \ldots + A_{n-1}\right]$

(b) $V = \frac{D}{2}\left[\frac{A_1 + A_n}{4} + A_2 + A_3 + \ldots + A_{n-1}\right]$

(c) $V = \frac{D}{2}[A_1 + A_n + 2(A_2 + A_4 + \ldots + A_{n-1}) + 4(A_3 + A_5 + \ldots + A_{n-2})]$

(d) $V = \frac{D}{2}[A_1 + A_n + 4(A_2 + A_4 + \ldots + A_{n-1}) + 4(A_3 + A_5 + \ldots + A_{n-2})]$.

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3.224. If h_1 and h_2 are the differences in level between ground and the formation levels, m is the slope of the sloping sides. D is the distance between the cross sections then, prismoidal correction for a level section is

(a) $D/2m(h_1 - h_2)$ (b) $D/3m(h_1 - h_2)$
(c) $D/6m(h_1 - h_2)^2$ (d) $D/6m(h_1 - h_2)^3$
(e) $D/6m(h_1 + h_2)^2$.

3.225. Pick up the correct statement from the following :

(a) If the slope of the curve of a mass diagram in the direction of increasing abscissa is downward, it indicates an embankment
(b) The vertical distance between a maximum ordinate and the next forward maximum ordinate represents the whole volume of the embankment
(c) The vertical distance between a minimum ordinate and the next forward maximum ordinate represents the whole volume of a cutting
(d) The area enclosed by a loop of the curve and balancing line, measures the haul in that direction.
(e) all the above.

3.226. For indirect ranging, number of ranging rods required, is

(a) 1 (b) 2
(c) 3 (d) 4
(e) 5.

3.227. The main plate of a transit is divided into 1080 equal divisions. 60 divisions of the vernier coincide exactly with 59 divisions of the main plate. The transit can read angles accurate upto

(a) 5″ (b) 10″
(c) 15″ (c) 20″
(e) 30″.

3.228. For a closed traverse the omitted measurements may be calculated

(a) length of one side only
(b) bearing of one side only
(c) both length and bearing of one side
(d) length or bearing of adjacent side
(e) all the above.

3.229. If L is the perimeter of a closed traverse, ΔD is the closing error in departure, the correction for the departure of a traverse side of length l, according to Bowditch rule, is

(a) $\Delta D \times \frac{L}{l}$ (b) $\Delta D \frac{l^2}{L}$
(c) $L \frac{l}{\Delta D}$ (d) $\Delta D \times \frac{l}{L}$.

3.230. If arithmetic sum of latitudes of a closed traverse is ΣLat and closing error in latitude is dx, the correction for a side whose latitude is l, as given by Transit Rule, is

(a) $l \times \frac{dx}{\Sigma Lat}$ (b) $l \times \frac{\Sigma Lat}{dx}$
(c) $\Sigma Lat \times \frac{dx}{l}$ (d) none of these.

3.231. A clinometer is used for

(a) measuring angle of slope
(b) correcting line of collimation
(c) setting out right angles
(d) defining natural features.

3.232. Permanent adjustments of a level are

(a) 2 in number (b) 3 in number
(c) 4 in number (d) 6 in number.

3.233. Planimeter is used for measuring

(a) volume (b) area
(c) contour gradient (d) slope angle
(e) none of these.

3.234. Number of subdivisions per metre length of a levelling staff is

(a) 100 (b) 200
(c) 500 (d) 1000.

3.235. Number of links per metre length of a chain are

(a) 2 (b) 5
(c) 8 (d) 10
(e) 20.

3.236. Cross-staff is used for

(a) setting out right angles
(b) measuring contour gradient
(c) taking levels
(d) measuring distances
(e) none of these.

3.237. Pantagraph is used for

(a) measuring distances (b) measuring areas
(c) enlarging or reducing plans (d) setting out right angles.

3.238. In chain surveying, perpendiculars to the chain line, are set out by

(a) a theodolite (b) a prismatic compass
(c) a level (d) an optical square.

3.239. Profile levelling is usually done for determining

(a) contours of an area
(b) capacity of a reservoir
(c) elevations along a straight line
(d) boundaries of property.

3.240. The 'point of curve' of a simple circular curve, is

(a) point of tangency (b) point of commencement
(c) point of intersection (d) mid-pdint of the curve.

3.241. Pick up the correct statement from the following :

(a) Box sextant is used for the measurement of horizontal angles
(b) Cross staff is used for setting out right angles
(c) Gradiometer is used for setting out any required gradient
(d) Line ranger is used for locating intermediate stations on a survey line
(e) All the above.

3.242. Ramsden eye-piece consists of

(a) two convex lenses short distance apart
(b) two concave lenses short distance apart
(c) one convex lens and one concave lens short distance apart
(d) two plano-convex lenses short distance apart, with the convex surfaces facing each other.

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3.243. The ratio of the angles subtended at the eye, by the virtual image and the object, is known as telescope's
(*a*) resolving power (*b*) brightness
(*c*) field of view (*d*) magnification.

3.244. In a perfect prismatic compass
(*a*) magnetic axis and geometric axis of the needle coincide
(*b*) ends of the needle and pivot are in same vertical and horizontal planes
(*c*) pivot is vertically over the centre of the graduated circle
(*d*) needle is always kept sensitive
(*e*) all the above.

3.245. α, β are the horizontal angles measured at the ends of a base line AB to a hill top whose angle of elevation from station A is θ°. The height of the hill top above the trunnion axis of the theodolite station, is
(*a*) $\frac{AB \sin\beta \tan\theta}{\sin[180^\circ - (\alpha+\beta)]}$ (*b*) $\frac{AB \sin\theta \tan\alpha}{\sin[180^\circ - (\alpha+\theta)]}$
(*c*) $\frac{AB \sin\theta \tan\beta}{\sin[180^\circ - (\alpha+\beta)]}$ (*d*) $\frac{AB \sin\alpha \tan\theta}{\sin[180^\circ - (\alpha+\beta)]}$.

3.246. The bearings of two traverse legs AB and BC are N52° 45′ E and N34° 30′ E respectively. The deflection angle is
(*a*) 18° 15′ E (*b*) 18° 15′ N
(*c*) 18° 15′ W (*d*) 18° 15′ R
(*e*) 18° 15′ L.

3.247. The bearing of lines OA and OB are 16° 10′ and 332° 18′, the value of the included angle BOA is
(*a*) 316° 10′ (*b*) 158° 28′
(*c*) 348° 08′ (*d*) 43° 52′.

3.248. The bearing of line AB is 152° 30′ and angle ABC measured clockwise is 124° 28′. The bearing of BC is
(*a*) 27° 52′ (*b*) 96° 58′
(*c*) 148° 08′ (*d*) 186° 58′.

3.249. The whole circle bearing of a line is 290°. Its reduced bearing is
(*a*) N 20° E (*b*) N 20° W
(*c*) N 70° W (*d*) S 70° E.

3.250. A bearing of a line is also known as
(*a*) magnetic bearing (*b*) true bearing
(*c*) azimuth (*d*) reduced bearing.

3.251. $ABCD$ is a rectangular plot of land. If the bearing of the side AB is 75°, the bearing of DC is
(*a*) 75° (*b*) 255°
(*c*) 105° (*d*) 285°.

3.252. $ABCD$ is a regular parallelogram plot of land whose angle BAD is 60°. If the bearing of the line AB is 30°, the bearing of CD, is
(*a*) 90° (*b*) 120°
(*c*) 210° (*d*) 270°.

3.253. Back bearing of a line is equal to
(*a*) Fore bearing ± 90° (*b*) Fore bearing ± 180°
(*c*) Fore bearing + 360° (*d*) Fore bearing + 270°.

3.254. The magnetic bearing of a line is 32° and the magnetic declination is 10° 15′ W. The true bearing is
(*a*) 21° 45′ (*b*) 42° 15′
(*c*) 42° 15′ W (*d*) 21° 45′ W.

3.255. Ranging in chain survey means
(*a*) looking at an isolated point not on the line
(*b*) establishing an intermediate point on the line
(*c*) determining the distance between end points
(*d*) determining the offset distance
(*e*) none of these.

3.256. Ranging is an operation of
(*a*) reconnaissance
(*b*) judging the distance
(*c*) determination of slope
(*d*) establishing intermediate points between terminals.

3.257. Measuring with a 30 m chain, 0.01 m too short, introduces
(*a*) positive compensating error
(*b*) negative compensating error
(*c*) positive cumulative error
(*d*) negative cumulative error.

3.258. If L is the specified length of a tape, L_1 its actual length and S the measured distance, then, the true distance is given by the formula,
(*a*) $\frac{L_1}{L} \times S$ (*b*) $\frac{L}{L_1} \times S$
(*c*) $\frac{L - L_1}{L} \times S$ (*d*) $\left(\frac{L_1}{L}\right)^2 \times S$.

3.259. Metric chains are generally available in
(*a*) 10 m and 20 m length
(*b*) 15 m and 20 m length
(*c*) 20 m and 30 m length
(*d*) 25 m and 100 m length.

3.260. The reduced level of a floor is 99.995 m, the staff reading on the floor is 1.505 m. If the inverted staff reading against the roof is 1.795 m, the floor level below the slab, is
(*a*) 3.290 m (*b*) 3.300 m
(*c*) 3.275 m (*d*) 2.790 m.

3.261. The method of finding out the difference in elevation between two points for eliminating the effect of curvature and refraction, is
(*a*) reciprocal levelling (*b*) precise levelling
(*c*) differential levelling (*d*) flying levelling.

3.262. A uniform slope was measured by the method of stepping. If the difference in level between two points is 1.8 m and the slope distance between them is 15 m, the error is approximately equal to
(*a*) cumulative, + 0.11 m (*b*) compensating, ± 0.11 m
(*c*) cumulative, – 0.11 m
(*d*) none of these.

3.263. A standard steel tape of length 30 m and cross-section 15 × 1.0 mm was standardised at 25°C and at 30 kg pull. While measuring a base line at the same temperature, the pull applied was 40 kg. If the modulus of elasticity of steel tape is 2.2×10^6 kg/cm^2, the correction to be applied is
(*a*) – 0.000909 m (*b*) + 0.0909 m
(*c*) 0.000909 m (*d*) none of these.

3.264. The bearing of AB is 190° and that of CB is 260° 30′

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The included angle ABC, is
(a) 80° 30′ (b) 99° 30′
(c) 70° 30′ (d) none of these.

3.265 . A dumpy level was set up at mid-point between pegs A and B, 80 m apart and the staff readings were 1.32 and 1.56. When the level was set up at a point 10 m from A on BA produced, the staff readings obtained at A and B were 1.11 and 1 .39. The correct staff reading from this set up at B should be
(a) 1.435 (b) 1.345
(c) 1.425 (d) none of these.

3.266 . The desired sensitivity of a bubble tube with 2 mm divisions is 30″. The radius of the bubble tube should be
(a) 13.75 m (b) 3.44 m
(c) 1375 m (d) none of these.

3.267 . Offsets are measured with an accuracy of 1 in 40. If the point on the paper from both sources of error (due to angular and measurement errors) is not to exceed 0.05 cm on a scale of 1 cm = 20 m, the maximum length of offset should be limited to
(a) 14.14 (b) 28.28 m
(c) 200 m (d) none of these.

3.268 . A dumpy level was set up at the mid-point between two pegs A and B, 50 m apart and the staff readings at A and B were 1.22 and 1.06. With the level set up a A, the readings at A and B were 1.55 and 1.37. The collimation error per 100 m length of sight is
(a) 0.02 m inclined upwards
(b) 0.04 m inclined downwards
(c) 0.04 m inclined upward
(d) none of these.

3.269 . The bearings of the lines AB and BC are 146° 30′ and 68° 30′. The included angle ABC is
(a) 102° (b) 78°
(c) 45° (d) none of these.

3.270 . While setting a plane table at a station it was found that the error in centering was 30 cm away from the ray of length 40 m drawn from the station. If the scale of the plan is 1 cm = 2 cm. the displacement of the end of the ray in plan from the true position will be
(a) 0.02 cm (b) 0.15 cm
(c) 02 cm (d) 0.1 cm.

3.271 . The staff reading at a distance of 80 m from a level with the bubble at its centre is 1.31 m. When the bubble is moved by 5 divisions out of the centre, the reading is 1.39 m. The angular value of the one division of the bubble, is
(a) 28.8 secs (b) 41.25 secs
(c) 14.52 secs (d) 25.05
(e) none of these.

3.272 . Staff readings on pegs x and y from X station are 1.755 m and 2.850 m, and from station Y on staff head at Y and X are 0.655 m and 1.560 m. If reduced level of X is 105.5 m, the reduced level of Y is
(a) 104.0 m (b) 104.5 m
(c) 105.0 m (d) 105.5 m.

3.273 . Probable accidental error in precise levelling as recommended by International Geodetic Association, should not exceed
(a) $\pm 0.1\sqrt{k}$ mm (b) $\pm 0.5\sqrt{k}$ mm
(c) $\pm 1\sqrt{k}$ mm (d) $\pm 2\sqrt{k}$ mm
(e) $\pm 5\sqrt{k}$ mm
where k is in kilometers.

3.274. Probable systematic error in precise levelling as recommended by International Geodetic Association should not exceed
(a) $\pm 0.1\sqrt{k}$ mm (b) $\pm 0.2\sqrt{k}$ mm
(c) $\pm 0.1\sqrt{k}$ (d) $0.2\sqrt{k}$ mm.

3.275. While measuring with a metallic tape of 30 m length pull should be applied
(a) 1 kg (b) 2 kg
(c) 3 kg (d) 4 kg.

3.276. A sewer is laid from a manhole A to a manhole B, 250 m away along a gradient of 1 in 125. If the reduced level of the invert at A is 205.75 m and the height of the boning rod is 3 m, the reduced level of the sight rail at B, is
(a) 208.75 m (b) 202.75 m
(c) 206.75 m (d) 211.75 m.

3.277. The ratio of the distances at which a stated length can be distinguished by the telescope and the human eye, respectively, is called
(a) brightness of telescope
(b) magnification of telescope
(c) resolving power of telescope
(d) none of these.

3.278. Pick up the correct statement from the following :
(a) A level surface is perpendicular at all points to the direction of gravity
(b) A level line lies in level surface
(c) A horizontal surface is normal to the direction of gravity at only one point
(d) A horizontal line is tangential to the level surface
(e) All the above.

3.279. The first reading from a level station is
(a) foresight (b) intermediate sight
(c) back-sight (d) any sight.

3.280. In case of reduction of levels by the height of instrument method,
(a) Σ B.S. $-$ Σ F.S. = difference in R.L.S of the first station and last station
(b) Σ (R.L. + I + F.S.) $-$ first R.L.
$= \Sigma$ (H.I. + No. of R.L.s.)
(c) both (a) and (b) above
(d) neither (a) nor (b).

3.281. Bergchrund is a topograhical feature in
(a) plains (b) water bodies
(c) hills (d) glaciated region.

3.282. The distance between the point of intersection of an up grade $+g_1\%$ and downgrade $g_2\%$ and the highest point of the vertical curve of length L, is
(a) $\frac{L(g_1 - g_2)}{400}$ (b) $\frac{L(g_1 + g_2)}{400}$
(c) $\frac{L(g_1 + g_2)}{800}$ (d) $\frac{L(g_1 - g_2)}{800}$

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3.283. A level when set up 25 m from peg A and 50 m from peg B reads 2.847 on a staff held on A and 3.462 on a staff held on B, keeping bubble at its centre while reading. If the reduced levels of A and B are 283.665 m and 284.295 m respectively, the collimation error per 100 m is
(a) 0.015 m (b) 0.030 m
(c) 0.045 m (d) 0.060 m.

3.284. In a telescope the object glass of focal length 14 cm, is located at 20 cm from the diaphragm. The focussing lens is midway between them when a staff 16.50 m away is focussed. The focal length of the focussing lens, is
(a) 5.24 cm (b) 6.24 cm
(c) 7.24 cm (d) 8.24 cm.

3.285. The bearing of C from A is N 30° E and from B, 50 metres east of A, is N 60° W. The departure of C from A is
(a) 50 m (b) $50\sqrt{3}$ m
(c) $25\sqrt{3}$ m (d) 25 m.

3.286. The latitude of point C as stated in Q. No. 3.285. is
(a) 50 m (b) $50\sqrt{3}$ m
(c) $25\sqrt{3}$ (d) 25 m.

3.287. If the long chord and tangent length of a circular curve of radius R are equal the angle of deflection, is
(a) 30° (b) 60°
(c) 90° (d) 120°
(e) 150°.

3.288. The ratio of the length of long chord and the tangent length of a circular curve of radius R deflecting through angle Δ, is
(a) $\sin\frac{\Delta}{2}$ (b) $\cos\frac{\Delta}{2}$
(c) $\tan\frac{\Delta}{2}$ (d) $2\sin\frac{\Delta}{2}$
(e) $2\cos\frac{\Delta}{2}$.

3.289. The ratio of long chord and length of a curve of radius R deflecting through $\Delta°$, is
(a) $\frac{\pi\Delta}{180°\cos\frac{\Delta}{2}}$ (b) $\frac{\pi\Delta}{180°\sin\frac{\Delta}{2}}$
(c) $\frac{180°\sin\frac{\Delta}{2}}{\pi\Delta}$ (d) $\frac{180°\cos\frac{\Delta}{2}}{\pi\Delta}$.

3.290. The ratio of the radius and apex distance of a curve deflecting through $\Delta°$, is
(a) $\left(\sec\frac{\Delta}{2}-1\right)$ (b) $\left(1-\sec\frac{\Delta}{2}\right)$
(c) $\left(\cos\frac{\Delta}{2}-1\right)$ (d) $\left(\tan\frac{\Delta}{2}-1\right)$.

3.291. Pick up the correct statement from the following :
(a) The directions of plumb lines suspended at different points in a survey are not strictly parallel
(b) In surveys of small extent, the effect of curvature may be ignored and the level surface of the earth is assumed as horizontal
(c) In surveys of large extent, the effect of curvature of the earth must be considered
(d) All the above.

3.292. The sum of the interior angles of a geometrical figure laid on the surface of the earth differs from that of the corresponding plane figure only to the extent of one second for every
(a) 100 sq. km of area (b) 150 sq. km of area
(c) 200 sq. km of area (d) none of these.

3.293. Geodetic surveying is undertaken
(a) for production of accurate maps of wide areas
(b) for developing the science of geodesy
(c) making use of most accurate instruments and methods of observation
(d) for determination of accurate positions on the earth's surface of system of control points
(e) all the above.

3.294. The distances AC and BC are measured from two fixed points A and B whose distance AB is known. The point C is plotted by intersection. This method is generally adopted in
(a) chain surveying
(b) traverse method of surveys
(c) triangulation
(d) none of these.

3.295. Mistakes which may produce a very serious effect upon the final results arise due to
(a) in attention (b) in experience
(c) carelessness (d) all of these.

3.296. The systematic errors which persist and have regular effects in the performance of a survey operation, are due to
(a) carelessness (b) faulty instrument
(c) inattention (d) none of these.

3.297. Pick up the correct statement from the following :
(a) mistakes arise from inattention, inexperience or carelessness
(b) systematic errors persist and have regular effects in the survey performances
(c) accidental errors occur inspite of every precaution is taken
(d) all the above.

3.298. The method of reversal
(a) is usually directed to examine whether a certain part is truly parallel or perpendicular to another
(b) makes the erroneous relationship between parts evident
(c) both (a) and (b)
(d) neither (a) nor (b).

3.299. The apparent error on reversal is
(a) equal to the actual error
(b) twice the actual error
(c) thrice the actual error
(d) none of these.

3.300. Pick up the correct statement from the following :
(a) the apparent error on reversal is twice the actual error
(b) the correction may be made equal to half the observed discrepancy.

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(c) the good results may be obtained from a defective instrument by reversing and taking the mean of two erroneous results
(d) all the above.

3.301. Pick up the correct statement from the following :
(a) it is difficult to eliminate an error completely at first trial
(b) instability of the instrument makes it almost impossible to adjust it satisfactorily
(c) adjustment screws must be left bearing firmly but should never be forced
(d) all the above.

3.302. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Lens)	*List II (Position of optical centre)*
A. Double convex and double concave lenses	1. within the thickness of lens
B. Plano convex and plano-concave lenses	2. outide the lens on the same side as the surface of smaller radius
C. Menicus lenses	3. situated on the curved surface

Codes :

	A	B	C
(a)	3	2	1
(b)	1	2	3
(c)	2	3	1
(d)	1	3	2.

3.303. The power of a lens
(a) is reciprocal of its focal length
(b) is positive if it is a convex lens
(c) is negative if it is a concave lens
(d) is measured in diopter.

3.304. Diopter is the power of a lens having a focal length of
(a) 25 cm (b) 50 cm
(c) 75 cm (d) 100 cm
(e) 125 cms.

3.305. Pick up the correct statement from the following :
(a) the power of a lens is the reciprocal of its focal length
(b) the unit of power of the lens is diopter
(c) the power of two or more thin lenses in contact is the power of the combination of the lenses
(d) all the above.

3.306. Two concave lenses of 60 cm focal length are cemented on either side of a convex lens of 15 cm focal length. The focal length of the combination is
(a) 10 cm (b) 20 cm
(c) 30 cm (d) 40 cm.

3.307. If f_1 and f_2 are the distances from the optical centre of a convex lens of focal length f to conjugate two points P_1 and P_2 respectively, the following relationship holds good
(a) $f = f_1 + f_2$ (b) $f = \frac{1}{2}(f_1 + f_2)$
(c) $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ (d) none of these.

3.308. The lens equation $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ is applicable
(a) when the thickness of the lens is small
(b) only to conjugate distances along the principal axis
(c) the computed quantities are accurate enough for geometrical optics of simple distances
(d) all the above.

3.309. The defect of a lens whereby rays of white light proceeding from a point get dispersed into their components and conveyed to various foci, forming a blurred and coloured image is known as
(a) chromatic aberration (b) spherical aberration
(c) astigmatism (d) coma.

3.310. Flint glass
(a) has slightly the greater refracting power than crown glass
(b) has roughly double refracting power than that of crown
(c) and crown glass proportions yield the required focal length and neutralise the dispersion produced by the convex lens at the emergence from the concave
(d) all the above.

3.311. Pick up the correct statement from the following :
(a) spherical aberration may be reduced by diminishing the aperture
(b) spherical aberration may be minimised by replacing the single lens by a combination of the lenses.
(c) in telescope objectives, a combination of convex lens and concave lens is used.
(d) in eyepieces, two plano-convex lenses placed at a certain distance apart are used
(e) all the above.

3.312. A lens or combination of lenses in which the following defect is completely eliminated is called *aplanatic*
(a) spherical aberration (b) chromatic aberration
(c) coma (d) astigmatism.

3.313. The Huygen's telescope eye piece
(a) is aplanatic (b) achromatic
(c) both (a) and (b) (d) neither (a) nor (b).

3.314. Pick up the correct statement from the following :
(a) a refracting telescope consists optically of two lenses
(b) the principal axes of both the lenses coincide the optical axis of the telescope
(c) the lens nearer the object to be viewed is convex and is called objective
(d) the lens nearer the eye is called eyepiece
(e) all the above.

3.315. Pick up the correct statement from the following :
(a) in astronomical telescope, the rays from the object after refraction at the objective are brought to a focus before

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entering the eyepiece to produce a real inverted image in front of the eye piece

(b) in Galileo's telescope, the rays from the object get refracted at the objective and are intercepted by the eyepiece before a real image is formed

(c) a line passing through the optical centre of the objective traversing through the eyepiece, is called line of sight

(d) the line of sight which passes through the intersection of cross-lines marked on a diaphragm fixed in front of the eyepiece in a plane at right-angles to the axis, is called the line of collimation

(e) all the above.

3.316. Pick up the correct statement from the following :

(a) the diaphragm is placed between eyepiece and the objective but nearer to the former

(b) the diaphragm is placed between the eyepiece and objective but nearer to the later

(c) the outer component of the objective is a double-convex lens of crown glass

(d) the inner component of the objective is a flint glass, convexo-concave

(e) all the above.

3.317. In an internal focusing telescope

(a) the objective is at a fixed distance from the diaphragm

(b) the focusing is done by the sliding of a divergent lens.

(c) the focusing divergent lens is situated at about the middle of the tube

(d) all the above.

3.318. The minimum range for sliding the focusing lens in the internal focusing telescope for focusing at all distances beyond 4 m is

(a) 5 mm (b) 10 mm

(c) 15 mm (d) 20 mm.

3.319. Pick up the correct specification of Ramsden eyepiece from the following :

(a) it consists of two equal plano convex lenses

(b) the curved surfaces of plano-convex lenses face each other

(c) the two lenses are separated by a distance equal to 2/3 of the focal length of either lens.

(d) the distance between the diaphragm and the front lens of the eyepiece is kept equal to ¼ th of the focal length of a lens so that rays from a point on the diaphragm enter the eye as a parallel beam

(e) all the above.

3.320. Pick up the correct statement from the following :

(a) if the image of the object does not fall on the plane of the cross-lines, parallax exists

(b) parallax has nothing to do with the eyepiece

(c) the eyepiece is adjusted for clear vision of the cross hairs

(d) all the above.

3.321. The 10 mm markings on a levelling staff placed at 20 m are separated by

(a) $\frac{1}{1000}$ radian (b) $\frac{1}{1500}$ radian

(c) $\frac{1}{2000}$ radian (d) $\frac{1}{2500}$ radian.

3.322. Resolving power of a telescope depends on

(a) the diameter of the aperture

(b) the pupil aperture of the eye

(c) the diameter of the object glass

(d) all the above.

3.323. The longitudinal section of the surface of bubble tube is

(a) straight (b) circular

(c) parabolic (d) elliptic.

3.324. The bubble tube is nearly filled with

(a) alcohol or chloroform

(b) a liquid which is very mobile

(c) a liquid having low freezing point

(d) all the above.

3.325. The radius of curvature of the arc of the bubble tube is generally kept

(a) 10 m (b) 25 m

(c) 50 m (d) 100 m.

3.326. While rotating the theodolite in the horizontal plane the bubble of the bubble tube takes up the same position in its tube, it indicates

(a) the rotation axis is vertical

(b) the trummion axis is horizontal

(c) the line of collimation is perpendicular to vertical axis

(d) none of the above

3.327. For high sensivity of the bubble tube

(a) a liquid of low viscosity is used

(b) a liquid of low surface tension is used

(c) the bubble space should be long

(d) the bubble tube should not be too narrow

(e) all the above.

3.328. Pick up the correct statement from the following :

(a) in the earth's magnetic field, a magnetic needle rests in magnetic meridian

(b) the angle between the true meridian and the magnetic meridian is called magnetic variation

(c) one end of the magnetic needle supported at its centre of gravity tends to dip down towards the nearer magnetic pole of the earth

(d) the magnet properly pivoted is balanced by means of riding weight movable along the needle

(e) all the above.

3.329. Pick up the correct statement from the following :

(a) the length of the brass handle is included in the length of chain

(b) the handles are on swivel joints to prevent twisting of the chain

(c) the fifth tag from either end of the chain is numbered

(d) the length of the Gunter's chain is 66 ft.

(e) all the above.

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3.330. Match List I with List II and select a correct answer by using the codes given below to lists :

List I	*List II*
A. Rangingpoles	1. for setting out approximate right angles
B. Cross staff	2. for marketing the ends of full chain lengths
C. Arrows	3. for setting out accurate right angles
D. Optical squares	4. for ranging of the survey lines.

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	4	1	2	3
(*c*)	4	3	1	2
(*d*)	2	4	1	3.

3.331. If α and β be the elevations of two objects A and B respectively, θ be the angle observed by a sextant. The correct horizontal angle is

(*a*) $\cos \phi = \dfrac{(\cos \theta - \sin \alpha \sin \beta)}{\cos \alpha \cdot \cos \beta}$

(*b*) $\cos \phi = \dfrac{(\sin \theta - \sin \alpha \sin \beta)}{\cos \alpha \cdot \cos \beta}$

(*c*) $\cos \phi = \dfrac{(\cos \theta - \sin \alpha \sin \beta)}{\sin \alpha \cdot \sin \beta}$

(*d*) none of these.

3.332. In a theodolite

(*a*) the telescope axis is perpendicular to transit axis

(*b*) the axis of rotation is perpendicular to transit axis

(*c*) the telescope axis, the transit axis and the rotation axis pass through the centre of theodolite

(*d*) all the above.

3.333. A theodolite is said to be in perfect adjustment if

(*a*) rotation axis is vertical to the transit axis

(*b*) transit axis is perpendicular to line of collimation

(*c*) line of collimation sweeps out a vertical plane while the telescope is elevated or depressed

(*d*) all the above.

3.334. Pick up the correct statement from the following :

(*a*) the tangent screw enables to give small movement under conditions of smooth and positive control

(*b*) standing on the tripod is the levelling head or trib arch

(*c*) the levelling screws are used to tilt the instrument so that its rotation axis is truly vertical

(*d*) all the above.

3.335. Pick up the correct statement from the following :

(*a*) the theodolite in which telescope can be rotated in vertical plane is called a *transmit*

(*b*) when the vertical circle is to the left of the telescope during observation, it is called to be in left face

(*c*) when the vertical circle is to the right of the telescope during observation, it is called to be in right face

(*d*) all the above.

3.336. In optical reading instruments

(*a*) the vertical circle is usually continuous from 0° to 359°

(*b*) the readings increase when the telescope is elevated in the face left position

(*c*) the readings decrease when the telescope is elevated in the face right position

(*d*) all the above.

3.337. Pick up the correct statement from the following :

(*a*) the eyepiece plays no part in defining the line of sight

(*b*) the diaphragm plays no part in defining the line of sight

(*c*) the optical centre of the objective plays no part in defining the line of sight

(*d*) none of these.

3.338. Which one of the following statements is correct ?

(*a*) when the axes of rotation of the graduated circle and the verniers are not coincident, the instrument possesses eccentricity

(*b*) the mean of the readings of the two verniers gives correct reading free from the eccentricity

(*c*) one vernier may be used if the readings of two verniers differ by a constant

(*d*) all the above.

3.339. Pick up the correct statement from the following :

(*a*) with both handles in his left hand, the chain man throws out the chain with his right hand and the second chain man assists him to free it from knots

(*b*) the follower of the chaining operation should be more experienced than the leader

(*c*) at the end of the tenth chain length, the two chain men meet and the ten arrows are handed over to the leader

(*d*) all the above.

3.340. The chaining on sloping ground is

(*a*) easier along the falling gradient

(*b*) easier along the up gradient

(*c*) equally convenient along falling as well as up gradient

(*d*) all the above.

3.341. While measuring the distance between two points along upgrade with the help of a 20 m chain, the forward end of the chain is shifted forward through a distance

(*a*) 20 (sin θ – 1) (*b*) 20 (cos θ – 1)

(*c*) 20 (sec θ – 1) (*d*) 20 (cosec θ – 1).

3.342. The slope correction for a 3° slope for a length of 100 m, is

(*a*) 0.11 m (*b*) 0.12 m

(*c*) 1.13 m (*d*) 1.14 m.

3.343. The slope correction may be ignored if

(*a*) the slope of the ground is less than 3°

(*b*) to slope of the ground is say 1 in 19

(*c*) both (*a*) and (*b*) (*d*) neither (*a*) nor (*b*)

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3.344. Which one of the following mistakes/ errors may be cumulative + or – :
(*a*) bad ranging (*b*) bad straightening
(*c*) erroneous length of chain (*d*) sag.

3.345. Which of the following introduces an error of about 1 in 1000 off 20 m chain is used
(*a*) length of chain 20 mm wrong
(*b*) one end of the chain 0.9 m off the line
(*c*) one end of chain 0.9 m higher than the other
(*d*) middle of the chain 0.45 m off the line
(*e*) all the above.

3.346. Pick up the incorrect statement from the following :
(*a*) while measuring a distance with a tape of length 100.005 m, the distance to be increasing by 0.005 m for each tape length
(*b*) an increase in temperature causes a tape to increase in length and the measured distance is too large
(*c*) the straight distance between end points of a suspended tape is reduced by an amount called the *sag correction*
(*d*) a 100 m tape of cross section 10 mm × 0.25 mm stretches about 10 mm under 5 kg pull.

3.347. If F is the pull applied at the ends of tape in kg, l is the length of tape between end marks in metres, w is the weight of the tape in kg per metre run, then sag correction
(*a*) $C = \frac{w^2 l^3}{24 F^2}$ (*b*) $c = \frac{w^3 l^2}{24 F^2}$
(*c*) $C = \frac{w^2 l^3}{24 F^3}$ (*d*) $C = \frac{24 w^2 l^3}{80 F^3}$.

3.348. If θ is the slope of the ground and l is the measured distance, the correction is
(*a*) $2l \sin^2 \theta/2$ (*b*) $2l \cos^2 \theta/2$
(*c*) $2l \tan^2 \theta/2$ (*d*) $2l \cot^2 \theta/2$.

3.349. If h is the difference in level between end points separated by ℓ, then the slope correction is $\frac{h^2}{2l} + \frac{h^4}{8l^3}$. The second term may be neglected if the value of h in a 20 m distance is less than
(*a*) $\frac{1}{2}$ m (*b*) 1 m
(*c*) 2 m (*d*) 3 m.

3.350. If 50 m point of a 100 m tape is 50 cm off line, and 50 m sections are straight, an error is generated equal to
(*a*) $\frac{1}{10,000}$ (*b*) $\frac{1}{15,000}$
(*c*) $\frac{1}{20,000}$ (*d*) $\frac{1}{25,000}$.

3.351. The sag of 50 m tape weighing 4 kg under 5 kg tension is roughly
(*a*) 0.043 m (*b*) 0.053 m
(*c*) 0.063 m (*d*) 0.073 m
(*e*) 0.083 m.

3.352. The Random errors tend to accumulate proportionally to
(*a*) numbers of operations involved
(*b*) reciprocal of operations involved
(*c*) square root of the number of operation involved
(*d*) cube root of the number of operation involved.

3.353. The additional lines which are measured to show the correctness of the chain surveying are called :
(*a*) check clines (*b*) proof lines
(*c*) tie lines (*d*) all of these.

3.354. Pick up the correct statement from the following :
(*a*) the framework which consists of a series of connected lines, the lengths and directions of which are found from measurements, is called a traverse.
(*b*) the system of a series of lines which forms a circuit which ends at the starting point, is called a closed traverse
(*c*) the traverse that starts from a point already fixed in some survey system and ends on another such point, is called a controlled traverse
(*d*) the traverse that is not controlled is called a fly traverse
(*e*) all the above.

3.355. Pick up the correct statement from the following :
(*a*) The horizontal angle between magnetic meridian and true meridian at a place is called *magnetic declination* or variance of the compass
(*b*) the imaginary lines which pass through points at which the magnetic declinations are equal at a given time are called isogonic lines
(*c*) the isogonic lines through places at which the declination is zero are termed *agonic lines*
(*d*) all the above.

3.356. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Dirction)	*List II (Azimuthalaing)*
A. East	1. 90°
B. North	2. 180°
C. West	3. 278°
D. South	4. 360°

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	1	2	3	4
(*c*)	1	4	3	2
(*d*)	4	1	3	2.

3.357. If the declination of the needle is 10° W
(*a*) each of the whole circle reckoning has to be micros by 10°
(*b*) in the quadrantal method, the correction is positive in the 1st and 3rd quadrants
(*c*) in the quadrantal method, the corrections is negative in 2nd and 4th quadrants
(*d*) all the above.

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3.358. There are two stations A and B. Which of the following statements is correct :

(*a*) the fore bearing of AB is AB.

(*b*) the back bearing of AB is BA.

(*c*) the fore and back bearings of AB differ by 180°

(*d*) all the above.

3.359. Pick up the correct statement from the following

(*a*) 1 second of arc corresponds to a displacement ratio of 1: 206,300

(*b*) 1 degree of arc corresponds to a displacement ratio of 1: 57

(*c*) the angular errors tend to propagate themselves along a traverse as the square root of the number of stations

(*d*) the errors arising from the linear measures tend to be roughly proportional to the lengths of the lines

(*e*) all the above.

3.360. If deflection angles are measured in a closed traverse, the difference between the sum of the right-hand and that of the left hand angles should be equal to

(*a*) 0° (*b*) 90°

(*c*) 180° (*d*) 360°.

3.361. To set out a parallel from a given inaccessible point to a given line AB, the following observations and made

Distance AB and angle $PAM = a$ and angle $PBA = b$ are measured where M is a point on the line BA produced. The perpendicular to the desired parallel line from A and B are :

(*a*) $\dfrac{AB}{\cot b - \cot a}$ (*b*) $\dfrac{AB}{\cos b - \cos a}$

(*c*) $\dfrac{AB}{\cot a - \cot b}$ (*d*) $\dfrac{AB}{\cot a - \cos b}$

3.362. If θ is the probable error of an observed bearing of a line of length l, the error over the whole length of the traverse of n lines of length l is

(*a*) $l\sqrt{n}$ (*b*) $\dfrac{\theta}{l}\sqrt{n}$

(*c*) $\theta\sqrt[3]{n}$ (*d*) $\dfrac{1}{3}\theta\sqrt{n}$.

3.363. Pick up the correct statement from the following :

(*a*) to locate a gross error in bearing that may exist in controlled theodolite traverse, we may plot the traverse from each end. The traverse station having the same coordinates by each route is the one where the error lies

(*b*) to locate a gross error in bearing, in a controlled traverse, we plot the traverse and the station through which perpendicular to sector of the closing line passes is the station at which the error was made

(*c*) to locate a gross error due to taping in a controlled traverse, we plot the traverse to a convenient scale. The bearing of the closing error will be approximately the same as that of the leg in which the gross error consists

(*d*) all the above.

3.364. The probable error of the adjusted bearing at the middle is

(*a*) $\dfrac{1}{2}r\sqrt{n}$ (*b*) $\dfrac{1}{3}r\sqrt{n}$

(*c*) $\dfrac{1}{4}r\sqrt{n}$ (*d*) $\dfrac{1}{5}r\sqrt{n}$.

3.365. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Level line	1. the plane normal to the direction of gravity at all points
B. Horizontal line	2. the surface whose all points are normal to the direction of gravity
C. Level surface	3. in line which is normal to the direction of gravity at all points
D. Horizontal surface	4. the plane normal to the direction of gravity at the point

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	3	4	1
(*c*)	3	1	2	4
(*d*)	4	2	3	1.

3.366. Pick up the correct statement from the following :

(*a*) the lines of sight while observing back sight and fore sight lie in the same horizontal plane

(*b*) the staff readings are measurements made vertically downwards from a horizontal plane

(*c*) the horizontal plane with reference to which staff readings are taken, coincides with the level surface through the telescope axis

(*d*) all the above.

3.367. In levelling operation

(*a*) when the instrument is being shifted, the staff must not be moved

(*b*) when the staff is being carried forward, the instrument must remain stationary

(*c*) both (*a*) and (*b*)

(*d*) neither (*a*) nor (*b*).

3.368. Pick up the correct statement from the following :

(*a*) an observation or the resulting reading with the level on a levelling staff is called *sight*

(*b*) a back sight is the first sight taken after setting up the instrument in any position

(*c*) the first sight on each change point is a fore sight

(*d*) the second sight on each change point is a back sight

(*e*) all the above.

3.369. A back sight

(*a*) is always taken on a point of known elevation or can be computed

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(*b*) is added to the known level to obtain the instrument height
(*c*) taken on an inverted staff is treated as negative
(*d*) all the above.

3.370. Keeping the instrument height as $1\frac{1}{2}$ m, length of staff 4 m, the up gradient of the ground 1 in 10, the sight on the up slope must be less than
(*a*) 25 cm (*b*) 20 m
(*c*) 45 m (*d*) 10 m.

3.371. Keeping the instrument height as 1.5 m, length of staff 4 m, the slope of the ground as 1 in 10, the sight on the down-slope, must be less than
(*a*) 30 m (*b*) 25 m
(*c*) 20 m (*d*) 15 m.

3.372. The total change in level along the line is equal to total back sights
(*a*) minus total fore sights
(*b*) the total rises minus total falls
(*c*) the reduced level of last point minus reduced level of the first point
(*d*) all the above.

3.373. The difference of level between a point below the plane of sight and one above, is the sum of two staff readings and an error would be produced equal to
(*a*) the distance between the zero of gradient and the foot of the staff
(*b*) twice the distance between the zero of graduation and the foot of the staff
(*c*) thrice the distance between the zero of graduation and the foot of the staff
(*d*) none of the above.

3.374. If L is in kilometres, the curvature correction is
(*a*) 58.2 L^2 mm (*b*) 64.8 L^2 mm
(*c*) 74.8 L^2 mm (*d*) 78.4 L^2 mm.

3.375. The combined effect of curvature and refraction over a distance L kilometres is
(*a*) 67.2 L^2 mm (*b*) 76.3 L^2 mm
(*c*) 64.5 L^2 mm (*d*) none of these.

3.376. Pick up the method of surveying in which field observations and plotting proceed simultaneously from the following
(*a*) chain surveying
(*b*) compass surveying
(*c*) plan table surveying
(*d*) tacheometric surveying.

3.377. Which one of the following procedures for getting accurate orientation is the most distinctive feature of the art of plane tabling
(*a*) radiation (*b*) intersection
(*c*) traversing (*d*) resection.

3.378. The operation of resection involves the following steps
1. rough orientation of the plane table
2. the three lines form a triangle of error
3. drawing lines back through the three control points
4. select a point in the triangle of error such that each ray is equally rotated either clockwise or anti clockwise
5. the points obtained by three rays is the correct location.

The correct sequence is
(*a*) 1, 3, 2, 4, 5
(*b*) 1, 2, 3, 4, 5
(*c*) 1, 4, 3, 2, 5
(*d*) 1, 3, 2, 4, 5.

3.379. Match List I and List II and select a correct answer by using the codes given below the lists :

List I
A. Steep ground
B. Flat ground
C. Uniform slope
D. Plane surface.

List II
1. uniform distance between contours
2. contours widely separated
3. equally spaced parallel contours
4. contours sun close together.

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	4	2	1	3
(*c*)	3	1	2	4
(*d*)	2	3	4	1.

3.380. Contour lines of different elevations can unite to form one line, only in the case of
(*a*) a vertical cliff (*b*) a saddle
(*c*) a water shed line (*d*) a hill top.

3.381. Pick up the correct statement from the following
(*a*) the contour lines having the same elevation cannot unite and continue as one line
(*b*) a contour can not end abruptly, but must ultimately close itself not necessarily within the limits of map.
(*c*) the direction of steepest slope at a point on a contour is at right angles to the contour
(*d*) all the above.

The following 17 items, consist of two statements one labelled the 'Assertion A' and other labelled the 'Reason R'. You are to examine these two statements and decide if the Assertion A and the Reason R are individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answers to these items using the codes given below and mark your answers sheet accordingly.

Codes :
(*a*) Both A and R are true and R is the correct explanation of A
(*b*) Both A and R are true but R is not a correct explanation of A
(*c*) A is true but R is false
(*d*) A is false but R is true.

3.382. Assertion : The plane horizontal at one point does not

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precisely coincide with that through any other point.

Reason : The directions of plumb lines suspended at different points in a survey are not strictly parallel.

3.383. Assertion : In extensive survey operations in any area, it is always better to use the information of geodetic surveys available in the area.

Reason : It saves the engineer or surveyor a great deal of work in providing his own control points and also enables him to obtain most useful checks at various stages of his work.

3.384. Assertion : The working from the whole to the part presents the accumulation of error.

Reason : The error tends to magnify itself very quickly.

3.385. Assertion : An accurate basic control is required to be established for surveying an area of large extent.

Reason : Large errors are prevented and minor ones are controlled and localised.

3.386. Assertion : While making adjustment of survey instruments, they should be placed on firm ground.

Reason : Instability of the instrument makes it impossible to adjust it satisfactorily.

3.387. Assertion : The prisms of large deflection are not normally found in surveying instruments.

Reason : The light of different colours is differently deflected.

3.388. Assertion : An optical component known as parallel plate is widely used in surveying instruments.

Reason : This displaces a beam of light without changing its direction as there is no effect of colour dispersion.

3.389. Assertion : The complete achromatism can not be achieved by the use of only flint glass and crown glass.

Reason : The ratio of their dispersive powers varies at different parts of the spectrum.

3.390. Assertion : The component rays of a beam proceeding from a point on the principal axis are not refracted to pass through a single point.

Reason : They are focussed differently according to their positions of incidence on the lens.

3.391. Assertion : The Galileo's telescope is not suitable for surveying instruments.

Reason : It does not produce a real image.

3.392. Assertion : The interior of the body of internal focusing telescope is pointed dull black.

Reason : It prevents reflection from internal surfaces of the telescope.

3.393. Assertion : The most convenient and sensitive device for determining the position of a horizontal and a vertical plane is the bubble tube.

Reason : The action of bubble tubes depends on the fact that the free surface of still liquid is a level surface.

3.394. Assertion : The flat top with a control screw is provided in the theodolite tripod.

Reason : It is possible to provide 30 or 40 mm of lateral adjustments to facilitate the precise centering of the instrument over a ground mark.

3.395. Assertion : The main advantage of the non-transiting telescopes was that it did not require high supports.

Reason : The instrument is made comparatively compact.

3.396. Assertion : The change of zero is neither possible nor feasible.

Reason : The vertical angles are influenced by atmospheric refraction, the effects of which are somewhat irregular.

3.397. Assertion : The counting of the paces by the leader when pulling the chain forward should be carefully noted.

Reason : It saves the follower to search for the arrow in high grass.

3.398. Assertion : Measurement on the ground yields better results than stepping.

Reason : On short slopes of varying degree the method of stepping is quicker and generally used.

3.399. Assertion : The refined ranging in chaining is necessary if offsetting is to be done.

Reason : The offsets are put in error by the full amount of the divergence.

3.400. Assertion : The measured distance of a line at a height above sea level is longer than the distance between the points that are vertically below the ends of line.

Reason : The curvature of the earth increases the length.

3.401. Assertion : If an area has more than three straight boundaries, it is not sufficient to measure the sides only.

Reason : An infinite number of figures can be drawn satisfying the data.

3.402. Assertion : The true meridians through the various stations of a survey are not parallel to each other.

Reason : These meridians converge from the equator to the poles.

3.403. Assertion : The amount and direction of the declination is different at different parts of the earth's surface.

Reason : In some places the needle points west, and in others, east of true north.

3.404. Assertion : In the whole circle method of a bearing is completely specified by an angle.

Reason : There is no need to note the cardinal points.

3.405. Assertion : The line of sight between adjacent stations should be as high above ground level as possible to avoid grazing rays.

Reason : The grazing lines cause minor in accuracies in observing the angles.

3.406. Assertion : The level surface is not a plane, nor has it a regular form.

Reason : The local deviations of the plumb line is caused due to irregular distribution of the mass of the earth's crust.

3.407. Assertion : The height of instrument is open to objection.

Reason : A mistake in intermediate reduction may pass unnoticed.

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3.408. Assertion : The wear at the bottom of a staff is of no consequence.

Reason : It is unnecessary to keep the zero of graduation at the foot of the staff because the differences of staff readings represent differences of level.

3.409. Assertion : The staff should be held truely vertical.

Reason : If the staff is held off the plumb, the reading will be too great.

3.410. Assertion : The error accumulated in working up one side is more or less completely neutralised in descending the other side.

Reason : While levelling up a slope the observer reads up the staff in taking back sights and near the bottom for foresights and during levelling down hill, the fore sights are longer than back sights.

3.411. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Topographical surveys	1. used for determining the absolute locations
B. Cadastral surveys	2. used to prepare maps of water bodies
C. Hydrographic surveys	3. used for revenue maps
D. Astronomical surveys	4. used to depict the topography of the terrain

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	1	2	3	4
(*c*)	1	3	4	2
(*d*)	4	1	2	3

3.412. Match list I with *List II* and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Ranging rods	1. 40cm
B. Ranging poles	2. 3m
C. Offset rods	3. 4 m to 6 m
D. Chain arrows	4. 2 m to 3 m

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	1	2	3	4
(*c*)	1	2	4	3
(*d*)	1	4	3	2

3.413. Match list I with *List II* and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Main survey line	1. longest chain line
B. Tie line	2. used for checking the work
C. Check line	3. used for surveying details
D. Baseline	4. line joining two main survey stations

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	1	4	2	3
(*c*)	2	3	1	4
(*d*)	4	1	2	3

3.414. Match list I with List II and select the correct answe by using the codes given below the lists :

List I	*List II*
A. True bearing	1. clockwise angle between the magnetic meridian and the survey line
B. Magnetic bearing	2. clockwise angle between the true meridian and the survey line
C. Grid bearing	3. clockwise angle between the grid meridian and the survey line
D. Arbitrary bearing	4. clockwise angle between the arbitrary meridan and the survey line

Codes :

	A	B	C	D
(*a*)	2	1	3	4
(*b*)	1	2	3	4
(*c*)	4	3	2	1
(*d*)	1	2	3	4

3.415. What is the correct sequence of the following stages the plane table survey ?

1. Fixing the plane table on tripod
2. Orientation of the plane table
3. Levelling of the plane table
4. Centering of the plane table

Choose the answer from the codes given below :

Codes:

(*a*) 1, 2, 3, 4
(*b*) 2, 4, 1, 3
(*c*) 1, 4, 3, 2
(*d*) 1, 3, 4, 2

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3. 416. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Radiation method	1. To provide control points
B. Intersection method	2. For plan tabling of small area
C. Traversing method	3. To locate inaccessible points
D. Resection method	4. To interpolate the plane table position

Codes :

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	2	3	4

3 .417. A, B and C are the ground stations whose locations on the plane table are respectively a, b and c. To locate the position of the plane table, which is the correct sequence of operation by the Bessel' s method.

1. Aligning the alidade along ba, sight A. Pivoting the alidade about b, sight c. Draw ray be.
2. Aligning the alidade along ab, sight B. Pivoting the alidade about a, sight C. Draw a ray ac to cut the ray be at d.
3. Aligning the alidade along dc, sight c.
4. Pivoting the alidade about a and b, sight A and B in turn and draw rays to intersect the line dc.

Choose the answer from the codes given below :

Codes :

(a) 4, 2, 3, 1 (b) 1, 3,4, 2
(c) 1, 2, 3, 4 (d) 3, 1, 2,4

3.418. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Level line	1. The straight line tangential to level line
B. Horizontal line	2. The plumb line
C. Vertical line	3. The cross section of a stil lake water
D. Collimation line	4. The line joining the optical centre and interection of cross hairs

Codes:

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	3	2	1	4
(d)	1	4	2	3

3.419. Match list I with List II for entering the missing entries of the following page of the level work. Select the answer by using the codes given below the lists :

Stn.	*BS*	*IS*	*FS*	*Rise*	*Fall*	*RR*	*Remarks*
1	0.255					500.000	BM
2	A		3.125		B	497.130	CP
3		1.625			0.875	496.255	
4	2.855		C	0.525		D	C
5			1.700	1.155		497.935	BM
Σ	3.860		5.925	1.680	3.745		

List I	*List II*
A. Reading	1. 1.100
B. Reading	2. 496.780
C. Reading	3. 0.750
D. Reading	4. 2.870

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	3	4	1	2
(c)	1	4	3	2
(d)	1	2	3	4

3.420. For a perfectly adjusted level, match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. The axis of bubble tube	1. perpendicular to vertical axis
B. The vertical axis	2. perpendicular to axis of bubble tube
C. The axis of telescope	3. parallel to line of collination
D. The line of collimation	4. coincides the axis of telescope

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	1	3	2	4
(c)	4	2	3	1
(d)	4	1	2	3

3.421. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Fathoms	1. contours of water bodies
B. Contour	2. minimum horizontal distance between adjacent contours
C. Horizontal equivalent	3. imaginary line joining the points of same elevation

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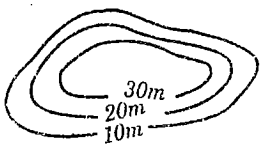
D. Contour interval — 4. vertical distance between two contours

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	2	3	4

3.422. Match list I with List II and select the correct answer by using the codes given below the lists :

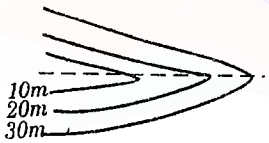
List I — *List II*

A. 

1. Saddle

B.

2. Valley

C. 

3. Ridge

D.

4. Hill

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	4	3	2

3.423. If $h_1, h_2, h_3, ..., h_n$ are the ordinates and 'd' is the common distance, L is the total length of the chain line, for calculating the area enclosed by the boundary, end ordinates and the chain line, match list I with List II and select the correct answer by using codes given below the lists :,

List I

A. The mid-ordinate rule

B. The average ordinate rule

C. The tapezoidal rule

D. The Simpson's rule

List II

1. $\frac{h_1 + h_2 + h_3 + h_4 + ... + h_n}{n} \times L$

2. $(h_1 + h_2 + h_3 + h_4 + ... + h_n)\, d$

3. $\frac{d}{3} h_1 + 2(h_3 + h_5 + h_7 + ...) + 4\,(h_2 + h_4 + ...) + h_n$

4. $d \left\{ \frac{h_1 + h_n}{n} + h_2 + h_3 + h_4 + ... + h_{n-1} \right\}$

Codes :

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	3	4
(c)	4	3	1	2
(d)	1	2	4	3

3.424. Match list I with List II and select the correct answer by using the codes given below the lists :

List I — *List II*

A. Centering theodolite — 1. Turning telescope in vertical plane

B. Transiting theodolite — 2. Moving telescope about vertical axis

C. Swing theodolite — 3. Keeping vertical circle to be the left

D. Telescope normal — 4. Bringing vertical axis over the ground point

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	4	3
(c)	3	2	1	4
(d)	1	3	2	4

3.425. Match list I with List IT and select the correct answe by using the codes given below the lists :

List I — *List II*

A. Eccentricity of the centres — 1. Reading both ver niers

B. Imperfect line of collimation — 2. Observations on both faces

C. The pointing of telescope — 3. Method of repetition

D. Errors in graduations — 4. Reading on differen zeros

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	2	1	4
(d)	1	2	4	3

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3.426. What is the correct sequence of the following columns of Gale's Traverse Table ?

1. R.B.
2. Included angle
3. W.C.B.
4. Length

Choose the answer from the codes given below :

Codes:

(*a*) 1, 2, 3, 4
(*b*) 2, 3, 4, 1
(*c*) 4, 2, 3, 1
(*d*) 1, 4, 2, 3

3.427. In a right handed equilateral triangle ABC, the W.C.B. of AB is 300. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. side BC	1. 270°
B. side CA	2. 150°
C. side AC	3. 330°
D. side CB	4. 90°

Codes :

	A	B	C	D
(*a*)	2	1	4	3
(*b*)	1	4	3	2
(*c*)	2	3	4	1
(*d*)	1	4	3	2

3.428. In a right handed square traverse ABCD, the bearing of AB is 450. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Side AB	1. 135°
B. Side BC	2. 225°
C. Side CD	3. 315°
D. Side DA	4. 45°

Codes:

	A	B	C	D
(*a*)	4	1	2	3
(*b*)	1	2	3	4
(*c*)	2	3	4	1
(*d*)	3	2	1	4

3.429. A : A, B, C are the stations sighted from the plane table Station P.

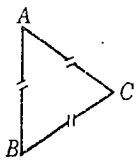
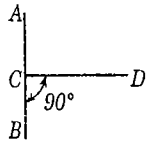
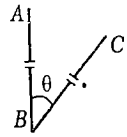
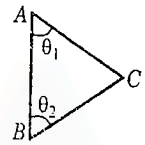
R : The fix is most accurate when plane table station *P* and stations A, B and C are on a circle.

(*a*) Both A and R are true
(*b*) A is true but R is not correct explanation
(*c*) A is true but R is false
(*d*) Both A and R are false.

3.430. If the angle of slope of 10°, then correction per 100 links, is

(*a*) 0.5 links (*b*) 1.0 links
(*c*) 1.5 links (*d*) 2.2 links

3.431. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. 	1. Intersection
B. 	2. Traverse surveys
C. 	3. Chain surveys
D. 	4. Offsets.

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	4	1	3	2
(*c*)	3	4	2	1
(*d*)	3	1	4	2

3.432. Pick up the correct statement from the following :

(*a*) The mirro optical square makes use of the fact that a ray of light reflected from two mirrors is turned through twice the angle between the mirrors.
(*b*) The prismatic type of optical square employs a pentagonal shaped prism
(*c*) The cross staff consists essentially of an octagonal brass box with slits cut in each face
(*d*) All the above.

3.433. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Engg. work)	*List II (Scale)*
A. Architectural works	1. 1 : 500 ; 1 : 1000 ; 1 : 1250 ; 1 : 2000
B. Civil Engineering works	2. 1 : 50,,000 ; 1 : 100,,000 ; 1 : 250,,000
C. Highway surveys	3. 1 : 50 ; 1 : 100 ; 1 : 200
D. Topographical surveys	4. 1 : 2000 ; 1 : 2500 ; 1 : 5000 ; 1 : 10,,000 ; 1 : 20,000 ; 1 : 50,,000

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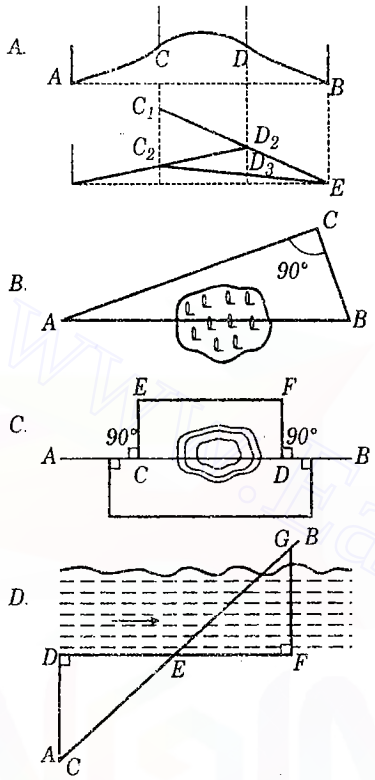
Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	3	1	4	2
(c)	3	1	2	4
(d)	2	4	3	1

3.434. Match List I with List II and select a correct answer by using the codes given below the lists :

List I



List II

1. Measuring across the river
2. Method of repeated alignment
3. Random line method
4. Chaining is prevented.

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	3	1	4	2
(c)	2	3	4	1
(d)	2	4	3	1

3.435. The defect of chromatic aberration in a levelling telescope is remedied by using two lenses which are cemented together

(a) One being a concave lens of flint glass and the other a convex lens of crown glass
(b) One being a concave lens of crown glass and the other a convex lens of flint glass
(c) Both being a crown glass
(d) Both being of flint glass.

3.436. Ramsden eye piece which is free from spherical aberration consists of two identical plano-convex lenses with their curved faces facing, and separated by a distance equal to

(a) One-fourth the focal length of either
(b) One-third the focal length of either
(c) One-half the focal length of either
(d) Two-third the focal length of either.

3.437. All level readings are taken to :

(a) trunnion axis (b) vertical line
(c) line of collimation (d) line of sight.

3.438. The first reading made with the staff on a point of known reduced level, is called

(a) fore sight (b) back sight
(c) intermediate sight (d) bench mark.

3.439. The line joining the points of equal altitude, is called

(a) Contour (b) Vertical interval
(c) Horizontal equivalent (d) None of these.

3.440. Match List I with List II and select suitable answer by using the codes given below the lists

List I (Order of levelling)	*List II (Accuracy)*
A. First	1. $45\sqrt{K}$ mm
B. Second	2. $120\sqrt{K}$ mm
C. Third	3. $12\sqrt{K}$ mm
D. Fourth	4. $8.4\sqrt{K}$ mm

Codes :

	A	B	C	D
(a)	4	3	1	2
(b)	1	4	3	2
(c)	2	1	4	3
(d)	3	1	2	4

3.441. Pick up the statement not applicable to Bowditch method of traverse adjustment from the following :

(a) The probable error in the bearing of a traverse leg due to some inaccuracy in angular measurement gives displacement of one end of the traverse leg, relative the other end, equal and at right angles to that displacement, due to probable error in a measurement of length.
(b) The probable error in length (l) is taken to be proportional to $\sqrt{l}$
(c) The total probable error is equal to the square root twice the square of the displacement due to the probable error in linear measurement
(d) Correction to a $\frac{\text{latitude}}{\text{deparature}}$

$$= \text{total}\frac{\text{latitude}}{\text{departure}}\text{correction} \times \frac{\text{lenght of the side}}{\text{perimeter of the traver}}$$

(e) None of the above.

3.442. Pick up the correct statement regarding the transit rule for traverse adjustment from the following :

(a) The transit rule is based on the method of least squar

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(*b*) The corrections are made in both latitude and departure even if a line has no latitude or departure

(*c*) Correction of $\frac{\text{latitude}}{\text{departure}}$ of a traverse leg Total correction of $= \frac{\text{latitude}}{\text{departure}} \times \frac{\frac{\text{latitude}}{\text{departure}} \text{ of the leg}}{\text{sum of } \frac{\text{latitude}}{\text{deparatures}}}$

(*d*) None of the above.

3.443. For calculating the area enclosed by an irregular boundary we generally use :

(*a*) Planimeter (*b*) Bowditch's rule
(*c*) Simpson's rule (*d*) Trapezoidal rule.

3.444. For calculating the area of an enclosed traverse by using the coordinates of the traverse stations, we make use of

(*a*) longitudes (*b*) latitudes
(*c*) double longitudes (*d*) both (*a*) and (*b*)

3.445. The longitude of traverse line n = longitude of line $(n-1)$:

(*a*) $+\frac{1}{2}$ deparature of line $(n-1)$ $+\frac{1}{2}$ deparature of line n

(*b*) $-\frac{1}{2}$ deparature of line $(n-1)$ $+\frac{1}{2}$ deparature of line n

(*c*) $+\frac{1}{2}$ deparature of line $(n-1)$ $-\frac{1}{2}$ deparature of line n

(*d*) $+\frac{1}{3}$ deparature of line $(n-1)$ $+\frac{1}{3}$ deparature of line n

3.446. Which one of the following statements is not applicable to the Simpson's Rule for the calculation of areas :

(*a*) It is most accurate method of calculating areas
(*b*) It is assumeed that the irregular boundary is composed of a series of parabolic areas
(*c*) The geometrical figure must be divided into an odd number of equal strips
(*d*) None of these.

3.447. Simpson's Rule for areas states that the area enclosed by a curvilinear figure divided into an even number of strips of equal width : equal to one third the width of a strip multiplied by the sum of the two extreme offsets

(*a*) twice the sum of the remaining odd offsets, and four times the sum of the even offsets
(*b*) Thrice the sum of the remaining odd offsets, and four times the sum of the even offsets
(*c*) Four times the sum of the remaining odd offsets, and four times the sum of the even offsets
(*d*) Four tiems teh sum of the remaining odd offsets, and twice the sum of the even offsets.

3.448. Which one of the following statements is not true for mass haul diagrams

(*a*) The diagram is plotted after the earthwork quantities have been computed
(*b*) The aggregate volumes in cubic metres are plotted as the ordinates
(*c*) The horizontal base line is plotted to the same scale as the profile for plotting the volumes
(*d*) The cutings are assumed as positive, the fillings as negative and total volumes are plotted above or below the base line according to positive or negative
(*e*) None of the above.

3.449. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I	*List II*
A. Horizontal line	1. Line joining the centre of diaphgram and point on the objective
B. Level line	2. A line tangential to the level line at any particular objective
C. Line of collimation	3. A line at a constant height relative to mean sea level
D. Line of sight	4. The line joining the intersection of cross hairs and optical centre of the objective

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	3	4	1
(*c*)	3	4	1	2
(*d*)	4	1	2	3

3.450. The readings on back staff A and forward staff B are respectively 3.222 m and 1.414 m. Which one of the following statements is true

(*a*) The back staff A is at lower level than that of forward staff B.
(*b*) The forward staff B is at higher level than that of the back staff B.
(*c*) The difference is level between staves A and B is 1.808 m.
(*d*) All the above.

3.451. Which one of the following statements regarding levelling is correct ?

(*a*) If second reading is less than the first, there is a rise.
(*b*) If second reading is greater than the first, there is a fall.
(*c*) If second reading is equal to the first, the two stations are at same level.
(*d*) All the above.

3.452. The following technical terms are generally used in levelling :

1. Change point
2. Intermediate staff reading
3. Back staff reading
4. Forward staff reading

Their correct sequence is as under:

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(a) 1 2 3 4
(b) 2 3 4 1
(c) 3 2 4 1
(d) 4 1 2 3

3.453. Pick up the correct formula for the probable error per kilometre in ordinary levelling due to :
(a) reading = ± 1.6 mm
(b) displacement = ± 7.5 mm
(c) combined effect of reading and displacement = ± 7.7 mm
(d) all the above.

3.454. The mean of two vertical angles taken on two faces of a theodolite is the true verticala angle
(a) provided the altitude bubble is brought to the centre.
(b) even if the altitude bubble is nor brought central.
(c) even if the altitude bubble remains either right or left of the central position during both forces savals.
(d) None of the above.

3.455. The following permanent adjustments are required for complete adjustment of the transit :
1. To adjust the altitude bubble and vertical axis
2. The set the vertical axis of the instrument truly vertical and to adjust the plate bubble
3. To set the horizontal axis at right angles to the vertical axis
4. To set the telescope sighting line at right angles to the horizontal or trunnion axis

The correct sequences of the adjustments is
(a) 1 2 3 4
(b) 3 4 1 2
(c) 2 4 3 1
(d) 4 3 2 1

3.456. Pick up the incorrect statement from the following :
(a) The lines joining number of stations chosen to fulfil the demands of the survey is called traverse lines.
(b) If the lines form a polygon, then a closed traverse is obtained.
(c) A traverse run between two triangulation or traverse station, is called an open traverse.
(d) None of the above.

3.457. The whole circle bearing are measured :
(a) Clockwise from south, from 0° to 360°
(b) Clockwise from north, from 0° to 360°
(c) Anti-clockwise from north, from 0°r to 360°
(d) Anti-clockwise from south, from 0° to 360°

3.458. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I (Coordinate)	*List II (Direction)*
A. Positive latitude	1. West
B. Positive deparature	2. North
C. Negative deparature	3. South
D. Negative latitude	4. East

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	1	3
(c)	4	2	3	1
(d)	1	3	2	4

3.459. Match List I with List II and choose a correct answ by using the codes given below the lists :

List I (Order of traverse angle)	*List II (Accuracy o horizontal angle)*
A. First	1. $10\sqrt{N}$ sec
B. Second	2. $30\sqrt{N}$
C. Third	3. $2\sqrt{N}$
D. Fourth	4. $60\sqrt{N}$

Codes :

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	4	3	2	1
(d)	3	4	1	2

3.460. Weisbach triangle is generally used
(a) for establishing sewer lines
(b) for establishing a connection of surface and und ground lines
(c) for computation of astronomical data
(d) for hydrographical surveys.

3.461. Pick up the correct statement from the following :
(a) The method of measuring angular measurements degrees, minutes and seconds, is called the sexagesin system
(b) The method of measuring angular measurements grades, centesimals and centecentesimals, is called c tesimal system
(c) Incentesimal system, angles are expressed as decim
(d) All the above.

3.462. Pick up the correct statement from the following :
(a) Mass haul diagrams is of great value inplanning a construction of railway/road embankments
(b) The aggregate volumes of earthwork quantities plotted as ordinates
(c) The distance specified for transporting the excava anaterial in the bill estimate, is called free-haul
(d) Haul is the total of the produces of the separate volun of cut and the distance they are transported.
(e) All the above.

3.463. Pick up the planetable method which needs the help other planetable for surveying the entire area completely fr the following
(a) Method of radiation (b) Method of intersectio
(c) Method of resection (d) Method of traversing.

3.464. Pick up the correct statement regarding the nauti

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sextant from the following :
(a) It contains a 60° arc divided in degrees.
(b) Its index glass is wholly silvered and pivoted at the pivot end of index arm.
(c) Its horizon glass is half-silvered glass.
(d) The plane of horizon glass is parallel to the radius through the zero of the graduated arc
(e) All the above.

3.465. Assume that α and β are the angles of elevations of two points. If the observed horiontal angle by a sextant is θ then the true horizontal angle is

(a) $\frac{\sin\theta - \sin\alpha \,.\, \sin\beta}{\cos\alpha \,.\, \cos\beta}$ (b) $\frac{\cos\theta - \cos\alpha \,.\, \cos\beta}{\sin\alpha \,.\, \sin\beta}$

(c) $\frac{\sin\theta + \sin\alpha \,.\, \sin\beta}{\cos\alpha \,.\, \cos\beta}$ (d) $\frac{\cos\theta - \cos\alpha \,.\, \cos\beta}{\sin\alpha \,.\, \sin\beta}$

3.466. Which one of the following statements is not correct in respect of a prismatic compass :
(a) It consists of a glass-topped case of diameter 114 mm.
(b) An engine-divided aluminium ring carrying the needle rotates on a jewelled centre
(c) The scale is divided round the ring from 0° to 360° in degrees and half degree in an anticlock wise direction
(d) The zero reading is engraved at the south end of the graduated ring.

3.467. The actual staff intercept (S_1) for a δ° tilt and θ angle of slope is obtained from the following formula $S_1 = \frac{s\cos\theta}{\cos(\theta - \delta)}$ provided :
(a) the vertical angle θ is not greater than ± 30°
(b) The vertical angle θ is always greater than angle of tilt δ
(c) The angle of tilt is small and not greater than 3°
(d) The tachemoter is anallatic
(e) All the above.

3.468. For a design speed of 80 km/h, the normal radius (m) for 4 percent super elevation is :
(a) 200 (b) 500
(c) 275 (d) 75.

3.469. Pick up the correct statement from the following :
(a) super elevation = 1 in 314 $\frac{R}{V^2}$ where V is the design speed in km/h and R is the radius in metres
(b) superelevation should not be steeper than 7% (1 in 14.5)
(c) superelevation should not be flatter than 1 in 48
(d) All the above.

3.470. Pick up the correct correction applied to a triangulation base from the following :
(a) The correction for tension is positive if applied tansion is greater than standard tension
(b) The sag correction is negative
(c) The slope correction is negative
(d) The non-alignment correction is negative
(e) All the above.

3.471. The distance between satellite station and main triangulation station
(a) should be 10 to 15 metres
(b) shoulb be correct to 5 mm
(c) should retain an accuracy of 0.1 sec
(d) all the above.

3.472. Pick up the incorrect statement regarding the selection of the current meter station from the following :
(a) The channel should be regular in shape and straight up-and down stream of resection.
(b) The channel bed should be free of obstruction.
(c) The flow in the channel should be turbulent.
(d) None of these.

3.473. Pick up the correct statement from the following :
(a) The theodolite is essentially an English instrument from its first inception
(b) The survey of India provided the popularity to the plane table as survey instrument
(c) The plane table is used to prepare map in the field without the direct measurement of any angles and without calculation
(d) All the above.

3.474. Usefullness of plane table is enhanced by providing :
(a) The Indian tangent clinometer
(b) The box compass
(c) The optical square
(d) The planimeter
(e) None of these.

3.475. For the revison of an existing survey with the heldp of plane table we generally use
(a) radiation method (b) intersection method
(c) resection method (d) none of these.

3.476. A point determined by resection on a plane table is called :
(a) survey point (b) survey station
(c) planetable fix (d) none of these.

3.477. Pick up the correct rule used to assist in determining the plane table fix from the following :
(a) The plane table fix will be inside the triangle of error if the instrument is inside the triangle formed by the three ground points sighted
(b) Looking along the rays from the plane table towards the points to which they refer, the plane table fix will lie either to the right of all three rays or to the left of all three rays
(c) The perpendicular distances of the planetable fix from the tree rays are proportional to the distances from the plane table of the corresponding points
(d) All the above.

3.478. The stadia lines of a tacheometer are :
(a) top line and middle line
(b) middle line and bottom line
(c) top line and bottom line
(d) none of these.

3.479. If the additive constant of a tacheometer is very small

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but not actually zero, which one of the following approximate formula may be used :

(a) $H = (C_s + K)\cos^2\theta$ (b) $V = (C_s + K)\frac{\sin 2\theta}{2}$

(c) Both (a) and (b) (d) Neither (a) nor (b)

3.480. Tilt of the vertically held staff increases the intercept when the telescope points :

(a) uphill and the staff tilted away from the telescope

(b) down hill and the staff tilted away from the telescope

(c) up hill and the staff titled towards the telescope

(d) none of the above.

3.481. The ratio of error in horizontal distance is equal to

(a) $1 + \frac{\cos(\theta \pm \delta)}{\cos\theta}$ (b) $1 - \frac{\cos(\theta \pm \delta)}{\cos\theta}$

(c) $1 \pm \frac{\cos(\theta + \delta)}{\cos\theta}$ (d) $1 \pm \frac{\cos(\theta - \delta)}{\cos\theta}$

3.482. If a staff is held with a 2° tilt when the angle of elevation is 15°, the probable error is :

(a) 1 : 50 (b) 1 : 75

(c) 1 : 100 (d) 1 : 125

(e) 1 : 150

(Assume cos 13° = 0.9744 ; cos 15° = 0.9659 ; cos 17° = 0.9563)

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5

Applied Mechanics

5.1. A retarding force on a body does not
(*a*) change the motion of the body
(*b*) retard the motion of the body
(*c*) introduce the motion of the body
(*d*) none of these.

5.2. The force acting on a point on the surface of a rigid body may be considered to act
(*a*) at the centre of gravity of the body
(*b*) on the periphery of the body
(*c*) on any point on the line of action of the force
(*d*) at any point on the surface normal to the line of action of the force.

5.3. A number of forces acting simultaneously on a particle of a body
(*a*) may not be replaced by a single force
(*b*) may be replaced by a single force
(*c*) may be replaced by a single force through C.G. of the body
(*d*) may be replaced by a couple
(*e*) none of these.

5.4. Parallelogram Law of Forces states, "if two forces acting simultaneously on a particle be represented in magnitude and direction by two adjacent sides of a parallelogram, their resultant may be represented in magnitude and direction by
(*a*) its longer side"
(*b*) its shorter side"
(*c*) the diagonal of the parallelogram which does not pass through the point of intersection of the forces"
(*d*) the diagonal of the parallelogram which passes through the point of intersection of the forces"
(*e*) half the sum of the diagonals".

5.5. The resultant of two forces P and Q acting at an angle θ, is
(*a*) $P^2 + Q^2 + 2P \sin\theta$ (*b*) $P^2 + Q^2 + 2PQ \cos\theta$
(*c*) $P^2 + Q^2 + 2PQ \tan\theta$ (*d*) $\sqrt{P^2 + Q^2 + 2PQ \cos\theta}$
(*e*) $\sqrt{P^2 + Q^2 + 2PQ \sin\theta}$.

5.6. If the resultant of two forces P and Q acting at an angle θ makes an angle α with P, then $\tan\alpha$ equals
(*a*) $\dfrac{P \sin\theta}{P - Q\cos\theta}$ (*b*) $\dfrac{Q \sin\theta}{P + Q\cos\theta}$
(*c*) $\dfrac{P \sin\theta}{P + Q\tan\theta}$ (*d*) $\dfrac{Q \sin\theta}{Q + P\sin\theta}$.

5.7. If two equal forces of magnitude P act at an angle θ, their resultant, will be
(*a*) $P\cos\theta/2$ (*b*) $2P\sin\theta/2$
(*c*) $P\tan\theta/2$ (*d*) $2P\cos\theta/2$
(*e*) $P\sin\theta/2$.

5.8. If two forces P and Q ($P > Q$) act on the same straight line but in opposite direction, their resultant, is
(*a*) $P + Q$ (*b*) P/Q
(*c*) Q/P (*d*) $P - Q$
(*e*) $Q - P$.

5.9. If two forces of 3 kg and 4 kg act at right angles to each other, their resultant force will be equal to
(*a*) 7 kg (*b*) 1 kg
(*c*) 5 kg (*d*) 1/7 kg
(*e*) none of these.

5.10. Two forces act an angle of 120°. If the greater force is 50 kg and their resultant is perpendicular to the smaller force, the smaller force is
(*a*) 20 kg (*b*) 25 kg
(*c*) 30 kg (*d*) 35 kg
(*e*) 40 kg.

5.11. The resolved part of the resultant of two forces inclined at an angle θ in a given direction is
(*a*) algebraic sum of the resolved parts of the forces in the direction
(*b*) arithmetical sum of the resolved parts of the forces in the direction
(*c*) difference of the forces multiplied by cosine θ°
(*d*) sum of the forces multiplied by the sine θ
(*e*) sum of the forces multiplied by the tangent θ°.

5.12. The resultant of two forces acting at right angles is $\sqrt{34}$ kg and acting at 60° is 70 kg. The forces are
(*a*) 1 kg and 4 kg (*b*) 2 kg and 3 kg
(*c*) 3 kg and $\sqrt{5}$ kg (*d*) $\sqrt{3}$ kg and 5 kg
(*e*) 3 kg and 5 kg.

5.13. A point subjected to a number of forces will be in equilibrium, if
(*a*) sum of resolved parts in any two directions at right angles, are both zero
(*b*) algebraic sum of the forces is zero
(*c*) two resolved parts in any two directions at right angles are equal
(*d*) algebraic sum of the moments of the forces about the point is zero
(*e*) none of these.

5.14. The forces which meet at one point and have their lines of action in different planes are called

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(*a*) coplaner non-concurrent forces
(*b*) non-coplaner concurrent forces
(*c*) non-coplaner non-current forces
(*d*) intersecting forces
(*e*) none of these.

5.15. Lami's theroem states that
(*a*) three forces acting at a point are always in equilibrium
(*b*) if three forces acting on a point can be represented in magnitude and direction by the sides of a triangle, the point will be in the state of equilibrium
(*c*) three coplaner forces acting at a point will be in equilibrium, if each force is proportional to the sine of the angle between the other two
(*d*) three coplaner forces acting at a point will be in equilibrium if each force is inversely proportional to the sine of the angle between the other two
(*e*) none of these.

5.16. Principle of Transmissibility of Forces states that, when a force acts upon a body, its effect is
(*a*) maximum if it acts at the centre of gravity of the body
(*b*) different at different points on its line of action
(*c*) same at every point on its line of action
(*d*) minimum if it acts at the C.G. of the body
(*e*) none of these.

5.17. According to Law of Triangle of Forces
(*a*) three forces acting at a point, can be represented by the sides of a triangle, each side being in proportion to the force
(*b*) three forces acting along the sides of a triangle are always in equilibrium
(*c*) if three forces acting on a point can be represented in magnitude and direction, by the sides of a triangle taken in order, these will be in equilibrium
(*d*) if three forces acting at a point are in equilibrium each force is proportional to the sine of the angle between the other two
(*e*) if the forces acting on a particle be represented in magnitude and direction by the two sides of a triangle taken in order, their resultant will be represented in magnitude and direction by the third side of the triangle, taken in opposite order.

5.18. The Law of Polygon of Forces states that
(*a*) if a polygen representing the forces acting at point in a body is closed, the forces are in equilibrium
(*b*) if forces acting on a point can be represented in magnitde and direction by the sides of a polygon taken in order, then the resultant of the forces will be represented in magnitude and direction by the closing side of the polygon
(*c*) if forces acting on a point can be represented in magnitude and direction by the sides of a polygon taken in order, their resultant will be represented in magnitude and direction by the closing side of the polygon taken in opposite order
(*d*) if forces acting on a point can be represented in magnitude and direction by the sides of a polygon in order, the forces are in equilibrium

5.19. Effect of a force on a body depends upon its
(*a*) direction (*b*) magnitude
(*c*) position (*d*) all the above.

5.20. If two forces each equal to T in magnitude act at right angles, their effect may be neutralised by a third force acting along their bisector in opposite direction whose magnitude will be
(*a*) $2\,T$ (*b*) $1/2\,T$
(*c*) $\sqrt{2}\,T$ (*d*) $3T$
(*e*) none of these.

5.21. If a body is acted upon by a number of coplaner non-concurrent forces, it may
(*a*) rotate about itself without moving
(*b*) move in any one direction
(*c*) move in any one direction rotating about itself
(*d*) be completely at rest
(*e*) all the above.

5.22. The necessary condition of equilibrium of a body, is :
(*a*) algebraic sum of horizontal components of all the forces must be zero
(*b*) algebraic sum of vertical components of all the forces must be zero
(*c*) algebraic sum of the moments of the forces about a point must be zero
(*d*) all (*a*), (*b*) and (*c*).

5.23. A smooth cylinder lying on its convex surface remains
(*a*) in stable equilibrium (*b*) in unstable equilibrium
(*c*) in neutral equilibrium (*d*) out of equilibrium
(*e*) none of these.

5.24. The height at which the end of a rope of length l should be tied so that a man pulling at the other end may have the greatest tendency to overturn the pillar, is
(*a*) $\frac{3}{4}l$ (*b*) $\frac{1}{2}$
(*c*) $\frac{l}{\sqrt{2}}$ (*d*) $\frac{2}{\sqrt{3}}l$
(*e*) none of these.

5.25. A heavy ladder resting on a floor and against a vertical wall may not be in equilibrium, if
(*a*) floor is smooth and the wall is rough
(*b*) floor is rough and the wall is smooth
(*c*) floor and wall both are smooth surfaces
(*d*) floor and wall both are rough surfaces.

5.26. Varigon's theorem of moments states
(*a*) arithmetical sum of the moments of two forces about any point, is equal to the moments of their resultant about that point
(*b*) algebraic sum of the moments of two forces about any point, is equal to the moment of their resultant about that point
(*c*) arithmetical sum of the moments of the forces about any point in their plane, is equal to the moment of their

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resultant about that point

(*d*) algebraic sum of the moments of the forces about any point in their plane, is equal to the moment of their resulant about that point.

5.27. A uniform rod 9 m long weighing 40 kg is pivoted at a point 2 m from one end where a weight of 120 kg is suspended. The required force acting at the end in a direction perpendicular to rod to keep it equilibrium, at an inclination 60° with horizontal, is

(*a*) 40 kg (*b*) 60 kg
(*c*) 10 kg (*d*) 100 kg.

5.28. The centre of gravity of a plane lamina will not be at its geometrical centre if it is a

(*a*) circle (*b*) equilateral triangle
(*b*) rectangle (*d*) square
(*e*) right angled triangle.

5.29. The centre of gravity of a homogenous body is the point at which the whole

(*a*) volume of the body is assumed to be concentrated
(*b*) area of the surface of the body is assumed to be concentrated
(*c*) weight of the body is assumed to be concentrated
(*d*) all the above.

5.30. Pick up the incorrect statement from the following :

(*a*) The C.G. of a circle is at its centre
(*b*) The C.G. of a triangle is at the intersecton of its medians
(*c*) The C.G. of a rectangle is at the intersection of its diagonals
(*d*) The C.G. of a semicircle is at a distance of $r/2$ from the centre
(*e*) The C.G. of an ecllipse is at the intersection of axes.

5.31. The centre of gravity of a quadrant of a circle lies along its central radius at a distance of

(*a*) 0.2 R (*b*) 0.3 R
(*c*) 0.4 R (*d*) 0.5 R
(*e*) 0.6 R.

5.32. The C.G. of a right circular cone lies on its axis of symmetry at a height of

(*a*) $h/2$ (*b*) $h/3$
(*c*) $h/4$ (*d*) $h/5$
(*e*) $h/6$.

5.33. The C.G. of a hemisphere from its base measured along the vertical radius is at a distance of

(*a*) $\frac{4R}{3\pi}$ (*b*) $\frac{3R}{8}$
(*c*) $\frac{3\pi R}{4}$ (*d*) $\frac{8R}{3}$
(*e*) $R/2$.

5.34. Centre of gravity of a thin hollow cone lies on the axis of symmmetry at a height of

(*a*) one-half of the total height above base
(*b*) one-third of the total height above base
(*c*) one-fourth of the total height above base
(*d*) none of these.

5.35. Centre of gravity of a trpezium of height h and parallel sides a and b, measured from the side b is at a distance of

(*a*) $\frac{h}{2}\left(\frac{b+2a}{b+a}\right)$ (*b*) $\frac{h}{2}\left(\frac{b-2a}{B+a}\right)$
(*c*) $\frac{h}{3}\left(\frac{b+2a}{b+a}\right)$ (*d*) $\frac{h}{3}\left(\frac{b-2a}{b+a}\right)$.

5.36. The Centre of gravity of a 10 × 15 × 5 cm T section from its bottom, is

(*a*) 7.5 cm (*b*) 5.0 cm
(*c*) 8.75 cm (*d*) 7.85 cm
(*e*) none of above.

5.37. A square hole is punched out of a circular lamina, the diagonal of the square being the radius of the circle. If r is the radius of the circle, the C.G. of the remainder from the corner of the square on the circumference will be

(*a*) $\frac{r(\pi+0.25)}{\pi-0.5}$ (*b*) $\frac{r(\pi-0.5)}{\pi+0.25}$
(*c*) $\frac{r(\pi-0.25)}{\pi-0.5}$ (*d*) $\frac{r(\pi+0.25)}{\pi+0.5}$.

5.38. From a circular plate of a diameter 6 cm is cut out a circle whose diameter is equal to the radius of the plate. The C.G. of the remainder from the centre of circular plate is at a distance of

(*a*) 2.0 cm (*b*) 1.5 cm
(*c*) 1.0 (*d*) 0.5 cm.

5.39. The units of moment of inertia of an area, are

(*a*) kg/m (*b*) kg/m^2
(*c*) m^4 (*d*) m^3
(*e*) kg-m^2.

5.40. The units of inertia of mass, are

(*a*) kg/m (*b*) kg/m^2
(*c*) m^4 (*d*) m^3
(*e*) kg-m^2.

5.41. If a spherical body is symmetrical about its perpendicular axes, the moment of inertia of the body about an axis passing through its centre of gravity as given by Routh's rule is obtained by dividing the product of the mass and the sum of the squares of two semi-axes by n where n is

(*a*) 2 (*b*) 3
(*c*) 4 (*d*) 5.

5.42. Moment of interia of a squares of side b about an axis through its centre of gravity, is

(*a*) $b^3/4$ (*b*) $b^4/12$
(*c*) $b^4/3$ (*d*) $b^4/8$
(*e*) $b^4/36$.

5.43. The moment of inertia of a hollow circular section whose external diameter is 8 cm and internal diameter is 6 cm, about centroidal axis, is

(*a*) 437.5 cm^4 (*b*) 337.5 cm^4
(*c*) 237.5 cm^4 (*d*) 137.5 cm^4
(*e*) 37.5 cm^4.

5.44. The moment of inertia of a triangular section (base b, height h) about centroidal axis parallel to the base, is

(*a*) $\frac{b^3h}{12}$ (*b*) $\frac{bh^3}{3}$
(*c*) $\frac{bh^3}{36}$ (*d*) $\frac{bh^3}{2}$

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(e) $\frac{bh^3}{8}$.

5.45. M.I. of a thin ring (external diameter D, internal diameter d) about an axis perpendicular to the plane of the ring, is

(a) $\frac{\pi}{64}(D^4 + d^4)$ (b) $\frac{\pi}{32}(D^4 - d^4)$

(c) $\frac{\pi}{32}(D^4 + d^4)$ (d) $\frac{\pi}{32}(D^4 \times d^4)$.

5.46. The moment of inertia of the shaded portion of the area shown in Fig. 5.1 about the X-axis, is

(a) 229.34 cm^4
(b) 329.34 cm^4
(c) 429.34 cm^4
(d) 529.34 cm^4.

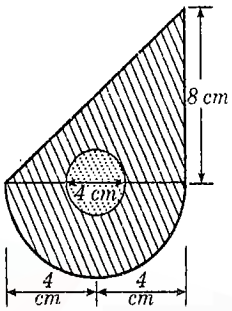

Fig. 5.1.

5.47. The M.I. of a thin spherical shell, is

(a) $Mr^4/2$
(b) Mr^2
(c) $2/3Mr^2$
(d) $2/5Mr^2$
(e) $3/8Mr^2$.

5.48. M.I. of solid sphere, is

(a) $2/3Mr^2$ (b) $2/5Mr^2$
(c) Mr^2 (d) $\pi r^4/2$
(e) $\frac{1}{2}Mr^2$.

5.49. The maximum frictional force which comes into play, when a body just begins to slide over the surface of a an other body, is known

(a) sliding friction (b) rolling friction
(c) limiting friction (d) none of these.

5.50. The angle of friction is :

(a) The ratio of the friction and the normal reaction
(b) The force of friction when the body is in motion
(c) The angle between the normal reaction and the resultant of normal raction and limiting friction
(d) The force of friction at which the body is just about to move.

5.51. The following is not a law of static friction :

(a) The force of friction always acts in a direction opposite to that in which the body tends to move
(b) The force of friction is dependent upon the area of contact
(c) The force of friction depends upon the roughness of the surface
(d) The magnitude of the limiting friction bears a constant ratio to the normal reaction between two surfaces.

5.52. Kinetic friction may be defined as

(a) friction force acting when the body is just about to move
(b) friction force acting when the body is in motion
(c) angle between normal reaction and resultant of normal reaction and limiting friction
(d) ratio of limiting friction and normal reaction.

5.53. The following statement is one of the laws of Dynamic friction

(a) The force of friction always acts in a direction opposite to that in which a body is moving
(b) The magnitude of the kinetic friction bears a constant ratio to the normal reaction between two surfaces. The ratio being slightly less than that in the case of limiting friction
(c) For moderate speeds the force of friction remains constant but decreases slightly with the increase of speed
(d) all the above.

5.54. The angle which an inclined surface makes with the horiontal when a body placed on it is on the point of moving down, is called

(a) angle of repose (b) angle of friction
(c) angle of inclination (d) none of these.

5.55. Which one of the following statements is true ?

(a) The tangent of the angle of friction is equal to coefficeint of friction
(b) The angle of repose is equal to angle of friction
(c) The tangent of the angle of repose is equal to coefficient of friction
(d) All the above.

5.56. On a ladder resisting on a smooth ground and leaning against a rough vertical wall, the force of friction acts

(a) towards the wall at its upper end
(b) away from the wall at its upper end
(c) upwards at its upper end
(d) downwards at its upper end
(e) none of these.

5.57. On a ladder resting on a rough ground and leaning against a smooth vertical wall, the force of friction acts

(a) downwards at its upper end
(b) upwards at its upper end
(c) perpendicular to the wall at its upper end
(d) zero at its upper end
(e) none of these.

5.58. A block of weight 50 kg is placed on a horizontal plane. When a horizontal force of 18 kg is applied, the block is just on the point of motion. The angle of friction is

(a) 17° 48′ (b) 18° 48′
(c) 19° 48′ (d) 20° 48′
(e) 21° 48′.

5.59. A body of weight w placed on an inclined plane is acted upon by a force P parallel to the plane which causes the body just to move up the plane. If the angle of inclination of the plane is θ and angle of friction is ϕ, the minimum value of P, is

(a) $\frac{w \sin(\phi - \theta)}{\cos \phi}$ (b) $\frac{w \sin(\theta - \phi)}{\cos \phi}$

(c) $\frac{w \cos(\theta + \phi)}{\cos \phi}$ (d) $\frac{w \sin \theta \cos(\theta - \phi)}{\sin \phi}$.

5.60. In order to keep a body in equilibrium, the force acting along the inclined plane must be

(a) $> \frac{w \sin(\theta - \phi)}{\cos \phi}$ (b) $> \frac{w \sin(\theta + \phi)}{\cos \phi}$

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(c) $\frac{w \sin(\theta - \phi)}{\cos \phi}$ or $\frac{w \sin(\theta + \phi)}{\cos \phi}$

(d) $> \frac{w \sin(\theta - \phi)}{\cos \phi}$.

5.61. The velocity of a moving body, is
(a) a vector quantity (b) a scalar quantity
(c) a constant quantity (d) none of these.

5.62. If a body moves in such a way that its velocity increases by equal amount in equal intervals of time, it is said to be moving with
(a) a uniform retardation (b) a uniform acceleration
(c) a variable acceleration (d) a variable retardation
(e) none of these.

5.63. Equation of motion of a point in a straight line, is
(a) $v = u + ft$ (b) $S = ut + \frac{1}{2} ft^2$
(c) $2fS = v^2 - u^2$ (d) all the above.

5.64. Time required to stop a car moving with a velocity 20 m/sec within a distance of 40 m, is
(a) 2 sec (b) 3 sec
(c) 4 sec (d) 5 sec
(e) 6 sec.

5.65. The velocity of a body fallen from height h, on reaching the ground is given by
(a) $v = 2gh$ (b) $v = 2gh^2$
(c) $v = \sqrt{2gh}$ (d) $v = 1/\sqrt{2gh}$
(e) $\frac{h^2}{2g}$.

5.66. A particle moves with a velocity of 2 m/sec in a straight line with a negative acceleration of 0.1 m/sec^2. Time required to traverse a distance of 1.5 m, is
(a) 40 sec (b) 30 sec
(c) 20 sec (d) 15 sec
(e) 10 sec.

5.67. A particle moves along a straight line such that distance x traversed in t seconds is given by $x = t^2(t + 1)$, the acceleration of the particle, will be
(a) $3t^3 - 2t$ (b) $3t^2 + 2t$
(c) $6t - 2$ (d) $6t + 2$
(e) $3t - 2$.

5.68. A ball is dropped from the top of a vertical tower 60 m high and another ball is projected from the foot of the same tower upwards at the same time. If they meet at a height of 18 m, the velocity of projection of the second ball, is
(a) 10 m/sec (b) 15 m/sec
(c) 20.48 m/sec (d) 48.20 m/sec
(e) 15.8 m/sec.

5.69. A lift descends with an acceleration of 0.5 m/sec^2 from the top floor of a multistoreyed building. The time required to travel a distance of 25 m, will be
(a) 5 sec (b) 8 sec
(c) 10 sec (d) 12 sec
(e) 15 sec.

5.70. A stone is projected upwards from the foot of a towar 50 m high with a velocity of 25 m/sec and at the same time an other stone is dropped from the top of the tower. The two stones cross each other after
(a) 2 sec (b) 3 sec
(c) 4 sec (d) 5 sec
(e) 6 sec.

5.71. A particle starts from rest moves in a straight line whose equation of motion is given by $s = t^2 - 2t^2 - 1$. The acceleration of the particle after one sec, will be
(a) 1 m/sec^2 (b) 2 m/sec^2
(c) 3 m/sec^2 (d) 4 m/sec^2.

5.72. The motion of a moving car is given by the equation $a = t^3 + 3t^2 + 5$ where a is the acceleration in m/sec^2 and t is the time in seconds. The velocity of the car after 2 secs, will be
(a) 4 m/sec (b) 8 m/sec
(c) 12 m/sec (d) 22 m/sec.

5.73. If s is the distance traversed by a particle within a time t, its acceleration is
(a) $\frac{ds}{dt}$ (b) $\frac{d^2s}{dt^2}$
(c) $\sqrt{\frac{d^2s}{dt^2}}$ (d) none of these.

5.74. If rain falls in the opposite direction of the movement of a pedestrian, he has to hold his umbrella
(a) more inlined when moving
(b) less inclined when moving
(c) more inclined when standing
(d) less inclined when standing.

5.75. To a cyclist riding west at 20 kg per hour, the rain appears to meet him at an angle of 45° with the vertical. When he rides at 12 km per hour, the rain meets him at an angle of 19° 48′ with the vertical, the actual direction of the rain, is
(a) 13° (b) 21°
(c) 31° (d) 70°.

5.76. A train moving at 30 kilometres per hour is struck by a bullet moving 500 m/sec at right angles to the train. The direction with which the bullet appears to strike the train, is
(a) 30° (b) 60°
(c) 60° (d) 90°.

5.77. A ship is moving N 48° 30′ W at 20 knots/hour and a second ship is moving E 90° at 10 knots/hour, the relative velocity of the second ship with respect to first, is
(a) 15 knots (b) 10 knots
(c) 23 knots (d) 13 hnots.

5.78. A fighter plane flying horiozntally at an altitude of 4121 m with a velocity of 468 km/hour has aimed an enemy camp. In order to hit the camp, the exact distance of the plane from the camp, should be
(a) 2770 m (b) 3770 m
(c) 4770 m (d) 5770 m.

5.79. The path traced by a projectile in the sky, is
(a) circular (b) parabolic
(c) elliptical (d) catenary
(e) straight line.

5.80. Cartesian equation of a trajectory, is
(a) $y = x \sin \alpha - \frac{gx^2}{2u^2 \sin^2 \alpha}$ (b) $y = x \tan \alpha - \frac{gx^2}{2u^2 \tan^2 \alpha}$

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(c) $y = x \tan \alpha + \frac{gx^2}{2u^2 \cos^2 \alpha}$ (d) $y = x \tan \alpha - \frac{gx^2}{2u^2 \cos^2 \alpha}$

(e) $y = x \tan \alpha + \frac{gx^2}{2u^2 \sin^2 \alpha}$.

5.81. Time of flight of a projectile on a horizontal plane, is

(a) $\frac{2u \sin \alpha}{g}$ (b) $\frac{2u \cos \alpha}{g}$

(c) $\frac{2u \tan \alpha}{g}$ (d) $\frac{2u \cot \alpha}{g}$.

5.82. For maximum range of a projectile, the angle of projection should be

(a) 30° (b) 45°

(c) 60° (d) none of these.

5.83. A projectile is fired at an angle θ to the vertical. Its horizontal range will be maximum when θ is

(a) 0° (b) 30°

(c) 45° (d) 60°

(e) 90°.

5.84. If the velocity of projection is 4 m/sec and the angle of projection is α°, the maximum height of the projectile from a horizontal plane, is

(a) $\frac{u^2 \cos^2 \alpha}{2g}$ (b) $\frac{u^2 \sin^2 \alpha}{2g}$

(c) $\frac{u^2 \tan^2 \alpha}{2g}$ (d) $\frac{u^2 \sin 2\alpha}{2g}$.

5.85. If a particle is projected inside a horizontal tunnel which is 554 cm high with a velocity of 60 m per sec, the angle of projection for maxi-mum range, is

(a) 8° (b) 9°

(c) 10° (d) 11°

(e) 12°.

5.86. If the angle of projection is double the angle of inclination (α) of the plane on which particle is projected, the ratio of times of fligh up the inclined plane and down the inclined plane, will be

(a) $\frac{1}{2 \cos \alpha}$ (b) $\frac{1}{2 \sin \alpha}$

(c) $\frac{1}{2 \tan \alpha}$ (d) $2 \cos \alpha$.

5.87. For the given values of initial velocity of projection and angle of inclination of the plane, the maximum range for a projectile projected upwards will be obtained, if the angle of projection is

(a) $\alpha = \frac{\pi}{4} - \frac{\beta}{2}$ (b) $\alpha = \frac{\pi}{2} + \frac{\beta}{2}$

(c) $\alpha = \frac{\beta}{2} - \frac{\pi}{2}$ (d) $\alpha = \frac{\pi}{4} - \frac{\beta}{4}$

(e) $\alpha = \frac{\pi}{2} - \frac{\beta}{2}$.

5.88. The ratio of the ranges on the inclined plane with motion upward and with motion downward for a given velocity, angle of projection will be

(a) $\frac{\sin (\alpha + \beta)}{\sin (\alpha - \beta)}$ (b) $\frac{\sin (\alpha - \beta)}{\sin (\alpha + \beta)}$

(c) $\frac{\cos (\alpha - \beta)}{\cos (\alpha + \beta)}$ (d) $\frac{\tan (\alpha - \beta)}{\tan (\alpha + \beta)}$.

5.89. The angle of projection for a range is equal to the distance through which the particle would have fallen in order to acquire a velocity equal to the velocity of projection, will be

(a) 30° (b) 45°

(c) 60° (d) 75°.

5.90. The direction of projection should bisect the angle between the inclined plane and the vertical for a range of a projectile on inclined plane

(a) to be zero (b) to be maximum

(c) to be minimum (d) none of the these.

5.91. A body is said to move with Simple Harmonic Motion if its acceleration, is

(a) always directed away from the centre, the point of reference

(b) proportional to the square of the distance from the point of reference

(c) proportional to the distance from the point of reference and directed towards it

(d) inversely proportion to the distance from the point of reference

(e) none of these.

5.92. One half of a vibration of a body, is called

(a) period time (b) oscillation

(c) beat (d) amplitude.

5.93. Periodic time of a particle moving with simple harmonic motion is the time taken by the particle for

(a) half oscillation (b) quarter oscillation

(c) complete oscillation (d) none of these.

5.94. Periodic time of body moving with simple harmonic motion, is

(a) directly proportional to its angular velocity

(b) directly porportional to the square of its angular velocity

(c) inversly proportional to the square of its angular velocity

(d) inversely proportional to its angular velocity.

5.95. For a body moving with simple harmonic motion, the number of cycles per second, is known as its

(a) oscillation (b) amplitude

(c) periodic time (d) beat

(e) frequency.

5.96. If a particle moves with a uniform angular velocity ω radians/sec along the circumference of a circle of radius r, the equation for the velocity of the particle, is

(a) $v = \omega \sqrt{y^2 - r^2}$ (b) $\bar{y} = \omega \sqrt{y - r}$

(c) $v = \omega \sqrt{r^2 + y^2}$ (d) $v = \omega \sqrt{r^2 - y^2}$.

5.97. The piston of a steam engine moves with a simple harmonic motion. The crank rotates 120 r.p.m. and the stroke length is 2 metres. The linear velocity of the piston when it is at a distance of 0.5 metre from the centre, is

(a) 5.88 m/sec (b) 8.88 m/sec

(c) 10.88 m/sec (d) 12.88 m/sec.

5.98. A particle moving with a simple harmonic motion, attains its maximum velocity when it passes

(a) the extreme point of the oscillation

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(*b*) through the mean position
(*c*) through a point at half amplitude
(*d*) none of these.

5.99. Pick up the incorrect statement from the following. In a simple harmonic motion
(*a*) velocity is maximum at its mean position
(*b*) velocity is minimum at the end of the storke
(*c*) acceleration is minimum at the end of the stroke
(*d*) acceleration is zero at the mean position.

5.100. The maximum velocity of a body vibrating with a simple harmonic motion of amplitude 150 mm and frequency 2 vibrations/sec, is
(*a*) 188.5 m/sec (*b*) 18.85 m/sec
(*c*) 1.885 m/sec (*d*) 0.18845 m/sec.

5.101. For a particle moving with a simple harmonic motion, the frequency is
(*a*) directly proportional to periodic time
(*b*) inversely proportional to periodic time
(*c*) inversely proportional to its angular velocity
(*d*) directly proportional to its angular velocity
(*e*) none of these.

5.102. The acceleration of a particle moving along the circumference of a circle with a uniform speed, is directed
(*a*) radially
(*b*) tangentially at that point
(*c*) away from the centre
(*d*) towards the centre.

5.103. In simple harmonic motion, acceleration of a particle is proportional to
(*a*) rate of change of velocity (*b*) displacement
(*c*) velocity (*d*) direction
(*e*) none of these.

5.104. The frequency of oscillation on moon as compared to that on earth, will be
(*a*) 2.44 times more (*b*) 2.44 times less
(*c*) 3 times less (*d*) 3 times more.

5.105. Angular acceleration of a particle may be expressed as
(*a*) radians/sec^2 (*b*) degrees/sec^2
(*c*) revolutions/sec (*d*) all the above.

5.106. The linear velocity (v) of a moving particle along the circumference of a circle of radius r, with a uniform angular velocity ω radians/sec^2 will be given by
(*a*) $v = r\omega^2$ (*b*) $v = r\omega^2$
(*c*) $v = r\omega$ (*d*) $v = \omega/r$
(*e*) $v = r\omega$.

5.107. A particle executes a simple harmonic motion. While passing through the mean position, the particle possesses
(*a*) maximum kinetic energy & minimum potential energy
(*b*) maximum kinetic energy & maximum potential energy
(*c*) minimum kinetic energy & maximum potential energy
(*d*) minimum kinetic energy & minimum potential energy
(*e*) none of these.

5.108. In case of S.H.M. the period of oscillation (T), is given by
(*a*) $T\dfrac{2\omega}{\pi^2}$ (*b*) $T = \dfrac{2\pi}{\omega}$
(*c*) $T = \dfrac{2}{2\omega}$ (*d*) $T = \dfrac{\pi}{2\omega}$
(*e*) $T = \dfrac{\pi}{3\omega}$.

5.109. The motion of a particle moving with S.H.M. from an extremity to the other, constitutes
(*a*) half an oscillation (*b*) one full oscillation
(*c*) two oscillations (*d*) none of these.

5.110. For a simple pendulum, the period of one oscillation is
(*a*) $2\pi\sqrt{l/2g}$ (*b*) $2\pi\sqrt{2g/l}$
(*c*) $2\pi\sqrt{l/g}$ (*d*) $2\pi\sqrt{g/2l}$.

5.111. For a simple pendulum, time period for a beat, is
(*a*) $\pi\sqrt{l/g}$ (*b*) $\pi\sqrt{2l/g}$
(*c*) $\pi\sqrt{g/2l}$ (*d*) $\pi\sqrt{l/2g}$
(*e*) $\pi\sqrt{2g/l}$.

5.112. Which one of the following laws is not applicable to a simple pendulum ?
(*a*) The time period does not depend on its magnitude
(*b*) The time period is proportional to its length l
(*c*) The time period is proportional to $\sqrt{l}$ where l is length
(*d*) The time period is inversely proportional to $\sqrt{g}$ where g is the acceleration due to gravity.

5.113. A Seconds pendulum executes
(*a*) 0.5 beat per second (*b*) 1.0 beat per second
(*c*) 2.0 beats per second (*d*) 2.5 beats per second
(*e*) 3 beats per second.

5.114. To double the period of oscillation of a simple pendulum
(*a*) the mass of its bob should be doubled
(*b*) the mass of its bob should be quadrupled
(*c*) its length should be quadrupled
(*d*) its length should be doubled

5.115. The length of a Second's pendulum, is
(*a*) 99.0 cm (*b*) 99.4 cm
(*c*) 100 cm (*d*) 101 cm
(*e*) 101.10 cm.

5.116. If the radius of the earth is 6000 km the height of a mountain above sea level at the top of which a beat seconds pendulum at sea level, looses 27 seconds a day, is
(*a*) 500 metres (*b*) 1000 metres
(*c*) 1500 metres (*d*) 2000 metres
(*e*) 25000 metres.

5.117. A Second's pendulum gains 2 minutes a day. To make it to keep correct time its length
(*a*) must be decreased
(*b*) must be increased
(*c*) is not changed but weight of the bob is increased
(*d*) is not changed but weight of the bob is decreased
(*e*) none of these.

5.118. A rigid body suspended vertically at a point and oscillating with a small amplitude under the action of the force of gravity, is called
(*a*) simple pendulum (*b*) compounded pendulum

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(c) Second's pendulum (d) none of these.

5.119. If α is the angular acceleration of a compound pendulum whose angular displacement is θ, the frequency of the motion is

(a) $2\pi\sqrt{\alpha/\theta}$ (b) $\frac{1}{2\pi}\sqrt{\frac{\alpha}{\theta}}$

(c) $4\pi\sqrt{\alpha/\theta}$ (d) $2\pi\sqrt{\alpha-\theta}$.

5.120. If v and ω are linear and angular velocities, the centripetal acceleration of a moving body along the circular path of radius r, will be

(a) $\frac{r}{v^2}$ (b) $\frac{v^2}{r}$

(c) $\frac{r}{\omega^2}$ (d) $\frac{\omega^2}{r}$

(e) $r\omega$.

5.121. Centrifugal force acting on a body, moving along a circular path, will be

(a) proportional to centripetal force

(b) inversely proportional to centripetal force

(c) equal and similar to centripetal force

(d) equal and opposite to centripetal force

(e) none of these.

5.122. A railway engine weighing 60 tonnes is moving with a speed of 10 m/sec on a circular track whose radius is 200 metres. The force exerted on the rails towards the centre of the track, is

(a) 3061 kg (b) 2061 kg

(c) 1061 kg (d) 4061 kg.

5.123. If G is the Gauge of track, v is velocity of the moving vehicle, g is the acceleration due to gravity and r is the radius of a circular path, the required superelevation is

(a) $\frac{gv^2}{Gr}$ (b) $\frac{Gr^2}{gr}$

(c) $\frac{Gr^2}{gv^2}$ (d) $\frac{Gv^2}{gr}$.

5.124. Superelevation for a broad gauge railway track of 500 m radius at an average speed of 50 km/hour, is equal to

(a) 66 mm (b) 55 mm

(c) 44 mm (d) 33 mm.

5.125. The vehicle moving on a level circular path will exert pressure such that reaction on

(a) outer wheels will be more

(b) inner wheels will be more

(c) inner as well as outer wheels will be equal

(d) none of these.

5.126. If $2a$ is the distance between wheels and h is the height of the C.G. of the vehicle, the reaction on the inner wheel of a moving vehicle on a circular level road, will be

(a) $R=\frac{w}{2}\left(1+\frac{gra}{v\,h}\right)$ (b) $R=\frac{w}{2}\left(1-\frac{v^2h}{gra}\right)$

(c) $R=\frac{w}{2}\left(1-\frac{v^2h}{gra}\right)$ (d) $R=\frac{w}{2}\left(1-\frac{gra}{v^2h}\right)$.

5.127. A 1200 kg vehicle is to negotiate a circular curve of radius 100 metres with a velocity of 36 km p.h. If the height of its C.G. above road level is 1 metre and the distance between the centre lines of the wheels is 1.5 metres, the reaction on the outer wheels, will be

(a) 538.8 kg (b) 661.2 kg

(c) 438.8 kg (d) 461.2 kg.

5.128. A vehicle weighing w kg is to run on a circular curve of radius r. If the height of its centre of gravity above the road level is h and the distance between the centres of wheels is $2a$, the maximum velocity, in order to avoid over turning, will be

(a) $\frac{gra}{h}$ (b) $\sqrt{\frac{gra}{h}}$

(c) $\sqrt[3]{\frac{rga}{h}}$ (d) $\sqrt[4]{\frac{gra}{h}}$.

5.129. Newton's law of motion of rotation which states, "Every body continues in its state of rest or of uniform motion of rotation about an axis unless it is acted upon by some external torque" is

(a) first law of motion (b) second law of motion

(c) third law of motion (d) fourth law of motion.

5.130. Power developed by a torque, is

(a) $2\pi NT$ kg m/min (b) $\frac{2\pi NT}{4500}$ h.p.

(c) $\frac{2\pi NT}{60}$ watts (d) all the above.

5.131. Radius of gyration of a solid sphere of radius

(a) $0.1\,r^2$ (b) $0.2\,r^2$

(c) $0.3\,r^2$ (d) $0.4\,r^2$

(e) $0.5\,r^2$.

5.132. Minimum coefficient of friction between the sphere and a plane inclined 0° to the horizontal, so that the sphere may roll without slipping, is

(a) 2/7 tan θ (b) 2/5 tan θ

(c) 2/3 tan θ (d) 1/2 tan θ

(e) 7/2 tan θ.

5.133. Acceleration (f) and radius of gyration (k) of a spherical body of radius r, rolling down a plane inclined 0° to the horizontal, without slipping satisfies the equation

(a) $f=\frac{g\tan\theta}{1+\frac{k^2}{r^2}}$ (b) $\frac{g\cos\theta}{1+\frac{k^2}{r^2}}$

(c) $f=\frac{g\sin\theta}{1+\frac{k^2}{r^2}}$ (d) $f=\frac{g\cot\theta}{1+\frac{k^2}{r^2}}$.

5.134. The motion of a bicycle wheel is

(a) translatory (b) rotary

(c) rotary and translatory (d) curvilinear

5.135. When a body moves round a fixed axis, it has

(a) a rotary motion (b) a circular motion

(c) a translatory

(d) a rotary motion and translatory motion.

5.136. A satellite moves in its orbit around the earth due to

(a) Gravitational force (b) Centripetal force

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(c) Centrifugal force (d) none of these.

5.137. If α and u are angle of projection and initial velocity of a projectile respectively, the total time of flight, is given by

(a) $T = \frac{u \sin 2\alpha}{g}$ (b) $T = \frac{u \sin^2 \alpha}{g}$

(c) $T = \frac{u \sin^2 \alpha}{2g}$ (d) $T = \frac{2u \sin \alpha}{g}$.

5.138. If α and u are the angle of projection and initial velocity of a projectile respectively, the horizontal range of the projectile, is

(a) $\frac{u^2 \sin \alpha}{g}$ (b) $\frac{u^2 \sin^2 \alpha}{g}$

(c) $\frac{u^2 \sin \alpha}{2g}$ (d) $\frac{u^2 \sin^2 \alpha}{2g}$

5.139. The point about which combined motion of rotation and translation of a rigid body takes place, is known as

(a) Virtual centre (b) Instantaneous centre
(c) Instantaneous axis (d) Point of rotation
(e) All the above.

5.140. The locus of the instantaneous centre of a moving rigid body, is

(a) straight line (b) involute
(c) centroid (d) spiral.

5.141. If three rigid rods are hinged together to form a triangle and are given rotary as well as translatory motion, the number of instantaneous centres of the triangle, will be

(a) 1 (b) 2
(c) 3 (d) 4
(e) 5.

5.142. The instantaneous centre of a member lies at the point of intersection of two lines drawn at the ends of the member such that the lines are inclined to the direction of motion of the ends at

(a) 30° (b) 45°
(c) 60° (d) 90°.

5.143. A rod 5 m in length is moving in a vertical plane. When it is inclined at 60° to horizontal, its lower end is moving horizontally at $\sqrt{3}$ m/sec and upper end is moving in vertical direction. The velocity of its upper end, is

(a) 0.5 m/sec (b) 1.0 m/sec
(c) 1.5 m/sec (d) 2.5 m/sec
(e) 3.0 m/sec

5.144. ω rad/sec is the angular velocity of a crank whose radius is r. If it makes $\theta°$ with inner dead centre and obliquity of the connecting rod l is ϕ, the velocity v of the piston, is given by the equation

(a) $\omega^2(l \cos \phi + r \sin \phi \tan \theta)$
(b) $\omega^2(l \sin \phi + r \cos \phi \tan \theta)$
(c) $\omega(l \sin \phi + r \cos \phi \tan \theta)$
(d) $\omega(l \sin \phi - r \cos \theta \tan \phi)$.

5.145. The phenomenon of collision of two elastic bodies takes place because bodies

(a) immediately after collision come momentarily to rest
(b) tend to compress each other till they are compressed maximum possible
(c) attempt to regain its original shape due to their elasticities
(d) all the above.

5.146. The total time of collision and restitution of two bodies, is called

(a) time of collision (b) period of collision
(c) period of impact (d) all the above.

5.147. Newton's law of Collision of elastic bodies states that when two moving bodies collide each other, their velocity of separation

(a) is directly proportional to their velocity of approach
(b) is inversely proportional to their velocity of approach
(c) bears a constant ratio to their velocity of approach
(d) is equal to the sum of their velocities of approach.

5.148. u_1 and u_2 are the velocities of approach of two moving bodies in the same direction and their corresponding velocities of separation are v_1 and v_2. As per Newton's law of collision of elastic bodies, the coefficient of restitution (e) is given by

(a) $e = \frac{v_1 - v_2}{u_2 - u_1}$ (b) $e = \frac{u_2 - u_1}{v_1 - v_2}$

(c) $e = \frac{v_2 - v_1}{u_1 - u_2}$ (d) $e = \frac{v_1 - v_2}{u_2 + u_1}$

5.149. For perfectly elastic bodies, the value of coefficient of restitution is

(a) zero (b) 0.5
(c) 1.0 (d) between 0 and 1.

5.150. A ball of mass 1 kg moving with a velocity of 2 m/sec collides a stationary ball of mass 2 kg and comes to rest after impact. The velocity of the second ball after impact will be

(a) zero (b) 0.5 m/sec
(c) 1.0 m/sec (d) 2.0 m/sec.

5.151. The masses of two balls are in the ratio of 2 : 1 and their respective velocities are in the ratio of 1 : 2 but in opposite direction before impact. If the coefficient of restitution is $\frac{1}{2}$, the velocities of separation of the balls will be equal to

(a) original velocity in the same direction
(b) half the original velocity in the same direction
(c) half the original velocity in the opposite direction
(d) original velocity in the opposite direction.

5.152. A marble ball is rolled on a smooth floor of a room to hit a wall. If the time taken by the ball in returning to the point of projection is twice the time taken in reaching the wall, the coefficient of restitution between the ball and the wall, is

(a) 0.25 (b) 0.50
(c) 0.75 (d) 1.0.

5.153. If a ball which is dropped from a height of 2.25 m on a smooth floor attains the height of bounce equal to 1.00 m, the coefficient of the restitution between the ball and floor, is

(a) 0.25 (b) 0.50
(c) 0.67 (d) 0.33
(e) 0.75.

5.154. A ball moving with a velocity of 5 m/sec impinges a fixed plane at an angle of 45° and its direction after impact is equally inclined to the line of impact. If the coefficient of restitution is 0.5, the velocity of the ball after impact will be

(a) 0.5 m/sec (b) 1.5 m/sec

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(c) 2.5 m/sec (d) 3.5 m/sec
(e) 4.5 m/sec.

5.155. Pick up the correct statement from the following. A rubber ball when strikes a wall rebounds but a lead ball of same mass and velocity when strikes the same wall, falls down
(a) rubber and lead balls undergo equal changes in momentum
(b) change in momentum suffered by lead ball is less that of rubber ball
(c) momentum of rubber ball is less than that of lead ball
(d) none of these.

5.156. Pick up the correct statement from the following. The kinetic energy of a body
(a) before impact is equal to that after impact
(b) before impact is less than that after impact
(c) before impact is more than that after impact
(d) remains constant
(e) none of these.

5.157. Newtons's Law of Motion is :
(a) Every body continues in its state of rest or of uniform motion, in a straight line, unless it is acted upon by some external force
(b) The rate of change of momentum is directly proportional to the impressed force, and takes place in the same direction, in which the force acts
(c) To every action, there is always an equal and opposite reaction
(d) All the above.

5.158. The inherent property of a body which offers reluctance to change its state of rest or uniform motion, is
(a) weight (b) mass
(c) interia (d) momentum.

5.159. The unit of force in C.G.S. system of units, is called
(a) dyne (b) Newton
(c) kg (d) all the above.

5.160. Engineer's units of force, is
(a) Newton in absolute units
(b) Dyne in absolute units
(c) Newton and dyne in absolute units
(d) All the above.

5.161. If the gravitational acceleration at any place is doubled, the weight of a body, will
(a) be reduced to half (b) be doubled
(c) not be affected (d) none of these.

5.162. If g_1 and g_2 are the gravitational accelerations on two mountains A and B respectively, the weight of a body when transported from A to B will be multiplied by
(a) g_1 (b) g_2
(c) $\frac{g_1}{g_2}$ (d) $\frac{g_2}{g_1}$.

5.163. P is the force acting on a body whose mass is m and acceleration is f. The equation $P - mf = 0$, is known as
(a) equation of dynamics
(b) equation of dynamic equilibrium
(c) equation of statics
(d) none of these.

5.164. The tension in a cable supporting a lift
(a) is more when the lift is moving downwards
(b) is less when the lift is moving upwards
(c) remains constant whether it moves downwards or upwards
(d) is less when the lift is moving downwards.

5.165. If the tension in a cable supporting a lift moving upwards is twice the tension when the lift is moving downwards, the acceleration of the lift, is
(a) $\frac{g}{2}$ (b) $\frac{g}{3}$
(c) $\frac{g}{4}$ (d) $\frac{g}{5}$.

5.166. When a body slides down an inclined surface, the acceleration (f) of the body, is given by
(a) $f = g$ (b) $f = g \sin \theta$
(c) $f = g \cos \theta$ (d) $f = g \tan \theta$.

5.167. A train weighing 196 tonnes experiences a frictional resistance of $5\frac{11}{22}$ per tonne. The speed of the train at the top of a down gradient 1 in 78.4 is 36 km/hour. The speed of the train after running 1 km down the slope, is
(a) $5\sqrt{10}$ m/sec (b) $10\sqrt{5}$ m/sec
(c) $5\sqrt{3}$ m/sec (d) $3\sqrt{5}$ m/sec.

5.168. A bullet weighing 200 g is fired horizontally with a velocity of 25 m/sec from a gun carried on a carriage which together with the gun weighs 100 kg. The velocity of recoil of the gun, will be
(a) 0.01 m/sec (b) 0.05 m/sec
(c) 1.00 m/sec (d) 1.5 m/sec.

5.169. If two bodies of masses M_1 and M_2 ($M_1 > M_2$) are connected by a light inextensible string passing over a smooth pulley, the tension in the string, will be given by
(a) $T = \frac{g(M_1 - M_2)}{M_1 + M_2}$ (b) $T = \frac{g(M_1 + M_2)}{M_1 \times M_2}$
(c) $T = \frac{g(M_2 - M_1)}{M_1 + M_2}$ (d) $T = \frac{g(M_2 + M_1)}{M_2 - M_1}$.

5.170. When a body of mass M_1 is hanging freely and an other of mass M_2 lying on a smooth inclined plane (α) are connected by a light inextensible string passing over a smooth pulley, the acceleration of the body of mass M_1, will be given by
(a) $\frac{g(M_1 + M_2 \sin \alpha)}{M_1 + M_2}$ m/sec (b) $\frac{g(M_1 - M_2 \sin \alpha)}{M_1 + M_2}$ m/sec^2
(c) $\frac{g(M_2 + M_1 \sin \alpha)}{M_1 + M_2}$ m/sec^2 (d) $\frac{g(M_2 \times M_1 \sin \alpha)}{M_2 - M_1}$ m/sec^2.

5.171. The unit of moments in M.K.S system, is
(a) kgm (b) kg/m^2
(c) kg/sec^2 (d) kg/sec.

5.172. The characteristic of a couple, is :
(a) algebraic sum of forces, constituting a couple is zero
(b) algebraic sum of moments of the forces, constituting a couple, about any point, is same

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(c) a couple can be balanced only by a couple but of opposite sense
(d) a couple can be never the balanced by a single force
(e) all the above.

5.173. The unit of Moment of Inertia of a body, is
(a) m (b) m^2
(c) m^3 (d) m^4
(e) none of these.

5.174. The velocity of a moving body, is
(a) a vector quantity
(b) a scalar quantity
(c) a scalar as well as a vector quantity
(d) none of these.

5.175. The rate of change of displacement of a body with respect to its surrounding, is known
(a) velocity (b) acceleration
(c) speed (d) none of these.

5.176. A stone is whirled in a vertical circle, the tension in the string, is maximum
(a) when the string is horizontal
(b) when the stone is at the highest position
(c) when the stone is at the lowest position
(d) at all the positions.

5.177. If the linear velocity of a point on the rim of a wheel of 10 m diameter, is 50 m/sec, its angular velocity will be
(a) 20 rad/sec (b) 15 rad/sec
(c) 10 rad/sec (d) 5 rad/sec.

5.178. The resultant of the forces acting on a body will be zero if the body
(a) rotates
(b) moves with variable velocity in a straight line
(c) moves along a curved path
(d) does not move at all.

5.179. The apparent weight of a man in a moving lift is less than his real weight when it is going down with
(a) uniform speed (b) an acceleration
(c) linear momentum (d) retardation.

5.180. When a body falls freely under gravitational force, it possesses
(a) maximum weight (b) minimum weight
(c) no weight (d) no effect on its weight.

5.181. The force which produces an acceleration of 1 m/sec^2 in a mass of one kg, is called
(a) dyne (b) Netwon
(c) joule (d) erg.

5.182. Two forces of 6 Newtons and 8 Newtons which are acting at right angles to each other, will have a resultant of
(a) 5 Newtons (b) 8 Newtons
(c) 10 Newtons (d) 12 Newtons.

5.183. A satellite goes on moving along its orbit round the earth due to
(a) gravitational force (b) centrifugal force
(c) centripital force (d) none of these.

5.184. A ball which is thrown upwards, returns to the ground describing a parabolic path during its flight
(a) vertical component of velocity remains constant
(b) horizontal component of velocity remains constant
(c) speed of the ball remains constant
(d) kinetic energy of the ball remains constant.

5.185. Work may be defined as
(a) force × distance (b) force × velocity
(c) force × acceleration (d) none of these.

5.186. Energy may be defined as
(a) power of doing work (b) capacity of doing work
(c) rate of doing work (d) all the above.

5.187. Power can be expressed as
(a) work/energy (b) work/time
(c) work × time (d) work/distance.

5.188. The practical units of work, is
(a) erg (b) joule
(c) Newton (d) dyne.

5.189. The product of mass and velocity of a moving a body, is called
(a) moment (b) momentum
(c) power (d) impulse.

5.190. The unit of impulse, is
(a) kg.m/sec (b) kg.m/sec
(c) $kg.m/sec^2$ (d) kg.m/sec.

5.191. According to Kennedy's theorem, if three bodies have plane motion, their instantaneous centres lie on
(a) a point (b) a straight line
(c) two straight lines (d) a triangle.

5.192. Total no of instantaneous centres of a machine having n links, is
(a) $n/2$ (b) n
(c) $(n-1)$ (d) $\frac{n(n-1)}{2}$.

5.193. When a body in equilibrium undergoes an infinitely small displacement, work imagined to be done, is known as
(a) imaginary work (b) negative work
(c) virtual work (d) none of these.

5.194. If the angle between the applied force and the direction of motion of a body, is between 90° and 180°, the work done, is called
(a) virtual work (b) imaginary work
(c) zero work (d) negative work.

5.195. If l is the span of a light suspension bridge whose each cable carries total weight (w) and the central dip is y, the horizontal pull at each support, is
(a) $\frac{wl}{4y}$ (b) $\frac{wl}{8y}$
(c) $\frac{wl}{2y}$ (d) wl.

5.196. The maximum pull in a cable at supports of a light suspension bridge of span l, dip (y) and total weight (w) carried by each cable, is
(a) $\frac{w}{4}\sqrt{1+\frac{l^2}{8y^2}}$ (b) $\frac{w}{2}\sqrt{1+\frac{l^2}{2y^2}}$

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(c) $\frac{\omega}{2}\sqrt{1+\frac{l^2}{16y^2}}$ (d) $\frac{\omega}{2}\sqrt{1+\frac{l^2}{2y^2}}$.

5.197. If the distance between end supports of a light bridge is l and maximum dip allowed at its centre is y, the length of the cable, is

(a) $l-\frac{5}{3}\frac{y^2}{l}$ (b) $l+\frac{5}{3}-\frac{l}{y^2}$

(c) $l+\frac{8}{3}\frac{y^2}{l}$ (d) $1-\frac{8}{3}-\frac{y^2}{l}$.

5.198. A cable loaded with 0.5 tonne per horizontal metre span is stretched between supports in the same horizontal line 400 m apart. If central dip is 20 m, the minimum tension in the cable, will be

(a) 200 tonnes at the centre
(b) 500 tonnes at the centre
(c) 200 tonnes at the right support
(d) 200 tonnes at the left support.

5.199. To avoid bending action at the base of a pier,

(a) suspension and anchor cables are kept at the same level
(b) suspension and anchor cables are fixed to pier top
(c) suspension cable and anchor cables are attached to a saddle mounted on rollers on top of the pier
(d) none the these.

5.200. Pick up the incorrect statement from the following. In case of suspension bridge due to rise in temperature,

(a) dip of the cable increases
(b) length of the cable increases
(c) dip of the cable decreases
(d) none of the these.

5.201. The shape of a suspended cable under its own weight, is

(a) parabolic (b) circular
(c) catenary (d) elliptical.

5.202. The intrinsic equation of catenary is

(a) $S = c \tan \psi$ (b) $y = c \cosh x/c$
(c) $y = c \cosh \psi$ (d) $y = c \sinh \psi$.

5.203. Maximum efficiency of a screw jack for the angle of friction ϕ, is

(a) $\frac{\sin\theta}{1+\sin\theta}$ (b) $\frac{1-\sin\theta}{\sin\theta}$

(c) $\frac{1+\sin\theta}{1-\sin\theta}$ (d) $\frac{1-\sin\theta}{1+\sin\theta}$.

5.204. Pick up the correct statement from the following :

(a) Nature plays an important role in the launch of a satellite
(b) The earth's gravity reduces the speed of a satellite by 32 km per second
(c) The gravitational force relents as the satellite climbs higher
(d) The gravitational intensity declines with height
(e) All the above.

5.205. The gravitational force makes a satellite go round the earth in a circular orbit, if it is projected with an initial velocity of

(a) 8.04 km/sec at a height of 285 km
(b) 11.11 km/sec at a height of 37,400 km
(c) 11.26 km/sec, the satellite escapes the pull of the earth
(d) all the above.

5.206. A satellite is said to move in a synchronous orbit if it moves at an altitude of 36,000 km with a maximum velocity of about

(a) 7,000 km per hour (b) 8,000 km per hour
(c) 9,000 km per hour (d) 10,000 per hour
(e) 11,000 km per hour.

5.207. To attain the synchronous orbit, the launch of a satellite, is done from a place

(a) on equator (b) on 30° latitude
(c) on 45° latitude (d) on 60° latitude
(e) on the poles.

5.208. The rotational velocity of a satellite is increased by 450 m per second if its launch is done from equator

(a) eastward (b) northward
(c) westward (d) southward
(e) upward.

5.209. The following factor affects the orbit of a satellite up to an altitude of 720 km from the earth's surface

(a) uneven distribution of the gravitational field
(b) gravity of the sun and the moon
(c) aerodynamic forces
(d) none of these.

5.210. The moment of intertia of a circular lamina of diameter d, about an axis perpendicular to the plane of the lamina and passing through its centre, is

(a) $\frac{\pi d^4}{12}$ (b) $\frac{\pi d^4}{16}$

(c) $\frac{\pi d^4}{24}$ (d) $\frac{\pi d^4}{32}$

(e) $\frac{\pi d^4}{36}$.

5.211. A sphere is resting on two planes BA and BC which are inclined at 45° and 60° respectively with the horizontal. The reaction on the plane BA will be

(a) less than that on BC (b) more than that of BC
(c) equal to that on BC (d) zero
(e) none of these.

5.212. A weight W is suspended at the free end of a light member hinged to a vertical wall. If the angle of inclination of the member with the upper wall is θ°, the force introduced in the member, is

(a) $W \sec\theta$ (b) $W \cos\theta$
(c) $W \sin\theta$ (d) $W \operatorname{cosec}\theta$
(e) $W \tan\theta$.

5.213. At a given instant ship A is travelling at 6 km/h due east and ship B is travelling at 8 km/h due north. The velocity of B relative to A is

(a) 7 km/h (b) 2 km/h
(c) 1 km/h (d) 10 km/h

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(e) 14 km/hrs.

5.214. One Newton force, is
(a) 10^3 dynes (b) 10^4 dynes
(c) 10^5 dynes (d) 10^6 dynes
(e) 10^7 dynes.

5.215. Joule is the unit of
(a) work (b) force
(c) power (d) energy
(e) none of these.

5.216. A geo-stationary satellite is one which orbits the earth with a velocity of rotation of
(a) moon (b) earth
(c) sun (d) pole.

5.217. If the horizontal range is 2.5 times the greatest height, the angle of projection of the projectile, is
(a) 57° (b) 58°
(c) 59° (d) 60°.

5.218. Two particles have been projected at angles 64° and 45° to the horizontal. If the velocity of projection of first is 10 m/sec, the velocity of projection of the other for equal horizontal ranges is
(a) 9.3 m/sec (b) 8.3 m/sec
(c) 7.3 m/sec (d) 6.3 m/sec.

5.219. The velocity ratio of the differential wheel and axle is
(a) $\frac{R}{r_1 - r_2}$ (b) $\frac{2R}{r_1}$
(c) $\frac{3R}{r_1 - r_2}$ (d) $\frac{2R}{r_1 + r_2}$.

5.220. μ is coefficient of friction. A wheeled vehicle travelling on a circular level track will slip and overturn simultaneously if the ratio of its wheel distance to the height of its centroid, is
(a) μ (b) 2μ
(c) 3μ (d) $\frac{1}{2}\mu$.

5.221. If two forces acting at a point are in equilibrium, they must be equal in magnitude and their line of action must be along
(a) the same line in the same sense
(b) the same line in opposite sense
(c) the perpendicular to both the lines
(d) none of these.

5.222. The resultant of two forces acting at right angles is 5 kgf and if they act at an angle of 60°, it is $\sqrt{37}$ kgf. The magnitudes of the forces are :
(a) 2 kgf, 3 kgf (b) 3 kgf, 4 kgf
(c) 4 kgf, 5 kgf (d) 5 kgf, 3 kgf.

5.223. A string of length 90 cm is fastened to two points A and B at the same level 60 cm apart. A ring weighing 120 g is slided on the string. A horizontal force P is applied to the ring such that it is in equilibrium vertically below B. The value of P is :
(a) 40 g (b) 60 g
(c) 80 g (d) 100 g.

5.224. Two parallel forces 20 kg and 15 kg act. In order that the distance of the resultant from 20 kg force may be the same as that of the former resultant was from 15 kg, the 20 kg force is diminished by
(a) 5.5 kg (b) 6.25 kg
(c) 8.75 kg (d) 10.5 kg.

5.225. The ends of a string weighing w/metre are attached to two points at the same horizontal level. If the central dip is very small, the horizontal tension of the string throughout is
(a) $\frac{wl}{4d}$ (b) $\frac{wl^2}{4d}$
(c) $\frac{wl^2}{8d}$ (d) $\frac{wl^2}{16d}$.

5.226. A trolley wire weighs 1 kg per metre length. The ends of the wire are attached to two poles 20 m apart. If the horizontal tension is 1000 kg, the central dip of the cable is
(a) 2 cm (b) 3 cm
(c) 4 cm (d) 5 cm.

5.227. The centre of gravity of a trapezoidal dam section whose top width is a, bottom width is b and the vertical side is a, from its vertical face is
(a) $\frac{a^2 + ab + b^2}{3(a + b)}$ (b) $\frac{b^2 + bc + c^2}{3(b + c)}$
(c) $\frac{a^2 + ab + c^2}{3(a + c)}$ (d) none of these.

5.228. The c.g. of the shaded area of the Fig. 5.2 whose curve OM is a parabola from y-axis, is
(a) $\frac{a}{4}$
(b) $\frac{3a}{4}$
(c) $\frac{3b}{10}$
(d) $\frac{3a}{10}$
(e) $\frac{3a}{5}$.

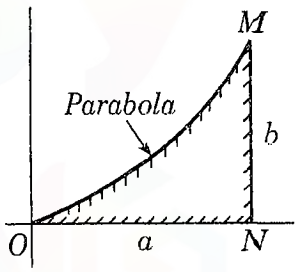

Fig. 5.2.

5.229. The c.g. of the shaded area of the Fig. 5.2 from the x-axis is
(a) $\frac{a}{4}$ (b) $\frac{3a}{4}$
(c) $\frac{3b}{4}$ (d) $\frac{3a}{10}$
(e) $\frac{3a}{5}$.

5.230. From the circular plate of a diameter 6 cm is cut out a circular plate whose diameter is equal to radius of the plate. The c.g. of the remainder shifts from the original position through
(a) 0.25 cm (b) 0.50 cm
(c) 0.75 cm (d) 1.00 cm.

5.231. The distance of the c.g. of a semi-circular arc of radius r from its diameter along the radius of symmetry, is
(a) $\frac{3r}{\pi}$ (b) $\frac{2r}{3\pi}$
(c) $\frac{2\pi}{r}$ (d) $\frac{2r}{\pi}$.

5.232. The c.g. of a thin hollow cone of height h, above its base

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lies on the axis, at a height of
(a) $\frac{h}{3}$ (b) $\frac{h}{4}$
(c) $\frac{2h}{3}$ (d) $\frac{3h}{4}$.

5.233. From a solid cylinder of height 8 cm and radius 4 cm, a right circular cone is scooped out on the same base and having the same height as that of the cylinder. The c.g. of the remainder is at a height of
(a) 4.5 cm (b) 5.0 cm
(c) 5.25 cm (d) 5.5 cm.

5.534. The acceleration of a train starting from rest at any instant is $\frac{1}{6(V+1)}$ m/sec^2 where V is the velocity of the train in m/sec. The train will attain a velocity of 36 km/hour after travelling a distance of
(a) 2000 m (b) 2100 m
(c) 2200 m (d) 2300 m
(e) 2500 m.

5.235. The motion of a particle is described by the relation $x = t^2 - 10t + 30$, where x is in metres and t in seconds. The total distance travelled by the particle from $t = 0$ to $t = 10$ seconds would be
(a) zero (b) 30 m
(c) 50 m (d) 60 m
(e) none of these.

5.236. Three forces which act on a rigid body to keep it in equilibrium. The forces must be coplanar and
(a) concurrent (b) parallel
(c) concurrent parallel (d) none of these.

5.237. The equation of motion of a particle starting from rest along a straight line is
$x = t^3 - 3t^2 + 5$. The ratio of the velocities after 5 sec and 3 sec will be
(a) 2 (b) 3
(c) 4 (d) 5
(e) 4.5.

5.238. The ratio of the accelerations of the particle stated in Q. 5.237 after 5 sec and 3 sec will be
(a) 2 (b) 3
(c) 4 (d) 5.

5.239. A ball is dropped from a height of 2.25 m on a smooth floor and rises to a height of 1.00 m after the bounce. The coefficient of restitution between the ball and the floor is
(a) 0.33 (b) 0.44
(c) 0.57 (d) 0.67.

5.240. A glass ball is shot to hit a wall from a point on a smooth floor. If the ball returns back to the point of projection in twice the time taken in reaching the wall, the coefficient of restitution between the glass ball and the wall is
(a) 0.25 (b) 0.33
(c) 0.40 (d) 0.50
(e) 0.55.

5.241. Ball A of mass 250 g moving on a smooth horizontal table with a velocity of 10 m/s hits an identical stationary ball B on the table. If the impact is perfectly elastic, the velocity of the ball B just after impact would be
(a) zero (b) 5 m/sec
(c) 10 m/sec (d) none of these.

5.242. A particle is dropped from the top of a tower 60 m high and another is projected upwards from the foot of the tower to meet the first particle at a height of 15.9 m. The velocity of projection of the second particle is
(a) 16 m/sec (b) 18 m/sec
(c) 20 m/sec (d) 22 m/sec.

5.243. Pick up the correct statement from the following:
(a) If two equal and perfectly elastic smooth spheres impinge directly, they interchange their velocities.
(b) If a sphere impinges directly on an equal sphere which is at rest, then a fraction $\frac{1}{2}(1 - e^2)$ the original kinetic energy is lost by the impact.
(c) If a smooth sphere impinges on another sphere, which is at rest, the latter will move along the line of centres.
(d) If two equal spheres which are perfectly elastic impinge at right angles, their direction after impact will still be at right angles.
(e) All the above.

5.244. Two shots fired simultaneously from the top and bottom of a vertical tower with elevations of 30° and 45° respectively strike a target simultaneously. If horizontal distance of the target from the tower is 1000 m, the height of the tower is
(a) 350 m (b) 375 m
(c) 400 m (d) 425 m.

5.245. A 49 kg lady stands on a spring scale in an elevator. During the first 5 sec, starting from rest, the scale reads 69 kg. The velocity of the elevator will be
(a) 10 m/sec (b) 15 m/sec
(c) 20 m/sec (d) 25 m/sec.

5.246. For lifting a load of 50 kg through a distance of 2.5 cm, an effort of 12.5 kg is moved through a distance of 40 cm. The efficiency of the lifting machine, is
(a) 60% (b) 65%
(c) 70% (d) 75%.

5.247. A load of 500 kg was lifted through a distance of 13 cm by an effort of 25 kg which moved through a distance of 650 cm. The mechanical advantage of the lifting machine is
(a) 15 (b) 18
(c) 20 (d) 26.

5.248. The velocity ratio of the lifting machine as stated in Q. 5.247, is
(a) 50 (b) 55
(c) 60 (d) 65
(e) 70.

5.249. The efficiency of the lifting machine as stated in Q. 5.247 is
(a) 50% (b) 40%
(c) 55% (d) 30%.

5.250. For a self-locking machine, the efficiency should be
(a) less than 60% (b) 50%
(c) more than 50% (d) None of these.

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5.251. The velocity ratio of an inclined plane of inclination θ with horizontal for lifting a load is
(a) sin θ (b) cos θ
(c) tan θ (d) sec θ
(e) cosec θ.

5.252. The ratio of the reactions R_A and R_B of a simply supported beam shown in Fig. 5.3 is

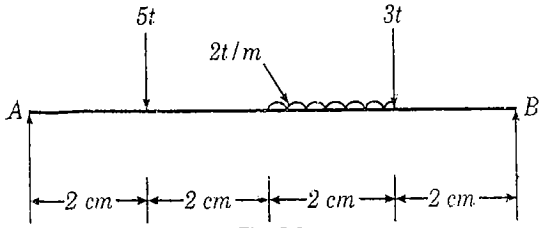

Fig. 5.3.

(a) 0.50 (b) 0.40
(c) 0.67 (d) 1.00
(e) 1.50.

5.253. The beam shown in Fig. 5.4 is supported by a hinge at A and a roller at B. The reaction R_A of the hinged support A of the beam, is

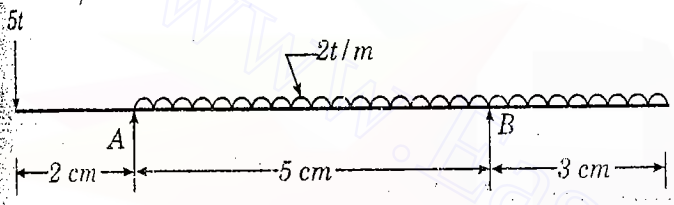

Fig. 5.4.

(a) 10.8 t (b) 10.6 t
(c) 10.4 t (d) 10.2 t.

5.254. The reaction R_B of the roller support B of the beam shown in Fig. 5.4 is
(a) 10.8 t (b) 10.6 t
(c) 10.4 t (d) 10.2 t.

5.255. The reaction at the central support B of the beam ABC hinged at D (Fig. 5.5) is
(a) 2t (b) 5.8 t
(c) 0.2 t (d) 3.5 t.

5.256. The reaction at the support A of the beam shown in Fig. 5.5 is

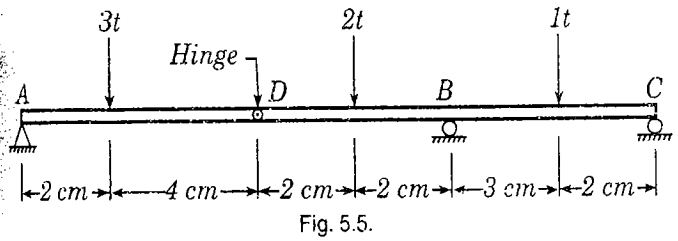

Fig. 5.5.

(a) 2 t (b) 5.8 t
(c) 0.2 t (d) 3.5 t.

5.257. The reaction at the support D of the continuous beam $ABCD$, hinged at two points shown in Fig. 5.6 is

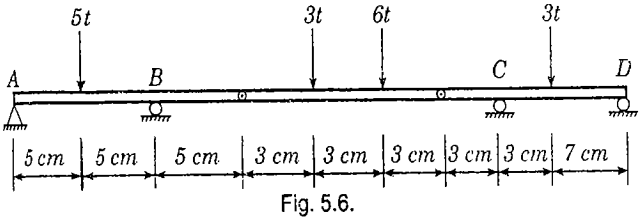

Fig. 5.6.

(a) 1.6 t ↑ (b) 1.6 t ↓
(c) 0.5 t ↑ (d) 0.5 t ↓
(e) 8.5 t ↑.

5.258. The reaction at the support B of the beam shown in Fig. 5.7 is

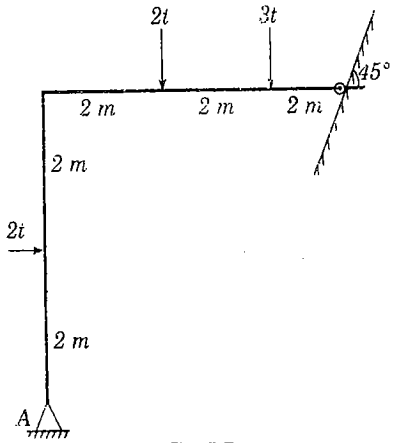

Fig. 5.7.

(a) 1.6 t (b) 9.6 t
(c) 8.5 t (d) 0.5 t.

5.259. The vertical reaction at the support A of the structure shown in Fig. 5.7, is
(a) 1 t (b) 2 t
(c) 3 t (d) 2.5 t.

5.260. The horizontal reaction at the support A of the structure shown in Fig. 5.7 is
(a) zero (b) 1 t
(c) 2 t (d) 3 t
(e) 2.5 t.

5.261. The load shared by the member BC of the structure shown in Fig. 5.8 is
(a) $2\sqrt{3}t$
(b) $3\sqrt{2}t$
(c) 4 t
(d) 3 t.

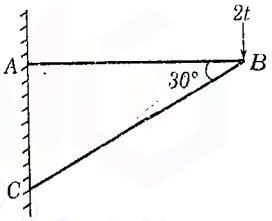

Fig. 5.8.

5.262. Pick up the correct statement from the following for the structure shown in Fig. 5.8.
(a) The horizontal reaction at A is $2\sqrt{3}t \leftarrow$
(b) The horizontal reaction at C is $2\sqrt{3}t \rightarrow$
(c) The vertical reaction at A is zero
(d) The vertical reaction at C is 2 t ↑
(e) All the above.

5.263. The member which does not carry zero force in the structure shown in Fig. 5.9., is

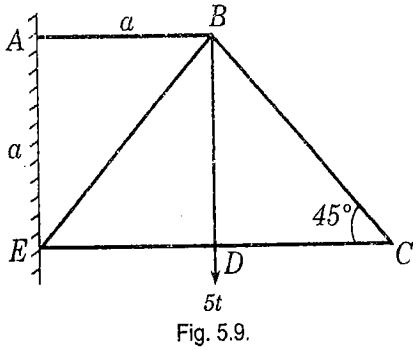

Fig. 5.9.

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(a) *ED*
(b) *DC*
(c) *BC*
(d) *BD*.

5.264. In the structure shown in Fig. 5.10, the member which carries zero force, is

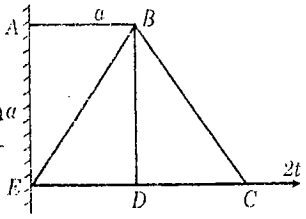

Fig. 5.10.

(a) *AB*
(b) *BC*
(c) *BE*
(d) *BD*
(e) All the above.

5.265. A weight of 100 kg is supported by a string whose ends are attached to pegs *A* and *B* at the same level (Fig. 5.11). The tension in the string is

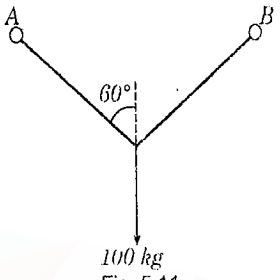

Fig. 5.11.

(a) 50 kg
(b) 75 kg
(c) 100 kg
(d) 120 kg.

5.266. Two loads of 50 kg and 75 kg are hung at the ends of a rope passing over a smooth pulley (Fig. 5.12). The tension in the string is :

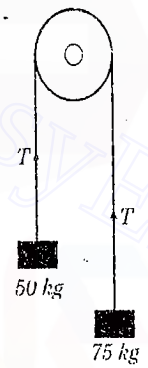

Fig. 5.12

(a) 50 kg
(b) 75 kg
(c) 25 kg
(d) 60 kg.

5.267. A body *A* of mass 6.6 kg which is lying on a horizontal platform 4.5 m from its edge is connected to the end of a light string whose other end is supporting a body of mass 3.2 kg (Fig. 5.13). If the friction between the platform and the body *A* is 1/3, the acceleration is

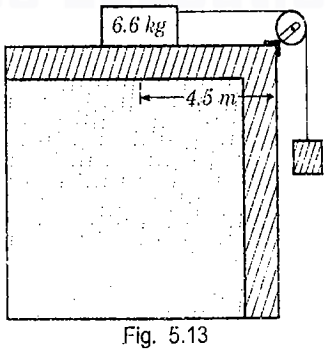

Fig. 5.13

(a) 0.5 m/sec^2
(b) 0.75 m/sec^2
(c) 1.00 m/sec^2
(d) 1.25 m/sec^2.

5.268. For the system of the loads shown in Fig. 5.13, the time required for the 6.6 kg load to fall on the edge, is

(a) 1 sec.
(b) 2 sec.
(c) 3 sec.
(d) 4 sec.
(e) 5 sec.

5.269. A projectile is fired with a velocity of 100.3 m/sec. at an elevation of 60°. The velocity attained by the projectile when it is moving at a height of 100 m, is

(a) 70 m/sec.
(b) 75 m/sec.
(c) 80 m/sec.
(d) 85 m/sec.
(e) 90 m/sec.

5.270. One end of a light string 4 m in length is fixed to a point on a smooth wall and the other end fastened to a point on the surface of a smooth sphere of diameter 2.25 m and of weight 100 kg. The tension in the string is

(a) 17.5 kg
(b) 19.5 kg
(c) 22.5 kg
(d) 25 kg.

5.271. The reaction between the sphere and the wall of the arrangement made in Q. 5.270, is

(a) 102.5 kg
(b) 105.5 kg
(c) 108.5 kg
(d) 110 kg.

5.272. On a mass *m* describing a circular path of radius *r*, the centrifugal force

(a) acts tangentially to the circular path
(b) acts towards the centre of rotation
(c) acts away from the centre of rotation
(d) is $\frac{mw^2r}{g}$ – kfg.

5.273. A stone of mass 1 kg is tied to a string of length and whirled in a horizontal circle at a constant angular speed 5 rad/sec. The tension in the string is,

(a) 5 N
(b) 10 N
(c) 15 N
(d) 25 N
(e) None of these.

5.274. In a simple screw jack, the pitch of the screw is 9 mm and length of the handle operating the screw is 45 cm. The velocity ratio of the system is

(a) 1.5
(b) 5
(c) 25
(d) 314.

5.275. A body of weight 14 g appears to weight 13 g when weighed by a spring balance in a moving lift. The acceleration of the lift at that moment was

(a) 0.5 m/sec^2
(b) 0.7 m/sec^2
(c) 1 m/sec^2
(d) 1 cm/sec^2.

5.276. A spring scale in a stationary lift shows a reading of 60 kg for a man standing on it. If the lift starts descending at an acceleration of g/5, the scale reading would be

(a) 48 kg
(b) 60 kg
(c) 72 kg
(d) none of these.

5.277. A ball of mass 250 g moving on a smooth horizontal table with a velocity of 10 m/sec hits an identical stationary ball *B* on the table. If the impact is perfectly plastic, the velocity of the ball *B* just after impact would be

(a) zero
(b) 5 m/sec.
(c) 10 m/sec.
(d) none of these.

5.278. The mechanical advantage of an ideal machine is 10. For moving the local through 2 m, the effort moves through

(a) 0.02 m
(b) 2 m
(c) 2.5 m
(d) 20 m.

5.279. A projectile is thrown at an angle α to the horizontal with a velocity *v*. It will have the maximum centripetal acceleration

(a) at the start
(b) at the top of the trajectory
(c) as it strikes the ground
(d) else where.

5.280. A 50 kg boy climbs up a 8 m rope in gymnasiam in

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sec. The average power developed by the boy is approximately
(a) 400 watts (b) 500 watts
(c) 4000 watts (d) none of these.

5.281. A pilot flies a small plane in a vertical loop of radius r. At the top of its trajectory he experiences weightlessness. If the acceleration due to gravity is g, the speed of the plane at the top of its trajectory would be
(a) zero (b) infinite
(c) $\sqrt{gr}$ (d) $\sqrt{2gr}$.

5.282. The displacement of a particle which moves along a straight line is given by $S = 4t^3 + 3t^2 - 10$ where S is in meters and t is in seconds. The time taken by the particle to acquire a velocity of 18 m/sec from rest, is
(a) $\frac{1}{2}$ sec (b) 1 sec
(c) 1.5 sec (d) 1.5 sec.

5.283. The acceleration of the particle stated in Q. No. 5.282 when its velocity is 18 m/sec, is
(a) 15 m/sec^2. (b) 20 m/sec^2.
(c) 25 m/sec^2. (d) 30 m/sec^2.

5.284. The ratio of the moment of inertia of a rectangle about its centroidal axis to the moment of inertia about its base, is
(a) 1/4 (b) 1/2
(c) 3/4 (d) 2.

5.285. The centre of gravity of a triangle is at the point where three
(a) medians of the triangle meet
(b) perpendicular bisectors of the sides of the triangle meet
(c) bisectors of the angle of the triangle meet
(d) none of these.

5.286. Math List I with List II and select a correct answer by using the codes given below the lists :

List I (Figures)	*List II (Centre of gravity)*
A. Semi circle of radius r	1. $3r/8$
B. Hemisphere of radius r	2. $4r/3\pi$
C. Sphere of radius r	3. $r/4$
D. Right circular cone of height r	4. r

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	1	3	2
(c)	2	1	1	3
(d)	3	4	1	2.

5.287. The centre of gravity of the trapezium (Fig. 5.14) from the side is at a distance of

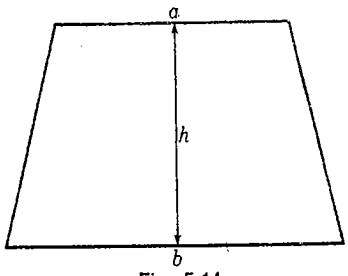

Fig. 5.14

(a) $\frac{h}{3} \times \left(\frac{b+2a}{b+a}\right)$ (b) $\frac{h}{3} \times \left(\frac{2b+a}{b+a}\right)$
(c) $\frac{h}{2} \times \left(\frac{b+2a}{b+2a}\right)$ (d) $\frac{h}{2} \times \left(\frac{2b+a}{b+a}\right)$.

5.288. A square hole is made in a circular lamina, the diagonal of the square is equal to the radius of the circle (Fig. 5.15) the shift in the centre of gravity is

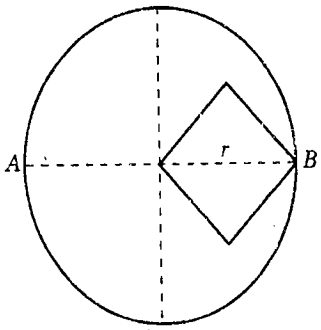

Fig. 5.15

(a) $\frac{r(\pi - 0.75)}{(\pi - 0.5)}$ (b) $\frac{r(\pi - 0.25)}{(\pi - 0.75)}$
(c) $\frac{r(\pi - 0.5)}{(\pi - 0.75)}$ (d) $\frac{r(\pi - 0.5)}{(\pi - 0.25)}$.

5.289. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Moment of Inertia)	*List II (Magnitude)*
A. Rectangular section of breadth b and depth d about central axis I_{YY}	1. $\frac{db^3}{12}$
B. Circular section of diameter d	2. $\frac{\pi d^4}{32}$
C. Circular section about an axis passing through *e.g.* I_{XX}	3. $\frac{bd^3}{12}$
D. Triangular section of base b and height d about an axis passing through c.g.	4. $\frac{\pi d^4}{64}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	1	2	4	3
(c)	4	3	1	2
(d)	3	2	1	4.

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6 Strength of Materials

6. 1. The property by which a body returns to its original shape after removal of the force, is called
(*a*) plasticity (*b*) elasticity
(*c*) ductility (*d*) malleability.

6. 2. The property of a material by which it can be drawn to a smaller section, due to tension, is called
(*a*) plasticity (*b*) ductility
(*c*) elasticity (*d*) malleability.

6. 3. The property of a material by which it can be beaten or rolled into thin plates, is called
(*a*) malleability (*b*) ductility
(*c*) plasticity (*d*) elasticity.

6. 4. As the elastic limit reaches, tensile strain
(*a*) increases more rapidly
(*b*) decreases more rapidly
(*c*) increases in proportion to the stress
(*d*) decreases in proportion to the stress.

6. 5. The stress necessary to initiate yielding, is considerably
(*a*) more than that necessary to continue it
(*b*) less than that necessary to continue it
(*c*) more than that necessary to stop it
(*d*) less than that necessary to stop it.

6. 6. The phenomenon of slow extension of materials having constant load, *i.e.* increasing with the time is called
(*a*) creeping (*b*) yielding
(*c*) breaking (*d*) none of these.

6. 7. The stress at which extension of a material takes place more quickly as compared to the increase in load, is called
(*a*) elastic point (*b*) plastic point
(*c*) breaking point (*d*) yielding point.

6. 8. Every material obeys the Hooke's law within its
(*a*) elastic limit (*b*) plastic point
(*c*) limit of proportionality (*d*) none of these.

6. 9. The materials which have the same elastic properties in all directions, are called
(*a*) isotropic (*b*) brittle
(*c*) homogeneous (*d*) hard.

6. 10. The law which states, "within elastic limits strain produced is proportional to the stress producing it", is known as
(*a*) Bernoulli's law (*b*) Stress law
(*c*) Hooke's law (*d*) Poisson's law
(*e*) none of these.

6. 11. When equal and opposite forces applied to a body, tend to elongate it, the stress so produced, is called
(*a*) shear stress (*b*) compressive stress
(*c*) tensile stress (*d*) transverse stress.

6.12. The under mentioned type is simple strain
(*a*) tensile strain (*b*) compressive strain
(*c*) shear strain (*d*) volumetric strain
(*e*) all the above.

6.13. A solid cube is subjected to equal normal forces on all its faces. The volumetric strain will be x-times the linear strain in any of the three axes when
(*a*) $x = 1$ (*b*) $x = 2$
(*c*) $x = 3$ (*d*) $x = 4$.

6.14. In a bar of large length when held vertically and subjected to a load at its lower end, its own-weight produces additional stress. The maximum stress will be
(*a*) at the lower cross-section
(*b*) at the built-in upper cross-section
(*c*) at the central cross-section
(*d*) at every point of the bar.

6.15. If the stress produced by a prismatic bar is equal to the working stress, the area of the cross-section of the prismatic bar, becomes
(*a*) zero (*b*) infinite
(*c*) maximum (*d*) minimum.

6.16. The ratio of elongations of a conical bar due to its own weight and that of a prismatic bar of the same length, is
(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{3}$
(*c*) $\frac{1}{4}$ (*d*) $\frac{1}{5}$
(*e*) $\frac{1}{6}$.

6.17. If all the dimensions of a bar are increased in the proportion $n : 1$, the proportion with which the maximum stress produced in the prismatic bar by its own weight, will increase in the ratio
(*a*) $1 : n$ (*b*) $n : 1$
(*c*) $1 : \frac{1}{n}$ (*d*) $\frac{1}{n} : 1$
(*e*) $1 : \sqrt{n}$.

6.18. If the stress in each cross-section of a pillar is equal to its working stress, it is called
(*a*) body of equal (*b*) body of equal section
(*c*) body of equal strength (*d*) none of these.

6.19. For a given material, if E, C, K and m are Young's modulus, shearing modulus, bulk modulus and poisson ratio, the following relation does not hold good
(*a*) $E = \frac{9KC}{3K + C}$ (*b*) $E = 2K\left(1 - \frac{2}{m}\right)$

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(c) $E = 2C\left(1 + \frac{1}{m}\right)$ (d) $\frac{1}{m} = \frac{3K - 2C}{6K + 2C}$

(e) $E = 3C\left(1 - \frac{1}{m}\right)$.

6.20. A steel rod of 2 cm diameter and 5 metres long is subjected to an axial pull of 3000 kg. If $E = 2.1 \times 10^6$, the elongation of the rod will be
(a) 2.275 mm (b) 0.2275 mm
(c) 0.02275 mm (d) 2.02275 mm.

6.21. If a steel rod of 20 mm diameter and 5 metres long elongates by 2.275 mm when subjected to an axial pull of 3000 kg, the stress developed, is
(a) 9.5541 kg/cm^2 (b) 95.541 kg/cm^2
(c) 955.41 kg/cm^2 (d) 9554.1 kg/cm^2.

6.22. When two plates butt together and are riveted with two cover plates with two rows of rivets, the joint is known as
(a) lap joint
(b) butt join
(c) single riveted single cover butt joint
(d) double riveted double cover butt joint.

6.23. If the rivets in adjacent rows are staggered and outermost row has only one rivet, the arrangement of the rivets, is called
(a) chain riveting (b) zig-zag riveting
(c) diamond riveting (d) none of these.

6.24. The distance between the centres of adjacent rivets in the same row, is called
(a) pitch (b) lap
(c) gauge (d) staggered pitch.

6.25. Failure of riverted joints is due to
(a) Tearing of the plates between the rivet hole and the edge of the plate
(b) Tearing of plates between rivets
(c) Shearing of rivets
(d) Crushing of rivets
(e) All the above.

6.26. According to Unwin's formula, the diameter d of a rivet of plate of thickness t is :
(a) $d = 6.05\sqrt{t}$ (b) $d = 1.5t + 4$
(c) $d = \sqrt{5t}$ (d) $d = \sqrt{t} + 1.5$.

6.27. The minimum number of rivets for the connection of a gusset plate, is
(a) 1 (b) 2
(c) 3 (d) 4.

6.28. The weakest section of a diamond riveting, is the section which passes through
(a) first row
(b) second row
(c) central raw
(d) one rivet hole of end row.

6.29. If b is the width of a plate joined by diamond riveting of diameter d, the efficiency of the joint is given by
(a) $\frac{b + d}{b}$ (b) $\frac{b - d}{b}$
(c) $\frac{d - b}{d}$ (d) $\frac{b - d}{d}$.

6.30. In case of an eccentric loading on a bracket subjected to moment M, the tangential force developed in any rivet, at right angles to its radius vector r is
(a) $\frac{Mr}{\Sigma r^2}$ (b) $\frac{\Sigma r^2}{Mr}$
(c) $\frac{Mr^2}{\Sigma r^2}$ (d) $\frac{\sqrt{Mr}}{\Sigma r^2}$.

6.31. Pick up the incorrect statement
(a) The cross-sectional area of the welded member is effective
(b) A welded joint develops strength of its parent metal
(c) Welded joints provide rigidity
(d) Welded joints have better finish
(e) Welding takes more time than riveting.

6.32. The type of butt joints in common use, is :
(a) single inverted V-butt joint (b) double V-butt joint
(c) double U-butt joint (d) single V-butt joint.

6.33. The maximum load to which a fillet joint of length L can be subjected to, is
(a) $0.7 \times S \times$ fillet size $\times L$
(b) $2 \times S \times$ fillet size $\times L$
(c) permissible shear stress $\times$ fillet size $\times L$
(d) $\frac{S \times \text{fillet size} \times L}{3}$
(e) none of these.

6.34. The maximum resistance against rotation, is offered by the weld at a point
(a) most distant (b) least distant
(c) at either end (d) centrally located.

6.35. Along the principal plan subjected to maximum principal stress
(a) maximum shear stress acts
(b) minimum shear stress acts
(c) no shear stress acts
(d) none of these.

6.36. If the normal cross-section A of a member is subjected to tensile force P, the resulting normal stress in an oblique plane inclined at angle θ to transverse plane will be
(a) $\frac{P}{A}\sin^2\theta$ (b) $\frac{P}{A}\cos^2\theta$
(c) $\frac{P}{2A}\sin 2\theta$ (d) $\frac{P}{2A}\cos 2\theta$.

6.37. If a member is subjected to a tensile force P, having its normal cross-section A, the resulting shear stress in an oblique plane inclined at an angle θ to its transverse plane, is
(a) $\frac{P}{A}\sin^2\theta$ (b) $\frac{P}{2A}\sin 2\theta$
(c) $\frac{P}{2A}\cos 2\theta$ (d) $\frac{P}{A}\cos^2\theta$
(e) $\frac{A}{P}\sin 2\theta$.

6.38. The ratio of the tensile stress developed in the wall of a

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boiler in the circumferential direction to the tensile stress in the axial direction, is
(a) 4 (b) 3
(c) 2 (d) 1.

6.39. If two tensile forces mutually perpendicular act on a rectangular parallelopiped bar are equal, the resulting elongation of the pipe, is
(a) $\frac{p}{E}(1-m)$ (b) $\frac{E}{p}(m-1)$
(c) $\frac{E}{p}(1-m)$ (d) $\frac{p}{E}(1+m)$
(e) $\frac{p}{E}(1+m^2)$.

6.40. A bending moment may be defined as :
(a) Arithmetic sum of the moments of all the forces on either side of the section
(b) Arithmetic sum of the forces on either side of the section
(c) Algebraic sum of the moments of all the forces on either side of the section
(d) None of these.

6.41. If Z and I are the section modulus and moment of inertia of the section, the shear force F and bending moment M at a section are related by
(a) $F = \frac{My}{I}$ (b) $F = \frac{M}{Z}$
(c) $F = \frac{dM}{dx}$ (d) $F = \int Mdx$.

6.42. At either end of a plane frame, maximum number of possible transverse shear forces, are
(a) one (b) two
(c) three (d) four
(e) zero.

6.43. At either end of a plane frame, maximum number of possible bending moments, are
(a) one (b) two
(c) three (d) four
(e) zero.

6.44. A simply supported beam of span L carries a uniformly distributed load W. The maximum bending moment M is
(a) $\frac{WL}{2}$ (b) $\frac{WL}{4}$
(c) $\frac{WL}{8}$ (d) $\frac{WL}{12}$
(e) $\frac{WL}{16}$.

6.45. A simply supported beam of span L carries a concentrated load W at its mid-span. The maximum bending moment M is
(a) $\frac{WL}{2}$ (b) $\frac{WL}{4}$
(c) $\frac{WL}{8}$ (d) $\frac{WL}{12}$
(e) $\frac{WL}{16}$.

6.46. A simply supported beam carries two equal concentrated loads W at distances $L/3$ from either support. The maximum bending moment M is
(a) $\frac{WL}{3}$ (b) $\frac{WL}{4}$
(c) $\frac{5WL}{8}$ (d) $\frac{3WL}{12}$
(e) $\frac{3WL}{5}$.

6.47. The shape of the bending moment diagram over the length of a beam, having no external load, is always
(a) linear (b) parabolic
(c) cubical (d) circular.

6.48. The shape of the bending moment diagram over the length of a beam, carrying a uniformly distributed load is always
(a) linear (b) parabolic
(c) cubical (d) circular.

6.49. The shape of the bending moment diagram over the length of a beam, carrying a uniformly increasing load, is always
(a) linear (b) parabolic
(c) cubical (d) circular.

6.50. The maximum bending moment due to a moving load on a simply supported beam, occurs
(a) at the mid span (b) at the supports
(c) under the load (d) anywhere on the beam
(e) none of these.

6.51. For a simply supported beam with a central load, the bending moment is
(a) least at the centre
(b) least at the supports
(c) maximum at the supports
(d) maximum at the centre.

6.52. For a cantilever with a uniformly distributed load W over its entire length L, the maximum bending moment is
(a) WL (b) $\frac{1}{2}WL$
(c) $\frac{1}{3}WL$ (d) $\frac{1}{2}W^2L$
(e) $\frac{1}{2}WL^2$.

6.53. For a simply supported beam carrying uniformly distributed load W on it entire length L, the maximum bending moment is
(a) $\frac{WL}{4}$ (b) $\frac{WL}{8}$
(c) $\frac{WL}{2}$ (d) $\frac{WL}{3}$
(e) $\frac{WL}{6}$.

6.54. The bending moment is maximum on a section where shearing force
(a) is maximum (b) is minimum
(c) is equal (d) changes sign.

6.55. For a beam of uniform strength keeping its depth constant, the width will vary in proportion to
(a) bending moment (M) (b) $\sqrt{M}$
(c) M^2 (d) none of these.

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6.56. A beam is said to be of uniform strength, if
(*a*) B.M. is same throughout the beam
(*b*) shear stress is same throughout the beam
(*c*) deflection is same throughout the beam
(*d*) bending stress is same at every section along its longitudinal axis.

6.57. In a continuous bending moment curve the point where it changes sign, is called
(*a*) point of inflexion (*b*) point of contraflexture
(*c*) point of virtual hinge (*d*) all the above.

6.58. In a simply supported beam L with a triangular load W varying from zero at one end to the maximum value at the other end, the maximum bending moment is
(*a*) $\frac{WL}{3}$ (*b*) $\frac{WL}{9\sqrt{3}}$
(*c*) $\frac{WL}{4}$ (*d*) $\frac{WL^3}{9\sqrt{3}}$
(*e*) $\frac{WL}{8}$.

6.59. Pick up the correct assumption of the theory of simple bending
(*a*) The value of the Young's modulus is the same in tension as well as in compression
(*b*) Transverse section of a beam remains plane before and after bending
(*c*) The material of the beam is homogeneous and isotropic
(*d*) The resultant pull or thrust on transverse section of a beam is zero
(*e*) All the above.

6.60. Along the neutral axis of a simply supported beam
(*a*) fibres do not undergo strain
(*b*) fibres undergo minimum strain
(*c*) fibres undergo maximum strain
(*d*) none of these.

6.61. The radius of gyration of a rectangular section is not proportional to
(*a*) square root of the moment of inertia
(*b*) square root of the inverse of the area
(*d*) square root of the moment of inertia divided by area of the section
(*d*) none of these.

6.62. The ratio of the moment of inertia of a circular plate and that of a square plate for equal depth, is
(*a*) less than one (*b*) equal to one
(*c*) more than one (*d*) equal to $3\pi/6$
(*e*) none of these.

6.63. The section modulus of a rectangular section is proportional to
(*a*) area of the section
(*b*) square of the area of the section
(*c*) product of the area and depth
(*d*) product of the area and width
(*e*) half moment of inertia of the section.

6.64. The shear force on a simply supported beam is proportional to
(*a*) displacement of the neutral axis
(*b*) sum of the forces
(*c*) sum of the transverse forces
(*d*) algebraic sum of the transverse forces of the section
(*e*) curvature of the neutral axis.

6.65. Pick up the correct statement from the following :
(*a*) The point through which the resultant of the shear stresses, passes is known as shear centre
(*b*) In the standard rolled channels, the shear centre is on the horizontal line passing through and away from the C.G. beyond web
(*c*) In equal angles, the shear centre is on the horizontal plane and away from the C.G., outside of the leg projection
(*d*) In T-sections, the shear centre is at the C.G. of the section
(*e*) All the above.

6.66. Simple bending equation is
(*a*) $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$ (*b*) $\frac{I}{M} = \frac{E}{R} = \frac{Y}{F}$
(*c*) $\frac{M}{I} = \frac{E}{R} = \frac{F}{Y}$ (*d*) $\frac{M}{I} = \frac{R}{E} = \frac{Y}{F}$
(*e*) none of these.

6.67. The intensity of direct longitudinal stress in the cross-section at any point distant r from the neutral axis, is proportional to
(*a*) r (*b*) $\frac{1}{r}$
(*c*) r^2 (*d*) $\frac{1}{r^2}$
(*e*) r^3.

6.68. The maximum compressive stress at the top of a beam is 1600 kg/cm^2 and the corresponding tensile stress at its bottom is 400 kg/cm^2. If the depth of the beam is 10 cm, the neutral axis from the top, is
(*a*) 2 cm (*b*) 4 cm
(*c*) 6 cm (*d*) 8 cm
(*e*) 10 cm.

6.69. A reinforced concrete beam is assumed to be made of
(*a*) homogeneous material (*b*) heterogeneous material
(*c*) isotropic material (*d*) none of these.

6.70. If a constant section beam is subjected to a uniform bending moment throughout, its length bends to
(*a*) a circular arc (*b*) a parabolic arc
(*c*) a catenary (*d*) none of these.

6.71. The maximum deflection of a simply supported beam of length L with a central load W, is
(*a*) $\frac{WL^2}{48\,EI}$ (*b*) $\frac{W^2L}{24\,EI}$
(*c*) $\frac{WL^3}{48\,EI}$ (*d*) $\frac{WL^2}{8\,EI}$
(*e*) $\frac{WL^2}{36\,EI}$.

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6.72. The ratio of the maximum deflections of a beam simply supported at its ends with an isolated central load and that of with a uniformly distributed load over its entire length, is

(*a*) 1 (*b*) $\frac{15}{24}$

(*c*) $\frac{24}{15}$ (*d*) $\frac{2}{3}$

(*e*) $\frac{3}{2}$.

6.73. The ratio of the maximum deflection of a cantilever beam with an isolated load at its free end and with a uniformly distributed load over its entire length, is

(*a*) 1 (*b*) $\frac{24}{15}$

(*c*) $\frac{3}{8}$ (*d*) $\frac{8}{3}$

(*e*) $\frac{5}{8}$.

6.74. Maximum deflection of a cantilever due to pure bending moment M at its free end, is

(*a*) $\frac{ML^2}{3\,EI}$ (*b*) $\frac{ML^2}{4\,EI}$

(*c*) $\frac{ML^2}{6\,EI}$ (*d*) $\frac{ML^2}{2\,EI}$

(*e*) $\frac{ML^2}{5\,EI}$.

6.75. A cantilever carries is uniformly distributed load W over its whole length and a force W acts at its free end upward. The net deflection of the free end will be

(*a*) zero (*b*) $\frac{5}{24}\frac{WL^3}{EI}$ upward

(*c*) $\frac{5}{24}\frac{WL^3}{EI}$ downward (*d*) none of these.

6.76. A cantilever carrying a uniformly distributed load W over its full length is propped at its free end such that it is at the level of the fixed end. The bending moment will be zero at its free end also at

(*a*) mid point of the cantilever
(*b*) fixed point of the cantilever
(*c*) 1/4th length from free end
(*d*) 3/4th length from free end
(*e*) half length from free end.

6.77. A simply supported beam carrying a uniformly distributed load over its whole span, is propped at the centre of the span so that the beam is held to the level of the end supports. The reaction of the prop will be

(*a*) half the distributed load (*b*) 3/8th distributed load
(*c*) 5/8th the distributed load (*d*) distributed load.
(*e*) none of these.

6.78. A uniform girder simply supported at its ends is subjected to a uniformly distributed load over its entire length and is propped at the centre so as to neutralise the deflection. The net B.M. at the centre will be

(*a*) WL (*b*) $\frac{WL}{8}$

(*c*) $\frac{WL}{24}$ (*d*) $\frac{WL}{32}$

(*e*) $\frac{WL}{64}$.

6.79. The moment diagram for a cantilever whose free end is subjected to a bending moment, will be a

(*a*) triangle (*b*) rectangle
(*c*) parabola (*d*) cubic parabola.

6.80. The moment diagram for a cantilever carrying linearly varying load from zero at its free end and to maximum at the fixed end will be a

(*a*) triangle (*b*) rectangle
(*c*) parabola (*d*) cubic parabola.

6.81. The moment diagram for a cantilever which is subjected to a uniformly distributed load will be a

(*a*) triangle (*b*) rectangle
(*c*) parabola (*d*) cubic parabola.

6.82. The moment diagram for a cantilever carrying a concentrated load at its free end, will be

(*a*) triangle (*b*) rectangle
(*c*) parabola (*d*) cubic parabola.

6.83. Shear force for a cantilever carrying a uniformly distributed load over its length, is

(*a*) triangle (*b*) rectangle
(*c*) parabola (*d*) cubic parabola.

6.84. When a rectangular beam is loaded longitudinally, shear develops on

(*a*) bottom fibre (*b*) top fibre
(*c*) middle fibre (*d*) every-horizontal plane.

6.85. When a rectangular beam is loaded transversely, the maximum compressive stress develops on

(*a*) bottom fibre (*b*) top fibre
(*c*) neutral axis (*d*) every cross-section.

6.86. If the shear force along a section of a beam is zero, the bending moment at the section is

(*a*) zero (*b*) maximum
(*c*) minimum
(*d*) average of maximum-minimum
(*e*) none of these.

6.87. Hooke's law states that stress and strain are

(*a*) directly proportional (*b*) inversely proportional
(*c*) curvilinearly related (*d*) none of these.

6.88. A cantilever beam rectangular in cross-section is subjected to an isolated load at its free end. If the width of the beam is doubled, the deflection of the free end will be changed in the ratio of

(*a*) 8 (*b*) 1/8
(*c*) 1/2 (*d*) 2
(*e*) 3.

6.89. If the length of a cantilever carrying an isolated load at its free end is doubled, the deflection of the free end will increase by

(*a*) 8 (*b*) 1/8
(*c*) 1/3 (*d*) 2
(*e*) 3.

6.90. If the width of a simply supported beam carrying an

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isolated load at its centre is doubled, the deflection of the beam at the centre is changed by

(a) 2 times (b) 4 times
(c) 8 times (d) 1/2 times
(e) 3 times.

6.91. If the width of a simply supported beam carrying an isolated load at its centre is doubled, the deflection of the beam at the centre is changed by

(a) 1/2 (b) 1/8
(c) 2 (d) 8
(e) 4.

6.92. If the depth of a simply supported beam carrying an isolated load at its centre, is doubled, the deflection of the beam at the centre will be changed by a factor of

(a) 2 (b) 1/2
(c) 8 (d) 1/8
(e) 4.

6.93. If the width b and depth d of a beam simply supported with a central load are interchanged, the deflection at the centre of the beam will be changed in the ratio of

(a) b/d (b) d/b
(c) $(d/b)^2$ (d) $(b/d)^2$
(e) $(b/d)^3$.

6.94. The deflection of any rectangular beam simply supported, is

(a) directly proportional to its weight
(b) inversely proportional to its width
(c) inversely proportional to the cube of its depth
(d) directly proportional to the cube of its length
(e) none of these.

6.95. Stress in a beam due to simple bending, is

(a) directly proportional (b) inversely proportional
(c) curvilinearly related (d) none of these.

6.96. For a beam, if fundamental equations of statics are not sufficient to determine all the reactive forces at the supports, the structure is said to be

(a) determinate (b) statically determinate
(c) statically indeterminate (d) none of these.

6.97. If the beam is supported so that there are only three unknown reactive elements at the supports. These can be determined by using the following fundamental equation of statics

(a) $\Sigma H = 0$ (b) $\Sigma V = 0$
(c) $\Sigma H = 0$; $\Sigma H = 0$ (d) $\Sigma H = 0$; $\Sigma V = 0$; $\Sigma M = 0$
(e) $\Sigma M = 0$; $\Sigma H = 0$.

6.98. For a beam having fixed ends, the unknown element of the reactions, is

(a) horizontal components at either end
(b) vertical components at either end
(c) horizontal component at one end and vertical component at the other
(d) horizontal and vertical components at both the ends.

6.99. A long vertical member, subjected to an axial compressive load, is called

(a) a column (b) a strut
(c) a tie (d) a stanchion
(e) all the above.

6.100. The ratio of the effective length of a column and minimum radius of gyration of its cross-sectional area, is known

(a) buckling factor (b) slenderness ratio
(c) crippling factor (d) none of these.

6.101. The region of the cross-section of a column in which compressive load may be applied without producing any tensile stress, is known as the core of the cross-section. In circular columns the radius of the core, is

(a) one-half of the radius (b) one-third of the radius
(c) one-quarter of the radius (d) one-fifth of the radius
(e) one-sixth of the radius.

6.102. In rectangular columns (cross-section $b \times h$), the core is a

(a) rectangle of lengths $b/2$ and $h/2$
(b) square of length $b/2$
(c) rhombus of length $h/2$
(d) rhombus of diagonals $b/3$ and $h/3$
(e) none of the these.

6.103. A column is said to be of medium size if its slenderness ratio is between

(a) 20 and 32 (b) 32 and 120
(c) 120 and 160 (d) 160 and 180
(e) 180 and 200.

6.104. Euler's formula states that the buckling load P for a column of length l, both ends hinged and whose least moment of inertia and modulus of elasticity of the material of the column are I and E respectively, is given by the relation

(a) $P = \dfrac{\pi^2 EI}{l^2}$ (b) $P = \dfrac{\pi l^2}{EI}$

(c) $P = \dfrac{\pi EI}{l^2}$ (d) $P = \dfrac{\pi^2 EI}{l^3}$

(e) $P = \pi E l^2$.

6.105. Columns of given length, cross-section and material have different values of buckling loads for different end conditions. The strongest column is one whose

(a) one end is fixed and other end is hinged
(b) both ends are hinged or pin jointed
(c) one end is fixed and the other end entirely free
(d) both the ends are fixed
(e) none of the these.

6.106. The length of a column, having a uniform circular cross-section of 7.5 cm diameter and whose ends are hinged, is 5 m. If the value of E for the material is 2100 tonnes/cm^2, the permissible maximum crippling load will be

(a) 1.288 tonnes (b) 12.88
(c) 128.8 tonnes (d) 288.0
(e) none of these.

6.107. Rankine-Golden formula accounts for direct as well as buckling stress and is applicable to

(a) very long columns (b) long columns
(c) short columns (d) intermediate columns
(e) all the above.

6.108. The length of a column which gives the same value of

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buckling load by Euler and Rankine-Gordon formula, is equal to

(a) $\frac{\pi^2 EK}{fa - \pi^2 E_a}$ (b) $\sqrt{\frac{\pi^2 EK}{fa - \pi^2 E_a}}$

(c) $\sqrt{\frac{\pi^2 EK^2}{\pi^2 E_a - fa}}$ (d) none of these.

6.109. The equivalent length of a column fixed at both ends, is

(a) 0.5 l (b) 0.7 l
(c) l (d) 2 l
(e) 1.5 l.

6.110. The equivalent length of a column fixed at one end and free at the other end, is

(a) 0.5 l (b) 0.7 l
(c) l (d) 2 l
(e) 1.5 l.

6.111. The slenderness ratio of a vertical column of a square cross-section of 2.5 cm sides and 300 cm length, is

(a) 200 (b) 240
(c) 360 (d) 416
(e) 500.

6.112. The slenderness ratio of a vertical column of square cross- section of 10 cm side and 500 cm long, is

(a) 117.2 (b) 17.3
(c) 173.2 (d) 137.2
(e) 13.72.

6.113. The range within which a load can be applied on a rectangular column, to avoid any tensile stress, is

(a) one-half of the base (b) one-fifth of the base
(c) one-fourth of the base (d) one-fifth of the base
(e) one sixth of the base on either side of centroid.

6.114. For keeping the stress wholly compressive the load may be applied on a circular column anywhere within a concentric circle of diameter

(a) $d/2$ (b) $d/3$
(c) $d/4$ (d) $d/8$
(e) $d/10$.

6.115. To ascertain the maximum permissible eccentricity of loads on circular columns, the rule generally followed, is

(a) middle half rule of columns
(b) middle third rule of columns
(c) middle fourth rule of columns
(d) none of these.

6.116. A short masonry pillar is 60 cm × 60 cm in cross-section, the core of the pillar is a square whose side is

(a) 17.32 cm (b) 14.14 cm
(c) 20.00 cm (d) 22.36 cm
(e) 25.22 cm.

6.117. The greatest eccentricity which a load W can have without producing tension on the cross-section of a short column of external diameter D and internal diameter d, is

(a) $\frac{4W}{\pi(D^2 - d^2)}$ (b) $\frac{\pi(D^4 - d^4)}{32D}$

(c) $\frac{D^2 + d^2}{8D}$ (d) $\frac{D^2 - d^2}{8D}$

(e) $\frac{D + d}{8D}$.

6.118. The section modulus of a rectangular light beam 25 metres long is 12.500 cm^3. The beam is simply supported at its ends and carries a longitudinal axial tensile load of 10 tonnes in addition to a point load of 4 tonnes at the centre. The maximum stress in the bottom most fibre at the mid span section, is

(a) 13.33 kg/cm^2 tensile (b) 13.33 kg/cm^2 compressive
(c) 26.67 kg/cm^2 tensile (d) 26.67 kg/cm^2 compressive
(e) none of these.

6.119. The effect of arching a beam, is

(a) to reduce the bending moment throughout
(b) to increase the bending moment throughout
(c) nothing on the bending throughout
(d) all the above.

6.120. A three-hinged arch is said to be :

(a) statically determinate structure
(b) statically indeterminate structure
(c) a bent beam
(d) none of these.

6.121. In a three hinged arch, the bending moment will be zero

(a) at right hinge only
(b) at left hinge only
(c) at both right and left hinges
(d) at all the three hinges.

6.122. In a three hinged arch, the third hinge is generally kept at

(a) crown of the arch
(b) midpoint of the crown and left support hinge
(c) midpoint of the crown and right support hinge
(d) none of these.

6.123. A three hinged arch is loaded with an isolated load 1000 kg at a horizontal distance of 2.5 m from the crown, 1 m above the level of hinges at the supports 10 metres apart. The horizontal thrust is

(a) 1250 kg (b) 125 kg
(c) 750 kg (d) 2500 kg
(e) 2325 kg.

6.124. If a three hinged parabolic arch carries a uniformly distributed load on its entire span, every section of the arch resists.

(a) compressive force (b) tensile force
(c) shear force (d) bending moment.

6.125. The rise of a parabolic arch at quarter points, is equal to

(a) $\frac{1}{3}$ times the rise of the crown
(b) $\frac{1}{4}$ times the rise of the crown
(c) $\frac{1}{2}$ times the rise of the crown

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(*d*) $\frac{3}{4}$ times the rise of the crown

(*e*) $\frac{5}{8}$ times the rise of the crown.

6.126. A linear arch is subjected only to
(*a*) shear force (*b*) thrust
(*c*) bending moment (*d*) both (*b*) and (*c*)
(*e*) both (*b*) and (*c*).

6.127. An arch with three hinges, is a structure
(*a*) statically determinate (*b*) statically indeterminate
(*c*) geometrically unstable
(*d*) structurally sound but indeterminate
(*e*) none of these.

6.128. In a three hinged arch, the shear force is usually
(*a*) maximum at crown (*b*) maximum at springings
(*c*) maximum at quarter points
(*d*) varies with slope.

6.129. In a solid arch, shear force acts
(*a*) vertically upwards (*b*) along the axis of the arch
(*c*) perpendicular to the axis of arch
(*d*) tangentially to the arch
(*e*) none of these.

6.130. An arch may be subjected to
(*a*) shear and axial force
(*b*) bending moment and shear force
(*c*) bending moment and axial force
(*d*) shear force and thrust
(*e*) thrust, shear force and bending moment.

6.131. A three hinged parabolic arch hinged at the crown and springings, has a horizontal span of 4.8 m and a central rise of 1 m. It carries a uniformly distributed load of 0.75 tonne per metre over half left hand span. The horizontal thrust at the support will be
(*a*) 10.8 tonnes (*b*) 1.08 tonnes
(*c*) 1.8 tonnes (*d*) 0.8 tonnes
(*e*) none of these.

6.132. For a stable frame structure, number of members required, is
(*a*) three times the number of joints minus three
(*b*) twice the number of joints minus three
(*c*) twice the number of joints minus two
(*d*) twice the number of joints minus one
(*e*) none of these.

6.133. n and j are numbers of members and joints in a frame. It contains redundant members if
(*a*) $n = 2j - 3$ (*b*) $n = 3j - 2$
(*c*) $n < 2j - 3$ (*d*) $n < j - 2$
(*e*) $n > 2j - 3$.

6.134. The reaction at the supports will be vertical to the plane of the support if the frame structure rests on
(*a*) roller supports (*b*) free supports
(*c*) hinged supports (*d*) all the above.

6.135. Reactions at the supports of a structure can be determined by equating the algebraic sum of
(*a*) horizontal forces to zero
(*b*) vertical forces to zero
(*c*) moment about any point to zero
(*d*) all the above.

6.136. If two forces acting at a joint are not along the straight line, then for the equilibrium of the joint
(*a*) one of the forces must be zero
(*b*) each force must be zero
(*c*) forces must be equal and of the same sign
(*d*) forces must be equal in magnitude but opposite in sign.

6.137. Stress in members of statically determinate simple frames, can be determined by
(*a*) method of joints (*b*) method of sections
(*c*) graphical solution (*d*) all the above.

6.138. A joint of a frame is subjected to three tensile force P, Q and R equally inclined to each other. If P is 10 tonnes, the other forces will be
(*a*) Q = 10 tonnes and R = zero
(*b*) R + 10 tonnes and Q = zero
(*c*) $Q + R$ = 10 tonnes
(*d*) $Q - R$ = zero
(*e*) Q and R each is equal to 10 tonnes.

6.139. A member is balanced at its end by two inclined members carrying equal forces. For equilibrium the angle between the inclined bars must be
(*a*) 3° (*b*) 45°
(*c*) 60° (*d*) 90°
(*e*) 120°.

6.140. Ties are load carrying members of a frame, which are subjected to
(*a*) transverse loads (*b*) axial tension loads
(*c*) axial compressive loads (*d*) torsional loads.

6.141. Struts are load carrying members of a frame structure which are subjected to
(*a*) axial tension loads (*b*) axial compressive loads
(*c*) torsional loads (*d*) transverse loads.

6.142. The shear stress at any section of a shaft is maximum
(*a*) at the centre of the section
(*b*) at a distance $r/2$ from the centre
(*c*) at the top of the surface
(*d*) at a distance 3/4 r from the centre
(*e*) none of these.

6.143. The following assumption is not true in the theory of pure torsion :
(*a*) The twist along the shaft is uniform
(*b*) The shaft is of uniform circular section throughout
(*c*) Cross-section of the shaft, which is plane before twist remains plane after twist
(*d*) All radii get twisted due to torsion.

6.144. In a shaft shear stress intensity at a point is not
(*a*) directly proportional to the distance from the axis
(*b*) inversely proportional to the distance from the axis
(*c*) inversely proportional to the polar moment of inertia
(*d*) directly proportional to the applied torque.

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6.145. The maximum twisting moment a shaft can resist, is the product of the permissible shear stress and
(*a*) moment of inertia
(*b*) polar moment of inertia
(*c*) polar modulus
(*d*) modulus of rigidly.

6.146. The ratio of the moments of resistance of a solid circular shaft of diameter D and a hollow shaft (external diameter D and internal diameter d), is
(*a*) $\frac{D^4}{D^4 - d^4}$ (*b*) $\frac{D^3}{D^3 - d^3}$
(*c*) $\frac{D^4 - d^4}{D^4}$ (*d*) $\frac{D^3 - d^3}{D^3}$
(*e*) none of these.

6.147. A shaft turning 150 r.p.m. is subjected to a torque of 150 kgm. Horse power transmitted by the shaft is
(*a*) π (*b*) 10π
(*c*) π^2 (*d*) $1/\pi$.

6.148. If a solid shaft is subjected to a torque T at its end such that maximum shear stress does not exceed f_z the diameter of the shaft will be
(*a*) $\frac{16\,T}{\pi fs}$ (*b*) $\sqrt{\frac{16\,T}{\pi fs}}$
(*c*) $\sqrt[3]{\frac{16\,T}{\pi fs}}$ (*d*) none of these.

6.149. A shaft 9 m long is subjected to a torque 30 *t*-m at a point 3 m distant from either end. The reactive torque at the nearer end will be
(*a*) 5 tonnes metre (*b*) 10 tonnes metre
(*c*) 15 tonnes metre (*d*) 20 tonnes metre
(*e*) none of these.

6.150. If n is the ratio of internal and external diameters of a hollow shaft, the ratio of the weight of the hollow shaft and that of solid shaft of same strength, will be
(*a*) $\frac{1 - n^2}{(1 - n^2)^{1/2}}$ (*b*) $\frac{1 - n^2}{(1 - n^4)^{2/3}}$
(*c*) $\frac{1 + n^3}{(1 + n^4)^{1/2}}$ (*d*) $\frac{1 + n^1}{(1 + n^4)^{2/3}}$.

6.151. If a shaft is simultaneously subjected to a toque T and a bending moment M, the ratio of maximum bending stress and maximum shearing stress is
(*a*) $\frac{M}{T}$ (*b*) $\frac{T}{M}$
(*c*) $\frac{2M}{T}$ (*d*) $\frac{2T}{M}$
(*e*) $\frac{MT}{2}$.

6.152. A member which does not regain its original shape after removed of load producing deformation is said
(*a*) plastic (*b*) elastic
(*c*) rigid (*d*) none of these.

6.153. Strain energy of any member may be defined as work done on it
(*a*) to deform it (*b*) to resist elongation
(*c*) to resist shortening (*d*) all the above.

6.154. Strain energy of a member may be equated to
(*a*) average resistance × displacement
(*b*) $\frac{1}{2}$ stress × strain × area of its cross-section
(*c*) $\frac{1}{2}$ stress × strain × volume of the member
(*d*) $\frac{1}{2}$ (stress)^2 × volume of the member ÷ Young's modulus E.

6.155. The maximum stress intensity due to a suddenly applied load is x-times the stress intensity produced by the load of the same magnitude applied gradually. The value of x is
(*a*) 1 (*b*) 2
(*c*) 3 (*d*) $\frac{1}{2}$
(*e*) $\frac{3}{4}$.

6.156. A member which is subjected to reversible tensile or compressive stress may fail at a stress lower than the ultimate stress of the material. This property of metal, is called
(*a*) plasticity of the metal (*b*) elasticity of the metal
(*c*) fatigue of the metal (*d*) workability of the metal

6.157. The phenomenon of slow growth of strain under a steady tensile stress, is called
(*a*) yielding (*b*) creeping
(*c*) breaking (*d*) none of these.

6.158. The shiftness factor for a prismatic beam of length L and moment of inertia I, is
(*a*) $\frac{IE}{L}$ (*b*) $\frac{2EI}{L}$
(*c*) $\frac{3EI}{L}$ (*d*) $\frac{4EI}{L}$
(*e*) $\frac{EI}{2L}$.

6.159. The tension coefficient of any member is
(*a*) force divided by the length
(*b*) tension divided by the length
(*c*) tension per unit area
(*d*) tension in the member.

6.160. When loads are applied proportionately to a frame structure containing its members in one plane, the structure is called
(*a*) grid frame (*b*) plane frame
(*c*) space frame (*d*) truss frame.

6.161. A cylinder is said to be thin if the ratio of its thickness and diameter, is less than
(*a*) 1/25 (*b*) 1/20
(*c*) 1/15 (*d*) 1/10
(*e*) 1/5.

6.162. If a shaft is rotating N revolutions per minute with an applied torque T kg-m, the horse power being transmitted by the shaft, is
(*a*) $\frac{2\pi NT}{550}$ (*b*) $\frac{2\pi NT}{750}$

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(c) $\frac{2\pi NT}{4500}$ (d) $\frac{2\pi NT}{55}$

(e) none of these.

6.163. If p is the internal pressure in a thin cylinder of diameter d and thickness t, the developed hoop stress, is

(a) $\frac{Pd}{2t}$ (b) $\frac{Pd}{4t}$

(c) $\frac{Pd}{t}$ (d) $\frac{2Pd}{t}$ (e) $\frac{Pd}{3t}$.

6.164. In a loaded beam, the point of contraflexture occurs at a section where

(a) bending moment is minimum

(b) bending moment is zero or changes sign

(c) bending moment is maximum

(d) shearing force is maximum

(e) shearing force is minimum.

6.165. The areas of cross-section of a square beam and a circular beam subjected to equal bending moments, are same.

(a) circular beam is more economical

(b) square beam is more economical

(c) both the beams are equally strong

(d) both the beams are equally economical

(d) none of these.

6.166. The stress in the wall of a cylinder in a direction normal to its longitudinal axis, due to a force acting along the circumference, is known as

(a) yield stress (b) longitudinal stress

(c) hoop stress (d) circumferential stress

(e) ultimate stress.

6.167. In a shaft rotated by a couple, the shear force varies

(a) from zero at the centre to a maximum at the circumference

(b) from minimum at the centre of maximum at the circumference

(c) from maximum at the centre to zero at the circumference

(d) equally throughout the section

(e) none of these.

6.168. If a member carries a tensile force P on its area of cross-section A, the normal stress introduced on an inclined plane making an angle θ with its transverse plane, is

(a) $\frac{P}{A}\sin^2\theta$ (b) $\frac{P}{A}\cos^2\theta$

(c) $\frac{P}{A}\tan^2\theta$ (d) $\frac{P}{2A}\sin^2\theta$

(e) $\frac{P}{2A}\cos 2\theta$.

6.169. In a square beam loaded longitudinally, shear develops

(a) on middle fibre along horizontal plane

(b) on lower fibre along horizontal plane

(c) on top fibre along vertical plane

(d) equally on each fibre along horizontal plane

(e) none of these.

6.170. In a beam, the neutral plane

(a) may be its centre

(b) passes through the C.G. of the area of cross-section

(c) does not change during deformation

(d) none of these.

6.171. A beam is said to be of uniform strength, if

(a) B.M. is same throughout the beam

(b) deflection is same throughout the beam

(c) bending stress is same throughout the beam

(d) shear stress is same throughout the beam

(e) none of these.

6.172. If a circular beam of diameter d experiences a longitudinal strain $\frac{P}{E}$ and a lateral strain $\frac{2P}{mE'}$ the volumetric strain is

(a) $\left(\frac{P}{E}+\frac{2P}{mE}\right)$ (b) $\left(\frac{P}{E}-\frac{2P}{mE}\right)$

(c) $\left(\frac{P}{E}+\frac{mE}{2P}\right)$ (d) $\left(\frac{P}{E}-\frac{mE}{2P}\right)$

(e) none of these.

6.173. The point of contraflexture occurs in

(a) cantilever beams only (b) continuous beams only

(c) over hanging beams only (d) all types of beams

(e) both (a) and (b).

6.174. A simply supported beam $(l + 2a)$ with equal overhangs (a) carries a uniformly distributed load over the whole length, the B.M. changes sign if

(a) $l > 2a$ (b) $l < 2a$

(c) $l = 2a$ (d) $l = 4a$ (e) $l = 3a$.

6.175. In a simply supported beam $(l + 2a)$ with equal overhangs (a) and carrying a uniformly distributed load over its entire length, B.M. at the middle point of the beam will be zero if

(a) $l = 2a$ (b) $l = 4a$

(c) $l < 2a$ (d) $l > a$ (e) $l > 3a$.

6.176. A beam of length L supported on two intermediate rollers carries a uniformly distributed load on its entire length. If sagging B.M. and hogging B.M. of the beam are equal, the length of each overhang, is

(a) 0.107 L (b) 0.207 L

(c) 0.307 L (d) 0.407 L (e) 0.5 L.

6.177. Pick up the correct statement from the following :

(a) The rate of change of bending moment is equal to rate of shear force

(b) The rate of change of shear force is equal to rate of loading

(c) neither (a) nor (b)

(d) both (a) and (b).

6.178. A diagram which shows the variations of the axial load for all sections of the span of a beam, is called

(a) bending moment diagram (b) shear force diagram

(c) thrust diagram (d) stress diagram

(e) none of these.

6.179. The width b and depth d of a beam cut from a wooden cylindrical log of 100 cm diameter for maximum strength are:

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(a) b = 57.73 cm d = 81.65 cm
(b) b = 81.65 cm d = 57.73 cm
(c) b = 50.00 cm d = 50.00 cm
(d) b = 40.00 cm d = 80.00 cm
(e) b = 30.00 cm d = 60.00 cm.

6.180. The ratio of the flexural strengths of two square beams one placed with its two sides horizontal and the other placed with one diagonal vertical, diagonal, is
(a) $\sqrt{2}$ (b) $\sqrt{3}$
(c) $\sqrt{5}$ (d) $\sqrt{7}$.

6.181. Beams of uniform strength are preferred to those of uniform section because these are economical for
(a) large spans (b) heavy weights
(c) light weights (d) short spans.

6.182. A 8 metre long simply supported rectangular beam which carries a distributed load 45 kg/m. experiences a maximum fibre stress 160 kg/cm^2. If the moment of inertia of the beam is 640 cm^4, the overall depth of the beam is
(a) 10 cm (b) 12 cm
(c) 15 cm (d) 16 cm
(e) 18 cm.

6.183. If a rectangular beam measuring 10 × 18 × 400 cm carries a unformly distributed load such that the bending stress developed is 100 kg/cm^2. The intensity of the load per metre length, is
(a) 240 kg (b) 250 kg
(c) 260 kg (d) 270 kg
(e) 280 kg.

6.184. In the cantilever truss (Fig. 6.1), the horizontal component of the reaction at A, is
(a) 30 tonnes
(b) 60 tonnes
(c) 90 tonnes
(d) 120 tonnes
(e) 150 tonnes.

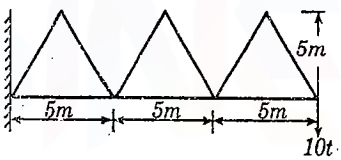

Fig. 6.1

6.185. The bending moment at C of a portal frame shown in Fig. 6.2 is

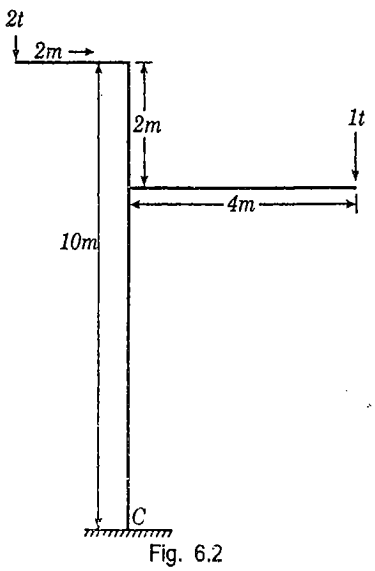

Fig. 6.2

(a) 8 t-m (b) 4 t-m
(c) 28 t-m (d) 16 t-m (e) zero.

6.186. The direction of the reaction at support B of a truss shown in Fig. 6.3 will be

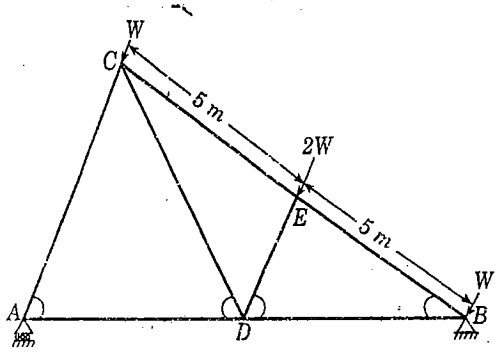

Fig. 6.3

(a) East of North (b) West of North
(c) East of South (d) West of South
(e) Vertical.

6.187. The nature of the stress in horizontal members of the truss shown in Fig. 6.3 may be
(a) compressive (b) tensile
(c) shear (d) zero
(e) all the above.

6.188. The force in DB of the truss shown in Fig. 6.3 is
(a) $\sqrt{3}$ W compression (b) $\sqrt{W}$ tension
(c) 2 W compression (d) 5 W tension
(e) 4 W tension.

6.189. The force in the member DE of the truss shown in Fig. 6.3 will be
(a) zero (b) 2 W tensile
(c) 2 W compressive (d) 4 W compressive
(e) 4 W tensile.

6.190. The force in BD of the truss shown in Fig. 6.4 is :

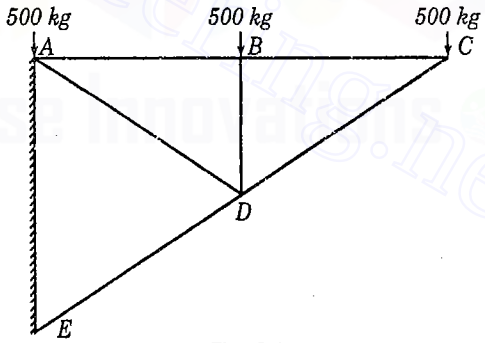

Fig. 6.4

(a) 500 kg compressive (b) 500 kg tensile
(c) 1500 kg tensile (d) 1500 kg compressive
(e) zero.

6.191. Pick up the correct statement from the following :
(a) A ductile material has large plastic zone
(b) A brittle material has no plastic zone
(c) A rigid material has no plastic zone
(d) All the above.

6.192. Pick up the correct statement from the following :
(a) The distance of the eccentric axial load from the C.G. beyond which tension develops, is known as kern distance
(b) In visco-elastic material, stress-strain relation is de-

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pendent on time
(c) An instropic material has different properties is different directions
(d) An orthotropic material has different properties in three mutually perpendicular directions
(e) All the above.

6.193. The value of Poisson's ratio always remains
(a) greater than one (b) less than one
(c) equal to one (d) none of these.

6.194. The number of points of contraflexure in a simple supported beam carrying uniformly distributed load, is
(a) 1 (b) 2
(c) 3 (d) 0.

6.195. In a fixed beam, the points of contraflexure,
(a) for a uniformly distributed load are 2
(b) for a concentrated load are 2
(c) for a moment applied at mid point are 3
(d) all the above.

6.196. Maximum deflection of a
(a) Cantilever beam carrying a concentrated load W at its free end is $\frac{WL^3}{3\,EI}$
(b) simply supported beam carrying a concentrated load W at mid-span is $\frac{WL^3}{48\,EI}$
(c) cantilever beam, carrying a uniformly distributed load over span is $\frac{WL^3}{8\,EI}$
(d) simply supported beam carrying a uniformly distributed load over the span is $\frac{5WL^3}{384\,EI}$
(e) All the above.

6.197. The maximum deflection of
(a) a simply supported beam carrying a uniformly increasing load from either end and having the apex at the mid span is $\frac{WL^3}{60\,EI}$
(b) a fixed ended beam carrying a distributed load over the span is $\frac{WL^3}{384\,EI}$
(c) a fixed ended beam carrying a concentrated load at the mid span is $\frac{WL^3}{192\,EI}$
(d) a cantilever beam subjected to a moment M at the free end is $\frac{WL^3}{3\,EI}$
(e) All the above.

6.198. For structural analysis, Maxwell's reciprocal theorem can be applied to :
(a) plastic structures (b) elastic structures
(c) symmetrical structures (d) all the above.

6.199. For structural analysis of forces, the method refers to
(a) moment-area-theorem (b) three-moment equation
(c) Maxwell's reciprocal theorem
(d) none of these.

6.200. Influence lines are drawn for structures
(a) of any type
(b) statically determinate
(b) pin-jointed truss
(d) none of these.

6.201. The tensile force required to cause an elongation of 0.045 mm in a steel rod of 1000 mm length and 12 mm diameter, is
(a) 166 kg (b) 102 kg
(c) 204 kg (d) 74 kg
where $E = 2 \times 10^6$ kg/cm^2.

6.202. The structure shown in Fig. 6.5 is stable, if
(a) $x = \frac{\sqrt{3}\,y}{2}$
(b) $x = 2y$
(c) $\sqrt{x} = y$
(d) $\sqrt{2x} = y$.

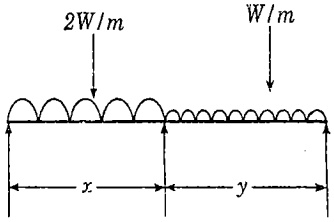

Fig. 6.5

6.203. The reaction at support A of the beam shown in Fig. 6.6, is
(a) zero
(b) 5 T
(c) 10 T
(d) 1 T
(e) 4 T.

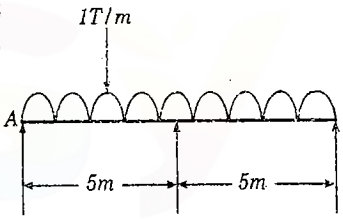

Fig. 6.6

6.204. The B.M. diagram of the beam shown in Fig. 6.7, is
(a) a rectangle
(b) a triangle
(c) a trapezium
(d) a parabola
(e) a circle.

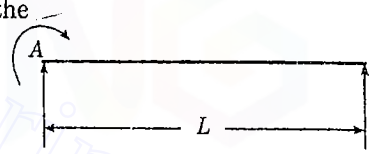

Fig. 6.7

6.205. The force in member U_2L_2 of the truss shown in Fig. 6.8, is

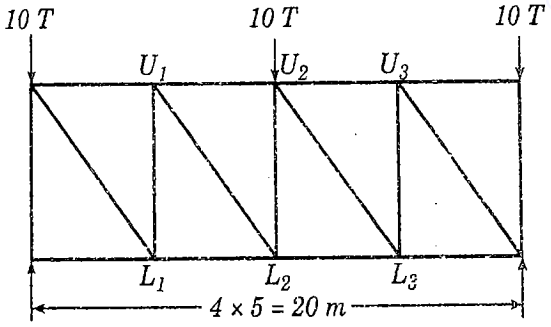

Fig. 6.8

(a) 10 T tension (b) 10 T compression
(c) zero (d) 15 T compression.

6.206. The B.M. of a cantilever beam shown in Fig. 6.9 at A, is
(a) zero
(b) 8 Tm
(c) 12 Tm
(d) 20 Tm.

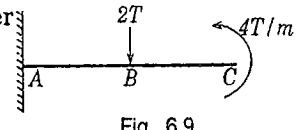

Fig. 6.9

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6.207. For the beam shown in Fig. 6.10, the maximum positive bending moment is nearly equal to negative bending moment when L_1 is equal to

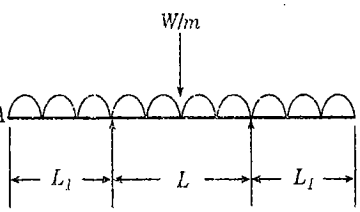

Fig. 6.10.

(a) 1.0 L
(b) 0.7 L
(c) 0.5 L
(d) 0.35 L.

6.208. In Fig. 6.11, the rivets with maximum stress, are :

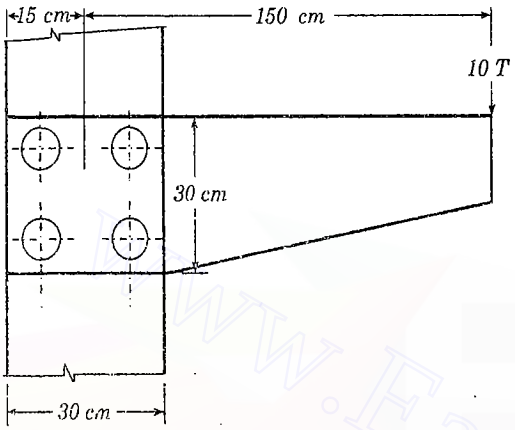

Fig. 6.11.

(a) 1 and 2 (b) 1 and 3
(c) 3 and 4 (d) 2 and 4.

6.209. The bending moment at E for the structure shown in Fig. 6.12, is

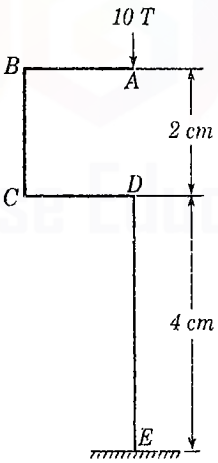

Fig. 6.12.

(a) zero (b) 10 Tm
(c) 20 Tm (d) 40 Tm.

6.210. A composite member shown in Fig. 6.13 was formed at 25°C and was made of two materials a and b. If the coefficient of thermal expansion of a is more than that of b and the composite member is heated upto 45°C, then

(a) a will be in tension and b in compression
(b) both will be in compression
(c) both will be in tension
(d) a will be in compression and b in tension.

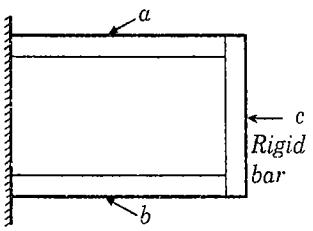

Fig. 6.13.

6.211. A closely coiled helical spring of radius R, contains n turns and is subjected to an axial load W. If the radius of the coil wire is r and modulus of rigidity of the coil material is C, the deflection of the coil is

(a) $\frac{WR^3n}{Cr^4}$ (b) $\frac{2WR^3n}{Cr^4}$
(c) $\frac{3WR^3n}{Cr^4}$ (d) $\frac{4WR^3n}{Cr^4}$.

6.212. The stress developed in the helical spring specified in Q. 6.211 is

(a) $\frac{WR}{\pi r^3}$ (b) $\frac{2WR}{\pi r^3}$
(c) $\frac{2WR}{\pi r^2}$ (d) $\frac{4WR}{\pi r^2}$.

6.213. According to Rankine's formula of earth pressure on retaining walls,

(a) $P = \frac{1}{2} WH^2 \frac{(1 - \sin \phi)}{(1 + \sin \phi)}$ (b) $P = \frac{1}{3} WH^2 \frac{(1 - \sin \phi)}{(1 + \sin \phi)}$
(c) $P = \frac{1}{2} WH^2 \frac{(1 + \sin \phi)}{(1 - \sin \phi)}$ (d) $P = \frac{1}{2} WH^2 \frac{(1 + \sin \phi)}{1 - \sin \phi)}$.

6.214. For a simply supported beam of length L, the bending moment M is described as $M = a\,(x - x^3/L^2)$, $0 \le x < L$; where a is a constant. The shear force will be zero at

(a) the supports (b) $x = L/2$
(c) $x = L/\sqrt{3}$ (d) $x = L/3$.

6.215. An open-ended cylinder of radius r and thickness t is subjected to internal pressure p. The Young's modulus for the material is E and Poisson's ratio is μ. The longitudinal strain is

(a) zero (b) $\frac{pr}{tE}$
(c) $\frac{pr}{2tE}$ (d) none of these.

6.216. The neutral axis of a beam cross-section must

(a) pass through the centroid of the section
(b) be equidistant from the top of bottom films
(c) be an axis of symmetry of the section
(d) none of these.

6.217. A beam of length L is pinned at both ends and is subjected to a concentrated bending couple of moment M at its centre. The maximum bending moment in the beam is

(a) M (b) $M/2$
(c) $M/3$ (d) $ML/2$.

6.218. A rectangular bar of width b and height h is being used as a cantilever. The loading is in a plane parallel to the side b. The section modulus is

(a) $\frac{bh^3}{12}$ (b) $\frac{bh^2}{6}$
(c) $\frac{b^2h}{6}$ (d) none of these.

6.219. A solid circular shaft of diameter d is subjected to a torque T. The maximum normal stress induced in the shaft, is

(a) zero (b) $\frac{16\,T}{\pi d^3}$

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(c) $\frac{32T}{\pi d^3}$ (d) none of these.

6.220. For a given material Young's modulus is 200 GN/m^2 and modulus of rigidity is 80 GN/m^2. The value of Poisson's ratio is

(a) 0.15 (b) 0.20
(c) 0.25 (d) 0.30 (e) 0.40.

6.221. The ratio of strengths of solid to hollow shafts, both having outside diameter D and hollow having inside diameter $D/2$, in torsion, is

(a) 1/4 (b) 1/2
(c) 1/16 (d) 15/16
(e) 3/8

6.222. During a tensile test on a ductile material

(a) nominal stress at fracture is higher than the ultimate stress
(b) true stress at fracture is higher than the ultimate stress
(c) true stress at fracture is the same as the ultimate stress
(d) none of these.

6.223. A rectangular log of wood is floating in water with a load of 100 N at its centre. The maximum shear force in the wooden log is

(a) 50 N at each end (b) 50 N at the centre
(c) 100 N at the centre (d) none of these.

6.224. A cast iron T section beam is subjected to pure bending. For maximum compressive stress to be three times the maximum tensile stress, centre of gravity of the section from flange side is

(a) $h/4$ (b) $h/3$
(c) $h/2$ (d) 2/3 h.

6.225. The deflection due to couple M at the free end of a cantilever length L is

(a) $\frac{ML}{EI}$ (b) $\frac{2ML}{EI}$
(c) $\frac{ML^2}{2EI}$ (d) $\frac{M^2L}{2EI}$.

6.226. The energy stored in a beam of length L subjected to a constant B.M. is

(a) $\frac{M^2L}{2EI}$ (b) $\frac{ML^2}{2EI}$
(c) $\frac{M^2L}{EI}$ (d) $\frac{ML^2}{EI}$.

6.227. While testing a cast iron beam (2.5 cm × 2.5 cm) in section and a metre long simply supported at the ends failed when a 100 kg weight is applied at the centre. The maximum stress induced is :

(a) 960 kg/cm^2 (b) 980 kg/cm^2
(c) 1000 kg/cm^2 (d) 1200 kg/cm^2.

6.228. The cross sections of the beams of equal length are a circle and a square whose per- missible bending stress are same under same maximum bending. The ratio of their flexural weights is,

(a) 1.118 (b) 1.338
(c) 1.228 (d) 1.108.

6.229. The width of a beam of uniform strength having a constant depth d length L, simply supported at the ends with a central load W is

(a) $\frac{2WL}{3fd^2}$ (b) $\frac{3WL}{2fd^2}$
(c) $\frac{2fL}{3Wd^4}$ (d) $\frac{3fL^2}{2Wd}$.

6.230. A rectangular beam 20 cm wide is subjected to a maximum shearing force of 10,000 kg, the corresponding maximum shearing stress being 30 kg/cm^2. The depth of the beam is

(a) 15 cm (b) 20 cm
(c) 25 cm (d) 30 cm.

6.231. For the same height, the bottom width for no tension,

(a) for triangular section is more than rectangular section
(b) for rectangular section is more than triangular section
(c) for triangular section is same as that of a rectangular section
(d) none of these.

6.232. For a channel section, the shear centre lies at a distance of

(a) $\frac{bdt}{2I}$ (b) $\frac{d^2bt}{3I}$
(c) $\frac{d^2b^2t}{4I}$ (d) $\frac{db^2t}{5I}$.

6.233. If S is the shear force at a section of an I-joist, having web depth d and moment of inertia I about its neutral axis, the difference between the maximum and mean shear stresses in the web is,

(a) $\frac{Sd^2}{8I}$ (b) $\frac{Sd^2}{12I}$
(c) $\frac{Sd^2}{16I}$ (d) $\frac{Sd^2}{24I}$.

6.234. A triangular section having base b, height h, is placed with its base horizontal. If the shear stress at a depth y from top is q, the maximum shear stress is

(a) $\frac{3S}{bh}$ (b) $\frac{4S}{bh}$
(c) $\frac{4b}{Sh}$ (d) $\frac{3b}{bS}$.

6.235. A simply supported wooden beam 150 cm long and having a cross section 16 cm × 24 cm carries a concentrated load, at the centre. If the permissible stress ft = 75 kg/cm^2 and f_s = 10 kg/cm^2 the safe load is

(a) 3025 kg (b) 3050 kg
(c) 3075 kg (d) 3100 kg.

6.236. Shear deflection of a cantilever of length L, cross sectional area A and shear modulus G, under a concentrated load W at its free end, is

(a) $\frac{2}{3}\frac{WL}{AG}$ (b) $\frac{1}{3}\frac{WL^2}{EIA}$
(c) $\frac{3}{2}\frac{WL}{AG}$ (d) $\frac{3}{2}\frac{WL^2}{AG}$.

6.237. Shear deflection of a cantilever of length L, cross sectional area A and shear modulus G, subjected to w/m u.d.l., is

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(a) $\frac{3L^2w}{4GA}$ (b) $\frac{3}{2}\frac{L^2w}{GA}$

(c) $\frac{2}{3}\frac{L^3w}{GA}$ (d) $\frac{3}{2}\frac{Lw}{GA^2}$.

6.238. As compared to uniaxial tension or compression, the strain energy stored in bending is only

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$

(c) $\frac{1}{3}$ (d) $\frac{1}{2}$.

6.239. The principal stresses at a point are 100, 100 and – 200 kgf/cm^2, the octo hedral shear stress at the point is :

(a) 100 $\sqrt{2}$ kg/cm^2 (b) 200 $\sqrt{2}$ kg/cm^2

(c) 300 $\sqrt{2}$ kg/cm^2 (d) 400 $\sqrt{2}$ kg/cm^2

(e) 500 $\sqrt{2}$ kg/cm^2.

6.240. In a tension test, the yield stress is 300 kg/cm^2, in the octa hedral shear stress at the point is :

(a) 100 $\sqrt{2}$ kg/cm^2 (b) 150 $\sqrt{2}$ kg/cm^2

(c) 200 $\sqrt{2}$ kg/cm (d) 250 $\sqrt{2}$ kg/cm^2.

6.241. Match list I with List II and select the correct answer by using codes given under the lists :

List I (Quantity)	*List II (Symbol of SI unit)*
A. Force	1. W
B. Power	2. ms^{-2}
C. Acceleration	3. Pa
D. Pressure/Stress	4. N

Codes.

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(a)	3	2	1	4
(d)	4	1	2	3

6.242. Match list I with List II and select correct answer by using codes given below the lists :

List I	*List II*
A. If two forces acting at a point O, be represented in direction and magnitude by the adjacent sides of a parallelogram than their resultant is represented in magnitude and direction by the diagonal of the parallelogram which passes through O	1. Lami's theorem
B. If three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between die other two	2. Parallelogram of forces
C. If three forces acting at a point be in equilibrium, they can be represented in magnitude and direction by die sides of any triangle which is drawn so as to have its sides respectively parallel to the direction of die forces	3. Law of triangle of forces
D. If three forces acting upon a particle be represented in magnitude and direction by the sides of a triangle, taken in order, they will be in equilibrium	4. Converse of law of triangle of forces.

Codes.

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	3	4
(c)	3	2	1	4
(d)	4	1	2	3

6.243. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Ratio of applied load and area of cross-section of the loaded section	1. Strain
B. Ratio of the change in length and original length of the loaded section	2. Ultimate stress
C. Ratio of maximum load and original area of cross-section	3. Young's modulus of elasticity D.
D. Ratio of stress and strain	4. Unit stress

Codes:

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	3	2	4

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6.244. Match list I with List II and select the correct answer by using codes given under the lists :

List I	*List II*
A. If λ is the density E is the young's modulus of elasticity, L is the length and D is the diameter of a solid uniform rod the elongation produced by its self load W is:	1. $\frac{rl^2}{6E}$
B. If l is the length D is diameter at the base d is the diameter at the taperred end P is the applied load and E is the young's modulus of elasticity of the load the elongation produced is:	2. $\frac{WL}{2AE}$
C. If l is the length D is the diameter at the base of a conical bar E is young's modulus of elasticity and r is the density of the material the elongation produced by self load is	3. $\frac{4pl}{\pi EDd}$
D. If l is the length A is the area of cross-section P is the stress intensity then change in length is:	4. $\frac{Pl}{AE}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	1	4
(c)	4	3	2	1
(d)	1	2	4	3

6.245. Match list I with List II and select the correct answer by using codes given under lists :

List I	*List II*
A. Rankine's theory of elastic failure	1. Maximum/minimum principal strain equal to the maximum/minimum strain at the elastic limit in simple tension/compression.
B. St. Venant's theory of elastic failure	2. Maximum/minimum principal stress reaches the elastic limit stress in simple tension/compression.
C. Coulomb Guas's theorgy of elastic failure	3. Strain energy per unit volume in it equals the maximum strain energy per unit in the material at elastic limit in simple tension
D. Beltram Haigh's theory of elastic failure	4. Maximum shear stress must equal the maximum shear stress at elastic limit in simple tension.

Codes :

	A	B	C	D
(a)	2	1	4	3
(b)	1	2	3	4
(c)	2	3	4	1
(d)	1	4	3	2

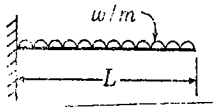
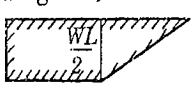
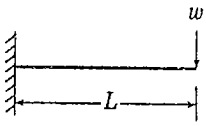
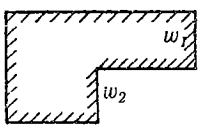
6.246. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Moment of inertia of a triangle about its base	1. $\frac{bh^3}{36}$
B. Moment of inertia of a rectangle about a centroidal axis parallel to the base	2. $\frac{bh^3}{12}$
C. Moment of inertia of a rectangle about the base of the rectangle	3. $\frac{bh^3}{3}$
D. Moment of inertia of a triangle about centroidal axis parallel to the base	4. $\frac{bh^3}{12}$

Codes:

	A	B	C	D
(a)	4	2	3	1
(b)	1	2	4	3
(c)	3	2	1	4
(d)	1	4	2	3

6.247. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Loaded Cantilever)	*List II (Shear force diagram)*
A. 	1. 
B. 	2. 

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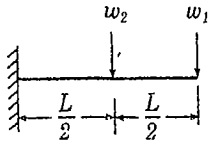
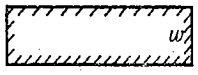
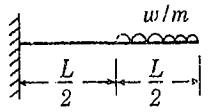
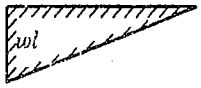
C. 

3. 

D. 

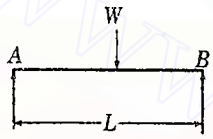
4. 

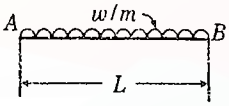
Codes :

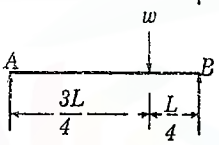
	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	1	4	2
(d)	2	4	3	1

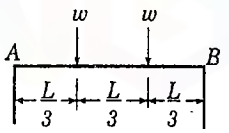
6.248. Match list I with List II and select the correct answer by using codes given below Ihe lists :

List I (Simply supportedloaded beams)

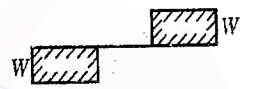
A. 

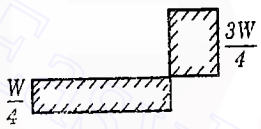
B. 

C. 

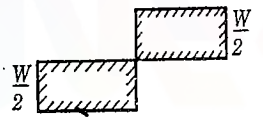
D. 

List II (Shear force diagrams)

1. 

2. 

3.

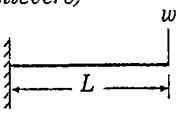
4. 

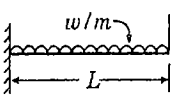
Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4
(c)	2	4	1	3
(d)	1	3	2	4

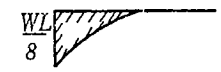
6.249. Match list I with List II and select the correct answer by using codes given below the lists :

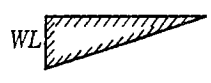
List I (Loaded cantilevers)

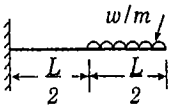
A. 

B. 

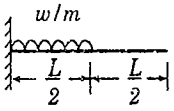
List II (Bending moment diagram)

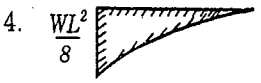
1. 

2. 

C. 

3.

D. 

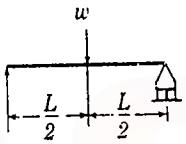
4. 

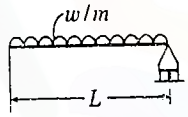
Codes :

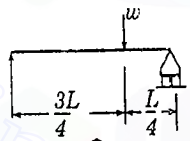
	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4
(c)	2	4	1	3
(d)	1	3	2	4

6.250. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Simply supported loaded beams)

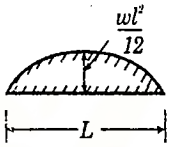
A. 

B. 

C. 

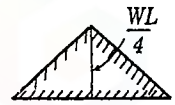
D.

List II (Bending moment diagram)

1. 

2.

3.

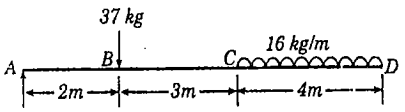
4. 

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	3	4	2	1
(d)	4	3	2	1

6.251. With reference to figure, match list I with List II and select the correct answer by using codes given below the lists.

List I	*List II*
A. S.F.is:	1. 6kg
B. S.F.is:	2. 58kg
C. S.F.is:	3. 43kg
D. S.F.is:	4. 48kg



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Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	3	4	1	2
(d)	2	4	1	3

6.252. Consider the following statements :

A. For the same shear force, maximum shear stress developed in circular section is lesser than in the rectangular section.

R. Circular section is stronger in shear Of these statements:

(a) A is true and R is false

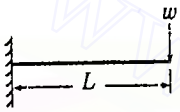
(b) A is false and R is true

(c) Both A and R are true

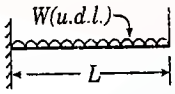
(d) Both A and R are false.

6.253. Match list I with List II and select the correct answer by using codes given below the lists :

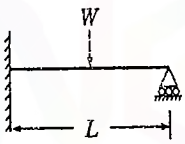
List I (Loaded member) *List II (Maximum deflection)*

A. 

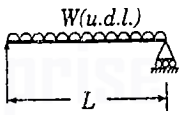
1. $\frac{WL^3}{8EI}$

B. 

2. $\frac{WL^3}{48EI}$

C. 

3. $\frac{WL^3}{3EI}$

D. 

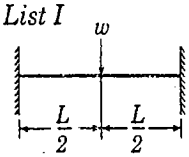
4. $\frac{5WL^3}{384EI}$

Codes.

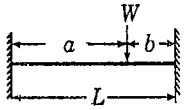
	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	2	3	4	1
(d)	4	2	3	1

6.254. Match list I with List II and select the correct answer by using codes given below the lists :

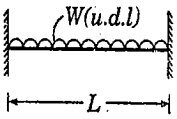
List I *List II*

A. 

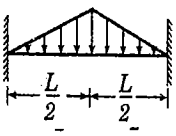
1. $M_A = \frac{Wab^2}{L^2}$

B. 

2. $M_A = -\frac{WL}{12}$

C. 

3. $M_A = -\frac{5WL}{48}$

D. 

4. $M_A = -\frac{WL}{8}$

Codes

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	3	2	1	4
(d)	1	4	2	3

6.255. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Cylinderical shell) *List II (Stress)*

A. Longitudinal stress 1. $\frac{pr}{2t}$

B. Hoop stress 2. $\frac{pr}{t}$

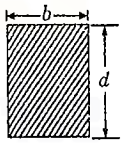
C. Maximum shear stress 3. $\frac{pr}{4t}$

Codes :

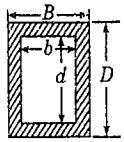
	A	B	C
(a)	2	1	3
(b)	1	2	3
(c)	3	2	1

6.256. Match list I with List II and select the correct answer by using codes given below the lists :

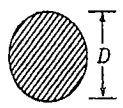
List I (Section) *List II Modulus of section (Z)*

A. 

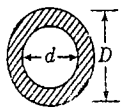
1. $\frac{\pi}{32}D^3$

B. 

2. $\frac{\pi}{32}\left(\frac{D^4 - d^4}{D}\right)$

C. 

3. $\frac{bd^2}{12}$

D. 

4. $\frac{1}{6}\left(\frac{D^3 - yd^3}{D}\right)$

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	1	3	2	4
(d)	3	4	1	2

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6.257. Match list I with List II and select the correct answer by using codes given under lists :

List I (Riverted joint failure)	*List II (Formula)*
A. Due to tearing of plates	1. $n \times p_s \times \frac{\pi d^2}{2}$
B. Due to bearing of plates	2. $n \times p_b \times d \times t$
C. Due to double shearing of rivets	3. $pt\,(p-d) \times t$
D. Due to double shearing of plate	4. may be avoided by keeping minimum edge distance

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	3	2	1	4
(*c*)	3	1	4	2
(*d*)	2	3	1	4

6.258. Match list I with List II and select the correct answer by using codes given below lists :

List I (Euler's crippling load)	*List II (End conditions of column)*
A. $\frac{\pi^2 EI}{L^2}$	1. Both ends hinged
B. $\frac{\pi^2 EI}{4L^2}$	2. Both ends fixed
C. $\frac{2pi^2 EI}{L^2}$	3. One end fixed, other free
D. $\frac{4pi^2 EI}{L^2}$	4. One end fixed, other hinged

Codes :

	A	B	C	D
(*a*)	1	3	2	4
(*b*)	4	1	3	2
(*c*)	1	2	4	3
(*d*)	2	4	1	3

6.259 The key of graphic construction is the cancelling of pairs of

(*a*) equal components (*b*) opposite components
(*c*) collinear components (*d*) all the above.

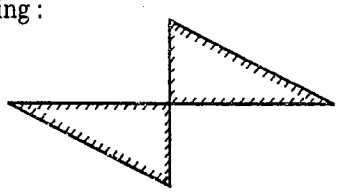
6.260 Which of the following is not applicable while determining graphically the resultant of the forces acting on a rigid body

(*a*) use of Bow's notation
(*b*) construction of a funicular polygon
(*c*) construction of a force polygon
(*d*) selection of an arbitrary point called a pole
(*e*) None of these.

6.261 The resistance offered by a loaded section of a bar per unit area, is called

(*a*) stress (*b*) strain
(*c*) intensity of stress (*d*) load.

6.262 Pick up the correct bending moment diagram of a simply supported beam carrying an isolated load at mid span, from the following :

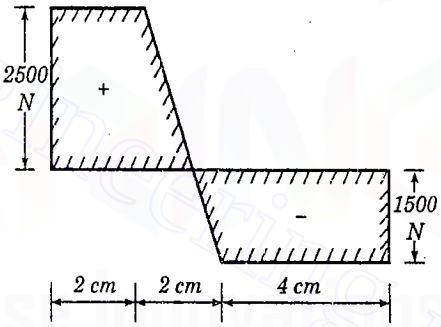
(*a*) 

(*b*)

(*c*)

(*d*)

6.263 If the S.F. diagram of a simply supported beam is as shown in the figure, the point of maximum bending moment occurs at a distance from B :



(*a*) 4.0 m (*b*) 4.25 m
(*c*) 4.75 m (*d*) 5.0 m

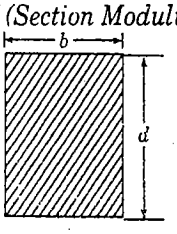
6.264 The value of the maximum B.M. of the loaded beam of the Q. No. 3 will be

(*a*) 6000 Nm (*b*) 5000 Nm
(*c*) 6562.5 Nm (*d*) 6312.5 Nm.

6.265 Assuming the normal notations, pick up the correct bending equation from the following :

(*a*) $\frac{M}{f} = \frac{I}{y} = \frac{E}{R}$ (*b*) $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$
(*c*) $\frac{R}{E} = \frac{I}{f} = \frac{y}{M}$ (*d*) $\frac{M}{I} = \frac{y}{f} = \frac{R}{E}$.

6.266 Match List I with List II and select a correct answer by using the codes given below the list :

List I (Section Modulus)	*List II (Section)*
	1. $\frac{BD^3 - bd^3}{6D}$

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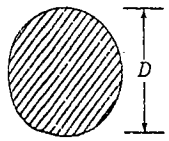
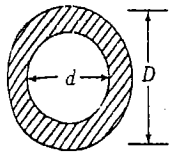
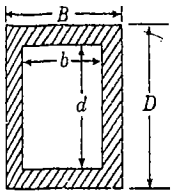


2. $\frac{\pi(D^2 + d^2)(D^2 - d^2)}{32D}$



3. $\frac{\pi d^3}{6}$



4. $\frac{bd^2}{6}$

Codes :

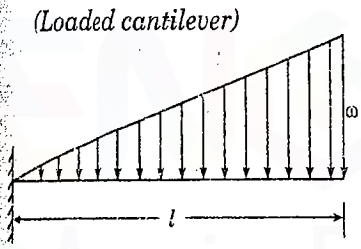
	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	1	3	2	4
(d)	3	2	1	4

6.267 The range within which an eccentric load may be applied on a vertical column to avoid any tensile stress is within the middle

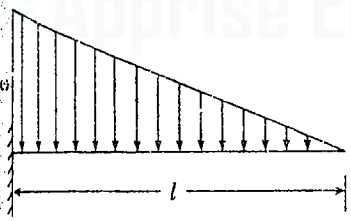
(a) half of the section (b) third of the section
(c) quarter of the section (d) sixth of the section.

6.268 Match List I with List II and choose a correct by using the codes given below the lists :

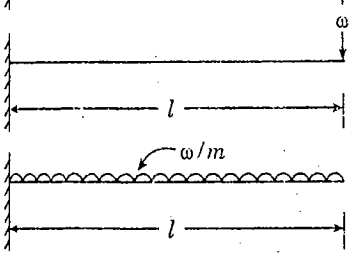
List I (Loaded cantilever) *List II (Defection at free end)*



1. $\frac{wl^3}{3El}$



2. $\frac{wl^4}{8El}$



3. $\frac{wl^4}{30El}$

4. $\frac{11}{120}\frac{wl^4}{El}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	4	3	1	2
(d)	2	1	4	3

6.269 A cantilever of span l which is fixed at one end and propped at the other end, carries a point load W at mid span. If the level of the prop is the same as that of the fixed end, the prop reaction is

(a) $\frac{5w}{16}$ (b) $\frac{7w}{16}$
(c) $\frac{9w}{16}$ (d) $\frac{11w}{16}$

6.270 The maximum shear stress on the circumference of a cylindrical shell of internal radium r and thickness t when subjected to internal pressure p, is :

(a) $\frac{pr}{4t}$ (b) $\frac{pr}{2t}$
(c) $\frac{pr}{3t}$ (d) $\frac{2pr}{t}$

6.271 Pick up the correct statement from the following :

(a) The shear stress is maximum at the axis of the shaft subjected to a torque
(b) The ratio of the polar moment of inertia and the radius of the shaft, is called the polar modulus of the shaft section.
(c) Torsinal rigidity of the shaft is the torque that produces a twist of one radian in the length of the shaft
(d) The angle of twist in a shaft subjected to a torque is inversely proportional to the twisting moment.
(e) None of the above.

6.272 A shaft rotating at $\left(\frac{500}{\pi}\right)$ r.p.m. produces 80 H.P. (metric). If the maximum permissible shearing stress is 850 kg/cm, the required diameter of the shaft is

(a) 4.5 cm (b) 5.0 cm
(c) 6.0 cm (d) 6.5 cm

6.273 Match List I with the List II and select a correct answer by using the codes given below the lists :

List I (Eulers formula) *List II (End conditions of long column)*

A. $P = \frac{\pi^2 El}{l^2}$ 1. One end fixed

B. $P = \frac{\pi^2 El}{4l^2}$ 2. Both ends fixed

C. $P = \frac{4\pi^2 El}{l^2}$ 3. Both ends hinged

D. $P = \frac{2\pi^2 El}{l^2}$ 4. One end fixed

Codes :

	A	B	C	D
(a)	1	4	3	2
(b)	3	2	4	1
(c)	3	1	2	4
(d)	4	3	3	2

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6.274. Pick up the correct statement regarding a single concentrated load rolling over a simplysupported girder from the following:

(*a*) The shear force attains the maximum positive magnitude at the section X when the load reaches the section X.

(*b*) The maximum B.M. atthe cross-section occurswhen theload isonthe section itself.

(*c*) The absolutely maximum bending moment anywhere inthe girder, occurs atthe centre, equal to $-\frac{WL}{4}$

(*d*) All the above.

6.275. Pick up the correct statement fromthe following :

(*a*) The resultant of three concurrent forces, P, Q and R can be obtained by the parallelogram method.

(*b*) The resultant of three or more concurrnet forces can be obtained by any convenient order of tip-tail vector addition.

(*c*) Mass is that invariant property of a body which measures its resistance to a change of motion.

(*d*) All the above.

6.276. Which one of the following is the axiom of mechanics?

(*a*) The resultant of two forces is the diagonal formed onthe vectors of these forces.

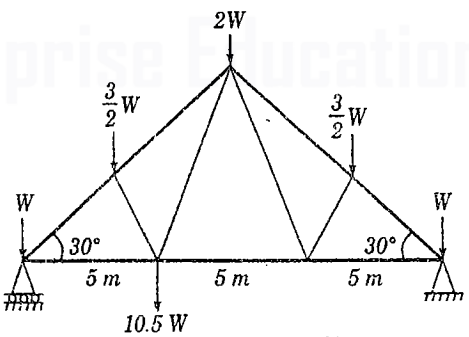
(*b*) The foreces are in equilibrium only when they are equal in magnitude, opposite in direction, and collnear in action.

(*c*) A set of forcesin equilibrium may be added to any system of forces without changing the effectofthe original system.

(*d*) Action and reaction forces are equal but oppositely directed.

(*e*) All the above.

6.277. The resultant of the loads acting on the Fink truss acts right of A at a distance of



(*a*) 4 m (*b*) 5 m
(*c*) 6 m (*d*) 7.5 m

6.278. Pick up the correct statement from the following :

(*a*) If the resultant of a force-system acting on a body is zero, the body is said to be in equilibrium.

(*b*) Balanced force system compose the subject matter of statics.

(*c*) Unbalanced force systems cause bodies to accelerate.

(*d*) All the above.

6.279. Pick up the correct statement from the following :

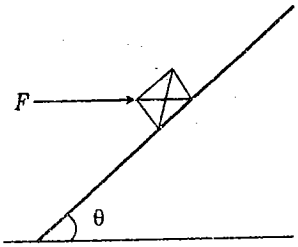
(*a*) The earth pull is treated as a downward vertical force equal to the weight W of the free body and acting through the centre of gravity.

(*b*) The action of a smooth surface is treated as a force N acting perpendicular to the smooth surface.

(*c*) The supporting force F acting at a smooth pin or hinge acts in any direction perpendicular to the pin axis.

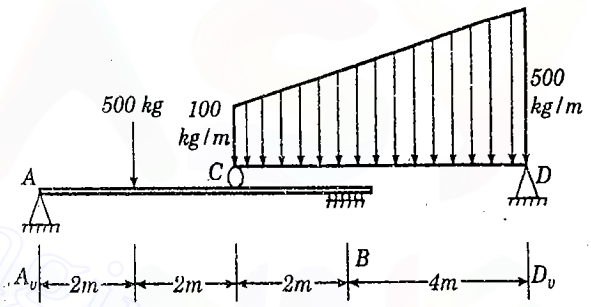
(*d*) All the above.

6.280. A 300 kgf box is held at rest on a smooth incline by a force F making an angle θ with the incline as shown in Figure. If $\theta = 45°$, the value of force F is



(*a*) 250 kgf (*b*) 285 kgf
(*c*) 212 kgf (*d*) 257 kgf.

6.281. For the loaded beams shown in Figure.



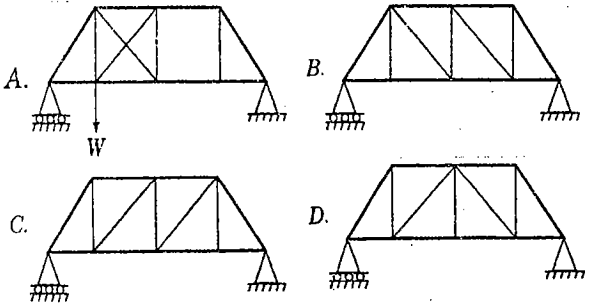
Match List I with List II and select a suitable answer by using the codes given below the list.

List I (Support reaction)	*List II (Magnitude)*
A. A_v	1. 800 kg
B. B_v	2. 1000 kg
C. C_v	3. 700 kg
D. D_v	4. 600 kg

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	4	1	2	3
(*c*)	4	3	1	2
(*d*)	3	2	4	1

6.282. Which one of the following trusses is unstable :



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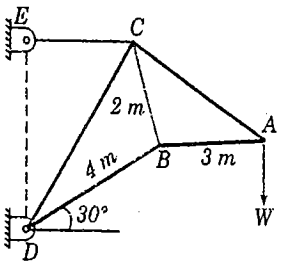
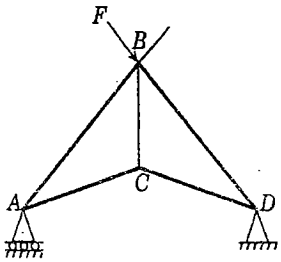
283. The member of the crane truss shown in figure which carries no force is :



(a) BC (b) BD
(c) CD (d) BA

284. For drawing Maxwell Diagram for finding the forces in the members, of truss shown in figures we start from :



(a) Joint A (b) Joint B
(c) Joint C (d) Joint D

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7

Hydraulics

7.1. Practical fluids possess
(*a*) viscosity (*b*) surface tension
(*c*) compressibility (*d*) all the above.

7.2. Liquids
(*a*) cannot be compressed
(*b*) do not occupy definite shape
(*c*) are not affected by change in pressure and temperature
(*d*) none of these.

7.3. The dimensional formula of force is
(*a*) MLT^{-2} (*b*) $M^{-1}LT^{2}$
(*c*) $ML^{-2}T$ (*d*) $M^{-1}L^{2}T^{-2}$
(*e*) none of these.

7.4. One metric slug is equal to
(*a*) 1 kg wt (*b* 9.81 kg wt
(*c*) 9.81 kg mass (*d*) 0.98 kg wt.

7.5. Mass density of liquid (ρ) is given by
(*a*) $\rho = \frac{\text{Mass}}{\text{Volume}}$ (*b*) $\rho = \frac{\text{Metric slug}}{m^2}$
(*c*) $\rho = \frac{\text{kg sec}^3}{\text{m}^4}$ (*d*) all the above.

7.6. Specific weight of liquid
(*a*) remains constant at every place
(*b*) does not remain constant at every place
(*c*) varies from place to place on the earth
(*d*) does not vary on any other planet.

7.7. The specific weight of water is 1000 kg/m^3
(*a*) at normal pressure of 760 mm
(*b*) at 4°C temperature
(*c*) at mean sea level
(*d*) all the above.

7.8. Specific weight of sea water is more than that of pure water because of
(*a*) dissolved air (*b*) dissolved salts
(*c*) suspended matter (*d*) all the above.

7.9. If the volume of a liquid weighing 3000 kg is 4 cubic metres, 0.75 is its
(*a*) specific weight (*b*) specific mass
(*c*) specific gravity (*d*) none of these.

7.10. In C.G.S. system the unit of visocity is
(*a*) dyne (*b*) joule
(*c*) poise (*d*) Newton
(*e*) none of these.

7.11. In Newton's viscosity equation $\pi = \mu \frac{dv}{dy}$, the coefficient (μ) is known as coefficient of
(*a*) viscosity (*b*) absolute viscosity
(*c*) dynamic viscosity (*d*) simple viscosity
(*e*) all the above.

7.12. Water belongs to
(*a*) Newtonian fluids
(*b*) non-Newtonian fluids
(*c*) compressible fluid
(*d*) none of these.

7.13. In C.G.S. system the units of kinematic viscosity, is
(*a*) stoke (*b*) poise
(*c*) Newton (*d*) none of these.

7.14. Kinematic viscosity of liquids by equation $V = 0.0022t - \frac{1.8}{t}$ is determined by :
(*a*) Redwood viscometer
(*b*) Engler viscometer
(*c*) Saybolt universal viscometer
(*d*) None of these.

7.15. Fluids change the volume under external presssure due to
(*a*) plasticity (*b*) viscosity
(*c*) compressibility (*d*) none of these.

7.16. Molecules of fluids get attracted due to
(*a*) capillarity action (*b*) surface tension
(*c*) adhesion (*d*) cohesion
(*e*) none of these.

7.17. Falling drops of water become spheres due to
(*a*) adhesion (*b*) cohesion
(*c*) surface tension (*d*) viscosity.

7.18. In an open tube, free surface of mercury remains
(*a*) horizontal (*b*) curved upwards
(*c*) curved downwards (*d*) none of these.

7.19. If cohesion between the molecules of a fluid is more than adhesion between the fluid and glass, the free level of fluid in a dipped glass tube will be
(*a*) higher than the surface of liquid
(*b*) same as the surface of liquid
(*c*) lower than the surface of liquid
(*d*) none of these.

7.20. A rise or fall of liquid in a glass tube of a very small diameter when dipped is
(*a*) directly proportional to the force per unit length of

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periphery
(b) direcly proportional to the sine of the angle of contact
(c) directly proportional to the specific weight of liquid
(d) inversely proportional to the diameter of the glass tube.

7.21. For exerting a pressure of 4.8 kg/cm^2, the depth of oil (specific gravity 0.8), should be
(a) 40 cm (b) 41 cm
(c) 56 cm (d) 60 cm
(e) 76 cm.

7.22. Hydrostatic pressure on a dam depends upon its
(a) length (b) depth
(c) shape (d) material
(e) both (b) and (c).

7.23. The unit of the viscosity is
(a) kg sec/m^2 (b) Newton sec per m^2
(c) Newton-sec^2/m^3 (d) m^2 per sec.

7.24. Unit of kinematic viscosity is
(a) m^2/sec (b) Newton sec/m^2
(c) Newton sec/m^3 (d) Kg sec/m^2.

7.25. Barometres are used to measure
(a) pressure in water channels, pipes etc.
(b) difference in pressure at two points
(c) atmospheric pressure
(d) very low pressure
(e) very high pressure.

7.26. Piezometers are used to measure
(a) pressure in water channels, pipes etc.
(b) difference in pressure at two points
(c) atmospheric pressure
(d) very low pressure.

7.27. Manometers are used to measure
(a) pressure in water channels, pipes etc.
(b) difference in pressure at two points
(c) atmospheric pressure
(d) very low pressure.

7.28. Differential manometers are used to measure
(a) pressure in water channels, pipes, etc.
(b) difference in pressure at two points
(c) atmospheric pressure
(d) very low pressure.

7.29. To measure very low pressure, we use
(a) barometers (b) piezometers
(c) manometers (d) differential manometers.

7.30. The pressure less than atmospheric pressure, is known
(a) suction pressure
(b) vacuum pressure
(c) negative gauge pressure
(d) all the above.

7.31. Gauge pressure is
(a) absolute pressure – atmospheric pressure
(b) absolute pressure + atmospheric pressure
(c) atmospheric pressure – absolute pressure
(d) none of these.

7.32. Atmospheric pressure varies with
(a) altitude (b) temperature
(c) weather conditions (d) none of these.

7.33. Mercury is generally used in barometers because
(a) its vaour pressure is practically zero
(b) the height of the barometer will be less
(c) it is a best liquid
(d) both (a) and (b) above
(e) both (b) and (c) above.

7.34. To avoid the force of surface tension in an inclined manometer, the minimum angle of inclination is
(a) 2° (b) 3°
(c) 4° (d) 5°.

7.35. The total pressure force on a plane area is equal to the area multiplied by the intensity of pressure at its centroid, if
(a) area is horizontal (b) area is vertical
(c) area is inclined (d) all the above.

7.36. The centre of pressure of a vertical plane immersed in a liquid is at
(a) centre of higher edge (b) centre of lower edge
(c) centroid of the area (d) none of these.

7.37. The depth of the centre of pressure on a vertical rectangular gate (4 m wide, 3 m high) with water upto top surface, is
(a) 1.0 m (b) 1.5 m
(c) 2.0 m (d) 2.5 m.

7.38. If the atmospheric pressure on the surface of an oil tank (sp. gr. 0.8) is 0.1 kg/cm^2, the pressure at a depth of 2.5 m, is
(a) 1 metre of water (b) 2 metres of water
(c) 3 metres of water (d) 3.5 metres of water
(e) 4.0 metres of water.

7.39. On an inclined plane, centre of pressure is located
(a) at the centroid (b) above the centroid
(c) below the centroid (d) anywhere.

7.40. When a body is totally or partially immersed in a fluid, it is buoyed up by a force equal to
(a) weight of the body
(b) weight of the fluid displaced by the body
(c) weight of the body and fluild displaced by the body
(d) difference of weights of the fluid displaced and that of the body
(e) none of these.

7.41. A floating body attains stable equilibrium if its metacentre is
(a) at the centroid (b) above the centroid
(c) below the centroid (d) anywhere.

7.42. Centre of buoyancy is
(a) centroid of the floating body
(b) centroid of the fluid displaced
(c) centre of pressure of the displaced liquid
(d) none of these.

7.43. A water tank partially filled with water is being carried on a truck moving with a constant horizontal acceleration. The level of the water
(a) rises on the front side of the tank

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(*b*) falls on the back side of the tank
(*c*) remains the same at both sides of the tank
(*d*) rises on the back side and falls on the front side
(*e*) none of these.

7.44. For mountaneous regions having steep slope, wagons for carrying liquid are made with bottom
(*a*) parallel to the road surface
(*b*) parallel to the horizontal surface
(*c*) inclined upward while moving upwards
(*d*) inclined downward while moving downwards.

7.45. A cylindrical vessel 40 cm high is revolved about its vertical axis so that the water touches the bottom when it just spills out. If the radius of the cylinder is $\sqrt{5}$ cm, the angular velocity of rotation, is
(*a*) 2 rad/sec. (*b*) 3 rad/sec.
(*c*) 4 rad/sec. (*d*) 5 rad/sec.
(*e*) none of these.

7.46. The rise of the liquid along the walls of a revolving cylinder above the initial level, is
(*a*) greater than the depression of the liquid at the axis of rotation
(*b*) lesser than the depression of the liquid at the axis of rotation
(*c*) the same as the depression of the liquid at the axis of rotation
(*d*) none of these.

7.47. When a liquid rotates at constant angular velocity about a vertical axis of a rigid body, the pressure
(*a*) increases linearly to its radial distance
(*b*) varies inversely as the altitude along any vertical line
(*c*) varies as the square of the radial distance
(*d*) decreases as the square of the radial distance
(*e*) none of these.

7.48. Total pressure on the top of a closed cylindrical vessesl completely filled with liquid, is directly proportional to
(*a*) radius (*b*) $(\text{radius})^2$
(*c*) $(\text{radius})^3$ (*d*) $(\text{radius})^4$
(*e*) none of these.

7.49. A closed cylindrical vessel of 100 cm diameter and 200 cm high is completely filled with a liquid (sp. weight 1600 kg/m^3) when rotated about its vertical axis at 100 r.p.m. The total pressure on its lid, is
(*a*) 459 kg (*b*) 549 kg
(*c*) 945 kg (*d*) 954 kg
(*e*) 95.4 kg.

7.50. The imaginary line drawn such that the tangents at its all points indicate the direction of the velocity of the fluid particles at each point, is called
(*a*) path line (*b*) stream line
(*c*) potential line (*d*) streak line.

7.51. In fluids, steady flow occurs when
(*a*) conditions of flow change steadily with time
(*b*) conditions of flow do not change with time at a point
(*c*) conditions of flow remain the same at adjacent point
(*d*) velocity vector remains constant at a point.

7.52. Uniform flow is said to occur when
(*a*) size and shape of the cross-section in a particular length remain constant
(*b*) size and shape of the cross-section change along a length
(*c*) frictional loss in the particular length of the channel will the more than the drop in its elevation
(*d*) frictional loss in the particular length of the channel will be less than the drop in elevation.

7.53. If velocities of fluid particles vary from point to point in magnitude and direction, as well as from instant to instant, the flow is said to be
(*a*) laminar (*b*) turbulent flow
(*c*) uniform flow (*d*) non-uniform flow.

7.54. A steady uniform flow is through
(*a*) a long pipe at decreasing rate
(*b*) a long pipe at constant rate
(*c*) an expanding tube at constant rate
(*d*) an expanding tube at increasing rate
(*e*) a long pipe at increasing rate.

7.55. A non-uniform steady flow is through
(*a*) a long tube at a decreasing rate
(*b*) an expanding tube at constant rate
(*c*) an expanding tube at increasing rate
(*d*) a long pipe at increasing rate.

7.56. An ideal flow of a liquid obeys
(*a*) Continuity equation
(*b*) Newton's law of viscosity
(*c*) Newton's second law of motion
(*d*) dynamic viscosity law.

7.57. The continuity equation
(*a*) expresses the relationship between work and energy
(*b*) relates the momentum per unit volume between two points on a stream line
(*c*) relates mass rate of flow along a stream line
(*d*) requires that Newton's second law of motion be satisfied at every point in fluid.

7.58. Equation of continuity of fluids is applicable only if
(*a*) flow is steady
(*b*) flow is compressive
(*c*) flow is one dimensional
(*d*) velocity is uniform over the cross-sections
(*e*) all the above.

7.59. The acceleration f required to accelerate a rectangular tank containing water horizontally so that the slope of its free surface is 45°, is
(*a*) $\frac{g}{2}$ (*b*) g
(*c*) $2g$ (*d*) $2.5\,g$ (*e*) $3g$.

7.60. On a flow net diagram, the distance between two consecutive steam lines at two successive sections are 1 cm and 0.5 cm respectively. If the velocity at the first section is 1 m/sec, the velocity at the second is
(*a*) 1.0 m/sec (*b*) 0.5 m/sec

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(c) 2.0 m/sec (d) 2.5 m/sec
(e) 3 m/sec.

7.61. For the two dimensional flow, the stream function is given by $\psi = 2xy$. The velocity at a point (3, 4) is
(a) 6 m/sec (b) 8 m/sec
(c) 10 m/sec (d) 12 m/sec
(e) 15 m/sec.

7.62. The flow in which each liquid particle has a definite path and the paths of adjacent particles do not cross each other, is called
(a) stream line flow (b) uniform flow
(c) steady flow (d) turbulent flow.

7.63. In flow, the liquid particles may possess
(a) potential energy (b) kinetic energy
(c) pressure energy (d) all the above.

7.64. Total head of a liquid particle in motion is the sum of
(a) potential head and kinetic head
(b) kinetic head and pressure head
(c) potential head and pressure head
(d) potential head, kinetic head and pressure head.

7.65. The main assumption of Bernoulli's equation is :
(a) The velocity of energy of liquid particle, across any cross-section of a pipe is uniform
(b) No external force except the gravity acts on the liquid
(c) There is no loss of energy of the liquid while flowing
(d) All the above.

7.66. Euler's equation for the motion of liquids assumes that
(a) fluid is viscous
(b) fluid is homogeneous and incompressible
(c) velocity of flow is non-uniform over the section
(d) flow is unsteady along the stream line.

7.67. Euler's equation for motion of liquids, is given by
(a) $\frac{dp}{\rho} - gdz + vdv = 0$ (b) $\frac{dp}{\rho} + dgz - vdv = 0$
(c) $\frac{dp}{\rho} + gdz + vdv = 0$ (d) $\rho dp + gdz + vdv = 0$.

7.68. In a venturimeter, the divergent cone is kept
(a) shorter than convergent cone
(b) equal to covergent cone
(c) longer than convergent cone
(d) none of these.

7.69. To avoid the tendency of separation of liquid flow, the most suitable ratio of the diameters of the throat and the pipe, is
(a) 1/4 to 1/3 (b) 1/3 to 1/2
(c) 1/2 to 3/4. (d) none of these.

7.70. Reynold number is the ratio of initial force and
(a) viscosity (b) elasticity
(c) gravitational force (d) surface tension.

7.71. Flow in pipes is laminar if Reynold number is
(a) less than 2100 (b) more than 3000
(c) between 2100 and 3000 (d) none of these.

7.72. Flow in pipes is turbulent if Reynold number is
(a) less than 2100 (b) more than 3000
(c) between 2100 and 3000 (d) none of these.

7.73. Equation of continuity of flow is based on the principle of conservation of
(a) mass (b) momentum
(c) force (d) none of these.

7.74. The velocity of the fluid particle at the centre of the pipe section, is
(a) minimum (b) maximum
(c) equal throughout (d) none of these.

7.75. For solving the problems is hydraulic engineering, the velocity used is
(a) velocity at the centre of pipe section
(b) average velocity of flow over a section
(c) mean of the velocities at the centre and that along the pipe surface
(d) none of these.

7.76. The flow is called rotational if its velocity normal to the plane of area is equal to
(a) angular velocity vector
(b) twice the angular velocity vector
(c) thrice the angular velocity vector
(d) none of these.

7.77. For an irrotational flow, the equation $\frac{\delta^2\phi}{\delta x^2} + \frac{\delta^2\phi}{\delta y^2} = 0$ is given by
(a) Cauchy-Riemann (b) Reynold
(c) Laplaces (d) Bernoulli.

7.78. 'Flow net' can be drawn only if the flow is
(a) turbulent (b) rotational
(c) distortion (d) none of these.

7.79. A fluid particle may possess the displacement of
(a) translation (b) rotation
(c) distortion (d) all the above.

7.80. If u, v, w are the components of the velocity v of a moving particle, the equation $\frac{u}{dx} = \frac{v}{dy} = \frac{w}{dz}$ represents
(a) one diamensional flow (b) two dimensional flow
(c) three dimensional flow (d) none of these.

7.81. In two dimensional flow the components of velocity are given by $u = ax$; $v = by$. The stream lines will be
(a) circular (b) parabolic
(c) hyperbolic (d) elliptical.

7.82. In a two dimensional flow if the components of the velocity are $u = ax$; $v = by$, the point where no motion occurs, is known as
(a) critical point (b) neutral point
(c) stagnation point (d) stationary point
(e) none of these.

7.83. The property of steam function ψ is :
(a) ψ is constant everwhere on any stream line
(b) the flow around any path in the fluid is zero for continuous flow
(c) the rate of change of ψ with distance in an arbitrary direction, is proportional to the component of velocity

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normal to that direction
(*d*) the velocity vector may be found by differentiating the stream function
(*e*) all the above.

7.84. In a fluid flow a particle may posses
(*a*) elevation energy (*b*) kinetic energy
(*c*) pressure energy (*d*) initial energy
(*e*) all the above.

7.85. An independent mass of a fluid does not posses
(*a*) elevation energy (*b*) kinetic energy
(*c*) pressure energy (*d*) none of these.

7.86. Frictional loss of head includes the loss of energy due to
(*a*) viscosity (*b*) turbulence
(*c*) both (*a*) and (*b*) (*d*) none of these.

7.87. Energy equation is usually applicable to
(*a*) non-uniform flow (*b*) turbulent flow
(*c*) laminar flow (*d*) steady flow.

7.88. The differential equation $dp/\rho + gdz + vdv = 0$ for a fluid motion is suggested by
(*a*) Bernoulli (*b*) Cauchy-Riemann
(*c*) Laplace (*d*) Leonhard Euler.

7.89. The most familiar form of Bernoulli's equation, is
(*a*) $\frac{P_1}{\omega} + Z_1 + \frac{v_1^2}{2g} = \frac{P_2}{\omega} + Z_2 + \frac{v_2^2}{2g}$
(*b*) $\frac{dp}{\rho} + g \,.\, dz + vdv = 0$
(*c*) $\left[\frac{P}{\omega} + Z + \frac{v^2}{2g}\right]_{\text{any section}}$ = constant head
(*d*) none of these.

7.90. Bernoulli's equation assumes that
(*a*) fluid is non-viscous
(*b*) fluid is homogeneous
(*c*) flow is steady
(*d*) flow is along the stream line
(*e*) all the above.

7.91. While applying the Bernoulli's equation $\left[\frac{P}{\omega} + Z + \frac{v^2}{2g}\right]_{\text{any section}}$ = total head, the work done on the flow system, if any
(*a*) is added on the right side of the equation
(*b*) is added on the left side of the equation
(*c*) is ignored
(*d*) none of these.

7.92. Which one of the following statements is true ?
(*a*) The value of kinetic energy correction factor for turbulent flow lies between 1.03 to 1.06
(*b*) The value of kinetic energy correction factor for laminar flow is 2
(*c*) The practical value of kinetic energy correction factor for turbulent flow is unity
(*d*) all the above.

7.93. The line joining the points to which the liquid rises in vertical piezometer tubes fitted at different cross-sections of a conduit, is known as
(*a*) hydraulic gradient (*b*) piezometric line
(*c*) pressure grade line (*d*) hydraulic grade line
(*e*) all the above.

7.94. Hydraulic grade line
(*a*) remains above the centre line of conduit
(*b*) remains below the centre line of conduit
(*c*) remains parallel to the centre line of conduit
(*d*) may be above or below the centre line of conduit.

7.95. Pick up the correct statement from the following :
(*a*) Total energy gradient is the graphical representation of the total head at any section of a pipe line
(*b*) Vertical distance between the total energy line and hydraulic grade line is equal to the velocity head
(*c*) Vertical distance between the total energy line and total energy gradient represents loss of head
(*d*) all the above.

7.96. If the total head of the nozzle of a pipe is 37.5 m and discharge is 1 cumec, the power generated is
(*a*) 400 H.P. (*b*) 450 H.P.
(*c*) 500 H.P. (*d*) 550 H.P.

7.97. From a nozzle exposed to atmosphere, the liquid jet traverses
(*a*) a straight line (*b*) a circular path
(*c*) an elliptical path (*d*) a parabolic path.

7.98. The ratio of the maximum height to which a jet inclined through θ rises to its total horizontal span is
(*a*) $\frac{1}{4}\sin\theta$ (*b*) $\frac{1}{4}\cos\theta$
(*c*) $\frac{1}{4}\tan\theta$ (*d*) $\frac{1}{4}\cot\theta$.

7.99. A jet projected at an angle of 45°, 40 m from the foot of a vertical column, just reaches the top of the column. The height of the column is
(*a*) 15 m (*b*) 20 m
(*c*) 30 m (*d*) 40 m
(*e*) 60 m.

7.100. Pick up the incorrect statement from the following :
(*a*) In radial flow, fluid flows such that pressure and velocity at any point change with respect to its distance from the central axis
(*b*) In radial flow, velocity of flow is in a radial direction
(*c*) In radial flow, flow may take place radially inward to or outward from the centre
(*d*) In radial flow, flow is one dimensional with stream lines parallel.

7.101. When the whole fluid mass rotates either due to fluid pressure or gravity or rotation previously imparted, the motion is known as
(*a*) free vortex (*b*) forced vortex
(*c*) non-potential vortex (*d*) rotational vortex.

7.102. In a centrifugual pump casing, the flow of water leaving the impeller, is
(*a*) rectilinear flow (*b*) radial flow
(*c*) free vortex motion (*d*) forced vertex.

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7.103. A pitot tube is used to measure
(*a*) pressure
(*b*) difference in pressure
(*c*) velocity of flow
(*d*) none of these.

7.104. If a pitot tube is placed with its nose facing down stream, the liquid
(*a*) does not rise in the tube
(*b*) rises in the tube to a height $\sqrt{\frac{v^2}{2g}}$
(*c*) falls in the tube to a depth $\sqrt{\frac{v^2}{2g}}$
(*d*) none of these.

7.105. The ratio of the inertia and viscous forces acting in any flow, ignoring other forces, is called
(*a*) Euler number (*b*) Frode number
(*c*) Reynold number (*d*) Weber number.

7.106. The ratio of the inertia and gravitational force acting in any flow, ignoring other forces, is called
(*a*) Euler number (*b*) Frode number
(*c*) Reynold number (*d*) Weber number.

7.107. Mach number is the ratio of inertia force to
(*a*) viscosity (*b*) surface tension
(*c*) gravitational force (*d*) elasticity.

7.108. Weber number is the ratio of inertia force to
(*a*) surface tension (*b*) gravitational force
(*c*) elasticity (*d*) viscosity.

7.109. The dimensionless parameter not applicable to flowing liquids, is
(*a*) Reynold number (*b*) Weber number
(*c*) Pressure coefficient (*d*) Kinematic viscosity
(*e*) Friction factor.

7.110. For the flow of liquid from an open ended tube (or nozzle) leading to the formation of spray of liquid drops, the number generally applied, is
(*a*) Froude number (*b*) Weber number
(*c*) Reynold number (*d*) Mach number.

7.111. If the forces are due to inertia and gravity, and frictional resistance plays only a minor role, the design of the channels is made by comparing
(*a*) Reynold number (*b*) Froude number
(*c*) Weber number (*d*) Mach number.

7.112. The following is not a laminar flow
(*a*) Flow of oil in measuring instruments
(*b*) Flow in beds in ground water
(*c*) Rise of water in plants through roots
(*d*) Flow of blood in the arteries of human body
(*e*) Flow in water pipe lines.

7.113. In a circular pipe of length L and diameter d, a viscous liquid is flowing with a velocity v. The loss in head, is
(*a*) $\frac{16}{R_e} \times \frac{4L}{d} \times \frac{v^2}{2g}$ (*b*) $\frac{R_e}{16} \times \frac{L}{d} \times \frac{v^2}{2g}$
(*c*) $R_e \frac{L^2}{d} \times \frac{v}{2g}$ (*d*) $\frac{R_e L}{d^2} \times \frac{v^2}{2g}$
(*e*) none of these.

7.114. The value of kinetic energy correction factor (a) for a laminar flow through a circular pipe, is
(*a*) 0.5 (*b*) 1.0
(*c*) 1.5 (*d*) 2.0
(*e*) 2.5.

7.115. The value of momentum correction factor (β) for a laminar flow through a circular pipe, is
(*a*) 1/2 (*b*) 2/3
(*c*) 3/4 (*d*) 4/3
(*e*) 3/2.

7.116. The ratio of frictional factor and coefficient of friction used in general equation for a head loss in a pipe, is
(*a*) 1 (*b*) 2
(*c*) 3 (*d*) 4.

7.117 If the Mach number for a fluid flow is less than 1, the flow is
(*a*) sonic (*b*) supersonic
(*c*) sub-sonic (*d*) none of these.

7.118. The instrument used for measuring the velocity of flow, is known as
(*a*) venturimeter (*b*) orifice meter
(*c*) pitot tube (*d*) none of these.

7.119. An orifice is an opening in a vessel with
(*a*) closed perimeter of regular shape through which water flows
(*b*) the water level of the liquid on the up stream side is below the top of the orifice
(*c*) partially full flow
(*d*) prolonged sides having length of 2 to 3 diameters of the opening in thick wall.

7.120. If a_1 and a_2 are the cross-sectional areas of a tank and orifice, h the height of water level in tank above the centre of the orifice, the velocity of approach is given by
(*a*) $v = \sqrt{\frac{2gh}{1 - a_2^2/a_1^2}}$ (*b*) $\sqrt{1 - \frac{a_2^2}{a_1^2}}$
(*c*) $v = \sqrt{\frac{2gh}{1 - a_1^2/a_2^2}}$ (*d*) $\sqrt{\frac{2gh}{1 - a_2^2/a_1^2}}$.

7.121. The height of water level in a tank above the centre of a circular hole 2.5 cm in diameter is 50 m. The velocity of water flowing through the hole, is
(*a*) 31.1 m/sec (*b*) 31.2 m/sec
(*c*) 31.3 m/sec (*d*) 31.4 m/sec.

7.122. Hydraulic coefficient of an orifice means the coefficient of
(*a*) velocity (*b*) contraction
(*c*) resistance (*d*) all the above.

7.123. If C_v, C_c, C_d and C_r are the hydraulic coefficients of an orifice, then
(*a*) $C_d = C_c . C_v$ (*b*) $C_r = 1 + C_v^2/C_d$
(*c*) $C_v = C_c + C_d$ (*d*) $C_c = C_v/C_d$.

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7.124. If v_1 and v_2 are the velocities of flow before and after sudden enlargement in a pipe, the head loss given by Carnot and Borda equation, is
(a) $(v_2^2 - v_1^2)/2g$ (b) $(v_1 - v_2)^2/2g$
(c) $(v_2 - v_1)^2/2g$ (d) $(v_1 + v_2)^2/2g$.

7.125. A pipe of 0.1 m^2 cross sectional area suddenly enlarges to 0.3 m^2 cross-sectional area. If the discharge of the pipe is 0.3 m^3/sec, the head loss is
(a) 2g m of water (b) g/2 m of water
(c) 1g m of water (d) $\sqrt{g}$ m of water.

7.126. In a short cylindercial external mouthpiece, the venacontracta occurs at a distance from the outlet of orifice equal to
(a) diameter of the orifice
(b) one-fourth the diameter of the orifice
(c) one-third the diameter of the orifice
(d) two-third the diameter of the orifice

7.127. The shape of fire hose nozzle is generally kept
(a) divergent (b) convergent
(c) convergent divergent (d) cylindrical.

7.128. A short tube mouthpiece will not run full at its outlet if the head under which the orifice works, is
(a) less than 12.2 m of the water
(b) more than 12.2 m of the water
(c) equal of 12.2 m of water
(d) none of these.

7.129. A piezometer opening in pipes measures
(a) velocity head (b) static pressure
(c) total pressure (d) negative static pressure.

7.130. In an inclined position, a venturimeter records
(a) more reading (b) less reading
(c) same reading (d) none of these.

7.131. If H is the difference of liquid levels on two sides of an orifice (width b, depth d), the discharge through the orifice will be
(a) $C_d b d^2 \sqrt{2gH}$ (b) $C_d b^2 d \sqrt{2gH}$
(c) $C_d b d \sqrt{2gH}$ (d) $C_d b d.2g\, H^{1/2}$.

7.132. Time of emptying liquid from a hemispherical vessel through an orifice at its bottom, is
(a) $\frac{\pi R^{3/2}}{15 C_d a \sqrt{2g}}$ (b) $\frac{2\pi R^{3/2}}{15 C_d a \sqrt{2g}}$
(c) $\frac{7\pi R^{3/2}}{15 C_d a \sqrt{2g}}$ (d) $\frac{14\pi R^{3/2}}{15 C_d a \sqrt{2g}}$.

7.133. The initial difference between liquid levels of two identical cylindrical vessels having their area of cross-section A, is H. Flow time T from one vessel to another through an orifice having coefficient of discharge C_d and area a will be
(a) $\frac{\sqrt{AH}}{C_d a \sqrt{2g}}$ (b) $\frac{A\sqrt{H}}{C_d a \sqrt{2g}}$
(c) $\frac{AH^{3/2}}{C_d a \sqrt{2g}}$ (d) $\frac{A^{1/2} H^{3/2}}{C_d a \sqrt{2g}}$.

7.134. Water flows through a convergent mouthpiece of diameter 4 cm at convergence under a head of 3 metres. If the maximum vacuum pressure is 9 metres of water, the maximum diameter of divergence, to aviod separation of flow, is
(a) 4 cm (b) 6 cm
(c) $\sqrt{2}$ cm (d) $2\sqrt{3}$ cm.

7.135. An orifice is called a large orifice if water head, is
(a) twice the diameter of the orifice
(b) thrice the diameter of the orifice
(c) four times the diameter of the orifice
(d) five times the diameter of the orifice.

7.136. Discharge through a totally submerged orifice, is directly proportional to
(a) difference in elevation of water surfaces
(b) square root of the difference in elevation of water surface
(c) square root of the opening
(d) reciprocal of the area of the opening
(e) none of these.

7.137. The width of a weir with end contraction, is
(a) equal to the width of the channel
(b) less than the width of the channel
(c) half the width of the channel
(d) none of these.

7.138. The upper surface of the weir over which water flows, is known as
(a) vein (b) nappe
(c) sill (d) none of these.

7.139. Discharge Q over a rectangular weir of length L and height H, is given by the equation
(a) $Q = 2/3\, C_d \sqrt{2g}\, LH^{3/2}$ (b) $Q = 2/3\, C_d L\, H\sqrt{2gH}$
(c) $Q = 2/3\, C_d H \sqrt{2gL^2 H}$ (d) all the above.

7.140. To ensure that water does not rise more than 100 cm above the crest, for a discharge of 5.00 m^3/sec, the length of water will be
(a) 2.48 m (b) 2.49 m
(c) 2.50 m (d) 2.51 m.

7.141. If S is the length of the crest, H is the height of water source of a weir whose length is L and discharge is Q m^3/sec, the velocity of approach V_d is
(a) $\sqrt{2gH}$ (b) $\frac{Q}{L(H-L)}$
(c) $\frac{Q}{L(H+S)}$ (d) $\frac{L(H+S)}{Q}$
(e) none of these.

7.142. The Empirical formula $Q = \left(0.405 - \frac{0.003}{Q}\right)\sqrt{2g} H^{3/2}$ for discharge over large rectangular weirs, is known as
(a) Francis formula (b) Bazin formula
(c) Rehbook formula (d) Kutter's formula.

7.143. When water flows over a rectangular suppressed weir, the negative pressure created beneath the nappe
(a) increases the discharge (b) decreases the discharge
(c) does not effect the discharge
(d) none of these.

7.144. When no air is left below the nappe and water stream adheres to the down stream face of the weir, it is known as

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(a) free nappe (b) depressed nappe
(c) clinging nappe (d) none of these.

7.145. With a clinging nappe of a weir, the excess discharge, is
(a) 6% to 7% (b) 8% to 10%
(c) 18% to 20% (d) 25% to 30%
(e) 30% to 40%.

7.146. The notch angle for maximum discharge over a triangular notch, is
(a) 30° (b) 60°
(c) 90° (d) 120°.

7.147. A triangular notch is preferred to a rectangular notch because
(a) only one reading is required
(b) its formula is simple to remember
(c) it gives more accurate results for low discharge
(d) it measures a wide range of flows accurately
(e) all the above.

7.148. The discharge through a V-notch weir varies as
(a) $\sqrt{H}$ (b) $\frac{1}{\sqrt{H}}$
(c) $H^{3/2}$ (d) $H^{7/2}$
(e) $H^{5/2}$.

7.149. Manning's formula is used for
(a) flow in open channels
(b) head loss due to friction in open channels
(c) head loss due to friction in pipes flowing full
(d) flow in pipes.

7.150. A stepped notch is a combination of
(a) rectangular notches of different sizes
(b) triangular notches of different sizes
(c) rectangular and triangular notches
(d) all the above.

7.151. The ratio of the percentage error in the discharge and percentage error in the measurement of head, over rectangular notch, is
(a) 1/2 (b) 2/3
(c) 3/2 (d) 3/4.

7.152. The ratio of the percentagge error in the discharge and percentage error in the measurement of head over a triangular notch, is
(a) 2/3 (b) 3/2
(c) 2/5 (d) 5/2.

7.153. If H is height of the liquid above the sill, the effect of end contractions, according to Francis formula, is
(a) 0.1 H (b) 0.2 H
(c) 0.3 H (d) 0.4 H
(e) 0.5 H.

7.154. Cappoletti weir is a
(a) rectangular weir whose length is kept 3 times the height of the water above sill
(b) triangular weir whose notch angle is 90°
(c) trapezoidal weir, whose sides slope 1 horizontal to 2 verticals
(d) a combination of rectangular and triangular weirs.

7.155. The thickness of a sharp crested weir is kept less than
(a) one-third of the height of water on the sill
(b) one-half of the height of water on the sill
(c) one-fourth of the height of water on the sill
(d) two-third of the height of water on the sill
(e) none of these.

7.156. Discharge over an ogee weir remains the same as that of
(a) sharp crested weir (b) triangular weir
(c) cippoletti weir (d) drowned weir.

7.157. In an inclined pipe, the pressure difference at its two ends is due to
(a) sudden head drop at inlet (b) exit head drop
(c) frictional loss head (d) elevation head
(e) all the above.

7.158. To avoid vapourisation, pipe lines are laid over the ridge so that these are above the hydraulic gradient line, not more than
(a) 2.4 m (b) 6.4 m
(c) 10.0 m (d) 5.0 m.

7.159. A syphon is used
(a) to connect water reservoirs at different levels intervened by a hill
(b) to supply water to a town from higher level to lower level
(c) to fill up a tank with water at higher level from a lower level
(d) none of these.

7.160. To avoid an interruption in the flow of a syphon, an air vessel is provided
(a) at the inlet (b) at the outlet
(c) at the summit
(d) at any point between intet and outlet.

7.161. The velocity of flow (v) at the outlet of a syphon of length l, is given by
(a) $v = \frac{\sqrt{gh}}{1.5 + 4fl/d}$ (b) $v = \sqrt{\frac{2gh}{1.5 + 4fl/d}}$
(c) $v = \sqrt{\frac{1.5 + 4fl/d}{2gh}}$ (d) $v = \sqrt{\frac{1.5 + 4fl/d}{gh}}$.

7.162. For a long pipe, the head loss
(a) at the entrance is ignored
(b) at the outlet is ignored
(c) at the entrance and outlet both are ignored
(d) due to friction is ignored.

7.163. A pipe consisting of several pipes of varying diameters and lengths, may be replaced by an equivalent pipe of diameter D of length
(a) $L = D^4\left(\frac{l_1}{d_1^4} + \frac{l_2}{d_2^4} + \frac{l_3}{d_3^4} + \ldots\right)$
(b) $L = D^3\left(\frac{l_1}{d_1^3} + \frac{l_2}{d_2^3} + \frac{l_3}{d_3^3} + \ldots\right)$

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(c) $L = D^5\left(\frac{l_1}{d_1^5} + \frac{l_2}{d_2^5} + \frac{l_3}{d_3^5} + \ldots\right)$

(d) $L = D^2\left(\frac{l_1}{d_1^2} + \frac{l_2}{d_2^2} + \frac{l_3}{d_3^2} + \ldots\right)$.

7.164. To replace a pipe of diameter D by n parallel pipes of diameter d, the formula is

(a) $d = \frac{D}{n}$ (b) $d = \frac{D}{n^{1/2}}$

(c) $d = \frac{D}{n^{3/2}}$ (d) $d = \frac{D}{n^{2/5}}$

(e) $d = \frac{D}{n^{2/3}}$.

7.165. For solving network problems of pipes, necessary condition is

(a) continuity equation (b) energy equation
(c) Darcy-Weisbach equation (d) all the above.

7.166. Power transmitted through a pipe is maximum when friction head loss, is

(a) one-half of the total head supplied
(b) one-third of the total head supplied
(c) one-fouth of the total head supplied
(d) equal to the total head supplied.

7.167. Maximum efficiency of transmission of power through a pipe, is

(a) 25% (b) 33.3%
(c) 50% (d) 66.67%.

7.168. If the pressure at the inlet of a pipe is 90 kg/cm^2 and pressure drop over the pipe line is 10 kg/cm^2, the efficiency of transmission, is

(a) 66.6% (b) 77.7%
(c) 55.5% (d) 88.8%.

7.169. For maximum horse power of a nozzle, the head supplied must be equal to

(a) head loss in the pipe due to friction
(b) twice the head loss in the pipe due to friction
(c) thrice the head loss in the pipe due to friction
(d) four times the head loss in the pipe due to friction.

7.170. Hydraulic gradient is equal to

(a) $\frac{\text{difference in water surfaces}}{\text{total length of the channel}}$

(b) $\frac{\text{head loss due to friction}}{\text{total length of the channel}}$

(c) $\frac{\text{wetted perimeter}}{\text{total length of the channel}}$

(d) $\frac{\text{area of the cross section}}{\text{total length of the channel}}$.

7.171. The ratio of the hydraulic radius of a pipe running full to the hydraulic radius of a square section of a channel whose side is equal to the diameter of the pipe, is

(a) 1 (b) $\frac{1}{2}$

(c) $\frac{1}{3}$ (d) $\frac{3}{4}$.

7.172. For uniform flow in canals

(a) there is a balance between the frictional loss and drop in elevation of the channel
(b) bed and free water surfaces of a channel are parallel to each other
(c) bed of channel represents the hydraulic gradient
(d) all the above.

7.173. When a valve of a rigid and non-elastic pipe, carrying water whose Bulk Modulus is k and mass density is ρ is closed suddenly, the rise of pressure P due to water hammer, is

(a) $P = k\rho$ (b) $P = \sqrt{k}\rho$
(c) $P = k\sqrt{\rho}$ (d) $P = \rho\sqrt{k}$.

7.174. Hydraulic radius is equal to

(a) area divided by the square of wetted perimeter
(b) area divided by wetted perimeter
(c) wetted perimeter divided by area
(d) square root of the area.

7.175. For pipes not running full, the hydraulic mean depth is given by

(a) $m = r(\theta - \sin\theta)$ (b) $m = \frac{\frac{r^2}{2}(\theta - \sin\theta)}{r\theta}$

(c) $m = \frac{\frac{r^2}{2}(\sin\theta - \theta)}{r\theta}$ (d) $m = \frac{\frac{r^2}{2}(\tan\theta - \theta)}{r\theta}$.

7.176. The diameter (d) of a nozzle fixed at the end of a pipe (diameter D, length L) for maximum energy, is

(a) $\sqrt[3]{\frac{D^3}{8fL}}$ (b) $\sqrt{\frac{D^2}{8fL}}$

(c) $\sqrt[4]{\frac{D^4}{8fL}}$ (d) $\sqrt{\frac{D^2}{4fL}}$.

7.177. The magnitude of water hammer in a pipe depends upon

(a) speed at which value is closed
(b) length of the pipe line
(c) elastic properties of the pipe material
(d) elastic properties of the following liquid
(e) all the above.

7.178. In pipe lines, a surge tank is provided

(a) to relieve the pressure due to water hammer
(b) to provide additional water head
(c) to overflow the pipe line when suddenly closed
(d) to remove the frictional loss in pipe.

7.179. The flow in a channel is said to be non-uniform, if

(a) free water surface of an open channel is not parallel to the bed of channel
(b) head needed to overcome frictional reistance is less than the drop in elevation of channel bed
(c) head needed to overcome frictional resistance is more than the drop in elevation of channel bed
(d) all the above.

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7.180. Chezy's constant $C = \dfrac{157.6}{1.81 + \dfrac{K}{\sqrt{M}}}$ is suggested by
(a) Bazin (b) Kutter
(c) Manning (d) Powell.

7.181. For most economical rectangular section of a channel, the depth is kept
(a) one-fourth of the width
(b) three times the hydraulic radius
(c) half the width
(d) hydraulic mean depth
(e) none of these.

7.182. For the most economical trapezoidal section of a channel with regards to discharge, the required condition, is
(a) half of top width = sloping side
(b) hydraulic depth = half the depth
(c) $\dfrac{b}{d} = 6Q^{1/6} - n$ (roughly)
(d) perpendiculars drawn from the centre of the top width on to the bottom sloping side, are all equal
(e) all the above.

7.183. Most economical section of a triangular channel, is
(a) equilateral triangle
(b) right angled triangle
(c) isosceles triangle with 45° vertex angle
(d) right angled triangle with equal sides.

7.184. Most economical section of a circular channel for maximum discharge
(a) depth of water = 0.95 diameter of circular section
(b) hydraulic mean depth = 0.286 diameter of circular section
(c) wetted perimeter = 2.6 diameter of circular section
(d) wetted perimeter = 2.83 depth of water
(e) all the above.

7.185. Most economical section of a circular channel for maximum velocity, is if,
(a) depth of water = 0.810 diameter
(b) hydraulic mean depth = 0.304 diameter
(c) wetted perimeter = 2.245 diameters
(d) all the above.

7.186. The most efficient channel section, is
(a) semi-circular (b) rectangular
(c) triangular
(d) half hexagon in the form of trapezoid.

7.187. Chezy's formula is used to determine
(a) head loss due to friction in pipe
(b) velocity of flow in pipe
(c) velocity of flow in open channels
(d) none of these.

7.188. Critical depth (h) of a channel, is
(a) $h = \dfrac{v^2}{g}$ (b) $h = \dfrac{v^2}{2g}$
(c) $h = \dfrac{v}{2g}$ (d) $h = \dfrac{v}{g}$.

7.189. Pick up the correct statement from the following :
(a) For tranquil flow $h > \sqrt{2g}$ or $v < \dfrac{v^2}{2g}$
(b) For critical flow $h = \dfrac{v^2}{g}$
(c) For torrential flow $h > \dfrac{2}{g}$ or $v < \sqrt{gh}$
(d) None of these.

7.190. The phenomenon occuring in an open channel when a rapidly flowing stream abruptly changes to a slowly flowing stream causing a distinct rise of liquid surface, is
(a) water hammer (b) hydraulic jump
(c) critical discharge (d) none of these.

7.191. Back water curve is caused if
(a) friction head loss is more than the bed slope
(b) pressure is due to weir in the channel
(c) there is an increase in width of the channel
(d) none of these.

7.192. Hydraulic ram is a device
(a) for lifting water without an electric motor
(b) for accelerating water flow
(c) for lifting heavy loads
(d) none of these.

7.193. An ideal fluid
(a) is frictionless and incompressible
(b) obeys Newton's law of velocity
(c) is similar to gas
(d) is very viscous.

7.194. Flow of water in pipes of diameter more than 3 metres, can be measured by
(a) pitot tube (b) venturimeter
(c) orifice plate (d) rotameter.

7.195. An orifice is taken as large if
(a) $(H_2 - H_1) > H$ (b) $(H_2 - H_1) > H/4$
(c) $(H_2 - H_1) > H/2$ (d) $(H_2 - H_1) > H/3$.

7.196. The discharg formula $Q = C_d \sqrt{2gH} \times A$ is used for rectangular
(a) small orifices only
(b) large orifices only
(c) small and large orifices only
(d) for all types of orifices.

7.197. Though angle of deviation of liquid is more in internal mouth piece, the contraction of the jet, is
(a) more in the internal mouth piece
(b) less in the internal mouth piece
(c) equal to external mouth piece
(d) none of these.

7.198. The discharge through an internal mouth piece is more if its length is
(a) $< \frac{1}{2}$ diameter (b) $<$ diameter

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(c) ≥ diameter (d) none of these.

7.199. The intensity of pressure due to sudden closure of a valve of a pipe in which water flows with velocity v, is directly proportional to :

(a) square root of the bulk modulus of elasticity of water
(b) bulk modulus of elasticity of water
(c) specific weight of water
(d) none of these.

7.200. If L, D and f are the length, diameter and coefficient of friction of a pipe, the ratio of the areas of the pipe A and nozzle a, to transmit maximum power, is

(a) $\sqrt{\frac{8fL^2}{D^2}}$ (b) $\sqrt{\frac{8L^2f}{D}}$
(c) $\sqrt{\frac{8Llf}{D^2}}$ (d) $\sqrt{\frac{8fL}{D}}$.

7.201. The horizontal component of the force on a curved surface is equal to

(a) weight of liquid vertically below the curved surface
(b) force on a vetical projection of the curved surface
(c) product of pressure at its centroid and the area
(d) weight of liquid retained by the curved area.

7.202. In order to avoid capillary correction, the minimum diameter of a manometer used for measuring pressure, should be

(a) 2 mm (b) 4 mm
(c) 6 mm (d) 8 mm
(e) 10 mm.

7.203. If H is the depth of water retained by a vertical wall, the height of centre of pressure above the bottom is

(a) $\frac{H}{2}$ (b) $\frac{H}{3}$
(c) $\frac{2H}{3}$ (d) $\frac{H}{5}$.

7.204. The moment of inertia of a floating body along its longitudinal axis and the volume of water displaced by it are I and V respectively. The height of the metacentre above centre of buoyancy of the body, is

(a) $\frac{I}{2V}$ (b) $\frac{2I}{V}$
(c) $\frac{I}{V}$ (d) $\frac{3I}{V}$
(e) $\left(\frac{I}{V}\right)^2$.

7.205. A load w is rolled a distance d across the deck of a ship of weight W, due to which the ship heels through θ°. The metacentric height of the ship, is

(a) $\frac{Wd}{w \tan 0}$ (b) $\frac{w \tan 0}{Wd}$
(c) $\frac{wd}{W \tan 0}$ (d) $\frac{W \tan 0}{wd}$.

7.206. A spherical load 900 kg is rolled through 9.8 m across the deck of a ship weighing 10,000 kg. If the metacentric height of the ship is 5 metres, the angle of heel, is

(a) 10° 5′ (b) 10° 10′
(c) 10° 15′ (d) 10° 20′.

7.207. If k is the radius of gyration, h the metacentric height g the acceleration due to gravity, the time of oscillation of floating body, is

(a) $\pi\sqrt{\frac{K^2}{g}}$ (b) $2\pi\sqrt{\frac{K^2}{gh}}$
(c) $2\pi\sqrt{\frac{K}{h^2g}}$ (d) $\pi\sqrt{\frac{K^2}{g^2h^2}}$.

7.208. The radius of gyration of the water line of a floatin ship is 4 m and its metacentric height is 72.5 cm. The perio of oscillation of the ship, is

(a) π (b) 2π
(c) 3π (d) 4π
(e) $\frac{\pi}{2}$.

7.209. Water displaced by a floating wooden block of densit 0.75, 5 m long, 2 m wide and 3 m high, is

(a) 17.5 m^3 (b) 20.0 m^3
(c) 22.5 m^3 (d) 25 km^3.

7.210. In flowing liquids pitot tubes are used measure

(a) discharge (b) pressure
(c) velocity (d) depth.

7.211. When two layers of a fluid separated by dy move ov the other with a difference of velocity dv, causes a shearin stress $\tau = \mu \frac{dv}{dy}$, where μ is known as

(a) coefficient of viscosity (b) absolute viscosity
(c) dynamic viscosity (d) viscosity
(e) all the above.

7.212. The equation $\tau = \mu \frac{dv}{dy}$ for the viscosity, is suggested

(a) Bernoulli (b) Newton
(c) Chezy (d) Bezin
(e) Helmholtz.

7.213. Pick up the correct statement from the following :

(a) The fluids which follow $\tau = \frac{dv}{dy}$ are known as Newtonia fluids
(b) The fluids which do not follow the linear relationshi between shear and rate of strain are known as no Newtonian fluids
(c) The substances which flow after yield strains, a known as plastics
(d) all the above.

7.214. The terminal velocity (v) of a sphere of radius r an specific weight W, which travels vertically downwards in liquid of viscosity μ and specific weight W, is

(a) $v = \frac{2r^3}{9\mu}(W_s - W)$ (b) $v = \frac{2r^2}{9\mu}(W_s - W)$
(c) $v = 9\frac{r^2}{2\mu}(W_s - W)$ (d) $v = \frac{3r^2}{3\mu}(W_s - W)$.

7.215. An open container filled with water is moved vertical upward with a uniform linear acceleration. The pressure a its bottom will be

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(*a*) greater than static pressure
(*b*) equal to static pressure
(*c*) lesser than static pressure
(*d*) none of these.

7.216. An open container filled with water is moved vertically downward with a uniform linear acceleration. The pressure at its bottom will be
(*a*) greater than static pressure
(*b*) equal to static pressure
(*c*) lesser than static pressure
(*d*) none of these.

7.217. A tank 4 m × 3 m × 2 m containing an oil of specific gravity 0.83 is moved with an acceleration $g/2$ m-sec^2. The ratio of the pressures at its bottom when it is moving vertically up and down, is
(*a*) 2 (*b*) 3
(*c*) 1/2 (*d*) 1/3.

7.218. Highest dam in India, is
(*a*) Bhakra dam (*b*) Hirakund dam
(*c*) Nagarjuna Sagar dam (*d*) Iddiki dam.

7.219. Non-over flow double curvature concrete arch, is provided in
(*a*) Bhakra dam (*b*) Hirakund dam
(*c*) Nagarjuna Sagar dam (*d*) Iddiki dam.

2.220. Cavitation is caused by
(*a*) Low pressure (*b*) High pressure
(*c*) Low velocity (*d*) High velocity
(*e*) None of these.

7.221. An ideal fluid is
(*a*) incompressible
(*b*) compressible
(*c*) compressible and non-viscous
(*d*) slightly affected by surface torque.

7.222. Shear stress is directly proportional to
(*a*) the velocity (*b*) the shear strain
(*c*) the viscosity (*d*) the velocity.

7.223. Kinematics viscosity equals to
(*a*) dynamic viscosity ÷ density
(*b*) dynamic viscosity × density
(*c*) dynamic viscosity ÷ density
(*d*) pressure ÷ density.

7.224. Dimensions of the dynamic viscosity (μ) are
(*a*) MLT^{-2} (*b*) $M^{-1}L^{-1}T^{-1}$
(*c*) $ML^{-1}T^{-1}$ (*d*) $ML^{-1}T^{-2}$.

7.225. Poise is the unit of
(*a*) viscosity (*b*) velocity gradient
(*c*) mass density (*d*) kinematic viscous.

7.226. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I (*Property*)	*List II* (*Units*)
A. Viscosity	1. m^2/sec
B. Kinematic viscosity	2. $N.s/m^2$
C. Surface tension	3. $287 \frac{J}{kg.\,k}$
D. Gas constant	4. N/m.

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	2	1	4	3
(*c*)	3	2	1	4
(*d*)	1	4	3	2.

7.227. Match List I with List II and choose the correct answer by using the codes given below the lists :

List I (*Liquid*)	*List II (Type)*
A. Incompressible without viscosity	1. Real fluid
B. Viscous	2. Non-Newtonian fluid
C. Shear stress to the velocity gradiant	3. Ideal plastic
D. Shear stress not proportional to velocity gradient	4. Newtonian fluid
E. Shear stress is more than yield value	5. Ideal fluid.

Codes :

	A	B	C	D	E
(*a*)	5	1	4	2	3
(*b*)	1	3	2	4	5
(*c*)	5	4	2	1	3
(*d*)	4	1	4	3	2.

7.228. Match List I with List II and select a correct answer by using the codes given below the lists :

List I *List II*
A. Ideal fluid
B. Real fluid
C. Newtonian fluid
D. Non-Newtonian fluid
E. Ideal fluid

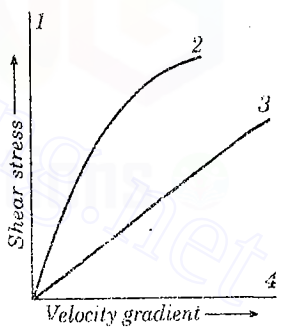

Fig. 7.1.

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	1	3	4
(*c*)	4	3	2	1
(*d*)	3	4	1	2

7.229. The gases are considered incompressible if Match number is
(*a*) equal to 1.0 (*b*) equal to 1.5
(*c*) is more than 0.5 (*d*) less than 0.2.

7.230. Atmospheric pressure is equal to water column head of
(*a*) 9.81 m (*b*) 5.0 m
(*c*) 10.30 m (*d*) 7.5 m.

7.231. The hydrostatic force acts through
(*a*) centre of pressure (*b*) centre of top edge
(*c*) centre of bottom edge (*d*) metacentre.

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7.232. Due to decrease of diameter of the droplet, inside pressure intensity
(*a*) increases (*b*) decreases
(*c*) remains unaffected (*d*) None of these.

7.233. Inside pressure in a hollow soap bubble in the air is :
(*a*) $\frac{4\sigma}{d}$ (*b*) $\frac{2\sigma}{d}$
(*c*) $\frac{6\sigma}{d}$ (*d*) $\frac{8\sigma}{d}$
where d is the diameter of the bubble.

7.234. Capillary rise of water is
(*a*) directly proportional to surface tension
(*b*) inversely proportional to water density
(*c*) inversely proportional to diameter of the tube
(*d*) All of these.

7.235. For stable equilibrium of a floating body, its metacentre
(*a*) coincides with centre of gravity
(*b*) is below the centre of gravity
(*c*) is above the centre of gravity
(*d*) None of above.

7.236. The metacentric height of a body equals the distance between
(*a*) the centre of gravity and centre of buoyancy
(*b*) the metacentre and centre of gravity
(*c*) the centre of buoyancy and metacentre
(*d*) none of these.

7.237. A cylinder 3 m in diameter and 4 m long retains water one side. (Fig. 7.2). If the weight of the cylinder is 2000 kgf, the horizontal reaction at B is

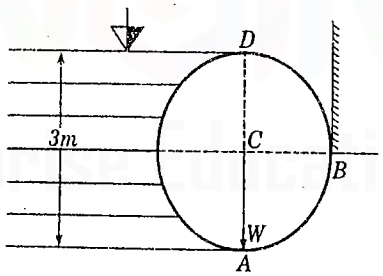

Fig. 7.2.

(*a*) 10,000 kgf (*b*) 15,000 kgf
(*c*) 20,000 kgf (*d*) 18,000 kgf.

7.238. The vertical reaction in the above question at A is
(*a*) 14,137 kgf (*b*) 5,863 kgf
(*c*) 20,000 kgf (*d*) 18,000 kgf.

7.239. A body of dimensions 1.5 m × 1.0 m × 2 m weighs 3000 kg in water. Its specific gravity is
(*a*) 0.8 (*b*) 0.9
(*c*) 1.0 (*d*) 1.1.

7.240. The pressure variation along the radial direction for vortex flow along a horizontal plane is related by
(*a*) $\frac{\partial p}{\partial r} = -\rho \frac{V^2}{r}$ (*b*) $\frac{\partial p}{\partial r} = \rho \frac{V^2}{r}$
(*c*) $\frac{\partial p}{\partial r} = \rho \frac{V}{r^2}$ (*d*) $\frac{\partial p}{\partial r} = \rho \frac{V^2}{r^2}$.

7.241. The momentum correction factor (β) for the viscous flow through a circular pipe is
(*a*) 1.25 (*b*) 1.33
(*c*) 1.50 (*d*) 1.66
(*e*) 2.00.

7.242. In case of laminar flow through a circular pipe,
(*a*) momentum correction factor is 1.33
(*b*) energy correction factor is 2.00
(*c*) both (*a*) and (*b*)
(*d*) Neither (*a*) nor (*b*).

7.243. The time required to close a valve gradually is
(*a*) $\frac{2L}{C}$ (*b*) $\leq \frac{2L}{C}$
(*c*) $> \frac{2L}{C}$ (*d*) $< \frac{4L}{C}$
where L is the length of pipe and C = velocity of pressure wave.

7.244. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Viscous force/elastic force	1. Froud's number
B. Inertia force/gravity force	2. Mach number
C. Inertia force/elastic force	3. Euler's number
D. Inertia force/pressure force	4. Renold's number

Codes :

	A	B	C	D
(*a*)	4	1	2	3
(*b*)	1	3	2	4
(*c*)	4	1	3	2
(*d*)	3	2	4	1

7.245. Product of Renold number, Froud's number and Mach number is :
(*a*) $\frac{\rho V^3 L}{\mu C\sqrt{Lg}}$ (*b*) $\frac{\rho V L^3}{\mu C\sqrt{Lg}}$
(*c*) $\frac{\rho V^2 L^2}{\mu C\sqrt{Lg}}$ (*d*) $\frac{1.5\rho V L^2}{\mu C\sqrt{Lg}}$.

7.246. If jet of water coming out from a nozzle with a velocity 9.81 m/s, the angle of elevation being 30°, the time to reach the highest point is
(*a*) 0.25 s (*b*) 0.50 s
(*c*) 1.0 s (*d*) 1.5 s.

7.247. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I	*List II*
A. Coefficient of velocity (C_v)	1. 0.95 to 0.99
B. Coefficient of contraction (C_c)	2. 0.61 to 0.65

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C. Coefficient of discharge (C_d)	3. 0.64	
	4. 0.85 to 0.89	

Codes :

	A	B	C
(a)	4	1	3
(b)	3	2	4
(c)	1	3	2
(d)	4	3	1

7.248. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I (Coefficient of discharge)	*List II (Valve)*
A. External mouth piece	1. 1.0
B. Internal mouth piece	2. 0.5 ring full
C. Internal mouth piece	3. 0.855 running free
D. Convergent divergent	4. 0.707

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	1	3	4	2
(c)	3	2	4	1
(d)	1	4	3	2.

7.249. The ratio of time for completely emptying the hemispherical tank and circular horizontal tank of equal radii both fitted with similar orifices at their bottoms is :

(a) $\frac{\pi}{3}\left[\frac{(4/3\,RH_1^{3/2} - 2/5\,H^{5/2})}{(2R)^{3/2} - (2R - H_1)^{3/2}}\right]$

(b) $\frac{\pi}{2}\left[\frac{2/5\,RH_1^{5/2} - 2/3\,H^{3/2}}{(3R)^{3/2} - (2R - H_1)^{3/2}}\right]$

(c) $\frac{\pi}{3}\left[\frac{(4/3\,RH_1^{3/2} + 2/5\,H^{5/2})}{(R)^{3/2} - (2R + H)^{3/2}}\right]$

(d) $\pi\left[\frac{2/3\,RH_1^{3/2} + 2/5\,H^{2/5}}{R^{3/4} + (4R + H_1)^{3/2}}\right]$.

7.250. The velocity distribution of viscous fluid through a circular/pipe is :

(a) hyperbolic (b) circular
(c) parabolic (d) elliptical.

7.251. The shear stress distribution in viscous fluid through a circular pipe is :

(a) maximum at the centre
(b) maximum at the inside of surface
(c) same throughout the section
(d) none of these.

7.252. The ratio of maximum velocity to average velocity of viscous fluid through a circular pipe is

(a) 0.5 (b) 0.75
(c) 1.25 (d) 2.00.

7.253. If R_e is the Renold's number, the coefficient of friction for laminar flow is

(a) $\frac{4}{R_e}$ (b) $\frac{8}{R_e}$
(c) $\frac{12}{R_e}$ (d) $\frac{16}{R_e}$.

7.254. If total head available at the inlet of pipe and f is the loss of head due to friction in the pipe, the maximum efficiency of transmission of power (η_{max}) is

(a) 1/2 (b) 2/3
(c) 3/4 (d) 4/5.

7.255. In steady flow, which one of the following changes with time

(a) velocity (b) pressure
(c) density (d) none of these.

7.256. Pick up the correct statement from the following :

(a) In incompressible flow the density of a fluid remains constant
(b) In compressible flow, the density of a fluid changes from point to point
(c) In uniform flow, the velocity of a fluid does not change with respect to length of flow direction
(d) All the above.

7.257. The discharge through a 100 mm diameter external mouth piece fitted to the side of a large vessel is 0.05948 m^3/s. The head over the mouth piece is

(a) 2 m (b) 2.5 m
(c) 3.0 m (d) 4.0 m.

7.258. Pick up the correct statement regarding convergent divergent mouth piece from the following :

(a) It converges upto Venacontracta and then diverges
(b) In this mouth piece there is no loss of energy due to sudden enlargement
(c) The coefficient of discharge is unity

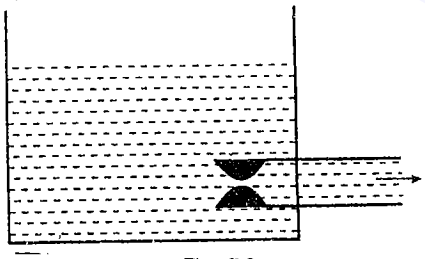

Fig. 7.3.

(d) All the above.

7.259. The mouth piece shown in Fig. 7.3 is generally known as

(a) Internal mouth piece (b) Re-entrant mouth piece
(c) Borda's mouth piece (d) All the above.

7.260. Pick up the correct statement from the following :

(a) When the length of the tube is equal to diameter of the internal mouth piece, the jet of liquid comes out without touching the sides of the tube
(b) When the length of the tube is three times the diameter

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of the internal mouth piece, the jet diameter is equal to diameter of the tube.
(c) both (a) and (b) (d) Neither (a) nor (b).

7.261. Pick up the correct statement regarding Borda's mouth piece running full from the following :
(a) Actual velocity at the out let is $\sqrt{gH}$
(b) Theoretical velocity at the outlet is $\sqrt{2gH}$
(c) Coefficient of velocity is $1/\sqrt{2}$
(d) Coefficient of contraction is 1
(e) All the above.

7.262. Match List I with List II and select a suitable answer by using the codes given below the lists :

List I (mouth piece)	*List II (coefficient of discharge)*
A. External mouth piece	1. 1.0
B. Internal mouth piece runningfull	2. 0.707
C. Internal mouth piece running free	3. 0.855
D. Convergent divergent	4. 0.50

Codes :

	A	B	C	D
(a)	3	2	4	1
(b)	1	2	3	4
(c)	4	3	2	1
(d)	2	4	1	3.

7.263. Pick up the incorrect statement from to following regarding triangular notch :
(a) For measuring low discharge, it gives more accurate result
(b) Only one reading (*i.e.* H) is required for computation of discharge
(c) Ventilation is necessary
(d) None of these.

7.264. Pick up the correct statement from the following :
(a) Discharge over a triangular notch is proportional to $H^{5/2}$
(b) Discharge over a rectangular notch is proportional to $H^{3/2}$
(c) Both (a) and (b)
(d) Neither (a) nor (b).

7.265. An error of 1% in measuring the head of water over the crest of a rectangular weir, produces an error in the discharge which is equal to
(a) 1.25% (b) 1.5%
(c) 1.75% (d) 2.25%.

7.266. An error of 1% in measuring the head of water over the crest of a triangular notch, produces an error in the discharge which is equal to
(a) 1.25% (b) 1.5%
(c) 2.0% (d) 2.5%.

7.267. Discharge with velocity of approach, over a rectangular weir is
(a) $\frac{2}{3} Cd \times L \times \sqrt{2g}\ [(H + ha)^{3/2} + ha^{3/2}]$
(b) $\frac{2}{3} Cd \times L \times \sqrt{2g}\ [(H + ha)^{3/2} - ha^{3/2}]$
(c) $\frac{2}{3} Cd \times L \times \sqrt{2g}\ [(H - ha)^{3/2} + ha^{3/2}]$
(d) $\frac{2}{3} Cd \times L \times \sqrt{2g}\ [(H - ha)^{3/2} - ha^{3/2}]$.

7.268. The formula $Q = m \times L \times \sqrt{2g} \times H^{3/2}$ where $m = 0.405 + \frac{0.003}{H}$ was suggested by :
(a) Bazin (b) Francis
(c) Cipolletti (d) None of these.

7.269. The side slope of Cipolletti weir is generally kept
(a) 1 to 4 (b) 1 to 3
(c) 1 to 2 (d) 1 : 5.

7.270. The discharge over a Cipolletti weir of length 2.185 m when the head over the weir is 1 m, is
(a) 2.0 m^3 (b) 2.5 m^3
(c) 3.0 m^3 (d) 4.0 m^3.

7.271. In Chezy's formula $V = C\sqrt{mi}$
(a) V is the mean velocity of flow
(b) m is the hydraulic mean depth
(c) i is the loss of head per unit length of pipe
(d) All the above.

7.272. Total energy line is
(a) pressure head (b) datum head
(c) kinetic head (d) All the above.

7.273. A nozzle is fitted at the end of a pipe whose length is 320 m and diameter is 10 cm. If the value of $f = 0.01$, the diameter of the nozzle for the maximum transmission of power through the nozzle is
(a) 2.4 cm (b) 2.5 cm
(c) 2.6 cm (d) 2.7 cm.

7.274. The pressure rise due to water hammer depends upon
(a) the velocity of flow of water in the pipe
(b) the length of pipe
(c) time taken to close the valve
(d) the elasticity of the pipe material
(e) All of above.

7.275. The valve closure is said to be sudden if
(a) $t < \frac{L}{C}$ (b) $t < \frac{2L}{C}$
(c) $t < \frac{3L}{C}$ (d) $t < \frac{5L}{C}$.

7.276. The length of pipe is L, velocity of flow of a liquid in the pipe is V. If t is the time in second required to close the valve, the head of pressure
(a) $H = \frac{LV}{gt}$ (b) $H = \frac{Lt}{Vg}$
(c) $H = \frac{LV^2}{gt}$ (b) none of these.

7.277. The maximum vacuum created at the summit of a syphon is

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(a) 2.7 m of water (b) 7.4 m of water
(c) 5.5 m of water (d) none.

7.278. If D is the diameter of a pipe of length L and f is the coefficient of friction of pipe then diameter of the nozzle d is

(a) $\left(\frac{D^5}{8fL}\right)^{1/4}$ (b) $\left(\frac{D^5}{8fL}\right)^{1/3}$

(c) $\left(\frac{D^5}{8fL}\right)^{1/2}$ (d) none of these.

7.279. For maximum power transmission through a nozzle,

(a) $h_f = \frac{H}{2}$ (b) $h_f = \frac{H}{3}$

(c) $h_f = \frac{H}{4}$ (d) $h_f = \frac{H}{5}$

where h_f is the head lost due to friction.

7.280. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I (Physical Quantity)	*List II (Dimensions)*
A. Angular velocity	1. L^2T^{-1}
B. Angular acceleration	2. T^{-1}
C. Discharge	3. T^{-2}
D. Kinematic viscosity	4. L^3T^{-1}

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	3	4	1	2
(d)	2	4	1	3.

7.281. The dimensions MLT^{-2} refers to
(a) specific weight (b) force
(c) discharge (d) none of these.

7.282. Pick up the correct statement from the following :
(a) Dimensional homogeneity means the dimensions of each term in an equation on both sides are equal
(b) Dimensionally homogeneous equations are independent of the system of units
(c) In dimensionally homogeneous equation, the powers of fundamental dimensions on either side of the equation are identical
(d) All the above.

7.283. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I	*List II*
A. Inertia force	1. Product of shear stress due to viscosity and surface area of flow
B. Viscous force	2. Product of elastic stress and area of flowing fluid
C. Pressure force	3. Product of mass and acceleration of the flowing fluid
D. Elastic force	4. Product of pressure intensity and cross-sectional area of the flowing fluid

Codes :

	A	B	C	D
(a)	4	2	3	1
(b)	3	4	1	2
(c)	3	1	4	2
(d)	4	2	3	1.

7.284. The ratio of inertia force of a flowing fluid and the viscous force of the liquid is called :
(a) Renold's number (b) Froude's number
(c) Euler's number (d) Weber's number.

7.285. Match List I with List II and choose a correct answer by using the codes given below the lists :

List I	*List II*
A. Square root of the ratio of inertia force of a flowing fluid to the gravity force	1. Euler's number
B. Square root of the ratio of the inertia force of a flowing fluid to the pressure force	2. Weber's number
C. Square root of the ratio of the inertia force of a flowing fluid to the surface tension	3. Mach's number
D. Square root of the ratio of the inertia force of a flowing fluid to the elastic force.	4. Froude's number.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	1	2	3
(c)	4	3	2	1
(d)	1	2	3	4.

7.286. Which one of the following equation is applicable to unsteady flow in open channels :

(a) $\frac{\partial V}{\partial t} = 0 ; \frac{\partial Y}{\partial t} \neq 0 ; \frac{\partial Q}{\partial t} = 0$

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(b) $\frac{\partial V}{\partial t} \neq 0 ; \frac{\partial Y}{\partial t} = 0 ; \frac{\partial Q}{\partial t} = 0$

(c) $\frac{\partial V}{\partial t} = 0 ; \frac{\partial Y}{\partial t} = 0 ; \frac{\partial Q}{\partial t} \neq 0$

(d) $\frac{\partial V}{\partial t} \neq 0 ; \frac{\partial Y}{\partial t} \neq 0 ; \frac{\partial Q}{\partial t} \neq 0.$

7.287. For steady flow in open channels, which one of the following does not change :
(a) depth of flow (b) velocity of flow
(c) rate of flow (d) All of these.

7.288. The flow in open channel is said to be subcritical if the Froude number is
(a) less than 1.0 (b) equal to 1.0
(c) greater than 1.0 (d) none.

7.289. The flow in open channel is said to be critical if the Froude number is :
(a) less than 1.0 (b) equal to 1.0
(c) greater than 1.0 (d) None of these.

7.290. A rectangular channel 6 m wide and 3 m deep and having a bed slope as 1 in 2000 is running full. If Chezy's constant C = 54.8, pick up the correct specification of the channel from the following :
(a) hydraulic mean depth = 1.5 m
(b) Velocity of flow = 1.5 m/sec
(c) Rate of flow = 27 m^3/sec
(d) All the above.

7.291. For a most economical rectangular channel, the width of the channel must be
(a) equal to depth of flow
(b) twice the depth of flow
(c) half the depth of flow
(d) None of these.

7.292. For a most economical rectangular channel, the hydraulic mean depth, is equal to
(a) the depth of flow
(b) half the depth of flow
(c) one-third depth of flow
(d) None of these.

7.293. For a most economical trapezoidal open channel, the half of the top width must be equal to
(a) the bed width (b) one sloping side
(c) the depth of flow (d) None of these.

7.294. For the most economical trapezoidal open channel,
(a) half of the top width must be equal to one of the sloping sides
(b) the hydraulic mean depth must be equal to half the depth of flow
(c) the semicircle drawn with top width as diameter must touch the three sides of the channel
(d) All of these.

7.295. The best side slope for most economical trapezoidal section, is
(a) 30° (b) 45°
(c) 60° (d) None of these.

7.296. Pick up the correct statement from the following :
(a) For maximum velocity of flow, the depth of water in the circular channel must be 0.81 times the diameter of the channel
(b) For maximum velocity, the hydraulic mean depth must be 0.3 times the diameter of circular channel
(c) For maximum discharge the depth of flow must be 0.95 times the diameter of circular channel
(d) All the above.

7.297. For critical depth of flow of water in open channels, the specific energy must be :
(a) minimum
(b) maximum
(c) average of maximum and minimum
(d) None of these.

7.298. The minimum specific energy of flow of water in open channel is :
(a) h_c (b) $\frac{h_c}{2}$
(c) $\frac{3h_c}{2}$ (d) $\frac{2}{3} h_c$
where h_c is the critical depth.

7.299. The velocity of flow at the critical depth (h_c) is called critical velocity (V_c) which is equal to
(a) $V_c = g \times h_c$ (b) $V_c = \sqrt{g \times h_c}$
(c) $V_c = \sqrt[3]{g \times h_c}$ (d) None of these.

7.300. For critical flow, the Froude number is :
(a) 1.0 (b) less than 1.0
(c) more than 1.0 (d) 2.

7.301. The length of hydraulic jump is roughly
(a) 2 to 3 times its height (b) 3 to 5 times its height
(c) 5 to 7 times its height (d) None of these.

7.302. If E_1 and E_2 are the specific energies at the start of back water curve and at the maximum rise of water respectively and ib and ie are the head slope and the energy line slope respectively, the length of back water (L) is given by
(a) $L = \frac{E_2 + E_1}{ib - ie}$ (b) $L = \frac{E_2 - E_1}{ib - ie}$
(c) $L = \frac{E_2 - E_1}{ib + ie}$ (d) None of these.

7.303. If q is the discharge per unit width, then critical depth (h_c) is related by
(a) $h_c = \sqrt{\frac{q^2}{g}}$ (b) $h = \sqrt[3]{\frac{q^2}{g}}$
(c) $\left(\frac{q^2}{g}\right)^{2/3}$ (d) None of these.

7.304. Orifice-meter is used to measure
(a) pressure at the point (b) discharge
(c) average speed (d) velocity.

7.305. The flow in open channel is laminar if the Reynold number is
(a) less than 500 (b) more than 500
(c) 1000 (d) none of these.

7.306. Specific energy of a flowing fluid per unit weight is

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(a) $\frac{P}{W}+\frac{V^2}{2g}$ (b) $\frac{P}{W}+\frac{V}{2g}$

(c) $\frac{V^2}{2g}+h$ (d) $\frac{P}{W}+\frac{V^2}{2g}+h$.

7.307. The depth of flow after hydraulic jump is

(a) $\frac{d_1}{2}+\sqrt{\frac{d_1^2}{4}+8(F_e)_1}$ (b) $\frac{d_1}{3}+\sqrt{\frac{d_1^2}{4}+8(F_e)_1}$

(c) $\frac{d_1}{2}[\sqrt{1+8(F_e)_1^2}-1]$ (d) $\frac{d_1}{2}[\sqrt{1+8(F_e)_1^3}]$.

7.308. Water pressureper meter length on a vertical masonary wall on dam is given by the relaton :

(a) $P=\frac{wH}{2}$ (b) $P=\frac{wH^2}{2}$

(c) $P=\frac{wH^3}{2}$ (d) $P=\frac{wH^2}{3}$

7.309. For which of the following points the stability of a dam is checked?

(a) Tension at the base (b) Overturning of the dam

(c) Sliding of the dam (d) All of these.

7.310. Pick up the correct statement from the following :

(a) Stable equilibrium occures when the meta centre is higher than the centre of gravity of the floating body.

(b) Unstable equilibrium occures when the meta centre is lower than the centre of gravity of the floating body.

(c) Neutral equilibrium occurs when the meta centre coincides with the centre of gravity of the floating body

(d) All of these.

7.311. For a conical body having 2α apex angle and an immersed length l in liquid, the meta centric height is :

(a) $3/4\ l \tan \alpha$ (b) $3/4\ l \tan^2 \alpha$

(c) $4/3\ l \tan^3 \alpha$ (d) $4/3\ l^2 \tan \alpha$

7.312. If h is the height of the liquid in the Pitot tube, then velocity of the liquid is :

(a) $\sqrt{2gh}$ (b) $3\sqrt{3gh}$

(c) $(2gh)^2$ (d) $\frac{2gh}{3}$

7.313. Match list I with List II and select the correct answer by using the codes given below the lists :

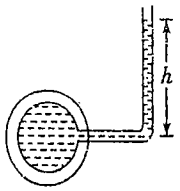
List I	*List II*
A. Atmospheric pressure	1. Pressure measured with reference to absolute vacuum pressure
B. Gauge pressure	2. Pressure measured with the help of a pressure measuring instrument
C. Absolute pressure	3. The pressure below atmospheric pressure
D. Vacuum pressure	4. Pressure exerted by atmospheric gases

Codes:

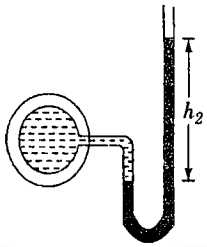
	A	B	C	D
(a)	4	2	1	3
(b)	1	2	3	4
(c)	3	4	2	1
(d)	4	1	3	2

7.314. Match list I with List II and select the correct answer by using the codes given below the lists :

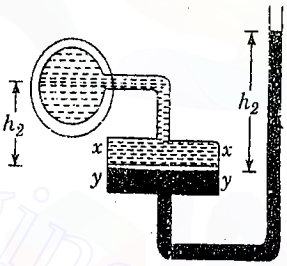
List I *List II*

A. 

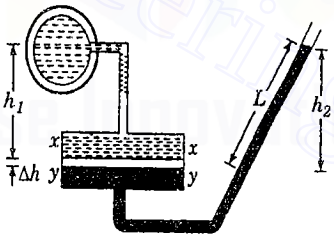
1. Inclined single column manometer

B. 

2. U-tube manometer

C. 

3. Vertical single column manometer

D. 

4. Piezometer

Codes :

	A	B	C	D
(a)	4	2	3	1
(b)	3	4	2	1
(c)	1	2	3	4
(d)	3	4	2	1

7.315. Match list I with List II and select the correct answer by using codes given below the lists:

List I	*List II*
A. Centre of pressure	1. The point about which a body starts oscillating if tilted by a small angle

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B. Centre of buoyancy	2. The distance between the ntre of a floa ty and its cent gravity
C. Meta centre	3. The point through which the force of buoyancy acts
D. Meta centric height	4. The point of application of the total pressure

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	1	2
(c)	3	2	4	1
(d)	1	3	2	4

3.316. Match List I with List II and select the correct answer for free liquid jets by using codes given below the lists:

List I	*List II*
A. Maximumheight attained	1. $\frac{u^2}{8}$
B. Maximum range	2. $\frac{24 \sin \theta}{g}$
C. Time of flight	3. $\frac{u^2}{8} \sin \theta$
D. Horizontal range of jet	4. $\frac{u^2 \sin^2 \theta}{2g}$

7.317. Match list 1 with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. The type of vortex ilow in which no external torque rotates the fluid mass	1. equals the fall of liquid at the axis of rotation
B. Flow of liquid inside the impeller of a centrifugal pump	2. Free vortex flow
C. Free surface of forced vortex flow	3. Parabolic
D. In forced vortex the rise of liquid level at ends	4. Forced vortex flow

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	3	2	1	4
(d)	4	3	2	1

7.318. Match List I with List II and choose the correct answer by using codes given below the lists', for an open cylindrical vessel which is 12 cm in diameter and 30 cm deep, and filled with water upto its top.

List I (Speed of rotation)	*List II (Volume of water spilled)*
A. 286.5 r.p.m.	1. 933.83 cm^3
B. 300.0 r.p.m.	2. 1023.53 cm^3
C. 200.0 r.p.m.	3. 455.22 cm^3
D. 250.0 r.p.m.	4. 710.82 cm^3

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	3	2	1	4
(c)	1	2	3	4
(d)	4	3	1	2

7.319. If $\frac{\partial p}{\partial x}$ = pressure gradient, r = radius at any point, R is radius of the pipe, and U_{max} is central line velocity, μ is average velocity, j. is coefficient of viscosity and D is diameter of the pipe, then match List I with List II and choose the correct answer by using codes given below the lists :

List I	*List II*
A. Shear stress	1. $\frac{1}{4\mu} \frac{\partial p}{\partial x} [R^2 - r^2]$
B. Velocity	2. 2.0
C. Ratio of velocities	3. $\frac{32 \mu u L}{\rho g D^2}$
D. Loss of pressure head	4. $-\frac{\partial p}{\partial x} \frac{r}{2}$

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	4	1	2	3
(c)	4	3	2	1
(d)	1	3	2	4

7.320. Match list I with List II and select the correct answer by using codes given below the lists :

List II	*List I*
A. Reynold number less than 2000	1. The flow is turbulent in pipes
B. Loss of pressure head in laminar flow	2. Proportional to the mean velocity
C. Reynold number is more than 4000	3. The flow is laminar in pipes
D. Loss of pressure head in turbulent flow	4. Proportional to square of velocity

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Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	4	1
(c)	3	2	1	4
(d)	1	4	3	2

7.321. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. $\frac{\rho VD}{\mu}$	1. Darcy-Weisbach equation
B. $\frac{4fLV^2}{d \times 2g}$	2. Coefficient of friction in terms of shear stress
C. $\frac{2\tau_0}{\rho V^2}$	3. Reynold's number (Re)
D. $\rho u'V'$ (where u', V' are fluctuating components)	4. Reynold's turbulent shear stress

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	4	1	2
(d)	2	1	4	3

7.322. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Chezy's formula for loss of head in pipes	1. $h_f = \frac{4fLV^2}{d \times 2g}$
B. Darcy-Weisbach formula for loss of head in pipes due to friction	2. Centre of pressure
C. The intensity of pressure for a liquid at rest is equal in all directions	3. Pascal's law
D. The point of application of the resultant pressure on an immersed surface	4. $V = C\sqrt{mi}$

Codes :

	A	B	C	D
(a)	1	2	4	3
(b)	4	1	3	2
(c)	2	1	4	3
(d)	4	3	2	1

7.323. Match List I with List II and choose the correct answer by using codes given under the lists :

List I	*List II*
A. Vena-contracta	1. $\sqrt{2g}$ H where H is height of water level above the centre of orifice
B. Theoretical velocity of flow through an orifice	2. Varies from 0.95 to 0.99
C. Coefficient of velocity	3. occurs at a distance of half the diameter of the orifice
D. Coefficient of contraction	4. Varies from 0.61 to 0.69

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	3	1	2	4
(d)	4	1	2	3

7.324. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Coefficient of velocity (Cv)	1. 0.64
B. Coefficient of contraction (Cc)	2. 0.62
C. Coefficient of discharge	3. 0.98
D. Kinetic energy correction factor (α) for viscous flow through circular pipe	4. 2.00

Codes :

	A	B	C	D
(a)	3	1	2	4
(b)	3	2	1	4
(c)	4	3	1	2
(d)	2	1	4	3

7.325. Match List I with List II and select the correct answer by using codes given below the lists :

List I (Type of mouth piece)	*List II (Coefficient of discharge)*
A. External mouth piece	1. 0.707
B. Internal mouth piece running full	2. 0.500
C. Internal mouth piece running free	3. 0.855

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D. Convergent mouth piece — 4. 1.000

Codes:

	A	B	C	D
(a)	2	3	4	1
(b)	1	3	4	2
(c)	3	1	2	4
(d)	1	3	2	4

7.326. Match List I with List II and choose the correct answer by using codes given below the lists :

List I	*List II*
A. Discharge through fully submerged orifice	1. $Cdb\,(H_2 - H)\sqrt{2g}$ $H+2/3\ Cdb\sqrt{2g}$ $[H^{3/2} - H_1^{3/2}]$
B. Discharge through partially submerged orifice	2. $Cd.b.(H_2 - H_1)\sqrt{2gh}$
C. Discharge through a large rectangular orifice	3. $\frac{2}{3} Cd.b.\sqrt{2g}\ [H_2^{3/2} - H_1^{3/2}$
D. Time of emptying a tank through an orifice at its bottom	4. $\frac{2A\ [\sqrt{H_1} - \sqrt{H_2}]}{Cda\sqrt{2g}}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	4	1
(c)	2	1	3	4
(d)	1	3	2	4

7.327. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Head loss due to sudden expansion of pipe	1. $0.5\frac{V^2}{2g}$
B. Head loss due to sudden contraction of pipe	2. $\frac{V^2}{2g}$
C. Head loss at the entrance of a pipe	3. $\frac{(V_1 - V_2)^2}{2g}$
D. Head loss at the exit of pipe	4. $\left(\frac{1}{C_c} - 1\right)^2 \frac{V_2^2}{2g}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	3	2	1	4
(d)	4	1	2	3

7.328. Match list I with List II and select the correct answer by selecting the appropriate codes given below lists:

List I	*List II*
A. Head loss due to friction by Darcy formula	1. $\frac{V^2}{2g}$
B. Head loss due to friction by Chezy's formula	2. 7.4 m of water
C. Head loss at the exit of pipe	3. $\frac{4fLV^2}{d \times 2g}$
D. Max. vacuum at the syphon summit	4. $C\sqrt{mi}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	4	1	2
(d)	1	4	3	2

7.329. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. The nozzle transmits maximum power	1. $\left(\frac{D^5}{8fL}\right)^{\frac{1}{4}}$ where D is pipe diameter
B. For maximum power transmission by nozzle diameter of nozzle	2. $\frac{\omega Q}{75}\left[H - \frac{4fLV^2}{d \times 2g}\right]$
C. Horse power transmitted through nozzle	3. $h_f = \frac{H}{3}$
D. Velocity of water at the outlet of nozzle	4. $\sqrt{\frac{2gh}{1 + \frac{4fL}{D} \times \frac{a^2}{A_2}}}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	1	4	3	2
(d)	3	1	2	4

7.330. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. The ratio of inertia force of a flowing fluid and the viscous force of the fluid	1. Froude's number

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B. The square root ofthe ratio of inertia force of a flowing fluid to the gravity force	2. Mach's Number
C. The square root of the ratio of the inertia force of a flowing fluid to the pressure force	3. Reynold number
D. The square root of the ratio of the inertia force of a flowing fluid to the elastic force	4. Euler's number

Codes:

	A	B	C	D
(a)	3	2	4	1
(b)	1	2	3	4
(c)	3	1	4	2
(d)	4	2	3	1

7.331. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Based on Froude model law)	*List II (Scale ratio)*
A. Scale ratio for time	1. L_r^3
B. Scale ratio for acceleration	2. $L_r^{2.5}$
C. Scale ratio for discharge	3. 1
D. Scale ratio for force	4. $\sqrt{L_r}$

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4
(c)	3	4	2	1
(d)	1	3	2	4

7.332. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. In steady flow in open channel	1. Velocity of flow, depth of flow, slope of the channel and cross-section remain constant.
B. In uniform flow in open channel	2. Depth of flow, velocity of flow, rate of flow do not change
C. In open channel flow is laminar	3. If Reynold's number is more than 2000
D. In open channel, flow is turbulent	4. If Reynold's number is less than 500

Codes :

	A	B	C	D
(a)	1	4	3	2
(b)	2	1	4	3
(c)	1	2	3	4
(d)	3	2	4	1

7.333. Match List I with List II and select the correct answer by using codes given under the lists for the canal whose dimensions are:

Width of canal	6m
Depth of water	3 m
Bed slope of canal	1 in 2000
Chezy's constant C	55

List I	*List II*
A. Area of water cross-section	1. 12m
B. Perimeter of water	2. 1.5m
C. $18m^2$	3. 18 m^2
D. Hydraulic mean depth Rate of flow	4. 27.11 m^3/sec.

Codes :

	A	B	C	D
(a)	3	1	2	4
(b)	3	4	1	2
(c)	2	1	3	4
(d)	4	3	1	2

7.334. Match list I with List II and select the correct answer by using codes given under the lists for the open channel whose dimensions are as below :

Bottom width	8 m
Side slope	1 horizontal to 3 verticals
Depth of water	3 m
Bed slope	1 in 5000
Chezy's constant C	50

List I	*List II*
A. Wetted perimeter	1. 26.25m3
B. Area of water cross-section	2. 14.32m
C. Hydraulic mean depth	3. 27 m
D. Discharge Q	4. 1.89

Codes :

	A	B	C	D
(a)	1	4	3	2
(b)	2	3	4	1

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(c)	2	3	1	4
(d)	1	4	2	3

7.335. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Chezy's formula for discharge in open channel	1. $C = \dfrac{157.6}{1.81 + \dfrac{K}{\sqrt{m}}}$
B. Chezy's constant by Bazin's formula	2. $C = \dfrac{1}{N} m^{1/6}$
C. Chezy's constant by Kutter formula	3. $Q = A \times C \sqrt{mi}$
D. Manning's formula	4. $C = + \dfrac{23 + \dfrac{0.00155}{i} + \dfrac{1}{N}}{1 + \left(23 + \dfrac{0.00155}{i}\right) \dfrac{N}{\sqrt{m}}}$

Codes :

	A	B	C	D
(a)	1	3	4	2
(b)	3	1	4	2
(c)	2	4	1	3
(d)	3	4	1	2

7.336. Match List I with List II and select the correct answer by using codes given below the lists :

List I	List II
A. For maximum discharge through a circularchannel	1. depth of water = 0.81 times the diameter
B. For maximum velocity of flow, through a circular channel	2. half top width = length of one sloping side
C. For most economical trapezoidal section	3. depth of flow = 0.95 times the diameter
D. For most economical trapezoidal section	4. hydraulic mean depth = half the depth of water flow

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	4	3	2	1
(c)	3	1	2	4
(d)	1	4	2	3

7.337. Match list I with List II and select the correct answer by using codes given below the lists ;

List I	*List II*
A. The flow at which the specific energy is minimum	1. 1.5 hc
B. Maximum specific energy	2. Critical flow
C. Velocity of flow at the critical depth	3. Critical velocity
D. Depth of flow at which the specific energy is minimum	4. Critical depth

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	3	4
(c)	3	1	2	4
(d)	2	1	4	3

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8

Water Supply Engineering

8.1. Water contains
(a) one hydrogen atom and one oxygen atom
(b) two hydrogen atoms and one oxygen atom
(c) one hydrogen atom and two oxygen atoms
(d) three hydrogen atoms and two oxygen atoms
(e) two hydrogen atoms and three oxygen atoms.

8.2. In nature water may occur as
(a) liquid (b) solid
(c) vapours (d) all the above.

8.3. Water is useful for
(a) running hydroelectric turbines
(b) floating the boats and ships
(c) providing steam for running locomotives
(d) warming dwelling units
(e) all the above.

8.4. Hydrology is the science which deals with
(a) rain water (b) river water
(c) sea water
(d) surface and underground water
(e) flood water.

8.5. Unit Hydrograph theory was enunciated by
(a) Merril Bernard (b) W.W. Horner
(c) Le-Roy K. Shermen (d) Robert E. Horten.

8.6. The theory of infiltration capacity was given by
(a) Merrill Bernard (b) W.W. Horner
(c) Le-Roy K. Shermen (d) Robert E. Horten.

8.7. Knowledge of hydrology is necessary for civil engineers for
(a) designing and construction of irrigation structures
(b) designing and construction of bridges and culverts
(c) flood control works (d) all the above.

8.8. Hydrology helps in
(a) predicting maximum flows
(b) deciding the minimum reservoir capacity
(c) forecasting the availability of quantity of water at reservoir site
(d) predicting the effects on the river water level on completion of dams
(e) all the above.

8.9. Pick up the correct statement from the following :
(a) Rivers, lakes, oceans and springs get water from the rains
(b) Rain water is obtained by evaporation from rivers, lakes and oceans
(c) Water remains in atmosphere as vapours
(d) Hydrologic cycle is a continuous process of evaporation and precipitation of water in atmosphere
(e) all the above.

8.10. Pick up the correct statement from the following :
(a) Rain which is intercepted by buildings, vegetations and other objects, is generally known as rainfall interception
(b) The difference between the total rainfall and intercepted rainfall, is generally called ground rainfall
(c) When rainfall exceeds the interception rainfall, water reaches the ground and infiltration starts
(d) The maximum rate of absorbing water by the soil in any given condition, is known as infiltration capacity
(e) All the above.

8.11. The surface Run-off is the quantity of water
(a) absorbed by soil
(b) intercepted by buildings and vegetative cover
(c) required to fill surface depressions
(d) that reaches the stream channels
(e) that gets evaporated.

8.12. The surface run off is due to
(a) initial rain (b) residual rain
(c) rain in the net supply interval
(d) all the above.

8.13. Pick up the correct statement from the following :
(a) Run off and surface run off are the same
(b) Run off includes the water flowing over the surface
(c) Run off is sometimes called discharge of the river
(d) Surface run off is sometimes called stream flow.

8.14. Pick up the correct statement from the following :
(a) Yield of a drainage basin is the run off at any time
(b) Yield of a drainage basin is the run off over long periods
(c) Yield of a drainage basin is expressed as surface run off per year
(d) Run off is expressed as total volume per day
(e) None of these.

8.15. Run off includes
(a) precipitation over catchment area of the stream and its attributaries
(b) surface run off
(c) ground water flow
(d) all the above.

8.16. Pick up the correct equation from the following :

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(a) Run off = Surface run off + Ground water flow
(b) Run off = Surface run off – Ground water flow
(c) Run off = Surface run off + Ground water flow
(d) Run off = Surface run off × Ground water flow.

8.17. Hydrograph is a graphical representation of
(a) surface run off (b) ground water flow
(c) rain fall
(d) discharge flowing in the river
(e) none of these.

8.18. Pick up the correct statement from the following :
(a) Hydrograph is a plot of discharge and time
(b) In hydrographs, time is plotted on X-axis
(c) The maximum flow in the river due to rainfall, is called peak flow
(d) Peak flows are different for rainfalls
(e) All the above.

8.19. Infiltration capacity of soil depends upon
(a) number of voids present in the soil
(b) shape and size of soil particles
(c) arrangement of soil particles
(d) compaction of the soil particles
(e) all the above.

8.20. Pick up the correct statement from the following :
(a) When rainfall rate exceeds the infiltration capacity, the water enters the soil at full capacity rate
(b) When rainfall rate is less than the infiltration capacity, the infiltration rate is approximately equal to the rainfall rate
(c) The actual infiltration rate at any time may be equal to or less than the infiltration capacity
(d) The actual prevailing rate of infiltration of water in the soil at any time, is known as infiltration rate
(e) All the above.

8.21. A soil strata may consist of
(a) soil zone (b) intermediate zone
(c) capillary zone (d) ground water zone
(e) all the above.

8.22. Pick up the correct statement from the following :
(a) The amount of water retained on the surface of soil grains by molecular attraction, is known as pellicular water
(b) The degree of resistance to movement of the pellicular water generally expressed by the surface tension
(c) The pellicular water held in any soil, is called field capacity
(d) The portion of the pellicular water absorbed by the root action of the vegetation, is called available moisture
(e) All the above.

8.23. Pick up the correct statement from the following :
(a) The portion of pellicular water which remains unutilised, is called hygroscopic water
(b) The moisture content at which permanent wilting of plants takes place, is called the wilting point
(c) The path of the water required to bring the soil moisture content of a soil up to its field capacity is called soil moisture deficiency
(d) The moisture deficiency will be different at different points
(e) All the above.

8.24. The main factor which affects the infiltration capacity, is
(a) thickness of saturated layer
(b) depth of surface detention
(c) soil moisture
(d) all the above.

8.25. The infiltration capacity during rain storm, is considerably reduced due to
(a) surface detention (b) soil moisture
(c) compaction due to rain (d) washing of fine particles
(e) all the above.

8.26. According to Robert E. Horton, the equation of infiltration capacity curve, is
(a) $f = f_c (f_o - f_c) e^{kt}$ (b) $f = f_t - (f_o - f_c) e^{-kt}$
(c) $f = ft + (f_o - f_c) e^{-kt}$ (d) $f = f + (f_o - f_c) e^{kt}$
where letters carry their usual meanings.

8.27. Rain simulators are used for the determination of
(a) evaporation (b) precipitation
(c) run off (d) infiltration capacity
(e) none of these.

8.28. If the slope of a line for infiltration capacity curve is $\frac{1}{1.737}$, the value of constant k in Horton's equation of infiltration capacity curve, is
(a) 2.0 (b) 2.5
(c) 3.0 (d) 3.5
(e) 4.0.

8.29. The equation $P - Q = Te\ \phi_{index}$ for determining the infiltration capacity, was suggested by
(a) Horton (b) Horner
(c) Llyod (d) Bernard.

8.30. Pick up the correct statement from the following :
(a) If ground water enters the channel, the channel is known as effulent channel
(b) If water goes out of channel to meet ground water, the channel is said to be influent stream
(c) If the water table is at higher level than the water level in channel, ground water flows to the stream
(d) If the water level in stream is higher than the water table level, water from the channel enters into ground water
(e) All the above.

8.31. Precipitation includes
(a) rain (b) snow
(c) hail (d) all of these.

8.32. Pressure exerted by fully saturated air, is known
(a) partial pressure
(b) vapour pressure

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(c) saturation vapour pressure
(d) saturation pressure
(e) (c) and (d) of the above.

8.33. A volume of air at constant barometric pressure may be brought to dew point by
(a) increasing the temperature
(b) decreasing the temperature
(c) neither (a) nor (b)
(d) both (a) and (b).

8.34. If the dew point is greater than 0°C
(a) dew will be formed (b) frost will be formed
(c) vapours will be formed (d) neither of these.

8.35. Humidity refers to
(a) temperature of the air (b) pressure of the air
(c) moisture content of the air (d) volume of the air.

8.36. Relative humidity is the ratio of actual vapour pressure to the saturation vapour pressure
(a) at the same temperature (b) at the same pressure
(c) in the same volume (d) in the atmosphere.

8.37. Pick up the correct statement from the following :
(a) Absolute humidity at a given temperature is equal to weight of moisture present in a unit volume
(b) Relative humidity is the ratio of actual vapour pressure and saturation vapour pressure at the same temperature
(c) Relative humidity is the ratio of the weight of the vapours present per unit volume to the weight of vapours which could be contained at the same temperature when fully saturated
(d) Humidity can be measured by psychrometer
(e) All the above.

8.38. Absolute humidity in air
(a) decreases at higher altitudes
(b) increases at higher altitudes
(c) remains constant at all altitudes
(d) none of these.

8.39. Precipitation caused by lifting of an air mass due to the pressure difference, is called
(a) cyclonic precipitation
(b) convective precipitation
(c) orographic precipitation
(d) none of these.

8.40. Pick up correct statement from the following :
(a) The air from outer portion of cyclones gets lifted for causing precipitation
(b) The air from central portion of cyclones gets lifted for causing precipitation
(c) The air from entire surface of the cyclones gets lifted for causing precipitation
(d) None of those.

8.41. Precipitation caused due to upward movement of warmer air as compared to surrounding air, is called
(a) cyclonic precipitation (b) convective precipitation
(c) orographic precipitation (d) none of these.

8.42. Precipitation caused due to striking of air masses with a topographical feature, is called
(a) orographic precipitation
(b) convective precipitation
(c) cyclonic precipitation
(d) none of these.

8.43. Pick up the correct statement from the following :
(a) Central portion of a cyclone acts as a chimney through which air gets lifted
(b) Cyclonic precipitation caused by a warm front is generally continuous
(c) Convective precipitation generally occurs in the form of showers of high intensity in short duration
(d) Greatest amount of orographic precipitation falls in the windward side of the barrier
(e) All the above.

8.44. Non-recording rain gauges
(a) collect the rain whose volume is measured by means of graduated cylinders
(b) collect the rain which is directly measured by means of graduated cylinders in centimetres of water depth
(c) are generally used in hilly terrain
(d) are cylindrical in shape.

8.45. Indian Meteorological department uses the standard gauges whose collectors have apertures of
(a) 50 or 100 sq. cm area (b) 100 or 150 sq. cm area
(c) 100 or 200 sq. cm area (d) 250 or 500 sq. cm area.

8.46. The polythene bottles are used for collecting rain water and their capacities is
(a) 2 litres (b) 4 litres
(c) 10 litres (d) all the above.

8.47. The specifications of most commonly used standard gauges in India, are
(a) 200 sq. cm collector and 4 litres bottle
(b) 100 sq. cm collector and 2 litres bottle
(c) 200 sq. cm collector and 10 litres bottle
(d) 100 sq. cm collector and 4 litres bottle.

8.48. The standard height of a standard rain gauge, is
(a) 10 cm (b) 20 cm
(c) 30 cm (d) 50 cm.

8.49. In India, rain fall is generally recorded at
(a) 8 A.M. (b) 12 Noon
(c) 4 P.M. (d) 8 P.M.

8.50. A recording type rain gauge
(a) produces a mass curve of rain fall
(b) records the cumulative rain
(c) is sometimes called integrating rain gauge or continuous rain gauge
(d) all the above.

8.51. Symon's rain gauge is
(a) tipping-bucket gauge (b) weighing type gauge
(c) float recording gauge (d) non-recording gauge.

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8.52. In India the recording type rain gauge generally used, is
(*a*) weighing type (*b*) tipping type
(*c*) float recording type (*d*) none of these.

8.53. The deficiency in rain catch due to vertical acceleration of air forced upward over the gauge, is
(*a*) greater for heavy rain (*b*) greater for lighter rain
(*c*) greater for large drops
(*d*) lesser for small rain drops.

8.54. Pick up the correct statement from the following :
(*a*) Higher the gauge, more deficient will be the rain catch
(*b*) Heavier the rain, lesser will be the rain catch
(*c*) The trees serving as wind brakes in the vicinity of the gauge, should not subtend angles greater than 45°
(*d*) Coniferrous forest is idealy suited for installing the gauge
(*e*) All the above.

8.55. If a gauge is installed perpendicular to the slope, its measurement is reduced by multiplying
(*a*) sine of the angle of inclination with vertical
(*b*) cosine of the angle of inclination with vertical
(*c*) tangent of the angle of inclination with vertical
(*d*) calibration coefficient of the gauge.

8.56. The respective storm totals at three surrounding stations A, B and C are 110, 90 and 70 mm. If the normal annual precipitation amounts at stations X, A, B and C are respectively 1000, 1100, 1200 and 1250 mm, the estimated storm precipitation at X is
(*a*) 75 mm (*b*) 77 mm
(*c*) 79 mm (*d*) 81 mm.

8.57. The rainfall cycle period in India is taken as
(*a*) 15 years (*b*) 20 years
(*c*) 25 years (*d*) 30 years
(*e*) 35 years.

8.58. Pick up the correct statement from the following :
(*a*) Index of wetness = $\frac{\text{actual rainfall in a year at a place}}{\text{normal rainfall of that place}}$
(*b*) Normal annual rainfall is obtained by taking the mean of the annual rainfall over a period of 35 years
(*c*) Index of wetness gives an idea of the wetness of the year
(*d*) If the rainfall in a year is approximately equal to the annual average value, the particular year is said to be an average year
(*e*) All the above.

8.59. Isohytes are the imaginary lines joining the points of equal
(*a*) pressure (*b*) height
(*c*) humidity (*d*) rainfall.

8.60. The area enclosed by the adjacent isohyets of a catchment basin are shown under :

Isohyets in cms	40-50	50-60	60-70	70-80	80-90
Area in sq. km	1500	2500	3000	2000	1000

The average depth of annual precipitation in the catchment basin will be
(*a*) 60.0 cm (*b*) 60.5 cm
(*c*) 61.5 cm (*d*) 62.5 cm
(*e*) 63.5 cm.

8.61. For determination of average annual precipitation in a catchment basin, the best method is
(*a*) Arithmetical method (*b*) Thiessen's mean method
(*c*) Isohyetal method (*d*) None of these.

8.62. While calculating the average depth of annual precipitation in a catchment basin, importance to individual raingauge station is given in
(*a*) Arithmetical method (*b*) Thiessen's mean method
(*c*) Isohyetal method (*d*) both (*a*) and (*b*)
(*e*) both (*b*) and (*c*).

8.63. The rainfall at any place is described by
(*a*) its intensity (*b*) its duration
(*c*) its frequency (*d*) all the above.

8.64. Pick up the correct statement from the following :
(*a*) The intensity of rain is the rate at which it falls
(*b*) The duration of rain is the time for which it falls with a given intensity
(*c*) The frequency of rain is the number of times, if falls
(*d*) All the above.

8.65. The recurrence interval (R.I.) of 20 cm rain storm at a place is 5 years.
(*a*) The place will definitely have 20 cm rain storm after every five years
(*b*) The place may have 20 cm rain storm after every five years
(*c*) The place may have 20 cm rain storm within a set of years twice
(*d*) None of these.

8.66. Pick up the incorrect statement from the following :
(*a*) At two meteorologically homogeneous stations, the average annual precipitation is same
(*b*) If the average annual precipitation at two places same these are meteorologically homogeneous stations
(*c*) Neither (*a*) nor (*b*)
(*d*) Both (*a*) and (*b*).

8.67. Sharp crested weirs are generally used
(*a*) for large flows (*b*) for small flows
(*c*) for streams carrying high sediment loads
(*d*) for rivers carrying floating debris
(*e*) none of these.

8.68. The critical depth in a channel can be produced
(*a*) by raising the bottom of the channel
(*b*) by lowering the bottom of the channel
(*c*) by decreasing the width of the channel
(*d*) by increasing the width of the channel
(*e*) both (*a*) and (*c*) of above.

8.69. Pick up the correct statement from the following :
(*a*) The throat of the section of a control meter is either rectangular or trapezoidal

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(b) The floor of the control meter throat is almost level
(c) The floor of the expanding outlet of the control meter is given a steep slope
(d) A properly designed control meter is associated with the phenomena of hydraulic jump
(e) All the above.

8.70. A hydraulic jump in a control meter will be formed above the control, if its original
(a) depth is more than critical depth
(b) depth is less than the critical depth
(c) depth is equal to critical depth
(d) none of these.

8.71. For efficient working of a control meter, its throat length is approximately kept
(a) equal to the critical depth
(b) twice the critical depth
(c) three times the critical depth
(d) four times the critical depth.

8.72. A control meter is preferred to a weir because
(a) it measures the discharge even in silt laiden streams
(b) the velocity of approach of the channel increases above the control, and thus removes the silt completely
(c) it is not damaged by floating debris
(d) all the above.

8.73. A river is said to be of uniform section if in its section
(a) a segment of a circle can be fitted
(b) a parabolic section can be fitted
(c) a rectangular section can be fitted
(d) a trapezoidal section can be fitted
(e) all the above.

8.74. Discharge curve may be extended by logarithmic method if
(a) cross section of river is uniform
(b) river is broader and shallower
(c) river is of any type
(d) none of these.

8.75. Prof. Kunning suggested the method for extending the discharge curve. It is known as
(a) Logarithmic method (b) $\sqrt{y}$ method
(c) General method (d) None of these.

8.76. The best instrument for measuring the velocity of a stream flow is
(a) pitot tube (b) Price's current meter
(c) surface float (d) sub-surface float.

8.77. If y is the depth of water at any section, then the mean velocity is
(a) $0.1\,y$ (b) $0.2\,y$
(c) $0.3\,y$ (d) $0.5\,y$
(e) $0.6\,y$.

8.78. The average mean velocity of a stream having depth h, may be obtained by taking the average of the readings of a current meter at a depth of
(a) $0.1\,h$ and $0.9\,h$ (b) $0.2\,h$ and $0.8\,h$
(c) $0.3\,h$ and $0.7\,h$ (d) $0.4\,h$ and $0.6\,h$.

8.79. If the velocities of flow of a stream of 10 m depth recorded by a current meter at depths of 2 m and 8 m are 0.7 m and 0.3 m respectively, the discharge per unit width of the stream in cubic metres, is
(a) 2 (b) 3
(c) 4 (d) 5
(e) 6.

8.80. The run off is affected by
(a) type of precipitation
(b) rain intensity and duration of rainfall
(c) rain distribution and soil moisture deficiency
(d) direction of prevailing storm
(e) all the above.

8.81. The run off is affected by
(a) size of the basin
(b) shape of the basin
(c) elevation of the water shed
(d) all the above.

8.82. The form factor of a drainage basin is obtained by dividing
(a) area of the basin by the axial length
(b) average width of the basin by the axial basin
(c) area of the basin by the square of the axial length
(d) both (a) an (b)
(e) both (b) and (c).

8.83. If P and A are the perimeter and area of a drainage basin, its compactness coefficient, is
(a) $\frac{P^2}{2\pi A}$ (b) $\frac{P}{2\pi A}$
(c) $\frac{P}{2\sqrt{\pi A}}$ (d) $\frac{P^3}{\pi^3 A}$

8.84. The area of a drainage basin whose axial length is 100 km is 2500 sq. km. Its form factor is
(a) 0.10 (b) 0.20
(c) 0.25 (d) 0.30
(e) 0.35.

8.85. If the axial length of a drainage basin is 35 km and its form factor is 0.2, the total area of the basin is
(a) 205 sq. km. (b) 215 sq. km.
(c) 225 sq. km. (d) 235 sq. km.
(e) 245 sq. km.

8.86. The elevation Z of the watershed is :
(a) reduced level of the top most point of the basin
(b) reduced level of the lower most point of the basin
(c) average elevation of the highest and lowest point of the drainage basin
(d) obtained by the formula

$$Z = \frac{a_1 z_1 + a_2 z_2 + a_3 z_3 + a_n z_n}{A}$$

where letters carry their usual meanings.

8.87. Run off is measured in
(a) cubic metres (b) cubic metres per sec.
(c) cubic metres per minute (d) cubic metres per hour.

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8.88. The time required by rain water to reach the outlet of drainage basin, is generally called
(*a*) time of concentration
(*b*) time of overland flow
(*c*) concentration time of overland flow
(*d*) duration of the rainfall
(*e*) none of these.

8.89. Time of overland flow, is affected by
(*a*) slope of the basin
(*b*) type of the ground surface
(*c*) length of the flow path
(*d*) all the above.

8.90. The initial basin recharge is equal to
(*a*) interception
(*b*) depression storage
(*c*) rain absorbed by the moisture deficiency
(*d*) all the above.

8.91. The run off a drainage basin is
(*a*) Initial recharge + ground water accretion + precipitation
(*b*) Precipitation + ground water accretion + initial recharge
(*c*) Precipitation – ground water accretion + initial recharge
(*d*) Precipitation – ground water accretion – initial recharge.

8.92. For computing the run off volumes of large areas, number of infiltrations used are
(*a*) 2 (*b*) 3
(*c*) 4 (*d*) 5.

8.93. The rate of rainfall for successive 10 minute periods of a 60 minute duration storm, are shown in Fig. 8.1.

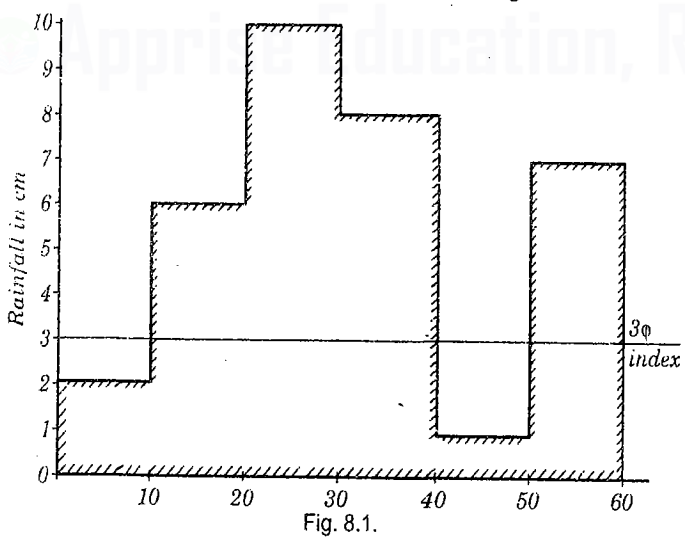

Fig. 8.1.

If the value of ϕ_{index} is 3 cm/hour, the run off will be
(*a*) 2 cm (*b*) 3 cm
(*c*) 4 cm (*d*) 5 cm.

8.94. From the pattern of the rainfall shown in Fig. 8.1, the total precipitation is
(*a*) 4 cm (*b*) 4.5 cm
(*c*) 5 cm (*d*) 5.5 cm (*e*) 6 cm.

8.95. From the data of the rain storm shown in Fig. 8.1, the value of W_{index} is
(*a*) 1.5 cm/hour (*b*) 2 cm/hour
(*c*) 2.5 cm/hour (*d*) 2 cm/hour.

8.96. The rational formula for calculating the discharge, is
(*a*) $\left(\frac{1}{12}\right) K.p_o\left(\frac{1}{1+T_e}\right).A$
(*b*) $\left(\frac{1}{24}\right) K.p_o\left(\frac{2}{1+T_e}\right).A$
(*c*) $\left(\frac{1}{36}\right) K.p_o\left(\frac{2}{1+T_e}\right).A$
(*d*) $\left(\frac{1}{48}\right) K.p_o\left(\frac{1}{1+T_e}\right).A$
where A is the area of basin and p_o is one hour rainfall.

8.97. Izzard formula for the time of concentration in minutes for the plots having no channels, is
(*a*) $T = \frac{111\, b.(L_o)^{1/3}}{(Kp)^{2/3}}$ (*b*) $T = \frac{222\, b.(L_o)^{1/2}}{(Kp)^{1/3}}$
(*c*) $T = \frac{333\, b.(L_o)}{(Kp)}$ (*d*) $T = \frac{111\, b.(L_o)^{1/3}}{(Kp)^{2/5}}$.
where L_o is the length of overland flow in metres and K_p rainfall intensity in cm/hour.

8.98. The formula for calculating the overland flow time (T_o) in hours for any basin, is
(*a*) $T_o = \left(0.225 \frac{L_o^3}{H}\right)^{0.385}$
(*b*) $T_o = \left(0.665 \frac{L_o^3}{H}\right)^{0.385}$
(*c*) $T_o = \left(0.435 \frac{L_o^3}{H}\right)^{0.385}$
(*d*) $T_o = \left(0.885 \frac{L_o^3}{H}\right)^{0.385}$
where L_o is the distance of the critical point and H is the difference in elevation

8.99. From the Survey of India map, the distance of the critical point is 20 km and difference in elevation is 193 m. The over land flow time, is
(*a*) 2 hours (*b*) 3 hours
(*c*) 2 hours and 30 minutes (*d*) 3 hours and 30 minutes
(*e*) 4 hours.

8.100. A unit hydrograph is a hydrograph of a rain storm of a specified duration resulting from a run-off of
(*a*) 15 mm (*b*) 20 mm
(*c*) 25 mm (*d*) 30 mm.

8.101. Pick up the correct statement from the following :
(*a*) The specified duration of unit hydrograph, is called unit duration
(*b*) The rain during specified duration, is called unit storm

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(c) A unit hydrograph for a particular unit duration may be utilised for evaluating the run off hydrographs of other storms of like durations

(d) The number of unit hydrographs for a given basin, is theoretically infinite

(e) All the above.

8.102. If the area of storm hydrograph is equal to 10^2 cm, the ordinates of a unit hydrograph may be obtained by dividing the ordinates of the storm hydrograph by

(a) 0.5 (b) 1
(c) 2 (d) 3
(e) 4.

8.103. Pick up the correct statement from the following :

(a) The unit hydrograph of a specified unit duration obtained from the past data can be used to obtain the hydrograph of future storms of like duration

(b) To obtain the ordinates of storm hydrograph, the ordinates of unit hydrograph are multiplied by the multiplying factor

(c) The multiplying factor for storm hydrograph may be obtained by dividing the run off in mm by 25 mm

(d) A tolerance of about 25% of specified duration of unit hydrograph may be accepted without any serious error

(e) All the above.

8.104. The best unit period of a unit hydrograph, is equal to basin lag divided by

(a) 2 (b) 3
(c) 4 (d) 5.

8.105. Bernard's distribution graph is a plot of time on X-axis and

(a) run off on the y-axis
(b) total run off on the y-axis
(c) percentage of total surface run off on y-axis
(d) percentage of total surface run off during uniform time intervals on y-axis
(e) none of these.

8.106. If total run off of a basin of 50 hectares is 0.8 cm, the ordinate of Bernard's distribution graph, may be calculated by the formula

(a) $y = 50\ Q$ (b) $y = 100\ Q$
(c) $y = 150\ Q$ (d) $y = 200\ Q$
(e) $y = 250\ Q$

where Q is the discharge in cumecs at the given time.

8.107. An intense rain is falling at a uniform rate of 7.5 cm/hour for a period of 60 minutes on a basin whose areas is 500 hectares. If the average infiltration capacity during the entire rain period is assumed to be 1.5 cm/hr, the maximum run-off rate based on 10 minute peak percentage of 16% from distributing graph of the basin, is

(a) 40 cumecs (b) 60 cumecs
(c) 80 cumecs (d) 100 cumecs.

8.108. If s is the potential infiltration, P is rainfall in cm in a drainage of a soil with fair pasture cover, the direct run off Q in cm is given by

(a) $Q = \dfrac{(P - 0.1\ S)^2}{P + 0.4\ S}$ (b) $Q = \dfrac{(P - 0.2\ S)^2}{P + 0.6\ S}$

(c) $Q = \dfrac{(P - 0.2\ S)^s}{P + 0.8\ S}$ (d) $Q = \dfrac{(P - 0.8\ S)^2}{P + 0.2\ S}$.

8.109. If the potential infiltration of a water shed having a soil with fair pasture cover, is 10 cm and rainfall is 12 cm, the direct run off is :

(a) 2 cm (b) 3 cm
(c) 5 cm (d) 8 cm.

8.110. Pick up the correct statement from the following :

(a) The zone below water table, is called zone of saturation
(b) The zone above water table, is called zone of aeration
(c) The water which exists in the zone of saturation, is called ground water
(d) Water in the zone of saturation, remains under hydrostatic pressure
(e) All the above.

8.111. Pick up the correct statement from the following :

(a) The ratio of total volume of voids in soil aggregates to the total volume of aggregate, is called Porosity
(b) Water retained by the interstices due to molecular attraction, is called pellicular water
(c) The ratio of volume of water obtained by gravity drainage to the total volume of the materials drained, is called 'yield'
(d) Sum of the percentage of specific yield and specific retention is 100
(e) All the above.

8.112. The quantity of water retained by the sub-soil against gravity, is known

(a) yield (b) porosity
(c) specific yield (d) specific retention
(e) none of these.

8.113. If the grain size of soil increases

(a) surface area decreases
(b) specific retention decreases
(c) specific yield increases
(d) water supply in well increases
(e) all the above.

8.114. Pick up the incorrect statement from the following :

(a) The rate of flow of water through a unit cross-sectional area under a unit hydraulic gradient, is called coefficient of permeability
(b) The rate of flow of water through a vertical strip of the acquifer of unit width and full depth under a unit hydraulic gradient, is called coefficient of transmissibility
(c) The flow of water through acquifers, is governed by the Darcy's law
(d) The term 'transmissibility' was introduced by Meinzer
(e) The ratio of coefficient of transmissibility and coefficient of permeability, is equal to the depth of acquifer through which water flows.

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8.115. With the usual meanings of letters, the equation $V = 400\, I \frac{D_{10}^2}{4}$ is used for determining the velocity of ground water flow in metres per day. It is known as

(*a*) Meinzer's formula (*b*) Slichter's formula
(*c*) Darcy's formula (*d*) Hazen's formula.

8.116. The equation $V = \frac{1000\, ID_{10}^2}{60} \times (1.8\, T + 42)$ which is used for determining the velocity of ground water flow in metres per day is known as

(*a*) Meinzer's formula (*b*) Slichter's formula
(*c*) Darcy's formula (*d*) Hazen formula.

8.117. If the viscosity of ground water is 1.00, the Slitcher's constant is 400, the effective size of soil particles in acquifer is 0.5 mm and hydraulic gradient is 1 in 80, the velocity of flow is

(*a*) 0.25 m/day (*b*) 0.50 m/day
(*c*) 0.75 m/day (*d*) 1.00 m/day
(*e*) 1.25 m/day.

8.118. Pick up the correct statement from the following :

(*a*) A confined bed of impervious material laid over an acquifer, is known as an aqui-clude
(*b*) The top most water bearing strata having no acquifer, is known as non-artesion acquifer
(*c*) The ordinary gravity wells which supply water from the top most water bearing strata, are called water table wells
(*d*) A permeable stratum which is capable to yield appreciate quantities of ground water, is known as an aquifer
(*e*) All the above.

8.119. Isopiastic lines are the contours

(*a*) drawn to represent water table
(*b*) drawn to represent piezometric heads
(*c*) drawn to piezometric surface
(*d*) none of these.

8.120. Pick up the correct statement from the following :

(*a*) Perched aquifer is found in unconfined aquifer
(*b*) The top surface of the water held in the perched aquifer, is known as perched water table
(*c*) Perched aquifer is formed in unfined accquifer if an impervious layer exists
(*d*) All the above.

8.121. Pick up the correct statement from the following :

(*a*) the rate of flow from a well per unit of draw-down is called specific capacity of the well
(*b*) the volume of water that an aquifer releases per unit surface area of the aquifer per unit change in head normal to the surface, is called the storage coefficient
(*c*) Infiltration wells are shallow wells constructed along the banks of rivers to collect the river water seeping through the river
(*d*) all the above.

8.122. While determining the yield of a gravity well by pumping, the depth of water table in two tests wells at distances r_1 and r_2 from the centre of the main well were found to be s_1 and s_2 respectively. Assuming the coefficient of transmissibility of the soil as T, the discharge Q may be given by

(*a*) $Q = \frac{\pi T(s_2 - s_1)}{2.3 \log_{10} \frac{r_1}{r_2}}$ (*b*) $Q = \frac{\pi T(s_1 - s_2)}{2.3 \log \frac{r_1}{r_2}}$

(*c*) $Q = \frac{2\pi t(s_1 - s_2)}{2.3 \log_{10} \frac{r_2}{r_1}}$ (*d*) $Q = \frac{2\pi t(s_2 + s_1)}{2.3 \log_{10} \frac{r_2}{r_1}}$.

8.123. According to Thiem, the permeability of an aquifer may be obtained from the equation

(*a*) $K = \frac{2.3\, Q \log_{10} \frac{r_2}{r_1}}{\pi(h_2^2 - h_1^2)}$ (*b*) $K = \frac{2.3\, Q \log_e \frac{r_2}{r_1}}{\pi(h_2^2 - h_1^2)}$

(*c*) $K = \frac{2.3\, Q \log_{10} \frac{r_2}{r_1}}{2\pi(s_1 - s_2)}$ (*d*) $K = \frac{2.3\, Q \log_{10} \frac{r_2}{r_1}}{2\pi T(s_1 - s^2)}$

(*e*) all the above.

8.124. In the derivation of Thiem's formula $Q = \frac{2\pi T(s_1 - s_2)}{2.3 \log_{10} \frac{r_2}{r_1}}$

the following assumption is not applicable

(*a*) The aquifer is homogeneous and isotropic
(*b*) Flow lines are radial and horizontal
(*c*) The slope of the water surface is too small
(*d*) The well has been sunk up to the surface of the unconfined aquifer
(*e*) None of these.

8.125. The coefficients of permeability of soils of an unconfined aquifer and another confined aquifer were determined by pumping water from the wells and observing the effect of water table in two test wells at equal distances was found to be equal. The total height of confined aquifer H is given by

(*a*) $H = h_2 - h_1$ (*b*) $H = h_1 - h_2$
(*c*) $H = h_2 + h_1$ (*d*) $\frac{1}{2}(h_1 + h_2)$.

8.126. The Dupuit formula is based on

(*a*) one observation well (*b*) two observation wells
(*c*) three observation wells (*d*) no observation well
(*e*) none of these.

8.127. The radius of influence is

(*a*) radius of the main well
(*b*) distance from the wall of main well to the point of zero draw down
(*c*) distance from the centre of main well to the point of zero draw down
(*d*) none of these.

8.128. When a constant discharge 2.91 litres/sec. was obtained in a pumping test, the draw downs in the test wells at 3 m and 6.184 m were 2.6 m and 0.3 m respectively. If over-all depth of the pumping well was 16 m, the permeability of the soil, is

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(a) 0.0005 cm/sec (b) 0.001 cm/sec
(c) 0.002 cm/sec (d) 0.01 cm/sec.

8.129. A well is sunk in an unconfined aquifer having a saturated depth of 100 m. Assuming the equilibrium flow conditions and a homogeneous aquifer and radius of influence to be same, the ratio of discharges at 20 m and 40 m draw downs, is
(a) 2/3 (b) 5/4
(c) 4/5 (d) 7/8
(e) 8/7.

8.130. A well penetrates to 30 m below the static water table. After 24 hours of pumping at 31.40 litres/minute, the water level in a test well at a distance of 80 m is lowered by 0.5 m and in a well 20 m away water is lowered by 1.0 m. The transmissibility of the auifer, is
(a) 1.185 m^2/minute (b) 1.285 m^2/minute
(c) 1.385 m^2/minute (d) 1.485 m^2/minute
(e) 1.585 m^2/minute.

8.131. Shrouding is provided in
(a) cavity type tube wells (b) slotted type tube wells
(c) strainer type tube wells
(d) perforated type tube wells.

8.132. If ω is unit weight of water, Q the discharge in cumecs, H the total head lift and η, the efficiency of the pump, the H.P. of the motor is
(a) H.P. $= \frac{\omega QH}{75\,\eta}$ (b) H.P. $= \frac{\omega QH}{4500\eta}$
(c) H.P. $= \frac{\omega Q\eta}{75\,H}$ (d) H.P. $= \frac{\omega Q\eta}{4500\,H}$.

8.133. The efficiency of a pump may be taken as
(a) 0.55 (b) 0.60
(c) 0.65 (d) 0.70.

8.134. If h is the loss due to friction in a pipe. Total losses in strainer and bends may be taken as
(a) 0.01 h (b) 0.45 h
(c) 0.20 h (d) 0.25 h
(e) 0.3 h.

8.135. If the loss due to friction in pipes is 4 m, the total losses in strainer and bends may be taken as
(a) 0.10 m (b) 0.20 m
(c) 0.5 m (d) 1.0 m.

8.136. Consumptive use of a crop during growth, is the amount of
(a) interception (b) transpiration
(c) evaporation (d) all the above.

8.137. Evaporation losses depend upon
(a) area of the water surface and depth of the water
(b) nature of precipitation and type of vegetation
(c) humidity and wind velocity
(d) atmospheric temperature
(e) all the above.

8.138. The rate of evaporation from reservoirs may be determined by
(a) pan-measurement method (b) empirical formulae
(c) storage equation method (d) energy budget method
(e) all the above.

8.139. For calculating the evaporation rate over a reservoir surface $E = 0.771\,(1.465 - 0.00732\,B)\,(0.44 - 0.007375\,V)\,(p_e - p_a)$, the equation is given by
(a) Roohwer's formula in M.K.S.
(b) Roohwer's formula in F.P.S.
(c) Dalton's formula in F.P.S.
(d) Dalton's formula in M.K.S.

8.140. In estimating the rate of evaporation from the reservoir surface, a pan 1.5 metres in diameter, was filled upto 8.0 cm. During a specified period of time, the rainfall recorded was 5 cm. 3 cm of water was removed from the pan to keep the depth of water. At the end of the time, the depth was 9 cm. If the pan coefficient is 0.6, the evaporation loss is
(a) 2 mm (b) 4 mm
(c) 6 mm (d) 6 mm.

8.141. Phytometer method is generally used for the measurement of
(a) interception (b) evaporation
(c) transpiration (d) none of these.

8.142. In the estimate of design flood, Dickens assumes that high flood in cumecs, is proportional to catchment area raised to the power
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) $\frac{3}{4}$ (d) $\frac{2}{3}$.

8.143. Dicken's formula for high flood estimate, is useful only for the catchments in
(a) Southern India (b) Northern India
(c) Eastern India (d) Western India.

8.144. For high flood estimates the average value of the constant C in Dicken's formula $Q = CA^{3/4}$, is
(a) 6.5 (b) 8.5
(c) 9.5 (d) 10.5
(e) 11.5.

8.145. Ryve's formula for flood estimate in cumecs, is
(a) $Q = CA^{3/4}$ (b) $Q = CA^{2/3}$
(c) $Q = CA^{1/2}$ (d) $Q = CA^{1/4}$.

8.146. For the estimate of high floods in fan-shaped catchment, the formula used is
(a) Dicken's formula (b) Ryve's formula
(c) Inglis formula (d) none of these.

8.147. Burge formula $Q = 19.6\,\frac{A}{L^{2/3}}$ cumecs is based upon
(a) rainfall and drainage area
(b) run off and drainage area
(c) drainage area and its shape
(d) drainage area.

8.148. Pettis formula $Q = C\,(P.B)^{5/4}$ cumecs, is based upon
(a) rainfall and drainage area
(b) run off and drainage area
(c) drainage area and its shape
(d) drainage area.

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8.149. Boston society of Civil Engineer's formula $Q = 0.0056 \frac{D}{t}$ in cumecs/square km is based upon

(*a*) rainfall and drainage area
(*b*) total run off and drainage area
(*c*) drainage area and its shape
(*d*) drainage area.

8.150. For predicting floods of a given frequency, the best reliable method is

(*a*) Unit hydrograph method
(*b*) Gumbel's analytical method
(*c*) California method
(*d*) None of these.

8.151. The earthen embankments constructed parallel to river banks at some suitable distance for flood control, known as

(*a*) floods walls (*b*) river walls
(*c*) levees (*d*) dikes
(*e*) both (*c*) and (*d*).

8.152. Levees and flood walls,

(*a*) are designed to carry unbalanced water load
(*b*) are designed with adequate dimensions
(*c*) are means of controlling floods
(*d*) are never provided free-boards.

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9

Environmental Engineering

9.1. Pick up the incorrect statement from the following :
(*a*) The mixture of water and waste products, is called sewage
(*b*) The treated sewage effluents, are generally used for irrigating the crops
(*c*) The process of collecting, treating and disposing off the sewage, is called sewerage
(*d*) The old convergency system was definitely better than water carried sewerage system
(*e*) None of these.

9.2. The sludge does not contain waste water from
(*a*) bath rooms (*b*) wash basins
(*c*) kitchen sinks (*d*) toilets.

9.3. The water carried sewerage system removes
(*a*) domestic sewage (*b*) industrial sewage
(*c*) storm sewage (*d*) all the above.

9.4. In a city the ratio of the drainage to sewage is 20, the percentage discharge passing through non-monsoon periods, is
(*a*) 5 (*b*) 10
(*c*) 15 (*d*) 20.

9.5. The sewerage system originates from
(*a*) house sewers (*b*) lateral sewers
(*c*) branch sewers (*d*) main sewers
(*e*) out fall sewers.

9.6. The sewer which transports the sewage to the point of treatment, is called
(*a*) house sewer (*b*) out-fall sewer
(*c*) branch sewer (*d*) lateral
(*e*) main sewer.

9.7. Pick up the in-correct statement from the following :
(*a*) Manholes are provided in sewer pipes at suitable intervals
(*b*) Catch basins are generally provided in sewers for carrying drainage discharge
(*c*) Inlets are generally provided in all sewers
(*d*) None of these.

9.8. Before discharging the foul sewage into rivers, it is generally treated by
(*a*) screening (*b*) sedimentation
(*c*) oxidation
(*d*) sludge digestion and disinfection
(*e*) all the above.

9.9. The sewers
(*a*) must be of adequate size to avoid over flow
(*b*) must flow under gravity $\frac{1}{2}$ to $\frac{3}{4}$ full
(*c*) must be laid at least 2 to 3 m deep to collect water from the basements
(*d*) all the above.

9.10. R.M.O. expenses include
(*a*) running expenses (*b*) maintenance expenses
(*c*) operation expenses (*d*) all the above.

9.11. For design of sewers, percentage of sewage discharge is assumed
(*a*) 65 to 70% (*b*) 70 to 75%
(*c*) 75 to 80% (*d*) 85%.

9.12. Design period of 40 to 50 years is adopted for
(*a*) branch sewers (*b*) main sewers
(*c*) trunk sewers (*d*) all the above.

9.13. The design period in years for pumping plants, is
(*a*) 1 (*b*) 2 to 3
(*c*) 3 to 5 (*d*) 5 to 10.

9.14. The ratio of maximum sewage flow to average sewage flow for trunk mains having diameters more than 1.25 m, is
(*a*) 1.5 (*b*) 2.0
(*c*) 3.0 (*d*) 4.0.

9.15. The ratio of maximum sewage flow to average sewage flow for mains up to 1 m in diameter, is
(*a*) 1.5 (*b*) 2.0
(*c*) 3.0 (*d*) 4.0.

9.16. If q is the average sewage flow from a city of population P, the maximum sewage flow
(*a*) $Q = \frac{4 + \sqrt{P}}{18 + \sqrt{P}} q$ (*b*) $Q = \frac{18 + P}{4 + \sqrt{P}} q$
(*c*) $Q = \frac{18 + \sqrt{P}}{4 + \sqrt{P}} q$ (*d*) $Q = \frac{5 + \sqrt{P}}{15 + \sqrt{P}} q$.

9.17. Pick up the correct statement from the following :
(*a*) Maximum daily flow = 2 times the average daily flow
(*b*) Maximum daily flow = $\frac{2}{3}$ × average daily flow
(*c*) Sewers are designed for minimum permissible velocity at minimum flow
(*d*) All the above.

9.18. Pick up the correct statement from the following :
(*a*) The maximum rate of storm run off is called peak drainage discharge
(*b*) Rational method of estimating peak run off, may be used precisely for areas less than 50 hectares

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(c) The period after which the entire area starts contributing to the run off, is called the time of concentration
(d) The time required by water to reach the outlet of a catchment from the most remote point, is called time of concentration
(e) All the above.

9.19. For estimating the peak run off the rational formula $Q = 0.0278$ KpA was evolved by
(a) Kinchling (b) Lloyd Davis
(c) Frubling (d) all the above.

9.20. The rainfall at any place may be determined by
(a) its intensity (b) its direction
(c) its frequency (d) all the above.

9.21. The intensity of rain is expressed in
(a) cm/minute (b) cm/hour
(c) cm/day (d) none of these.

9.22. If the length of overland flow from the critical point to the mouth of drain is 13.58 km and difference in level between the critical point and drain mouth is 10 m, the inlet time is
(a) 2 hours (b) 4 hours
(c) 6 hours (d) 8 hours.

9.23. The density of population over 40 hectares is 250/hectare. If water supply demand per day is 200 litres and sewage discharge is 80% of water supply, the sewage flow in sewers of separate system, is
(a) 0.05552 cumec (b) 0.05554 cumec
(c) 0.05556 cumec (d) 0.0556 cumec
(e) 0.0558 cumec.

9.24. The drainage area of a town is 12 hectares. Its 40% area is hard pavement ($K = 0.85$), the 40% area is unpaved streets ($K = 0.20$) and the remaining is wooded areas ($K = 0.15$). Assuming the time of concentration for the areas as 30 minutes and using the formula $P_s = \frac{900}{t + 60}$ the maximum run off is
(a) 0.10 cumec (b) 0.12 cumec
(c) 0.15 cumec (d) 0.20 cumec.

9.25. Pick up the correct statement from the following :
(a) The water supply pipes carry pure water free from solid particles
(b) The water supply pipes get clogged if flow velocity is less than self cleansing velocity
(c) The sewers may be carried up and down the hills and valleys
(d) The sewer pipes are generally laid along level hills
(e) None of these.

9.26. The sewer pipes
(a) carry sewage as gravity conduits
(b) are designed for generating self-cleansing velocities at different discharge
(c) should resist the wear and tear caused due to abrasion
(d) all the above.

9.27. $\frac{1}{3}$ rd or $\frac{1}{4}$ th extra space is left in sewer pipes at maximum discharge for
(a) low estimates of the average and maximum flows
(b) large scale infiltration of storm water
(c) unexpected increase in population
(d) all the above.

9.28. If the peak discharge of a storm water drain (S.W. Drain) is expected to exceed 150 cumecs, the free board to be provided, is
(a) 100 cm (b) 90 cm
(c) 80 cm (d) 50 cm.

9.29. In Chezy's formula $V = C\sqrt{rs}$ for calculating the velocity of flow in circular sewer of diameter D running full, the value of hydraulic mean radius is
(a) D (b) $\frac{D}{2}$
(c) $\frac{D}{3}$ (d) $\frac{D}{4}$ (e) $\frac{D}{6}$

9.30. The Chezy's constant C in the formula $V = C\sqrt{rs}$ depends upon
(a) size of the sewer (b) shape of the sewer
(c) roughness of sewer surface
(d) hydraulic characteristics of sewer
(e) all the above.

9.31. The value of Chezy's constant

$$C = \frac{\left(23 + \frac{0.00155}{s}\right) + \frac{1}{n}}{1 + \left(23 + \frac{0.00155}{s}\right)\frac{n}{\sqrt{r}}}$$

is used in
(a) Chezy's formula (b) Bazin's formula
(c) Kutter's (d) Manning's formula.

9.32. The value of Chezy's constant

$$C = \frac{157.6}{1.81 + \frac{K}{\sqrt{r}}}$$ is used in

(a) Chezy's formula (b) Bazin's formula
(c) Kutter's formula (d) Manning's formula.

9.33. The formula $V = \frac{1}{n} r^{2/3} \sqrt{S}$ used for determining flow velocities in sewers, is known as
(a) Chezy's formula (b) Bazin's formula
(c) Kutter's formula (d) Manning's formula.

9.34. The formula which accepts the value of rugosity coefficient $n = 0.012$ to be used in Manning's formula, is given by
(a) Bazin (b) Crimp and Bruge
(c) William-Hazen (d) Kutter.

9.35. If γ_w is the unit weight of water, r the hydraulic mean depth of the sewer and S the bed slope of the sewer, then the tractive force exerted by flowing water, is
(a) $\gamma_w . r.S$ (b) $\gamma_w r^{1/2} . S$
(c) $\gamma_w r \sqrt{S}$ (d) $\gamma_w r^{2/3} \sqrt{S}$.

9.36. The porosity of sediments in sewer pipes, is usually taken as
(a) 0.010 (b) 0.011
(c) 0.012 (d) 0.013
(e) 0.020.

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9.37. A sewer pipe contains 1 mm sand particles of specific gravity 2.65 and 5 mm organic particles of specific gravity 1.2, the minimum velocity required for removing the sewerage, is
(a) 0.30 m/sec (b) 0.35 m/sec
(c) 0.40 m/sec (d) 0.45 m/sec
(e) 0.50 m/sec.

9.38. If the diameter of a sewer is 100 mm, the gradient required for generating self cleansing velocity, is
(a) 1 in 60 (b) 1 in 100
(c) 1 in 120 (d) none of these.

9.39. If the diameter of a sewer is 150 mm, the gradient required for generating self cleansing velocity, is
(a) 1 in 60 (b) 1 in 100
(c) 1 in 120 (d) none of these.

9.40. If the diameter of sewer is 225 mm, the gradient required for generating self cleansing velocity, is
(a) 1 in 60 (b) 1 in 100
(c) 1 in 120 (d) none of these.

9.41. In sewers the effect of scouring is more on
(a) top side (b) bottom side
(c) horizontal side (d) all sides.

9.42. For non-scouring velocity 5 m/sec, the type of sewers generally preferred to, is
(a) cast iron sewers (b) cement concrete sewers
(c) glazed bricks sewers (d) stone ware sewers.

9.43. In sewers the highest non-scouring velocity is achieved in
(a) glazed bricks sewers (b) cast iron sewers
(c) cement concrete sewers (d) stone ware sewers.

9.44. Cement concrete sewers are only suitable if non-scouring velocity is between
(a) 2.5 to 3.0 m/sec (b) 3.0 t0 4.0 m/sec
(c) 3.5 to 4.5 m/sec (d) 4.5 to 5.5 m/sec.

9.45. The drop man holes are generally provided in sewers for
(a) industrial areas (b) large town ships
(c) hilly town ships (d) cities in plains.

9.46. With self cleansing velocity in sewers
(a) silting occurs at bottom
(b) scouring occurs at bottom
(c) both silting and scouring occur at bottom
(d) neither silting nor scouring occurs at bottom.

9.47. For efficient working of a sewer, it must be ensured that
(a) minimum velocity of 0.45 m/sec, is maintained at its minimum flow
(b) a maximum velocity of 0.90 m/sec, is maintained at its maximum flow
(c) both (a) and (b)
(d) neither (a) nor (b).

9.48. The angle subtended by the surface of sewer water with partial flow, at sewer centre is 120°, the depth of sewerage is
(a) 20 cm (b) 25 cm
(c) 40 cm (d) 50 cm
(e) 60 cm.

9.49. The ratio of depths at partial flow with central angle α and at full flow of a sewer, is
(a) $1 - \sin\frac{\alpha}{\beta}$ (b) $1 - \cos\frac{\alpha}{2}$
(c) $\frac{1}{2}\left(1 - \cos\frac{\alpha}{2}\right)$ (d) $\frac{1}{2}\left(1 - \sin\frac{\alpha}{2}\right)$
(e) $\frac{1}{2}\left(1 - \tan\frac{\alpha}{2}\right)$.

9.50. For having central angle α, the area of cross-section of sewers running partially full, is
(a) $A = \frac{D^2}{2}\left[\frac{\pi\alpha}{180°} - \frac{\sin\alpha}{2}\right]$ (b) $A = \frac{D^2}{4}\left[\frac{\pi\alpha}{360°} - \frac{\sin\alpha}{2}\right]$
(c) $A = \frac{D^2}{4}\left[\frac{\pi\alpha}{360°} - \frac{\cos\alpha}{2}\right]$ (d) $A = \frac{D^2}{2}\left[\frac{\pi\alpha}{360°} - \frac{\cos\alpha}{2}\right]$.

9.51. If the depth of partial flow in a sewer of diameter 2 m, is 50 cm, its wetted perimeter is
(a) π (b) $\frac{\pi}{2}$
(c) $\frac{\pi}{3}$ (d) $\frac{2\pi}{3}$ (e) $\frac{3\pi}{2}$.

9.52. For a circular sewer of diameter D running partially full with central angle α,
(a) $\frac{d}{D} = \frac{1}{2}\left(1 - \cos\frac{\alpha}{2}\right)$ (b) $\frac{a}{A} = \left[\frac{\pi}{360°} - \frac{\sin\alpha}{2\pi}\right]$
(c) $\frac{p}{P} = \frac{\alpha}{360°}$ (d) $\frac{r}{R} = \left[1 - \frac{360° \sin\alpha}{2\pi\alpha}\right]$
(e) all the above.

9.53. In circular sewers if depth of flow is 0.2 times the full depth, the nominal gradient,
(a) is only provided (b) is doubled
(c) is trebled (d) is not enough.

9.54. If the discharge of a sewer running half is 628 l.p.s., $i = 0.001$, and $n = 0.010$, the diameter of the sewer, is
(a) 1.39 m (b) 1.49 m
(c) 1.59 m (d) 1.69
(e) 1.79 m.

9.55. A circular sewer section is preferred to because
(a) it is cheaper in construction
(b) it provides maximum area for a given perimeter
(c) it provides maximum hydraulic mean depth
(d) all the above.

9.56. Pick up the correct statement from the following :
(a) The circular section of sewers provides maximum hydraulic mean depth
(b) The circular sewers are provided for separate sewerage system
(c) The circular sewers work efficiently if the sections run at least half full
(d) Two sewers of different shapes are said to be hydraulically equivalent if they discharge at the same rate while running full on the same grade
(e) All the above.

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9.57. If D is the diameter of upper circular portion, the overall depth of a standard egg shaped section, is
(a) D (b) 1.25 D
(c) 1.5 D (d) 1.75 D
(e) 2 D.

9.58. If D is the diameter of upper circular portion, the area of cross-section of a standard egg shaped sewer, is
(a) $\frac{(18+5\pi)}{32} D^2$ (b) $\frac{(12+5\pi)}{32} D^2$
(c) $\frac{(18+5\pi)}{16} D^2$ (d) $\frac{(82+5\pi)}{32} D^2$.

9.59. If D is the diameter of upper circular portion, the overall depth of New Egg shaped sewer section, is
(a) 1.250 D (b) 1.350 D
(c) 1.425 D (d) 1.625 D.

9.60. If D is the diameter of a circular sewer and D' is the top horizontal diameter of an equivalent egg shaped section, the relationship which holds good, is
(a) $D' = 0.64\ D$ (b) $D' = 0.74\ D$
(c) $D' = 0.84\ D$ (d) $D' = 0.94\ D$.

9.61. D is the diameter of a circular sewer and a is the side of a square section sewer. If both are hydraulically equivalent, the relationship which holds good, is
(a) $\pi D^{8/3} = 4\ b^{8/3}$ (b) $\pi D^{3/8} = 4\ b^{3/8}$
(c) $\pi D^{2/3} = 4\ b^{2/3}$ (d) $\pi D^{3/2} = 4\ b^{3/2}$
(e) none of these.

9.62. If the side of a square sewer is 1000 mm, the diameter of a hydraulically equivalent circular section, is
(a) 1045 mm (b) 1065 mm
(c) 1075 mm (d) 1095 mm.

9.63. The ratio of the diameter of a circular section and the side of a square section hydraulically equivalent, is
(a) 1.095 (b) 1.085
(c) 1.075 (d) 1.065.

9.64. The width of a rectangular sewer is twice its depth while discharging 1.5 m/sec. The width of the sewer is
(a) 0.68 m (b) 0.88 m
(c) 1.36 m (d) 1.76 m.

9.65. Maximum permissible velocity 1.5 m/sec, is adopted in drains
(a) with beds of rocks and gravels
(b) lined with stones
(c) both (a) and (b)
(d) neither (a) nor (b).

9.66. For drains up to 15 cumecs, the depth d and width B are related by
(a) $d = 0.2\sqrt{B}$ (b) $d = 0.5\sqrt{B}$
(c) $B = 0.2\sqrt{d}$ (d) $B = 0.5\sqrt{d}$.

9.67. For the open drain (N = 0.025) shown in Fig. 9.1, the discharge is

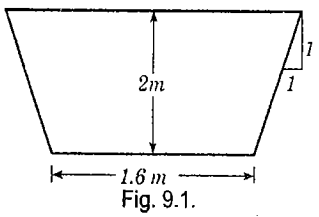

Fig. 9.1.

(a) 26.88 cumecs (b) 27.88 cumecs
(c) 28.88 cumecs (d) 29.88 cumecs.

9.68. For trunk and out-fall, the type of sewers generally used, is
(a) standard egg shaped (b) circular shaped
(c) horse shoe shaped (d) parabolic shaped
(e) semi-elliptical shaped.

9.69. The pressure exerted by
(a) the sewage when running full from inside, is called internal pressure
(b) the internal pressure if any, causes tensile stress in the pipe material
(c) pressure sewers are designed to be safe in tension
(d) All the above.

9.70. A sewer running partially full and burried with back filled, fails in compression due to
(a) weight of the pipe (b) weight of the back fill
(c) superimposed traffic loads (d) all the above.

9.71. Boussinesq's equation for ascertaining unit pressure at a depth H on sewers due to traffic loads, is
(a) $p_t = \frac{3H^3P}{2\pi Z^5}$ (b) $p_t = \frac{2H^3P}{3\pi Z^5}$
(c) $p_t = \frac{3H^3P}{2Z^5}$ (d) $p_t = \frac{2\pi H^3P}{3Z^5}$
(e) none of these.

9.72. The asbestos cement sewers are
(a) light in weight
(b) not structurally strong to bear large compressive stress
(c) susceptible to corrosion by sulphuric acid
(d) All the above.

9.73. The asbestos cement pipes are generally laid
(a) horizontally (b) vertically
(c) at an angle of 30° (d) at an angle of 60°.

9.74. Large diameter sewers subjected to external pressure alone, are reinforced
(a) near the inner surface of the pipe
(b) near the outer surface of the pipe
(c) both (a) and (b)
(d) with elliptical cage
(e) none of these.

9.75. Hume steel pipes are
(a) steel pipes
(b) R.C.C. pipes
(c) steel shell coated from inside with cement mortar
(d) steel shell coated from outside with cement mortar
(e) both (c) and (d).

9.76. Stoneware sewers are available in size
(a) 10 cm (b) 15 cm
(c) 20 cm (d) 25 cm
(e) all the above.

9.77. Pick up the incorrect size of stone ware sewers
(a) 52.5 cm (b) 67.5 cm
(c) 82.5 cm (d) 90 cm

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(e) none of these.

9.78. The stone ware sewers
(a) are used for carrying sewage and drainage from houses
(b) are manufactured from clays and shales
(c) after casting are dried and burnt at temperature 150°C, 700°C and 1200°C
(d) are generally provided with a water proof cover by vaporising sodium chloride
(e) all the above.

9.79. Stone ware pipes are
(a) highly resistant to sulphide corrosion
(b) highly impervious
(c) hydraulically efficient because of their smooth interior surface
(d) specially suited to pressure pipes
(e) none of these.

9.80. The sewer which resists sulphide corrosion, is
(a) Brick sewer (b) Cast iron sewer
(c) R.C.C. sewer (d) Lead sewer
(e) None of these.

9.81. For laying a sewer line in a trench of 2 m width, an offset line is marked on the ground parallel to the given centre line at a distance of
(a) 100 cm (b) 120 cm
(c) 140 cm (d) 160 cm
(e) 180 cm.

9.82. The reduced levels of the string at the consecutive sight rails A and B are 203.575 m, 203.475 m respectively. If the difference of their R.D.s is 10 m, the gradient of the sewer line is
(a) 1 in 100 upward (b) 1 in 500 upward
(c) 1 in 100 downward (d) 1 in 503 upward.

9.83. In case of sewer lines
(a) water test is carried out to check water tightness of the joints
(b) test for straightness is carried out with the help of a lamp and mirror
(c) obstruction test is carried out with the help of smooth ball of diameter 13 mm
(d) all the above.

9.84. A manhole is generally provided at each
(a) bend (b) junction
(c) change of gradient
(d) change of sewer diameter
(e) all the above.

9.85. The spacing of man holes along a straight portion of a sewer is 300 m, the diameter of the sewer may be
(a) 0.9 cm (b) 1.2 m
(c) 1.5 m (d) > 1.5 m.

9.86. A manhole is classified as shallow if its depth is between
(a) 0.4 to 0.5 m (b) 0.5 to 0.7 m
(c) 0.7 to 0.9 m (d) 0.9 to 1.20 m
(e) 1.2 to 1.50 m.

9.87. A drop manhole is provided if
(a) a sewer drops from a height
(b) a branch sewer joins the main sewer at higher level
(c) a lamp is inserted to check obstruction
(d) none of these.

9.88. Pick up the correct statement from the following :
(a) Inlets are provided on the road surface at the lowest point for draining rain water
(b) Inlets are generally provided at an interval of 30 m to 60 m along straight roads
(c) Inlets having vertical openings, are called curb inlets
(d) Inlets having horizontal openings, are called horizontal inlets
(e) All the above.

9.89. For sewers, inverted siphon is provided for
(a) one pipe (b) two pipes
(c) three pipes (d) four pipes.

9.90. The most effective arrangement for diverting excess storm water into a natural drainage, is
(a) leaping weir (b) overflow weir
(c) siphon spill way (d) none of these.

9.91. An inverted siphon is designed generally for
(a) one pipe (b) two pipes
(c) three pipes (d) four pipes.

9.92. Clogging of sewers, is caused due to
(a) silting
(b) low discharge
(c) greasy and oily matters
(d) domestic wastes thrown in manholes
(e) all the above.

9.93. The small sewers are cleaned by
(a) flushing (b) cane rodding
(c) wooden pills (d) none of these.

9.94. Pick up the correct statement from the following :
(a) Small sewers are cleaned by flushing
(b) Medium sewers are cleaned by cane rodding
(c) Medium sewers may be cleaned by pills
(d) Large sewers are cleaned by removing the deposited materials
(e) All the above.

9.95. In sewers the gas generally found, is
(a) Hydrogen sulphide (H_2S) (b) Carbon dioxide (CO_2)
(c) Methane (CH_4) (d) Petrol vapours
(e) All the above.

9.96. If a paper moistened with lead acetate for five minutes when placed in manhole turns black. The sewer certainly contains
(a) Hydrogen sulphide (b) Carbon dioxide
(c) Methane (d) Oxygen
(e) None of these.

9.97. If the flame of a miner's safety lamp in a manhole extinguishes within 5 minutes, the sewer certainly contains
(a) Hydrogen sulphide (b) Carbon dioxide
(c) Methane (d) Oxygen
(e) None of these.

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9.98. If the flame of a miner's safety lamp in the upper layers of the sewer forms an explosive, the sewer certainly contains
(a) Hydrogen sulphide (b) Carbon dioxide
(c) Methane (d) Oxygen
(e) None of these.

9.99. Pick up the incorrect statement from the following for allowing workers to enter sewers
(a) The particular manhole and one manhole on up stream and one manhole on down stream should remain open for 30 minutes
(b) Proper tests for the presence of poisonous gases must be carried out
(c) The men entering the manhole should be advised to smoke in the sewer
(d) Warning signals should be erected
(e) None of these.

9.100. Sewer ventilating columns are generally placed at
(a) distances 150 m to 300 m
(b) upper ends of branch sewers
(c) every change in the size of sewers
(d) all the above.

9.101. 'Cowl' is provided at
(a) lower end of ventilating column
(b) upper end of ventilating column
(c) upper end of the manhole
(d) first step in manhole.

9.102. The sewage is pumped up
(a) from low lying areas (b) from flat areas
(c) from basements (d) across a high ridge
(e) all the above.

9.103. The non-clog pump which permits solid matter to pass out with the liquid sewage, is
(a) centrifugal pump (b) reciprocating pump
(c) pneumatic ejector (d) none of these.

9.104. The disintegrating pump in which solid matter is broken up before passing out, is
(a) centrifugal pump (b) reciprocating pump
(c) pneumatic ejector (d) none of these.

9.105. The most widely used pump for lifting sewage is
(a) centrifugal pump (b) reciprocating pump
(c) pneumatic ejector (d) air pressure pump.

9.106. A cylindrical ejector having its height 2 m fills after every 10 minutes with a peak sewage discharge of 0.0157 cumec. The diameter of the ejector chamber, is
(a) 2.30 m (b) 2.40 m
(c) 2.45 m (d) 2.50 m.

9.107. For a peak discharge of 0.0157 cumec, with a velocity of 0.9 m/sec, the diameter of the sewer main, is
(a) 10 cm (b) 12 cm
(c) 15 cm (d) 18 cm
(e) 20 cm.

9.108. The Brake Horse power of the motor (efficiency 60 required for a pump of capacity 0.075 cumec for a total lift 12 m, is
(a) 10 (b) 15
(c) 20 (d) 25.

9.109. Pathogens (or pathogentic bacterias) in water m cause
(a) typhoid (b) cholera
(c) dysentery (d) infectious hepatitis
(e) all the above.

9.110. Aerobic bacterias
(a) flourish in the presence of free oxygen
(b) consume organic matter as their food
(c) oxidise organic matter in sewage
(d) All the above.

9.111. Faculative bacterias survive in
(a) the presence of oxygen
(d) the absence of oxygen
(c) both cases (a) and (b)
(d) neither (a) nor (b).

9.112. Nitrogen cycle of sewage, is
(a) Liberation of ammonia-formation of nitrites—form tion of nitrates—liberation of nitrogen
(b) Liberation of nitrogen—liberation ammonia—formation of nitrites—formation of nitra
(c) Liberation of nitrogen—formation of nitrates—form tion of nitrites—liberation of ammonia
(d) Formation of nitrates—formation of nitrites—libe tion of nitrates—liberation of nitrates
(e) None of these.

9.113. The following is the physical characteristic of sewa
(a) turbidity (b) colour
(c) odour (d) temperature
(e) all the above.

9.114. Pick up the correct statement from the following:
(a) Turbidity is more in strong sewage
(b) The black colour indicates septic sewage
(c) The fresh sewage is practically odourless
(d) The sewage omits offensive odours after four hours
(e) All the above.

9.115. The temperature affects the
(a) biological activity of bacterias in sewage
(b) solubility of gases in sewage
(c) viscosity of sewage
(d) all the above.

9.116. The average temperature of sewage in India, is
(a) 10°C (b) 15°C
(c) 20°C (d) 25°C
(e) 30°C.

9.117. In sewage, the solids in mg per litre is
(a) 100 to 500 (b) 500 to 1000
(c) 1000 to 1500 (d) 1500 to 2000.

9.118. 1000 kg of sewage contains
(a) 0.112 kg in suspension (b) 0.112 kg in solution

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(c) 0.225 kg in solution (d) 0.450 kg in suspension
(e) both (a) and (c) of above.

9.119. Imhoff cone is used to determine
(a) settlable solids (b) suspended solids
(c) dissolved solids (d) none of these.

9.120. If the pH value of sewage is 7
(a) it is acidic (b) it is alkaline
(c) it is neutral (d) none of these.

9.121. Pick up the correct statement from the following :
(a) pH value indicates acidity and alkalinity of sewage
(b) In acidic sewage, the pH value is less than 7
(c) In alkaline sewage, the pH value is more than 7
(d) Fresh sewage is generally alkaline
(e) All the above.

9.122. The pH value of sewage is determined with the help of
(a) Imhoff Cone (b) turbidimeter
(c) potentiometer (d) none of these.

9.123. In sewage having fully oxidised organic matter, the nitrogen exists in the form of
(a) nitrites (b) nitrates
(c) free ammonia (d) aluminoid nitrogen
(e) none of these.

9.124. In very first stage of decomposition of the organic matter in sewage
(a) nitrites are formed (b) nitrates are formed
(c) carbondioxide is formed (d) ammonia is formed.

9.125. The presence of free ammonia in sewage, is detected by
(a) boiling
(b) adding pottassium permanganate
(c) adding sulphuric acid
(d) phenol-di-sulphuric acid.

9.126. For detecting the nitrites in the sewage, the matching colour may be developed by adding
(a) Pottassium permanganate
(b) Sulphuric acid and napthamine
(c) Phenol-di-sulphuric acid pottassium hydroxide
(d) None of these.

9.127. For detecting the nitrates in sewage, the colour may be developed by adding
(a) Pottassium permanganate
(b) Sulphuric acid and napthamine
(c) Phenol-di-sulphuric acid and pottassium hydroxide
(d) None of these.

9.128. Pick up the correct statement from the following :
(a) Hydrogen sulphide gas in excess, may cause corrosion of concrete sewers
(b) 4 ppm of Dissolved Oxygen (D.O.) is ensured before discharging the treated sewage in river
(c) Solubility of oxygen in sewage is 95% of that of distilled water
(d) Dissolved oxygen content of sewage, may be determined by Winkler's method
(e) All the above.

9.129. To test chemical oxygen demand (C.O.D.) of sewage, organic matter is oxidised by pottassium dichromate in the presence of
(a) Hydrochloric acid (b) Sulphuric acid
(c) Nitric acid (d) Citric acid.

9.130. The amount of oxygen consumed by the aerobic bacterias which cause the aerobic biological decomposition of sewage, is known
(a) Bio-Chemical Oxygen Demand (B.O.D.)
(b) Dissolved Oxygen (D.O.)
(c) Chemical Oxygen Demand (C.O.D.)
(d) None of these.

9.131. The standard B.O.D. of water is taken for
(a) 1 day (b) 2 days
(c) 3 days (d) 5 days
(e) 10 days.

9.132. If the depletion of oxygen is found to be 5 ppm after incubating a 2.5% solution of sewage sample for 5 days at 21°C, B.O.D. of the sewage is
(a) 50 ppm (b) 100 ppm
(c) 150 ppm (d) 200 ppm
(e) 250 ppm.

9.133. If the depletion of oxygen is found to be 2.5 mg/litre after incubating 2.5 ml of sewage diluted to 250 ml for 5 days at 20°C, B.O.D. of the sewage is
(a) 50 mg/l (b) 100 mg/l
(c) 150 mg/l (d) 200 mg/l
(e) 250 mg/l.

9.134. Dilution method of disposing off sewage, is not preferred to
(a) when sewage is fresh
(b) when diluting water has high dissolved oxygen content
(c) when diluting water is used for water supply near the point of sewage disposed
(d) when the diluting water is having flow currents
(e) none of these.

9.135. No treatment of the sewage is given if dilution factor is
(a) less than 150 (b) between 150 to 200
(c) between 200 to 300 (d) between 400 to 500
(e) more than 500.

9.136. Pick up the correct statement from the following :
(a) The ratio of the quantity of the diluting water to that of the sewage, is known as dilution factor
(b) The automatic purification of polluted water, is known self purification phenomenon
(c) The photosynthesis is carried out in the presence of sun light
(d) Grab sample is generally obtained from the surface where turbulence mixes the sewage particles
(e) All the above.

9.137. The factor responsible for purification of sewage in river is
(a) Hydrology (b) Dissolved oxy. in water
(c) Temperature (d) Turbulence
(e) All the above.

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9.138. If D.O. concentration falls down to zero in any natural drainage, it indicates the zone of
(a) degradation (b) active decomposition
(c) recovery (d) cleaner water
(e) none of these.

9.139. The algae dies out in the zone of
(a) degradation (b) active decomposition
(c) recovery (d) cleaner water.

9.140. If 2% solution of a sewage sample is incubated for 5 days at 20°C and depletion of oxygen was found to be 5 ppm, B.O.D. of the sewage is
(a) 200 ppm (b) 225 ppm
(c) 250 ppm (d) None of these.

9.141. As compared to fresh river water, sea water contains oxygen
(a) 10% less (b) 20% less
(c) 10% more (d) 20% more.

9.142. During preliminary treatment of a sewage
(a) Oil and grease are removed from skimming tanks
(b) Floating materials are removed by screening
(c) Girt and sand are removed by girt chambers
(d) All the above.

9.143. Primary treatment of sewage consists of removal of
(a) large suspended organic solids
(b) oil and grease
(c) sand and girt
(d) floating materials
(e) none of these.

9.144. For treating the sewage of a large city, you will recommend
(a) a sedimentation tank and an activated sludge treatment plant
(b) a plant consisting of Imhoff tanks with low rate trickling filters
(c) sedimentation tanks with high rate trickling filters
(d) none of these.

9.145. The spacing of bars for perforations in coarse screens used for the treatment of sewage, is
(a) 20 mm (b) 30 mm
(c) 40 mm (d) 50 mm
(e) 100 mm.

9.146. The spacing of bars of perforations of fine screens used for the treatment of sewage, is
(a) 2 to 3 mm (b) 3 to 5 mm
(c) 5 to 8 mm (d) 8 to 10 mm.

9.147. The screens are fixed
(a) perpendicular to the direction of flow
(b) parallel to the direction of flow
(c) at an angle 30° to 60° to the direction of flow
(d) none of these.

9.148. The use of coarse screens for the disposal of sewage, may be dispensed with by
(a) comminutor (b) shredder
(c) both (a) and (b) (d) neither (a) nor (b).

9.149. Pick up the correct statement from the following:
(a) The materials separated by screens, is called screenings
(b) The screenings are disposed off either by burning or by burial or by dumping
(c) The process of burning the screenings, is called incineration
(d) The process of burning the screenings, is known as compositing
(e) All the above.

9.150. In a grit chamber of a sewage treatment plant,
(a) flow velocity 0.15 m to 0.3 m/sec is kept
(b) depth of 0.9 m to 1.20 m is kept
(c) one minute of detention period is kept
(d) all the above.

9.151. The grit chambers of sewage treatment plants, are generally cleaned after
(a) 2 days (b) 5 days
(c) 7 days (d) 12 days
(e) 14 days.

9.152. If the grit in grit chambers is 4.5 million litres per day, its cleaning is done
(a) manually (b) mechanically
(c) hydraulically (d) electrically.

9.153. The grit and silt of the grit chambers, may not be used for
(a) raising low lying areas by dumping
(b) concreting
(c) both (a) and (b)
(d) neither (a) nor (b).

9.154. In detritus tanks,
(a) flow velocity is kept 0.09 m/sec
(b) detention period is kept 3 to 4 minutes
(c) organic and inorganic materials are separated
(d) all the above.

9.155. For a grit chamber, if the recommended velocity of flow is 0.2 m/sec and detention period is 2 minutes, the length of the tank, is
(a) 16 m (b) 20 m
(c) 24 m (d) 30 m.

9.156. The sewage discharge in a detritus tank of a treatment plant is 576 litres/sec with flow velocity of 0.2 m/sec. If the ratio of width to depth is 2, the depth is
(a) 100 cm (b) 110 cm
(c) 120 cm (d) 150 cm.

9.157. In primary sedimentation, the 0.2 mm inorganic solids get separated if specific gravity is
(a) 2.25 (b) 2.50
(c) 2.55 (d) 2.65
(e) 2.75.

9.158. The settlement of a particle in sedimentation tank, is affected by
(a) velocity of flow (b) viscosity of water
(c) size and shape of solid (d) specific gravity of solid
(e) all the above.

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9.159. Discrete or granular particles change their
(*a*) size (*b*) shape
(*c*) weight (*d*) none of these.

9.160. Flocculated particles do not change their
(*a*) size (*b*) shape
(*c*) weight (*d*) none of these.

9.161. The settling velocity of a spherical particle of diameter less than 0.1 mm as per Stock's law, is
(*a*) $V_s = 418\,(G_s - G_w)d\left[\frac{3T + 70}{100}\right]$
(*b*) $V_s = 418\,(G_s - G_w)d^2\left[\frac{3T + 70}{100}\right]$
(*c*) $V_s = 218\,(G_s - G_w)d^2\left[\frac{3T + 70}{100}\right]$
(*d*) $V_s = 218\,(G_s - G_w)d\left[\frac{3T + 70}{100}\right]$.

9.162. Hazin's formula $V_s = 418\,(G_s - G_w)d\left[\frac{3T + 70}{100}\right]$ is used for the settlement velocity of the particles of diameter
(*a*) less than 0.01 mm
(*b*) less than 0.05 mm
(*c*) less than 0.1 mm
(*d*) greater than 0.1 mm.

9.163. The settlement velocity of a solid (diameter 0.5 mm, specific gravity 2.5) in water having temperature 10°C, is
(*a*) 213.5 cm/sec (*b*) 313.5 cm/sec
(*c*) 413.5 cm/sec (*d*) 500 cm/sec.

9.164. For a continuous flow type of sedimentation tanks
(*a*) width of the tank is normally kept about 6 m
(*b*) length of the tank is normally kept 4 to 5 times the width
(*c*) maximum horizontal flow velocity is limited to 0.3 m/minute
(*d*) capacity of the tank for 24 hours, is kept equal to maximum daily flow of sewage
(*e*) all the above.

9.165. The detention period for plain sedimentation water tanks, is usually
(*a*) 4 to 8 hours (*b*) 8 to 16 hours
(*c*) 16 to 24 hours (*d*) 24 to 36 hours.

9.166. In a sedimentation tank (length L, width B, depth D) the settling velocity of a particle for a discharge Q, is
(*a*) $\frac{Q}{B \times D}$ (*b*) $\frac{Q}{L \times D}$
(*c*) $\frac{Q}{L}$ (*d*) $\frac{Q}{B \times L}$.

9.167. The discharge per unit plan area of a sedimentation tank, is generally called
(*a*) over flow rate (*b*) surface loading
(*c*) over flow velocity (*d*) all the above.

9.168. The normal value of over flow rates for plain primary sedimentation tanks, ranges bet-ween
(*a*) 25,000 to 35,000 litres/sqm/day
(*b*) 40,000 to 50,000 litres/sqm/day
(*c*) 50,000 to 60,000 litres/sqm/day
(*d*) 80,000 to 100,000 litres/sqm/day
(*e*) none of these.

9.169. The normal values of over flow rates for sedimentation tanks using coagulent, ranges between
(*a*) 25,000 to 35,000 litres/sqm/day
(*b*) 40,000 to 50,000 litres/sqm/day
(*c*) 50,000 to 60,000 litres/sqm/day
(*d*) 80,000 to 100,000 litres/sqm/day
(*e*) none of these.

9.170. The normal values of over flow rates for secondary sedimentation tanks, ranges bet-ween
(*a*) 25,000 to 35,000 litres/sqm/day
(*b*) 40,000 to 50,000 litres/sqm/day
(*c*) 50,000 to 60,000 litres/sqm/day
(*d*) 80,000 to 10,000 litres/sqm/day
(*e*) none of these.

9.171. The maximum depth of sedimentation tanks, is kept
(*a*) 3 m (*b*) 3.5 m
(*c*) 4 m (*d*) 4.5 m.

9.172. The detention time (t) of a settling tank, may be defined as the time required for
(*a*) a particle to travel along its length
(*b*) a particle to travel from top surface to bottom sludge zone
(*c*) the flow of sewage to fill the tank
(*d*) none of these.

9.173. The detention time of a circular tank of diameter d and water depth H, for receiving the sewage Q per hour, is
(*a*) $\frac{d^2(0.011d + 0.785H)}{Q}$
(*b*) $\frac{d(0.022d + 0.085H)}{Q}$
(*c*) $\frac{d(0.785d + 0.011H)}{Q}$
(*d*) $\frac{d(0.285d + 0.011H)}{Q}$.

9.174. The settling velocity of the particles larger than 0.06 mm in a settling tank of depth 2.4 is 0.33 m per sec. The detention period recommended for the tank, is
(*a*) 30 minutes (*b*) 1 hour
(*c*) 1 hour and 30 minutes (*d*) 2 hours
(*e*) 3 hours.

9.175. The dimensions of a rectangular settling tank are : length 24 m, width 6 m and depth 3 m. If 2 hour detention period for tanks is recommended, the rate of flow of sewage per hour, is
(*a*) 204 cu m (*b*) 208 cu m
(*c*) 212 cu m (*d*) 216 cu m
(*e*) 220 cu m.

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9.176. The width of a settling tank with 2 hour detention period for treating sewage 378 cu m per hour, is
(a) 5 m (b) 5.5 m
(c) 6 m (d) 6.5 m
(e) 7 m.

9.177. Pick up the incorrect statement from the following :
(a) Septic tanks are horizontal continuous flow type of sedimentation tanks
(b) Septic tanks are generally provided a detention period of 12 to 36 hours
(c) Septic tanks are completely covered and high vent shafts are provided for the escape of foul gases
(d) Septic tanks are generally classified as tanks which work on the principle of anaerobic decomposition
(e) None of these.

9.178. The digested sludge from septic tanks, is removed after a maximum period of
(a) 3 years (b) 3.5 years
(c) 4 years (d) 5 years.

9.179. The rate of accumulation of sludge per person per year, is
(a) 10 litres (b) 15 litres
(c) 20 litres (d) 25 litres
(e) 30 litres.

9.180. In septic tanks,
(a) free board of 0.3 m may be provided
(b) the baffles or tees are extended up to top level of scum
(c) the clear space between the baffle top and covering slab is about 7.5 cm
(d) the inlet is kept 30 cm below the sewage line and outlet is kept at a level 40% depth of the sewage
(e) all the above.

9.181. The bottom of the sewage inlet chamber of septic tanks, is provided an outward slope
(a) 1 in 5 (b) 1 in 10
(c) 1 in 15 (d) 1 in 20
(e) 1 in 25.

9.182. Bottom openings 15 cm × 15 cm in the standing baffle wall are provided
(a) 15 cm c/c (b) 22.5 cm c/c
(c) 30 cm c/c (d) 50 cm c/c.

9.183. In a septic tank of de-sludging period of 1 year, receives sewage for 100 persons @ 120 litres per person per day. If the depth is kept 1.667 m and length-width ratio is 4, the length and width of the septic tank, are :
(a) 4 and 1 m (b) 4.80 m and 1.20 m
(c) 5.20 m and 1.30 m (d) 6.00 m and 1.50 m.

9.184. In case of Imhoff tanks,
(a) the shape is rectangular
(b) detention period is 2 hours
(c) the velocity of flow is restricted to 0.30 m/minute
(d) surface loading is limited to 30,000 litres/m^2 of plan area per day
(e) All the above.

9.185. The clarigesters are
(a) circular septic tanks
(b) rectangular septic tanks
(c) circular Imhoff double tanks with bottom hoppers
(d) circular Imhoff double storey tanks without bottom hoppers.

9.186. The coagulant which is generally not used for treating the sewage, is
(a) alum (b) ferric chloride
(c) ferric sulphate (d) chlorinated copperas.

9.187. The coagulant widely used for sewage treatment, is
(a) alum (b) ferric chloride
(c) ferric sulphate
(d) chlorinated copperas.

9.188. In a sludge digestion tank if the moisture content of sludge V_1 litres is reduced from p_1% to p_2% the volume V_2 is
(a) $\frac{100+p_1}{100-p_2}V_1$ (b) $\left(\frac{100-p_1}{100+p_2}\right)V_1$
(c) $\left(\frac{100-p_1}{100-p_2}\right)V_1$ (d) $\left(\frac{100+p_2}{100-p_1}\right)V_1$.

9.189. The moisture content of a sludge is reduced from 90% to 80% in a sludge digestion tank. The percentage decrease in the volume of sludge, is
(a) 25% (b) 50%
(c) 10% (d) 5%.

9.190. Pick up the incorrect statement from the following :
(a) The process of decomposing the organic matter under controlled anaerobic conditions, is called sludge digestion
(b) Sludge digestion is carried out in sludge tank
(c) The gases produced in sludge digestion process, contain 75% carbon dioxide
(d) The gases produced in sludge digestion process, contain 75% methane.

9.191. The first stage of neutral process of sludge digestion, is
(a) acid fermentation (b) acid regression
(c) alkaline fermentation (d) none of these.

9.192. Acid regression stage of sludge digestion at a temperature 21°C extends over a period of
(a) 15 days (b) 30 days
(c) 60 days (d) 90 days.

9.193. P_H value of sludge during alkaline regression stage, is
(a) more than 7 (b) less than 7
(c) less than 6 (d) more than 6.

9.194. Pick up the correct statement from the following :
(a) Rate of digestion of slugde is more at higher temperature
(b) Thermophilic organisms digest the sludge if the temperature ranges from 40° to 60°C
(c) Mesophilic organisms digest the sludge if the temperature is between 25° and 40°C
(d) 90% of digestion takes place in 30 days at 29°C, the optimum mesophilic temperature

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(e) All the above.

9.195. The sewerage system consists of
(a) house sewer (b) lateral sewer
(c) branch sewer (d) main sewer
(e) all of these.

9.196. The sewer that unloads the sewage at the point of treatment is called
(a) main sewer (b) outfall sewer
(c) branch sewer (d) house sewer.

9.197. The sewer pipe which carries sewage from a building for immediate disposal is
(a) house sewer (b) lateral sewer
(c) intercepting sewer (d) main sewer.

9.198. In areas where rainy season is limited to a few months, the type of sewerage system recommended is
(a) combined system
(b) partially separate system
(c) separate system (d) none of these.

9.199. In areas where light rains are uniformly distributed throughout the year, the type of sewerage system to be adopted is
(a) separate system (b) combined system
(c) partially combined system (d) none of these.

9.200. When drainage to sewage ratio is 20, the peak dry weather flow is
(a) 20% of the design discharge
(b) slightly less than 5% of the design discharge
(c) slightly more than 5% of the design discharge
(d) none of these.

9.201. Sewer pipes need be checked for
(a) minimum flow (b) maximum flow
(c) both (a) and (b) (d) none of these.

9.202. The design period of sewage treatment works in normally
(a) 5-10 years (b) 15-20 years
(c) 30-40 years (d) 40-50 years.

9.203. For sewer mains of 0.5 to 1 m diameter, the ratio of maximum daily sewage flow to the average daily sewage flow is assumed
(a) 1.5 (b) 2.0
(c) 2.5 (d) 3.0.

9.204. For trunk sewers more than 1.25 m in diameter, the ratio of the maximum daily sewage flow to the average daily sewage flow is assumed
(a) 1.5 (b) 2.0
(c) 2.5 (d) 3.0
(e) 3.5.

9.205. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Sewer)	*List II (Ratio of max. daily flow to the average daily flow)*
A. Main sewers 0.5 to 1 m diameter	1. 1.5
B. Trunk sewers 1.25 m diameter and above	2. 3.0
C. Small sewers/lateral 0.25 m in diameter	3. 2.0
D. Branch sewers 0.5 m in diameter	4. 4.0

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	4	2
(c)	2	3	2	1
(d)	4	3	1	2.

9.206. The ratio of minimum hourly flow to the average flow of sewage is
(a) 1/4 (b) 1/3
(c) 1/2 (d) 3/4.

9.207. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Minimum daily flow/average daily flow	1. 1/3
B. Minimum hourly flow/average daily flow	2. 2
C. Maximum daily flow/average daily flow	3. 3
D. Maximum hourly flow/average daily flow	4. 2/3

Codes :

	A	B	C	D
(a)	4	1	2	3
(b)	1	2	3	4
(c)	4	3	1	2
(d)	3	2	4	1.

9.208. Sewer pipes are designed for maximum discharge with 25% to 33% vacant cross-sectional area for
(a) unexpected large scale infiltration of stream water
(b) unexpected increase in the population
(c) under estimates of maximum and average flows
(d) All of the above.

9.209. The maximum diameter of sewers adopted in the designs is
(a) 1.0 m (b) 2.0 m
(c) 3.0 m (d) 4.0 m.

9.210. The minimum diameter of sewer to be adopted is
(a) 10 cm (b) 12.5 cm
(c) 15 cm (d) 25 cm.

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9.211. The rational formula for peak drainage discharge, was evolved by
(*a*) Fruhling (*b*) Lloyd David
(*c*) Kuichling (*d*) All of these.

9.212. If the over land flow from the critical point to the drain is 8 km and the difference in level is 12.4 m, the inlet time is
(*a*) 2 hours (*b*) 3 hours
(*c*) 4 hours (*d*) 5 hours.

9.213. If n is the rugosity coefficient, r is the hydraulic depth, s is the bed slope of sewer, the velocity of flow in m/sec may be obtained by the formula $V = \frac{1}{n} r^{2/3} s^{1/2}$ evolved by
(*a*) Chezy (*b*) Manning
(*c*) Bazin (*d*) Kutter.

9.214. Pick up the correct statement from the following :
(*a*) the sewer pipes of sizes less than 0.4 m diameter are designed as running full at maximum discharge
(*b*) the sewer pipes of sizes greater than 0.4 m diameter are designed as running 2/3rd or 3/4th full at maximum discharge
(*c*) the minimum design velocity of sewer pipes is taken as 0.8 m/sec
(*d*) all the above.

9.215. In a residential colony, sewers of diameters 100 mm, 150 mm and 225 mm were laid with a gradient 1 in 120. Which portion of the sewage system does not choke in due course of time
(*a*) 100 mm dia. (*b*) 150 mm dia.
(*c*) 225 mm dia. (*d*) all of these.

9.216. You are asked to design sewer pipes of diameters 0.4 m to 0.9 m at maximum flow, you will assume the sewer flow running at
(*a*) full depth (*b*) half full
(*c*) two third full (*d*) three fourth full.

9.217. The most efficient cross section of sewers in a separate sewerage system is
(*a*) parabolic (*b*) circular
(*c*) rectangular (*d*) new egged.

9.218. The most efficient cross-section of sewers in a combined sewerage system is
(*a*) parabolic (*b*) circular
(*c*) rectangular (*d*) new egged.

9.219. In sewers designed with self cleansing velocity,
(*a*) the bottom is silted
(*b*) the bottom is scoured
(*c*) both silting and scouring occur at the bottom
(*d*) neither silting nor scouring occurs at the bottom.

9.220. If the depth of flow in a circular sewer is 1/4th of its diameter D, the wetted perimeter is
(*a*) $\frac{\pi D}{2}$ (*b*) $\frac{\pi D}{4}$
(*c*) $\frac{\pi D}{3}$ (*d*) πD.

9.221. In olden days the type of section adopted in trunk and out fall sewers was
(*a*) parabolic shaped (*b*) horse shoe shaped
(*c*) egg shaped (*d*) circular shaped.

9.222. The underground sewers are more subjected to
(*a*) tensile force (*b*) compressive force
(*c*) bending force (*d*) shearing force.

9.223. In R.C. sewer pipes, the percentage longitudinal r forcement to the cross-sectional area of concrete is kept
(*a*) 10.0 (*b*) 5.0
(*c*) 2.0 (*d*) 0.25.

9.224. House connections to the laterals is generally mad
(*a*) R.C.C. (*b*) P.C.C.
(*c*) Cast iron (*d*) Glazed stonewares.

9.225. Which one of the following resists hydrogen sulph corrosion
(*a*) R.C.C. (*b*) Glazed stone wares
(*c*) Asbestos cement (*d*) Glazed ware.

9.226. Which one of the following tests is used for test sewer pipes :
(*a*) water test (*b*) ball test
(*c*) mirror test (*d*) all of these.

9.227. Match List I with List II and choose a correct ans by using the codes given below the lists :

List I	*List II*
A. Collar joint	1. Sewer pipes of le than 0.6 m
B. Simplex joint	2. Sewer pipes of mo than 0.6 m
C. Socket and spigot joint	3. Asbestos cemen pipes

Codes :

	A	B	C
(*a*)	1	2	3
(*b*)	3	1	2
(*c*)	2	3	1
(*d*)	2	1	3.

9.228. Sewer manholes are generally provided at
(*a*) the change of gradient
(*b*) the change of direction
(*c*) the junctions of sewers
(*d*) all of these.

9.229. Pick up the correct statement from the following :
(*a*) The boning rod is used for checking the levels of th sewer inverts
(*b*) Manhole covers are made circular for the convenienc of the cleaning staff
(*c*) A manhole is classified as deep manhole if its depth more than 1.5 m
(*d*) A manhole is classified as shallow man- hole if its depth is less than 0.9 m
(*e*) All the above.

9.230. The maximum spacing of manholes specified by Indi standard in sewers upto 0.3 m diameter is

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(a) 20 m (b) 30 m
(c) 45 m (d) 75 m.

9.231. The arrangement made for passing the sewer line below an obstruction below the hydraulic gradient lines called
(a) inverted syphon (b) depressed sewer
(c) sag pipe (d) all of these.

9.232. The gas evolved in sewers is
(a) Carbondioxide (b) Hydrogen sulphide
(c) Methane (d) All of these.

9.233. Lead acetate test in sewer manhole is done to test the presence of
(a) Methane gas (b) Hydrogen sulphide
(c) Carbondioxide gas (d) Diesel vapours.

9.234. A safety lamp when inserted in the upper portion of a manhole causes flames. It indicates the presence of
(a) Carbondioxide gas (b) Hydrogen sulphide gas
(c) Methane gas (d) Petrol vapours.

9.235. Inter-distance between ventilation columns in a sewer line is kept
(a) 25 to 50 m (b) 50 m to 100 m
(c) 100 m to 150 m (d) 150 m to 300 m.

9.236. Which of the following pumps in used to pump sewage solids with liquid sewage without clogging the pump is
(a) centrifugal pump (b) pneumatic ejector
(c) reciprocating pump (d) none of these.

9.237. Pick up the correct statement from the following :
(a) anaerobic bacteria flourish in the absence of oxygen
(b) aerobic bacteria flourish in the presence of oxygen
(c) facultative bacteria flourish with or without oxygen
(d) all the above.

9.238. A well oxidized sewage contains nitrogen mainly as
(a) nitrates (b) nitrites
(c) free ammonia (d) none of these.

9.239. In 1000 kg of sewage, the total solids approximate
(a) 0.5 to 1.0 kg (b) 1 kg to 2.0 kg
(c) 5 kg to 7.5 kg (d) 7.5 kg to 10 kg.

9.240. Imhoff cone is used to measure
(a) total organic solids (b) total solids
(c) total in organic solids (d) settleable solids.

9.241. The pH value of fresh sewage is usually
(a) equal to 7 (b) more than 7
(c) less than 7 (d) equal to zero.

9.242. For the survival of fish in a river stream, the minimum dissolved oxygen is prescribed
(a) 3 PPm (b) 4 PPm
(c) 5 PPm (d) 10 ppm.

9.243. 5 days-biochemical oxygen demand (BOD_5) is taken at a temperature of
(a) 0°C (b) 15°C
(c) 20°C (d) 25°C.

9.244. Kjedahl nitrogen is a mixture of
(a) ammonia and nitrogen
(b) nitrogen and organic nitrogen
(c) organic nitrogen and ammonia
(d) all the above.

9.245. Pick up the correct statement from the following :
(a) In treated sewage, 4 PPm of D.O. is essential
(b) Only very fresh sewage contains some dissolved oxygen
(c) The solubility of oxygen in sewage is 95% that is in distilled water
(d) All the above.

9.246. For the COD test of sewage, organic matter is oxidised by $K_2Cr_2O_7$ in the presence of
(a) H_2SO_4 (b) HNO_3
(c) HCl (d) none of these.

9.247. Bio-chemical oxygen demand (BOD) for the first 20 days in generally referred to
(a) initial demand
(b) first stage demand
(c) carbonaceous demand
(d) all of these.

9.248. 3.0 ml of raw sewage is diluted to 300 ml. The D.O. concentration of the diluted sample at the beginning of the test was 8 mg/l. After 5 day-incubation at 20°C, the DO. concentration was 5 mg/l. The BOD of raw sewerage is
(a) 100 mg/l (b) 200 mg/l
(c) 300 mg/l (d) 400 mg/l.

9.249. If a 2% solution of sewage sample is incubated for 5 days at 20°C and the dissolved oxygen depletion was found to be 8 mg/l. The BOD of the sewage is
(a) 100 mg/l (b) 200 mg/l
(c) 300 mg/l (d) 400 mg/l.

9.250. Sluge banks are formed if sewage is disposed of in
(a) rivers (b) seas
(c) lakes (d) none of these.

9.251. Math List I with List II and select a suitable answer by using the codes given below the lists :

List I (Bacteria)	*List II*
A. Anaerobic	1. Grows on another organism
B. Parasitic	2. Causes diseases
C. Saprophytic	3. Grows in the absence of oxygen
D. Pathogenic	4. Grows on dead or decayed organic matter.

Codes :

	A	B	C	D
(a)	3	1	4	2
(b)	1	2	3	4
(c)	4	3	1	2
(d)	2	4	1	3.

9.252. The recommended detention period for grit chambers is
(a) 1 minute (b) 2 minutes
(c) 3 minutes (d) 5 minutes.

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9.253. Match List I with List II and choose a correct answer by using the codes given below the lists :

	List I (Treatment plant)	*List II (Detention period)*
A.	Grit chambers	1. 1 to 2 hours
B.	Sewage sedimentation tanks	2. 1 minute
C.	Oxidation ponds	3. 24 hours
D.	Septic tanks	4. 2 to 6 weeks

Codes :

	A	B	C	D
(*a*)	4	3	2	1
(*b*)	3	1	2	4
(*c*)	2	1	4	3
(*d*)	1	4	3	2.

9.254. The rate of accumulation of sludge in septic tanks is recommended as
(*a*) 30 litres/person/year (*b*) 25 litres/person/year
(*c*) 30 litres/person/month (*d*) 25 litres/person/month.

9.255. Which one of the following statements regarding septic tanks is wrong :
(*a*) a gap of 7.5 cm between the bottom of the covering slab and the top level of scum is provided
(*b*) the outlet invert level is kept 5 to 7.5 cm below the inlet invert level
(*c*) the minimum width of septic level is 90 cm
(*d*) the depth of tank is kept equal to its width.

9.256. The ratio of design discharge to the surface area of a sedimentation tank is called
(*a*) surface loading (*b*) overflow rate
(*c*) overflow velocity (*d*) all of these.

9.257. The flow velocity in detritus tanks is
(*a*) 0.05 m/sec (*b*) 0.09 m/sec
(*c*) 1.25 m/sec (*d*) none of these.

9.258. The sewage treatment units in which anaerobic decomposition of organic matter is used, are called
(*a*) imhoff tanks
(*b*) trickling filters
(*c*) sludge sedimentation tanks
(*d*) none of these.

9.259. The sewage treatment in septic tanks is due to
(*a*) anaerobic decomposition (*b*) aerobic decomposition
(*c*) parasitic decomposition (*d*) none of these.

9.260. To maintain aerobic biological activity, the moisture content of the compost mass should be about
(*a*) 45% (*b*) 50%
(*c*) 55% (*d*) 60%.

9.261. Pick up the correct statement from the following :
(*a*) Indore method of composting involves decomposition under aerobic conditions
(*b*) Bangalore method of composting involves decomposing under anaerobic conditions
(*c*) Fully stabilised refuse by the Bangalore method compositing is a powdery mass called humus
(*d*) all of these.

9.262. The layers of vegetable wastes and night soil alternatively piled above the ground to form a mound, is called
(*a*) a heap (*b*) plateu
(*c*) windrow (*d*) none of these.

9.263. In a fully mechanised composting plant, involves
(*a*) mechanized receipt
(*b*) mechanized segregation
(*c*) mechanized pulverising of refuse
(*d*) all of these.

9.264. Depletion of ozone layer in the outer atmosphere may cause
(*a*) lung cancer (*b*) skin cancer
(*c*) bronchitis (*d*) heart disorder.

9.265. Which one of the following part of human body withstands minimum radiation
(*a*) thyroid (*b*) kidneys
(*c*) eyes (*d*) ovaries/testis.

9.266. Which one of the following gases is most significant air pollutant
(*a*) Carbondioxide (*b*) Oxygen
(*c*) Nitrogen (*d*) Sulphurdioxide.

9.267. A rainfall may be classified as acidic if its pH value less or equal to
(*a*) 6 (*b*) 7
(*c*) 5 (*d*) 6.5.

9.268. The most dangerous pollutant in vehicular emission is
(*a*) CO (*b*) SO_2
(*c*) CO_2 (*d*) O_3.

9.269. In SI units the power of sound is represented in
(*a*) kgs (*b*) joules
(*c*) neutons (*d*) watts.

The following 4 items, consist of two statements one labelled the 'Assertion A' and other labelled the 'Reason R'. You are to examine these two statements and decide if the Assertion A and the Reason R are individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answers to these items using the codes given below and mark your answers sheet accordingly.

Codes :
(*a*) Both A and R are true and R is the correct explanation of A
(*b*) Both A and R are true but R is not a correct explanation of A
(*c*) A is true but R is false
(*d*) A is false but R is true.

9.270. Assertion : The minimum self cleansing velocity in the sewer, at least once a day, must be generated.

Reason : If certain deposition takes place and is not removed, it obstructs free flow and causes further deposition leading to complete blocking of the sewer.

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9.271. Assertion : The determination of pH value of sewerage is important.
Reason : The efficiency of certain treatment methods depends upon the availability of pH value.

9.272. Assertion : Discharging the effluents from the oxidation ponds just up stream of lakes or reservoirs is undesirable.
Reason : The discharged algae get settled in the reservoirs and cause anaerobic decomposition and other water qualities.

9.273. Assertion : A free board of 0.3 m is provided above the top sewage line in septic tanks.
Reason : It helps to accommodate the scum in the septic tank.

9.274. The liquid wastes from kitchens, bath rooms and wash basins, is not called
(*a*) liquid waste (*b*) sullage
(*c*) sewage (*d*) none of these.

9.275. Dry weather flow is :
(*a*) average daily rate of flow
(*b*) average monthly rate of flow
(*c*) average annual rate of flow
(*d*) water supply allowance per capita
(*e*) none of these.

9.276. The quantity of liquid waste which flows in sewers during the period of rainfall, is known
(*a*) sanitary sewage (*b*) industrial waste
(*c*) storm sewage (*d*) none of these.

9.277. A rain sanitary sewer is constructed to carry
(*a*) sanitary sewage (*b*) storm sewage
(*c*) surface water (*d*) ground water
(*e*) all the above.

9.278. The sewer which collects the discharge from a collecting system and delivers it to a treatment plant, is known
(*a*) house sewer (*b*) lateral sewer
(*c*) branch sewer (*d*) sewer outfall.

9.279. The sewer which received discharge from two or more main sewers, is known as
(*a*) a trunk sewer (*b*) an outfall sewer
(*c*) a main sewer (*d*) an intercepting sewer.

9.280. Rate of flow of sewage is generally assumed
(*a*) more than the rate of water supply
(*b*) equal to the rate of water supply
(*c*) less than the rate of water supply
(*d*) at 150 litres per capita.

9.281. To prevent settling down of sewage both at the bottom and on the sides of a large sewer, self-cleaning velocity recommended for Indian conditions, is
(*a*) 0.50 m/sec (*b*) 0.60 m/sec
(*c*) 0.70 m/sec (*d*) 0.75 m/sec
(*e*) 1.0 m/sec.

9.282. Pick up the correct statement from the following :
(*a*) The larger the sewer in size, more will be velocity
(*b*) The smaller the sewer in size, less will be velocity
(*c*) The larger the sewer in size, no deposition will take place
(*d*) The larger the sewer in size, deposition will take place.

9.283. It is customary to design a sewer for D.W.F. on the basis of
(*a*) average demand
(*b*) twice the average demand
(*c*) thrice the average demand
(*d*) four times the average demand.

9.284. For design purposes, the normal rate of infiltration of ground water into the sewer, is
(*a*) 500 litres/km/cm (*b*) 1000 litres/km/cm
(*c*) 1500 litres/km/cm (*d*) 2000 litres/km/cm
(*e*) 2500 litres/km/cm.

9.285. The gradient of sewers depends upon
(*a*) velocity of flow (*b*) diameter of the sewer
(*c*) discharge (*b*) all the above.

9.286. The minimum diameter of a sewer is kept
(*a*) 10 cm (*b*) 15 cm
(*c*) 20 cm (*d*) 25 cm
(*e*) 30 cm.

9.287. The suitable cross-section of sewers to carry combined flow, is
(*a*) circular (*b*) egg shaped
(*c*) rectangular (*d*) horse shoe shaped.

9.288. For disposal of discharge by separate system, the recommended cross-section of sewers is :
(*a*) circular (*b*) egg shaped
(*c*) rectangular (*d*) horse shoe shaped.

9.288 (i). The joint for sewers shown in figure is known as :

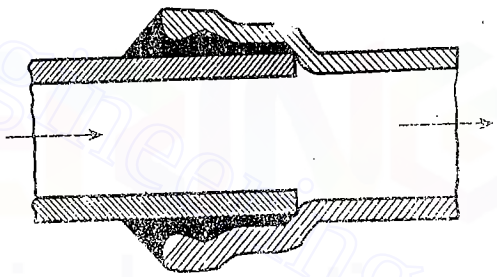

Fig. 9.2

(*a*) socket and spigot joint (*b*) collar joint
(*c*) flush joint (*d*) mortise joint.

9.289. Setting out the alignments of sewers may start from
(*a*) city (*b*) out-fall
(*c*) tail end (*d*) any point.

9.290. The laying of sewers is done with
(*a*) magnetic compass (*b*) theodolite
(*c*) level (*d*) clinometer
(*e*) plane table.

9.291. For drainage pipes in buildings the test applied before putting them to use, is
(*a*) water test (*b*) smoke test
(*c*) straightness test (*d*) all the above.

9.292. The gas which may cause explosion in sewers, is
(*a*) carbondioxide (*b*) methane
(*c*) ammonia (*d*) carbon monoxide.

9.293. Fresh sewage is generally
(*a*) alkaline (*b*) acidic

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(c) highly decomposed
(d) a source of objectionable odour.

9.294. For large sewers, maximum distance between manholes may be
(a) 50 m (b) 100 m
(c) 200 m (d) 300 m
(e) 400 m.

9.295. The minimum diameter of an opening of a manhole should be
(a) 25 m (b) 50 m
(c) 75 m (d) 100 m
(e) 150 m.

9.296. At the junction of sewers
(a) top of smaller sewer is kept lower
(b) top of larger sewer is kept lower
(c) tops of both the sewers are at the same level
(d) none of these.

9.297. Ventilating shafts are provided to a sewer line at every
(a) 100 m (b) 150 m
(c) 200 m (d) 300 m
(e) 500 m.

9.298. Aerobic activity is maximum
(a) in freshly produced sewage
(b) at sewer pipes
(c) in sewer treatment plants
(d) none of these.

9.299. During putrifaction process of sewage the gas given off, is
(a) carbon dioxide (b) hydrogen
(c) ammonia (d) methane
(e) all the above.

9.300. Oxidation process results in the formation of
(a) carbon dioxide (b) nitrates
(c) sulphates (d) all the above.

9.301. Fresh sewage may become stale in
(a) one hour (b) two to three hours
(c) three to four hours (d) six hours.
(e) ten hours.

9.302. Water content of sewage is about
(a) 90% (b) 95%
(c) 99% (d) 9.9%.

9.303. For evaporation and measurement of settlable solids, the apparatus used, is
(a) a jar (b) a breaker
(c) a test tube (d) an Imhoff cone.

9.304. A five day B.O.D. at 15°C of the sewage of a town is 100 kg/day. If the 5 day B.O.D. per head at 15°C for standard sewage is 0.1 kg/day, the population equivalent is
(a) 100 (b) 1000
(c) 5000 (d) 10000.

9.305. Disposal to sewage in large cities, is done in
(a) irrigation (b) dilution
(c) oxidation (d) putrifaction.

9.306. A nuisance is experienced in diluting water if dilution factor is less than
(a) 100 (b) 60
(c) 40 (d) 20
(e) 10.

9.307. The sewage in oxidation ponds, is treated by
(a) aerobic bacteria action (b) sedimentation
(c) action of algae (d) oxidation
(e) both (a) and (c).

9.308. In a trickling filter
(a) filtration process is used (b) biological action is used
(c) neither (a) nor (b) (d) both (a) and (b).

9.309. In trickling filter, B.O.D. is reduced to
(a) 30 to 40% (b) 40 to 60%
(c) 60 to 80% (d) 80 to 90%
(e) 95%.

9.310. In normal conditions, the period for sludge digestion, is
(a) 10 days (b) 20 days
(c) 30 days (d) 60 days
(e) 90 days.

9.311. In a sludge tank, the gas mainly produced, is
(a) Oxygen (b) Nitrogen
(c) Hydrogen (d) Carbon dioxide
(e) Methane.

9.312. For house drainage minimum gradient is
(a) 1 in 60 (b) 1 in 80
(c) 1 in 10 (d) 1 in 400.

9.313. Removal of oil and grease from sewage, is known
(a) screening (b) skinning
(c) filtration (d) none of these.

9.314. In septic tanks, decomposition of organic bacteria, is done by
(a) anaerobic bacteria (b) aerobic bacteria
(c) both types of bacterias (d) none of these.

9.315. The self-cleansing velocity of water flowing through pipe lines, is
(a) 2 metres/sec (b) 1 metre/sec
(c) 0.5 metre/sec (d) 0.25 metre/sec.

9.316. Dry water flow in a combined sewer, is
(a) industrial sewage (b) domestic sewage
(c) storm water
(d) inclusive of domestic and industrial sewage but excludes storm water.

9.317. Drop manholes at the junctions of sewer lines, are provided if
(a) invert level of a branch sewer is more than 60 cm that of the main sewer
(b) sewer line runs along a main road
(c) ordinary manhole cannot be built
(d) two sewer lines intersect.

9.318. Antisyphonage pipe is fitted
(a) at the end of septic tanks
(b) on manholes
(c) with a W.C. trap

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(*d*) at the beginning of sewer line.

9.319. Chlorination of water is done for the removal of
(*a*) bacterias (*b*) suspended solids
(*c*) sediments (*d*) hardness.

9.320. The effluent of a septic tank is
(*a*) fit for discharge into any open drain
(*b*) foul and contains dissolved and suspended solids
(*c*) as good as that from a complete treatment
(*d*) none of these.

9.321. Dried sewage after treatment is used as
(*a*) fertilizer
(*b*) building material
(*c*) chemical for lowering B.O.D.
(*d*) base material for paints.

9.322. In sewers the velocity of flow should not be
(*a*) more than the self-cleansing velocity
(*b*) less than the self-cleansing velocity
(*c*) less than 10 m/sec
(*d*) more than 20 m/sec.

9.323. Self-cleansing velocity is
(*a*) velocity at dry weather flow
(*b*) velocity of water at flushing
(*c*) velocity at which no accumulation remains in the drains
(*d*) velocity of water in a pressure filter.

9.324. Hydraulic mean radius is
(*a*) mean radius of sewer
(*b*) difference in heads between two points in circular pipes
(*c*) mean of radii in a pipe line of varying cross-sections
(*d*) cross-sectional area/wetted perimeter.

9.325. In the activated sludge process
(*a*) aeration is continued till stability
(*b*) aeration is done with an admixture of previously aerated sludge
(*c*) sludge is activated by constant stirring
(*d*) water is removed by centrifugal action.

9.326. Drop manholes are the manholes
(*a*) without entry ladders
(*b*) without manhole covers
(*c*) with depths more than 3.5 m
(*d*) having drains at different levels.

9.327. Skimming tanks are
(*a*) used to remove the grease and oil
(*b*) those from which sludge is skimmed out
(*c*) tanks provided with self-cleansing screens
(*d*) improved version of grit chambers.

9.328. Traps
(*a*) are water seals which prevent the entry of foul gases
(*b*) are used to trap the rats entering sewers
(*c*) dissolve the foul gases
(*d*) create syphonic action to increase the quick disposal of sewerage.

9.329. For providing an Indian type W.C., the R.C.C. slabs in the toilet portion
(*a*) should be sunk by 20 cm
(*b*) should be kept 20 cm above the adjacent portion
(*c*) should be sunk by 50 cm
(*d*) need not be sunk.

9.330. Lead caulked joints are used for laying
(*a*) stone ware pipes (*b*) earthern ware pipes
(*c*) C.I. pipes (*d*) G.I. pipes.

9.331. The minimum recommended diameter of sewers, is
(*a*) 5 cm (*b*) 10 cm
(*c*) 15 cm (*d*) 20 cm.

9.332. Which one of the following does not require treatment before its disposal
(*a*) storm sewage (*b*) domestic sewage
(*c*) Industrial sewage (*d*) All the above.

9.333. The following are the components of a sewerage system
1. Main sewers
2. Outfall sewers
3. Lateral sewers
4. House sewers
5. Branch sewers.

Pick up the correct occurrence of these components from the following

(*a*)	1	2	3	4	5
(*b*)	4	1	2	3	5
(*c*)	4	3	5	1	2
(*d*)	5	4	1	2	3

9.334. The complete treatement of the original contaminated sewage is done in the following order sewage is done in the following order before allowing is to be discharged directly into the natural drainage system
(*a*) Screening, sedimentation, oxidation, sludge digestion, disinfection
(*b*) Disinfection, sedimentation, sludge digestion, screening oxidation
(*c*) Oxidation, sludge digestion, disinfection, screening sedimentation
(*d*) Sludge digestion, sedimentation, screening oxidation.

9.335. %..... of per capita water demand in litres/day/person is assumed as per capita sewage produced in litres/day/person.
(*a*) 60% (*b*) 70%
(*c*) 75% (*d*) 80%

9.336. Match List I with List II regarding hourly variations in sewage flow and select a suitable answer by using the codes gives below the lists

List I (Type of sewer)	*List II (Ratio of maximum flow to average flow)*
A. Trunks above 1.25 m in diameter	1. 4.0
B. Mains up to 1 m in diameter	2. 3.0

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C. Branches upto 0.5 m diameter — 3. 2.0

D. Laterals upto 0.25 m diameter — 4. 1.5

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	1	2	3	4
(c)	3	2	4	1
(d)	4	2	1	3

9.337. The sizes of sewers are generally designed for carrying the computed maximum hourly flows, running

(a) $\frac{1}{2}$ full (b) $\frac{2}{3}$rd full

(c) $\frac{3}{4}$th full (d) $\frac{4}{5}$th full

9.338. Assuming L as the length of over land flow in kilometers from the critical point to the mouth of the drain, and H the total fall of level, then the time of concentration (T_i) is :

(a) $\left(0.885\frac{L^3}{H}\right)^{0.385}$ (b) $\left(0.385\frac{L^3}{H}\right)^{0.885}$

(c) $\left(0.385\frac{L^2}{H}\right)^{0.885}$ (d) $\left(0.885\frac{L^2}{H}\right)^{0.385}$

9.339. Match List I with List II regarding the hydraulic characteristics of circular sewer running the fall and select a suitable answer by using the codes given below the lists :

List I	*List II*
A. Area of cross-section	1. 1
B. Wetted perimeter	2. $D/4$
C. Hydraulic mean depth	3. $\frac{\pi}{4}D^2$
D. Proportionate depth	4. πD

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	3	4	2	1
(d)	4	2	3	1

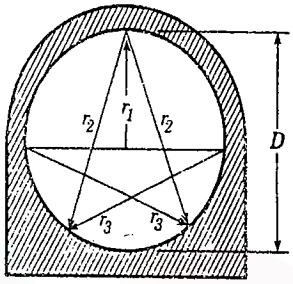
9.340. Match List I with List II regarding the hydraulic characteristics of circular sewer running partially and select a suitable answer by using the codes given below the lists :

List I	List II
A. Depth at partial flow	1. $\frac{1}{2}\left[1-\cos\frac{\alpha}{2}\right]$
B. Proportionate depth	2. $\frac{D^2}{4}\left[\frac{\alpha a}{360^\circ}-\frac{\sin\alpha}{2}\right]$
C. Area of cross-section	3. $\frac{1}{2}\left[1-\cos\frac{\alpha}{2}\right]$
D. Hydraulic mean depth	4. $\frac{D}{4}\left[1-\frac{360^\circ\sin\alpha}{2\pi\alpha}\right]$

Codes :

	A	B	C	D
(a)	1	3	4	2
(b)	3	1	2	4
(c)	4	2	3	1
(d)	2	4	1	3

9.341. For the construction of a horse shoe-shaped sewer of depth D, the value fo radii



(a) $r_1 = \frac{1}{2}D$ (b) $r_2 = D$

(c) $r_3 = D$ (d) All the above.

9.342. While laying of the sewer pipes, an offset line parallel to the proposed alignment of the sewer line is set out on the ground at a distance of ($\frac{1}{2}$th trench width) plus

(a) 0.2 m (b) 0.4 m

(c) 0.6 m (d) 1.0 m

9.343. Pick up the correct statement from the following :

(a) Before laying the sewer line, location of manholes is decided

(b) The sewer pipes are laid starting from their out fall ends

(c) The offset line is laid on the surface on the side which is not likely to be disturbed during digging

(d) All the above.

9.344. Pick up the correct statement from the following :

(a) The upper portion of a deep man hole is called access shaft

(b) The lower portion of the man hole is known as the working chamber

(c) The invert portion of the man hole is called the benching

(d) Steps in manholes are staggered at a horizontal distance of about 20 cm and a vertical centre to centre distance of roughly 30 cm

(e) All the above.

9.345. Referring to a typical section of a circular drop man hole match List I with List II and select a correct answer by using the codes grain below the lists :

List I	*List II*
A. (1)	1. Vertical pipe
B. (2)	2. Inspection arm
C. (3)	3. Plug
D. (4)	4. Benching

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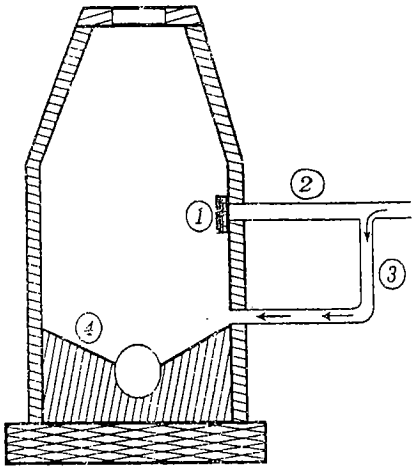

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	2	1	3
(c)	3	2	1	4
(d)	3	4	1	2

9.346. Solids in sewage are in the form of
(a) suspended solids (b) dissolved solids
(c) colloidal solids (d) settle able solids
(e) All the above.

9.347. In sewage, the organic matter is found as
(a) Carbohydrates (b) Fats and oils
(c) Nitrogenous compounds (d) All of these.

9.348. The strength of sewage depends upon
(a) volatile solids (b) fixed solids
(c) suspended solids (d) none of these.

9.349. Match List I with List II and select a suitable answer by using the codes given under the lists :

List I	*List II*
A. Settleable solids	1. Potentiometer
B. pH value	2. Titrating with standard silver nitrate with potassium chromate indicator
C. Chlorides	3. Imhoff cone
D. Nitrates	4. Colour matching method

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	4	1	2
(d)	2	4	3	1

9.350. Pick up the correct statement from the following :
(a) Sulphides and sulphates cause aerobic, and/or anaebic decomposition
(b) In sewage, sulphides and sulphates are formed due to the decomposition of substances containing sulphur
(c) In the initial decomposition of sulphur substances, the hydrogen sulphide gas is evolved
(d) All the above.

9.351. Matheomolobinemia, a blue baby disease is caused due to the presence in potable water of
(a) sulphides (b) sulphates
(c) nitrates (d) free ammonia.

9.352. Pick up the correct statement from the following :
(a) It is ensured that at least 4 ppm of D.O. is available while discharging the treated sewage in natural drainage
(b) The solubility of oxygen in sewage is 95% of that in distilled water
(c) Potassium dichromate, an oxidising agent is generally used to destroy the organic method
(d) All the above.

9.353. The first 20 days demand required for the oxidation of organic matter, is called
(a) the first stage demand (b) the initial demand
(c) carbonaceous demand (d) All the above.

9.354. BOD_5 is biochemical oxygen demand at a temperature of
(a) 0°C (b) 10°C
(c) 20°C (d) 30°C

9.355. Pick up the bacteria found in abundance from the following :
(a) anaerobic (b) saprophytic
(c) pathogenic (d) parasitic.

9.356. Sewage disposal by dilution is resorted to, if
(a) water body discharge is not low
(b) strong forward winds occur
(c) the sewage at outfall is fresh and non-septic
(d) All the above.

9.357. Sea water contains ..... less oxygen as compared to fresh river water
(a) 10% (b) 20%
(c) 30% (d) None of these.

9.358. The flowing river water in natural drainage gets cleaned by
(a) oxidation (b) photosynthesis
(c) self purification (d) None of these.

9.359. Match List I with List II and select an appropriate answers using the codes given below the lists :

List I	*List II*
A. Grit chamber	1. 2-6 weeks
B. Sedimentation tank	2. One minute
C. Oxidation ponds	3. 12-36 hours
D. Septic tank	4. 1 to 2 hours

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Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	1	3
(c)	4	3	2	1
(d)	3	1	4	2

9.360. In sludge digestion tank, the gas evolves, is
(a) methane (b) hydrogen sulphide
(c) ammonia (d) nitrogen

9.361. The most efficient method of BOD removal, is
(a) oxidation ditch (b) trickling filter
(c) oxidation pond (d) aerated lagoon.

9.362. Pick up the correct statement from the following :
(a) The flow velocity in Imhoff tanks is limited to 0.3 m/min
(b) The effluent of a septic tank is not fit for discharge into any open drain
(c) A septic tank can be used either as a settling tank or a digestion tank
(d) All the above.

9.363. Consider the following statements regarding the peaks in the sewers
1. The peaks get damped because of the storage space in the sewers
2. The peaks get damped because time is required for the sewage to the point of gauging
3. The peak flow is quite pronounced near its origin
4. The peak hourly flows decrease as the tributary area increases

Of these statements:
(a) 1 and 2 are correct (b) 2 and 3 are correct
(c) 3 and 4 are correct (d) All of these are correct

9.364. Match List I with List II regarding the empirical formulae for calculating storm water run off, using the codes given below the lists:

List I	*List II*
A. Dicken's formula	1. $Q_p = 6.8m^{2/3}$
B. Ryve's formula	2. $123\sqrt{M}$
C. Inglis	3. $Q_p = 11.5\ M^{3/4}$
D. Burge's formula	4. $19.6\frac{M}{L^{2/3}}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	4	1	2
(d)	2	3	1	4

9.365. Consider the following statements regarding water supply pipes and sewer pipes
1. The water supply pipes carry pure water without any contamination
2. The sewer pipes carry particles in suspension and the heavier ones settle down at(the bottom of the sewer resulting in the clogging of the sewers
3. The water supply pipes carry water under gravity
4. The sewer pipes carry sewage under pressure

Of these statements:
(a) 1 and 2 are correct (b) 2 and 3 are correct
(c) 3 and 4 are correct (d) None of these is correct

9.366. Consider the following statements regarding swears
1. The sewer pipes of sizes less than 0.7 m dia are designed as running half full at maximum discharge
2. The sewer pipes of sizes greater than 0.7 m dia, are designed as running 2/3rd or 3/4th full at maximum discharge
3. The extra space above the designed full supply line, acts as a factor of safety for unexpected increase of sewage
4. The flow in the sewers is under gravity

Of these statements:
(a) 1 and 2 are correct (b) 2 and 3 are correct
(c) 1 and 4 are correct (d) 3 and 4 are correct
(e) 1, 2, 3 and 4 are correct

9.367. Consider the following statements :
A. The flow velocities in the sewers should be such that neither the suspended materials in sewage get silted up nor the sewage pipe materials get scoured out.
R. The first condition limits the minimum velocity and second condition limits the maximum velocity.

Of these statements:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

9.368. Consider the following statements regarding the self cleansing velocity in the sewers:
1. For the removal of the inorganic sand particles of diameter 1 mm and specific gravity 2.65, 0.45 m/sec velocity is required
2. For the removal of organic particles of 5 mm diameter and specific gravity 1.2,0.45 m/sec velocity is required
3. For the removal of inorganic sand particles 1 mm dia and organic particles 5 mm dia with respective specific gravity 2.65 and 1.2,0.30 m/sec velocity is required

Of these statements:
(a) 1 alone is correct (b) 1 and 2 are correct
(c) 1 and 3 are correct (d) 2 and 3 are correct

9.369. According to National Building Organisation (N.B.O.) of India, gradients for preventing interference of sewage solids in small sized sewers are :

Dia. of the sewer (mm)	*Gradient for self cleansing velocity*
1. 100	1 in 60
2. 150	1 in 100
3. 22.5	1 in 120

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Of these statements:
(a) 1 alone is correct (b) 2 alone is correct
(c) 1 and 2 are correct (d) 1, 2 and 3 are correct

9.370. Match List I with List II and select the correct answer using the codes given below the lists :

List I (Sewer material)	*List II Limiting velocity (m/sec)*
A. Glazed tiles	1. 4.55.5
B. Cement concrete tiles	2. 3.54.5
C. Cast iron sewers	3. 3.04.0
D. Stoneware sewers	4. 2.53.0

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	1	4	2	3
(c)	4	3	1	2
(d)	4	1	3	2

9.371. Consider the following statements regarding the sewers
1. Manholes are generally provided in plane areas
2. Drop man holes are generally required in hilly areas
3. Lamp holes are generally provided at the bend of the sewer

Of these statements:
(a) 1 alone is correct (b) 2 alone is correct
(c) 1 and 3 are correct (d) 1, 2 and 3 are correct

9.372. Consider the following specification need be checked while designing the sewers
1. The minimum velocity of 0.45 m/sec is maintained at the 1/3rd of sewage flow
2. The velocity of 0.9 m/sec should be at least at the time of maximum flow
3. At the time of maximum flow, the velocity should not exceed the scouring values.

Of these statements:
(a) 1 alone is correct (b) 1 and 2 are correct
(c) 2 and 3 are correct (d) 1, 2 and 3 are correct

9.373. Match List I with List II regarding circular sewers running partially with angle a and select the correct answer using the codes given below the lists :

List I	*List II*
A. Proportionate depth	1. $\left[1 - \frac{360° \sin \alpha}{2\pi\alpha}\right]$
B. Proportionate area	2. $\frac{1}{2}\left(1 \cos \frac{\alpha}{2}\right)$
C. Proportionate perimeter	3. $\frac{\alpha}{360°} - \frac{\sin \alpha}{2\pi}$
D. Proportionate hydraulic mean depth	4. $\left[\frac{\alpha}{360°}\right]$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	3	4	2	1
(d)	2	1	3	4

9.374. Consider the following statements regarding flow in circular sewers
A. The decline in proportionate velocities is less as compared to the decline in discharge in sewers running less than half the full depth
R. The area reduces much faster than the hydraulic mean depth.

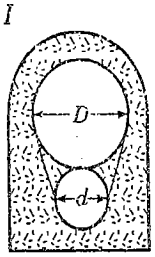
Of these statements:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true.

9.375. Consider the following statements regarding the circular sewers
1. These require highly technical method of manufacturing
2. These provide maximum area for a given perimeter
3. These provide most efficient section when running full or half fulL

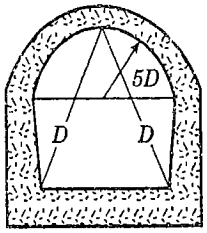
Of these statements:
(a) 1 alone is correct (b) 2 alone is correct
(c) 1 and 2 are correct (d) 1, 2 and 3 are correct

9.376. Match List I with List II and select the correct answer using codes given below the lists :

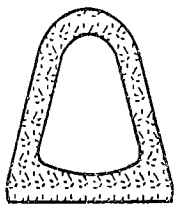
List I *List II*



1. Horse shoe shaped sewer



2. Parabolic shaped sewer



3. Standard egg shaped

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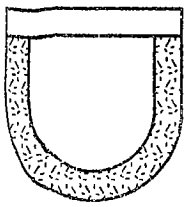

4. U-shaped sewer

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	1	4	2
(d)	2	4	1	3

9.377. Consider the following statements regarding the asbestos cement sewers
1. Light in weight and easy to transport
2. Easy assembly without skilled labour
3. The interior surface is very smooth
4. Ability to bear the large compressive stresses induced by the heavy external loads

Of these statements:
(a) 1 alone is correct (b) 1 and 3 are correct
(c) 1, 2 and 3 are correct (d) 1, 2, 3 and 4 are correct

9.378. Consider the following statements regarding cast iron sewers
1. These are used for out fall sewers for rising mains of pumping stations
2. These are used under heavy traffic loads
3. These are used over trestles in low lying areas
4. These are 100% leak proof

Of these statements:
(a) 1 alone is correct (b) 1 and 2 are correct
(c) 1 and 3 are correct (d) 1, 2, 3 and 4 are correct

9.379. Match List I with List II and select the correct answer using codes given below the lists :

List I	*List II*
A. Cast iron sewers	1. Highly resistant to sulphide corrosion
B. Stone-ware sewers	2. Corrosive and easily affected by the action of sulphuric acid produced from hydrogen sulphide gas.
C. Concrete sewers	3. Provides excellent hydraulically efficient sewer
D. Absestos cement sewer	4. Greater tensile compressive and bending stresses.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	4	3
(c)	4	1	2	3
(d)	3	2	1	4

9.380. Consider the following statements regarding the laying of the sewer pipes :
Assertion A : The sewer pipes are generally laid starting from their outfall ends towards their starting ends
Reason R : Tail sewers can be used during the initial periods of the construction Of these statements:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true.

9.381. Match List I with List II and select the correct answer using codes given below the lists :

List I	*List II*
A. Curb inlet	1. Concrete box having gratings in horizontal direction
B. Horizontal inlet	2. Street inlets provided with a settling basin for the settled grit
C. Catch pits	3. The devices used to flush the sewers
D. Flushing tanks	4. Concrete box having gratings in vertical direction

Codes :

	A	B	C	D
(a)	1	3	4	2
(b)	1	4	3	2
(c)	1	2	3	4
(d)	4	1	2	3

9.382. Consider the following statements regarding the design of inverted siphon in the sewers
1. Inlet chamber and outlet chambers are provided at either end of the inverted siphon
2. A self cleansing velocity of 0.45 m/sec even during minimum discharge is ensured
3. For sanitary sewers, two pipe lines are provided, one for minimum dry weather and the other for maximum dry weather flow
4. In long inverted siphon, hatch boxes at interval of about 30 m are provided.

Of these statements:
(a) 1 alone is correct (b) 2 and 4 are correct
(c) 1 and 3 are correct (d) All of these are correct

9.383. Match List I with List II and select correct answer using codes given below the lists :

List I (Size of sewer)	*List II (Method of cleaning)*
A. Small sized sewers	1. Canerodding
B. Medium sized sewers	2. Pills of suitable size are used

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C. Badly clogged medium sized sewers — 3. By manual labour

D. Large sized sewers — 4. A flexible fire hose with 2.5 cm nozzle

Codes :

	A	B	C	D
(a)	1	3	2	4
(b)	4	3	2	1
(c)	1	2	3	4
(d)	4	1	2	3

9.384. Consider the following statements regarding the foul gases in the sewers
1. Hydrogen sulphide (H_2S) is evolved
2. Carbon dioxide (CO_2) is evolved
3. Methane is evolved
4. Oxygen is evolved

Of these statements:
(a) 1 and 2 are correct
(b) 2 and 3 are correct
(c) 3 and 4 are correct
(d) 1, 2 and 3 are correct

9.385. Match List I with List II and select correct answer using codes given below the lists :

List I	*List II*
A. H_2S gas	1. Extinguishes the flame of miner's safety lamp in manholes B.
B. CO_2 gas	2. It forms an explosive mixture with air in upper layers of manhole
C. CH_4 gas	3. A paper moistened with lead acetate if placed in man hole turns black
D. O_2 gas	4. burns the miner's safety lamp

Codes:

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	2	4	3	1
(d)	1	4	2	3

9.386. Consider the following statements regarding ventilating column of sewers :
1. A covel is provided at the top of the shaft for the escape of gases into the atmosphere
2. A ventilating column is used near the street lamp posts
3. The diameter of the ventilating column is preferably kept equal to one third of the diameter of the sewer
4. The ventilating columns are generally kept lower than the height of noarby structures

Of these statements:
(a) 1 alone is correct
(b) 1 and 2 are correct
(c) 1 and 4 are correct
(d) 2 and 3 are correct

9.387. Consider the following statements regarding the bacteria present in municipal sewage
1. Aerobic bacteria flourish in the presence of free oxygen
2. Anaerobic bacteria flourish in the absence of free oxygen
3. Facultative bacteria flourish both in the presence as well as absence of free oxygen

Of these statements:
(a) 1 alone is correct
(b) 2 alone is correct
(c) 1 and 2 are correct
(d) 1, 2 and 3 are correct

9.388. Consider he following stages in Nitrogen cycle under aerobic oxidation
1. Formation of Nitraes
2. Formation of Ammonia
3. Formation of Nitrites
4. Photosynthsis

The correct sequence of the stages is
(a) 1, 4, 2, 3 (b) 2, 3, 1, 4
(c) 1, 2, 3, 4 (d) 4, 3, 2, 1

9.389. Consider the following stages in Sulphur cycle under aerobic oxidation
1. Formation of hydrogen sulphide
2. Formation of sulphates
3. Formation of sulphur
4. Photosynthesis

The correct sequence of the stages is:
(a) 1, 2, 3, 4 (b) 2, 4, 3, 1
(c) 1, 4, 3, 2 (d) 4, 3, 2, 1

9.390. Consider the following staes of Carbon cycle under aerobic conditions:
1. Oxidation of carbonaceous organic matter
2. Release of carbon dioxide
3. Carbon dioxide through photosynthesis gest converted into plant carbohydrates
4. The wastes produced by animals and their dead bodies from cabonaceous organic matter

Of these stages, the correct sequence is :
(a) 1, 2, 3, 4 (b) 2, 4, 3, 1
(c) 1, 4, 3, 2 (d) 4, 3, 2, 1

9.391. Consider the following statements regarding the decomposition of sewage
A well oxidised sewage contains.
1. Nitrates in excess
2. Sulphates in excess
3. Ammonia in excess
4. Hydrogen sulphide in excess

Of these statements :
(a) 1 alone is correct (b) 2 alone is correct
(c) 1 and 2 are correc (d) 3 and 4 are correct

9.392. Consider the following statement regarding the decomposition of sewage
1. Pathogens are harmful to man

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2. Non-pathogens are useful to man
3. Aeration tanks and contact beds work on oxidation
4. Septic tanks and imhoff tanks work on putrefaction

Of these statements:
1. One alone is correct
2. 1 and 2 are correct
3. 1 and 3 are correct
4. 1, 2, 3 and 4 are correct

9.393. Consider the following statements regarding the characteristics of sewage
1. The turbidity of sewage is directly proportional to the strength of sewage
2. The yellowish, grey or light brown colour indicates the freshness of the sewage
3. Fresh sewage is practically odourless
4. At higher temperature, the dissolved oxygen content (D.O.) of sewage gets reduced

Of these statements:
(*a*) 1 and 2 are correct (*b*) 2 and 3 are correct
(*c*) 3 and 4 are correct (*d*) All are correct

9.394. Match List I with List II and select correct answer using codes given below the lists :

List I	*List II*
A. B.O.D.	1. The ratio of oxygen available in effluent to the total oxygen required to satisfy the first stage B.O.D. demand
B. Relative stability	2. 12.5 times the total standard BOD (5 days) of the city in kg/day.
C. Population equivalent	3. Potassium dichromate
D. C.O.D.	4. Depleton of oxygen × dilution factor

Codes:

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	3	4	2	1
(*c*)	4	1	2	3
(*d*)	1	3	2	4

9.395. The various zones of pollution in a river system are :
1. Zone of cleaner water
2. Zone of degradation
3. Zone of recovery
4. Zone of decomposition

The correct sequence of the zones is:
(*a*) 1, 2, 3, 4 (*b*) 2, 3, 1, 4
(*c*) 2, 4, 3, 1 (*d*) 4, 1, 2, 3

9.396. Consider the following statements regarding self purification of river water.
1. In clean conditions in a river stream, the oxygen deficit must be nil.
2. The D.O. content goes on increasing due to decomposition of volatile organic matter.
3. In the process of re-oxygenation, consumption of D.O. due to deoxygenation is counter balanced by the atmospheric supplies of oxygen to the water.
4. If the D.O. content becomes zero, aerobic conditions are replaced by putrefaction conditions.

Of these statement:
(*a*) 1 alone is correct (*b*) 1 and 2 are correct
(*c*) 1, 2 and 3 are correct (*d*) 1, 3 and 4 are correct

9.397. Consider the following statements regarding dilution of sewage in sea water
1. The sea water contains 80% of oxygen contained in fresh river stream.
2. The sea water can absorb sewage solids more than the fresh water of a stream.
3. Sewage solids chemically react with the dissolved matters of sea water and thus form sludge banks
4. The sludge banks are free from hydrogen sulphide gas

Of these statements:
(*a*) 1 and 3 are correct (*b*) 2 and 4 are correct
(*c*) 1 and 4 are correct (*d*) 3 and 4 are correct

9.398. Match List I with List II and select the correct answer using codes given below the lists :

List I (Process of sewege treatement)	*List II (Materials removed)*
A. Screening	1. floating materials
B. Skimming tanks	2. Sand
C. Grit chambers	3. Oil and grease

Codes:

	A	B	C
(*a*)	1	2	3
(*b*)	2	1	3
(*c*)	1	3	2

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16.222. Width of vehicles affects the width of
(*a*) lanes (*b*) shoulders
(*c*) parking spaces (*d*) all the above.

16.223. Length of vehicles does not affect
(*a*) extra widening
(*b*) minimum radius of turning
(*c*) passing sight distance
(*d*) width of shoulders
(*e*) none of these.

16.224. The weight of vehicles affects
(*a*) pavement thickness (*b*) ruling gradient
(*c*) limiting gradient (*d*) design of bridges
(*e*) all the above.

16.225. If L metres is the distance between extreme axles of a vehicle, its gross load should not exceed
(*a*) $1525\ (L + 4.3) - 14.7\ L^2$ (*b*) $1526\ (L + 5.3) - 14.7\ L^2$
(*c*) $1525\ (L + 6.3) - 14.7\ L^2$ (*d*) $1525\ (L + 7.3) - 14.7\ L^2$
(*e*) $1526\ (L + 8.3) - 14.7\ L^2$.

16.226. Design of horizontal and vertical alignments, super-elevation, sight distance and grades, is worst affected by
(*a*) width of the vehicle (*b*) length of the vehicle
(*c*) height of the vehicle (*d*) speed of the vehicle.

16.227. Speed regulations on roads is decided on the basis of
(*a*) 60 percentile cumulative frequency
(*b*) 75 percentile cumulative frequency
(*c*) 80 percentile cumulative frequency
(*d*) 85 percentile cumulative frequency.

16.228. Minimum permissible speed on high speed roads, is decided on the basis of
(*a*) 15 percentile cumulative frequency
(*b*) 20 percentile cumulative frequency
(*c*) 30 percentile cumulative frequency
(*d*) 40 percentile cumulative frequency.

16.229. On most smooth hard surfaced roads, rolling resistance to moving vehicles, ranges from
(*a*) 5 kg to 7 kg/tonne (*b*) 7 kg to 9 kg/tonne
(*c*) 9 kg to 11 kg/tonne (*d*) 11 kg to 13 kg/tonne
(*e*) none of these.

16.230. Gradient resistance of moving vehicles along down slopes, is
(*a*) + 7 kg/tonne (*b*) + 9 kg/tonne
(*c*) – 9 kg/tonne (*d*) – 7 kg/tonne.

16.231. The maximum comfortable retardation applied to moving vehicles, is
(*a*) 3.42 m/sec^2 (*b*) 4.42 m/sec^2
(*c*) 5.56 m/sec^2 (*d*) 7.80 m/sec^2
(*e*) 10 m/sec^2.

16.232. The distance travelled by revolving the wheel of a vehicle more than its circumferential movement, is known as
(*a*) slip (*b*) skid
(*c*) neither (*a*) nor (*b*) (*d*) both (*a*) and (*b*).

16.233. Along horizontal curves, if centrifugal force exceeds lateral friction, vehicles may
(*a*) skid (*b*) slip
(*c*) not be affected (*d*) none of these.

16.234. Driving vehicles on wet surfaced roads, is dangerous because it may
(*a*) skid (*b*) slip
(*c*) overturn (*d*) all the above.

16.235. Roughness index of roads, is expressed as
(*a*) size of the stone on the pavement
(*b*) number of patches on the pavement
(*c*) cumulative deformation of surface per horizontal distance
(*d*) type of the road surface.

16.236. Traffic surveys are carried out
(*a*) to know the type of traffic
(*b*) to determine the facilities to traffic regulations
(*c*) to design proper drainage system
(*d*) all the above.

16.237. Traffic census is carried out for
(*a*) speed and delay study (*b*) road parking study
(*c*) traffic volume study
(*d*) origin and destination study
(*e*) all the above.

16.238. As per recommendations of I.R.C., traffic volume study is carried out for rural roads for 7 days continuously during
(*a*) harvesing (*b*) lean season
(*c*) harvesting and lean season
(*d*) none of these.

16.239. At intersection of roads, the traffic volume study is carried out to ascertain the number of vehicles
(*a*) moving along straights (*b*) turning left
(*c*) turning right (*d*) all the above.

16.240. Pick up the correct statement from the following :
(*a*) Seasonal cycle of traffic volume during April and November, is usually near the annual average
(*b*) Mid-winter seasonal cycle of traffic is least
(*c*) Mid-summer seasonal cycle of traffic is highest
(*d*) All the above.

16.241. Increase in traffic volume, due to increase in transport vehicles, is known as
(*a*) development traffic (*b*) normal traffic growth
(*c*) generated traffic growth (*d*) current traffic
(*e*) none of these.

16.242. Volume of traffic which is due to improvement carried out in adjacent area, is known as
(*a*) development traffic (*b*) generated traffic growth
(*c*) normal traffic growth (*d*) current traffic.

16.243. Volume of traffic which would immediately use a new road or an improved one when opened to traffic, is known
(*a*) development traffic (*b*) current traffic
(*c*) general traffic (*d*) normal traffic growth.

16.244. If P is the number of vehicles per day at last census, r is the increase in traffic and n is the number of years passed after last census, number of vehicles A per day for design, is
(*a*) $P\ (1 + r)^n$ (*b*) $P(1 - r)^n$
(*c*) $P(1 + r)^{-n+5}$ (*d*) $P\ (1 + r)^{5n}$.

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16.245. If present A.D.T. is 5000 vehicles and annual increase is 10%, the average future flow after 5 years will be
(*a*) 6050 vehicles (*b*) 7050 vehicles
(*c*) 8050 vehicles (*d*) 9050 vehicles.

16.246. Maximum number of passenger cars that can pass a given point on a road during one hour under the most ideal road way and traffic conditions, is known as
(*a*) traffic density
(*b*) basic capacity of traffic lane
(*c*) possible capacity of traffic lane
(*d*) all the above.

16.247. Maximum number of vehicles that can pass a given point on a lane during one hour without creating unreasonable delay, is known as
(*a*) traffic density of lane (*b*) basic capacity of lane
(*c*) probable capacity of lane (*d*) practical capacity of lane.

16.248. If C is basic capacity per lane, V is velocity in km/hour, S is stopping distance plus length of the vehicles in metres, the formula $C = \frac{1000V}{S}$ is applicable to
(*a*) district roads (*b*) two lane roads
(*c*) 2 lane roads in 1 direction (*d*) none of these.

16.249. If the velocity of moving vehicles on a road is 24 km/per hour, stopping distance is 19 metres and average length of vehicles is 6 metres, the basic capacity of lane, is
(*a*) 500 vehicles per hour (*b*) 700 vehicles per hour
(*c*) 1000 vehicles per hour (*d*) 1250 vehicles per hour.

16.250. Customers prefer parking of their vehicles at
(*a*) 90° to aisles (*b*) 85° to aisles
(*c*) 80° to aisles (*d*) 75° to aisles
(*e*) 60° to aisles.

16.251. The layout plan shown in Fig. 16.9 is

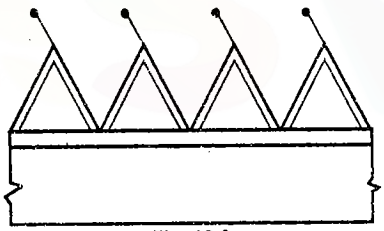

Fig. 16.9.

(*a*) a right angle parking (*b*) a parallel curb parking
(*c*) an acute angle parking (*d*) none of these.

16.252. In Fig. 16.10 parking of vehicles is wrongly done at

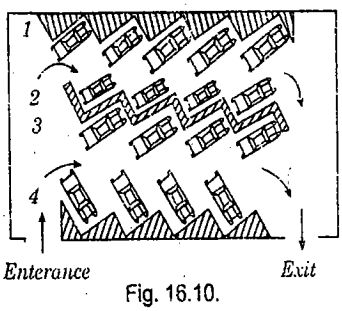

Fig. 16.10.

(*a*) position 1
(*b*) position 2
(*c*) position 3
(*d*) position 4.

16.253. On collision diagrams, the symbol shown in Fig. 16.11 indicates
(*a*) side-swip
(*b*) overturned vehicle
(*c*) rear end collision
(*d*) fatal accident.

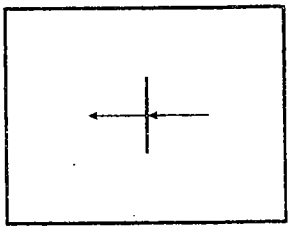

Fig. 16.11.

16.254. On collision diagrams, the symbol shown in Fig. 16.12 indicates
(*a*) side swip
(*b*) overturned vehicle
(*c*) rear end collision
(*d*) fatal accident.

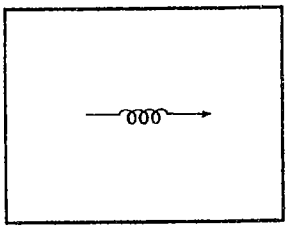

Fig. 16.12.

16.255. On collision diagrams, the symbol shown in Fig. 16.13 indicates
(*a*) injury accident
(*b*) fatal accident
(*c*) vehicle out of control
(*d*) fatal accident motor vehicle pedestrian.

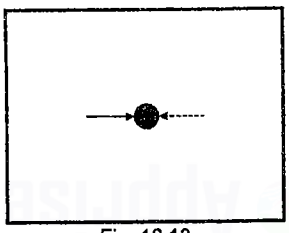

Fig. 16.13.

16.256. If brakes of vehicles are effective, the vehicle-running at 30 km/hour comes to a stop in
(*a*) 10 metres (*b*) 12 metres
(*c*) 15 metres (*d*) 18 metres.

16.257. The head light of vehicles should be such that its lower beam illuminates objects at
(*a*) 10 m (*b*) 20 m
(*c*) 30 m (*d*) 40 m
(*e*) 50 m.

16.258. In case of a multi-lane road, overtaking is generally permitted
(*a*) from right (*b*) from left
(*c*) from both sides right and left
(*d*) not at all.

16.259. At an uncontrolled junction shown in Fig. 16.14 vehicles A and B are to proceed straight and C is to take a right turn, the first right of way is

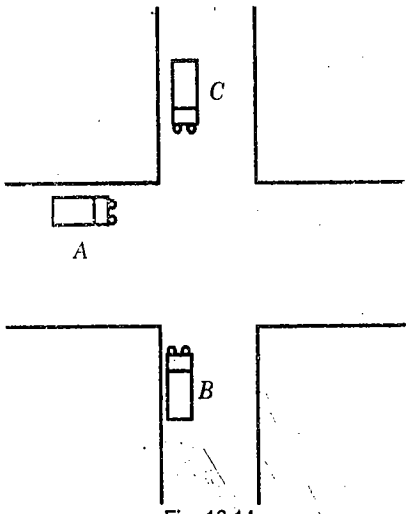

Fig. 16.14.

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(a) for vehicle A
(b) for vehicles A and B simultaneously
(c) for vehicle B
(d) for vehicle C.

16.260. One-way streets are generally provided in crowded cities as, these
(a) are inexpensive means of traffic flow
(b) reduce delays to vehicles
(c) permit higher speed
(d) reduce the number of accidents
(e) all the above.

16.261. At a road junction, 16 cross conflict points are severe, if
(a) both are one-way roads
(b) both are two-way roads
(c) one is two-way road and other is one-way road
(d) none of these.

16.262. At a road junction, 7 cross conflict points are severe if
(a) both are one-way roads
(b) both are two-way roads
(c) one is two-way road and other is one-way road
(d) none of these.

16.263. To prevent a head-on-collision of vehicles travelling in opposite directions along four-lane roads
(a) markings on the road are provided
(b) physical dividers are provided
(c) area dividers are provided
(d) medians of wide area are provided
(e) none of these.

16.264. Longitudinal pavement lines marked broken in white paint
(a) are for the guidance of the drivers
(b) are not to be crossed over
(c) may be crossed over at the discretion of the driver
(d) all the above.

16.265. Road makers along roads from the edge of a kerb should not be less than
(a) 40 cm (b) 45 cm
(c) 50 cm (d) 55 cm
(e) 60 cm.

16.266. From the point of tangency before an intersection, the route markers are fixed at a distance of
(a) 15 m to 30 m (b) 20 m to 35 m
(c) 40 m to 50 m (d) 50 m to 75 m
(e) 100 m to 150.

16.267. Along high ways confirmatory route markers are generally fixed
(a) before the crossing on the left side
(b) after the crossing on the left side
(c) before the crossing on the right side
(d) after the crossing on the right side.

16.268. The top height of a route marker above crown level is
(a) 1.50 m (b) 1.75 m
(c) 2.00 m (d) 2.25 m.

16.269. A route marker is located at A before two highway intersection as shown in Fig. 16.15. It indicates

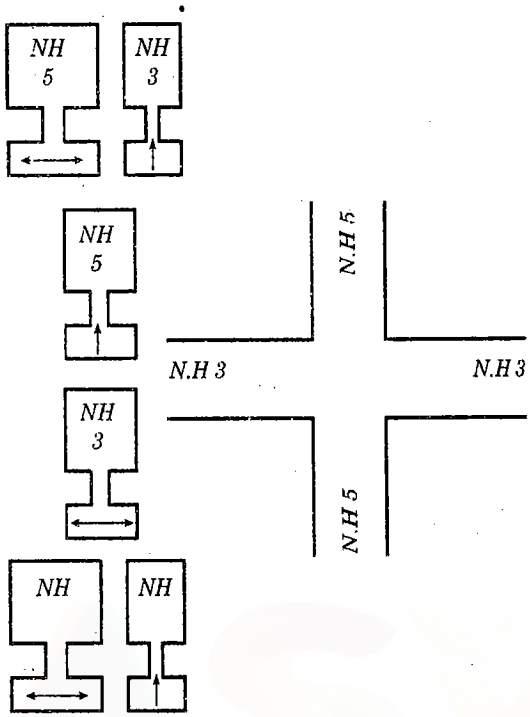

Fig. 16.15.

16.270. Thickness of broken centre line markings for a four lane road, is generally kept
(a) 10 cm (b) 12 cm
(c) 15 cm (d) 18 cm
(e) 20 cm.

16.271. Thickness of broken line markings on multi-lane road for lanes is generally kept
(a) 10 cm (b) 12 cm
(c) 15 cm (d) 18 cm
(e) 20 cm.

16.272. Passing zones are generally not provided on
(a) summit curves (b) horizontal curves
(c) two lane highways (d) all the above.

16.273. Fig. 16.16 represents an intersection of roads, known as
(a) scissor
(b) cross
(c) skewed
(d) multi-pole.

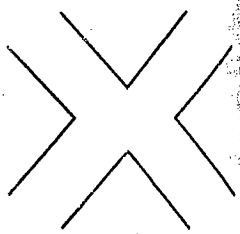
Fig. 16.16.

16.274. The type of intersection shown in Fig. 16.17, is known as
(a) channelised intersection
(b) channelised with median lanes intersection
(c) channelised with island intersection
(d) jug handle intersection.

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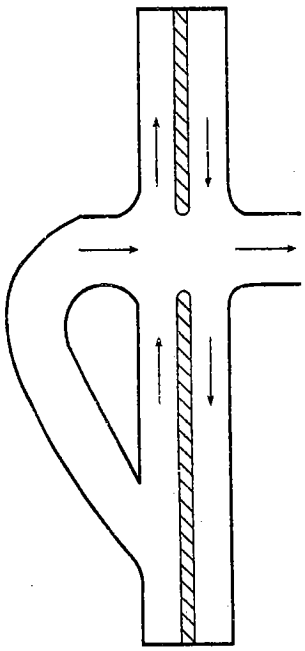

Fig. 16.17.

16.275. Round-abouts are not suitable if number of vehicles exceed
(a) 3000 (b) 4000
(c) 5000 (d) 6000.

16.276. Width of a rotary round should be equal to
(a) twice the width of narrowest radial road
(b) width of the widest road
(c) width of the widest road plus the width of one lane
(d) width of the widest road plus 2 metres.

16.277. The weaving length of a roadway is the distance
(a) between the channelising islands
(b) equal to half circumference
(c) equal to total width of adjoining radial roads
(d) equal to diameter of rotary.

16.278. The grade separator shown in Fig. 16.18, is known as

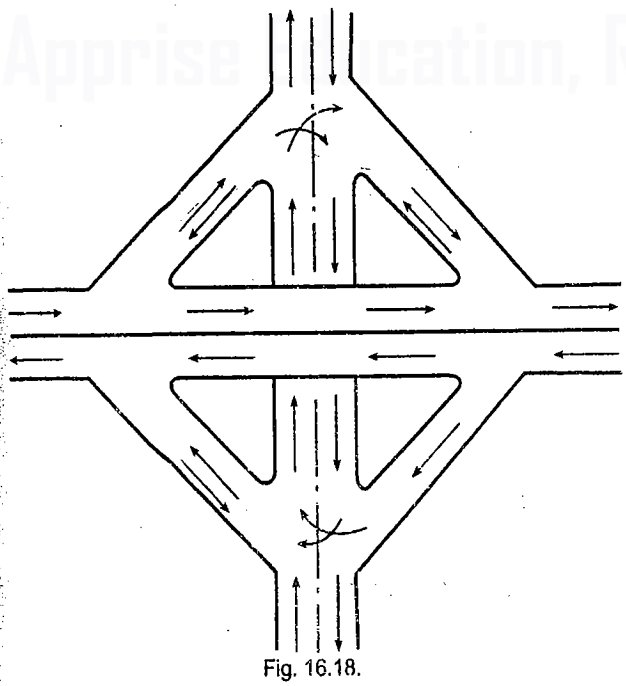

Fig. 16.18.

(a) trumpet (b) clover leaf
(c) diamond interchange (d) delta.

16.279. For the movement of vehicles at an intersection of two roads, without any interference, the type of grade separator generally preferred to, is
(a) delta (b) trumpet
(c) diamond interchange (d) clover leaf.

16.280. A subsidiary area in a carriageway placed so as to control the movement of the traffic, is
(a) median strip (b) island
(c) flower bed (d) refuge.

16.281. The total length of a valley formed by two gradients – 3% and + 2% curve between the two tangent points to provide a rate of change of centrifugal acceleration 0.6 m/sec^2, for a design speed 100 km ph, is
(a) 16.0 m (b) 42.3 m
(c) 84.6 m (d) none of these.

16.282. Extra widening required at a horizontal curve on a single lane hill road of radius 80 m for a design speed of 50 km ph and for a vehicle with wheel base 6.0 m is
(a) 0.225 m (b) 0.589 m
(c) 1.250 m (d) none of these.

16.283. In a braking test, a vehicle travelling at 36 km ph was stopped at a braking distance of 8.0 m. The average value of the vehicle's skid resistance (friction coefficient) is
(a) 0.64 (b) 6.25
(c) 0.16 (d) none of these.

16.284. The absolute minimum radius of horizontal curve for a design speed 60 km ph is
(a) 131 m (b) 210 m
(c) 360 m (d) none of these.

16.285. The absolute minimum sight distance required for stopping a vehicle moving with a speed of 80 km ph, is
(a) 120 m (b) 200 m
(c) 640 m (d) none of these.

16.286. Over taking time required for a vehicle with design speed 50 km ph and overtaking acceleration 1.25 m/sec^2 to overtake a vehicle moving at a speed 30 km ph, is
(a) 5.0 secs (b) 6.12 secs
(c) 225.48 secs (d) 30 secs.

16.287. The length of a submit curve needed to provide a stopping sight distance when the deviation angle $N = \frac{1}{20}$, is
(a) 180 m (b) 120 m
(c) 6 m (d) none of these.

16.288. If cross slope of a country is upto 10% the terain is classified as
(a) plain (b) rolling
(c) mountainous (d) steep.

16.289. If cross slope of a country is 10% to 25%, the terrain is classified as
(a) rolling (b) mountainous
(c) steep (d) plain.

16.290. If the cross slope of a country is 25% to 60%, the terrain is classified as
(a) plain (b) rolling
(c) steep (d) mountainous.

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16.291. If cross slope of a country is greater than 60%, the terrain is classified as
(*a*) rolling (*b*) mountainous
(*c*) steep (*d*) plain.

16.292. The minimum design speed of various types of highways in plain terrain is the same as the ruling design speed of
(*a*) rolling terrain (*b*) mountainous terrain
(*c*) steep terrain (*d*) none of these.

16.293. Pick up the correct statement from the following :
(*a*) Various geometric design features and generally guided by ruling design speed
(*b*) The design speed for a given highway should preferably be uniform
(*c*) Abrupt change in the design speed should not be permitted
(*d*) all the above.

16.294. The normal road land width for a National or State highway, in open areas should be
(*a*) 45 m (*b*) 30 m
(*c*) 24 m (*d*) 20 m.

16.295. The normal road land width for a major district road in open area, is
(*a*) 45 m (*b*) 25 m
(*c*) 15 m (*d*) 12 m.

16.296. The normal road width of National and State highways
(*a*) is kept 45 m
(*b*) in plain and rolling terrain built-up area, is 30 m
(*c*) in mountainous built-up area is 20 m
(*d*) All the above.

16.297. The minimum road width is taken
(*a*) 9 m (*b*) 12 m
(*c*) 16 m (*d*) 20 m.

16.298. Set-back distance is the distance between
(*a*) road land boundary and building line
(*b*) road land boundary and control line
(*c*) building line and control line
(*d*) road land boundary and control line.

16.299. Roadway width for a National highways and State highways (two-lanes) is
(*a*) 12 m (*b*) 9 m
(*c*) 9.5 m (*d*) 15 m.

16.300. Road width 8.8 m of two lane National highways or State highways in mountainous terrain
(*a*) excludes the width of parapet (0.6 m)
(*b*) excludes the width of side drain (0.6 m)
(*c*) excludes the width of parapet and side drain
(*d*) includes the width of parapet and side drain

16.301. Width of the shoulders of carriage way is generally kept
(*a*) 100 cm (*b*) 125 cm
(*c*) 150 cm (*d*) 200 cm
(*e*) 250 cm.

16.302. According to Indian Road Congress, the width of carriageway, is
(*a*) 3.75 m for single lane
(*b*) 7.0 m for two lanes without raised kerbs
(*c*) 7.5 m for two lanes with raised kerbs
(*d*) 10.5 m for three lanes pavements
(*e*) All the above

16.303. A single lane carriage way whenever changes to two-lane carriage way, is affected through a taper of
(*a*) 1 in 10 (*b*) 1 in 15
(*c*) 1 in 20 (*d*) 1 in 15 to 1 in 20.

16.304. Pick up the correct statement from the following :
(*a*) Minimum desirable width of medians on rural highways is 5 metres
(*b*) Minimum width of medians should be 3 metres
(*c*) On long bridges and viaducts, the width of medians should be 1.5 m
(*d*) All the above.

16.305. The desirable camber for straight cement concrete roads, is
(*a*) 1 in 33 to 1 in 25 (*b*) 1 in 40 to 1 in 33
(*c*) 1 in 150 to 1 in 140 (*d*) 1 in 160 to 1 in 140
(*e*) none of these.

16.306. The desirable camber for straight roads with water bound macadam or gravel surface, is
(*a*) 1 in 33 to 1 in 25 (*b*) 1 in 40 to 1 in 33
(*c*) 1 in 150 to 1 in 140 (*d*) 1 in 160 to 1 in 140
(*e*) none of these.

16.307. The desirable camber for straight roads with thin bituminous surfacing, is
(*a*) 1 in 33 to 1 in 25 (*b*) 1 in 40 to 1 in 33
(*c*) 1 in 150 to 1 in 140 (*d*) 1 in 160 to 1 in 140
(*e*) none of these.

16.308. The minimum cross fall of shoulders is kept
(*a*) 0.5% (*b*) 1.0%
(*c*) 1.5% (*d*) 2.5%
(*e*) 3%.

16.309. Pick up the correct statement from the following :
(*a*) The corss fall of the shoulder should be at least 0.5% steeper than camber
(*b*) On superelevated sections, the shoulders should be provided a cross fall equal to camber
(*c*) Earthern roads in general are provided steepest crossfall
(*d*) All the above.

16.310. While calculating the sight distances, the driver's eye above road surface, is assumed
(*a*) 90 cm (*b*) 100 cm
(*c*) 110 cm (*d*) 120 cm
(*e*) 150 cm.

16.311. While calculating the overtaking sight distance, the height of the object above road surface, is assumed
(*a*) Zero (*b*) 50 cm
(*c*) 75 cm (*d*) 100 cm
(*e*) 120 cm.

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16.312. Pick up the correct statement from the following :
(*a*) The height of head light above road surface, is taken as 0.75 m
(*b*) The beam of head light is up to one degree upwards from the grade of road
(*c*) While designing the valley curve, the height of the object is assumed nil
(*d*) All the above

16.313. Pick up the correct statement from the following :
(*a*) Long tangent sections exceeding 3 km in length should be avoided
(*b*) Curve length should be at least 150 metres for a deflection angle of 5 degress
(*c*) For every degree decrease in the deflection angle, 30 metre length of curve to be increased
(*d*) If the deflection angle is less than 1°, no curve is designed
(*e*) All the above.

16.314. Minimum radius of a simple circular curve deflecting through 5°, is
(*a*) 1618.9 m (*b*) 1816.9 m
(*c*) 1718.9 m (*d*) 1817.9 m.

16.315. Curves in the same direction separated by short tangents, are called
(*a*) simple circular curves (*b*) compound curves
(*c*) transition curves (*d*) broken-back curves.
(*e*) None of these.

16.316. The minimum ratio of the radii of two circular curves of a compound curve, is kept
(*a*) 1.25 (*b*) 1.5
(*c*) 1.75 (*d*) 2.0.

16.317. If V is speed in km/hour and R is radius of the curve, the superelevation e is equal to
(*a*) $\frac{V^2}{125R}$ (*b*) $\frac{V^2}{225R}$
(*c*) $\frac{V^2}{325R}$ (*d*) $\frac{V^2}{25R}$.

16.318. The minimum superelevation in rolling terrain in plains, is limited to
(*a*) 4% (*b*) 5%
(*c*) 6% (*d*) 7%
(*e*) 10%.

16.319. If the designed speed on a circular curve of radius 1400 m is 80 km/hour, no superelevation is provided, if the camber, is
(*a*) 4% (*b*) 3%
(*c*) 2% (*d*) 1.7%.

16.320. If N is deviation angle, the length L of a parabolic vertical curve for safe stopping distance S, is
(*a*) $\frac{NS^2}{4.4}$ *if* $L > S$ (*b*) $25 - \frac{4.4}{N}$ *if* $L < S$
(*c*) $\frac{VS^2}{4.4}$ *if* $L < S$ (*d*) $25 - \frac{4.4}{N}$ *if* $L > S$
(*e*) both (*a*) and (*b*).

16.321. If N is deviation angle the length L of a parabolic vetical curve for overtaking sight distance S, is
(*a*) $\frac{NS^2}{9.6}$ *if* $L > S$ (*b*) $\frac{NS^2}{9.6}$ *if* $L < S$
(*c*) $2S\frac{9.6}{N}$ *if* $L < S$ (*d*) $2S - \frac{9.6}{N}$ *if* $L > S$
(*e*) both (*a*) and (*c*).

16.322. The safe length L of a valley curve for night travel is
(*a*) $\frac{NS^2}{1.50 + 0.035S}$ *if* $L > S$
(*b*) $2S - \frac{1.50 + 0.035S}{N}$ *if* $L < S$
(*c*) neither (*a*) nor (*b*)
(*d*) both (*a*) and (*b*).

16.323. While designing hair pin bends on higways, the minimum
(*a*) designed speed is 20 k/hr (*b*) gradient is 1 in 40
(*c*) gradient is 1 in 200 (*d*) superelevations is 1 in 10
(*e*) All the above.

16.324. In case of a hair pin bend of a highway,
(*a*) minimum radius of inner curve is 14 m
(*b*) minimum radius of transition is 15 m
(*c*) circular compound curve may be provided
(*d*) minimum road way width at apex for single lane highway, is 9 m
(*e*) All the above.

16.325. When a number of hair pin bends are introduced, a minimum intervening distance in between is kept
(*a*) 20 m (*b*) 40 m
(*c*) 60 m (*d*) 100 m.

16.326. Pick up the correct statement from the following :
(*a*) During reconnaissance, the general route of the alignment is selected
(*b*) After reconnaissance, a trace is cut for the alignment
(*c*) Last stage is the detailed surveys for desired geometries of the highway
(*d*) All the above.

16.327. Reference pillars fixed on the centre line of a proposed road, provide the following information :
(*a*) reduced distance (R.D.)
(*b*) horizontal distance of road from the centre line
(*c*) reduced level at the top of pillar
(*d*) formation level of the road
(*e*) all the above.

16.328. The safe stopping sight distance D, may be computed from the equation
(*a*) $D = 0.278\ Vt + \frac{V^2}{254f}$ (*b*) $D = 0.254\ Vt + \frac{V^2}{278f}$
(*c*) $D = 0.254\ Vt + \frac{V^2}{225f}$ (*d*) $D = 0.225\ Vt + \frac{V^2}{254f}$.

16.329. The correct formula for calculating superelevation for the hill roads, is
(*a*) $e = \frac{V^2}{254R}$ (*b*) $e = \frac{V^2}{225R}$

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(c) $e = \frac{V^2}{278R}$ (d) $e = \frac{V^2}{114R}$.

16.330. A district road with a bituminous pavement has a horizontal curve of 1000 m for a design speed of 75 km ph. The super-elevation is
(a) 1 in 40 (b) 1 in 50
(c) 1 in 60 (d) 1 in 70
(e) none of these.

16.331. The total value of extra widening required at a horizontal curve on a two lane hill road of radius 42 m for a design speed of 50 kmph and for vehicles with wheel base 6 m, is
(a) 0.500 m (b) 0.589 m
(c) 1.089 m (d) 0.089 m.

16.332. The number of vehicles moving in a specified direction on a roadway that pass a given point during specified unit of time, is called
(a) traffic volume (b) traffic density
(c) basic capacity (d) traffic capacity.

16.333. The length of the side of warning sign boards of roads is
(a) 30 cm (b) 40 cm
(c) 45 cm (d) 50 cm.

16.334. Enoscope is used to determine
(a) spot speed (b) average speed
(c) travel time (d) none of these.

16.335. The traffic manoeuvre means
(a) diverging (b) merging
(c) crossing (d) all the above.

16.336. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Roman Roads	1. As per Robert Phillips specifications
B. Tresaguet Roads	2. Foundation stones of sizes 17 to 22 cm
C. Metcalf-Roads	3. Cross-slope of 1 in 45 to the surface
D. Telford Roads	4. Top surface is provided with large stone slabs in lime 10 to 15 cm thick

Codes:

	A	B	C	D
(a)	1	3	4	2
(b)	4	3	1	2
(c)	2	4	1	3
(d)	3	4	1	2

16.337. Match list I with List II and select the correct answers by using the codes given below the lists :

List I	*List II*
A. Central Road Fund	1. 1939
B. Indian Road Congress (IRC)	2. 1943
C. Motor Vehicles Act	3. 1934
D. Nagpur Road Conference	4. 1st March, 1929

Codes:

	A	B	C	D
(a)	4	3	1	2
(b)	1	4	2	3
(c)	2	3	4	1
(d)	1	2	3	4

16.338. Match List I with List II and select the correct answers by using the codes given below the lists :

List I	*List II*
A. Economic studies	1. For road location and alignment
B. Financial studies	2. For population and agricultural pattern
C. Traffic studies	3. For ascertaining the source of income
D. Engineering studies	4. For traffic volume and traffic flow patterns

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	3	4	2	1
(d)	1	3	2	4

16.339. Match list I with List II and select the correct answer by using codes below the lists :

List I (Type of road surface)	*List II (Percentage of camber in areas of heavy fall)*
A. Cement concrete	1. 4.0%
B. Thin bituminous surface	2. 3.0%
C. Water-bound mecadrum	3. 2.0%
D. Earth	4. 2.5%

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	3	2	1	4
(c)	4	3	2	1
(d)	3	4	2	I

16.340. Match List I with List II and select the correct answer by using the codes given below the lists :

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List (Road surface)I	*List II (Percentage of camber for light rainfall)*
A. Earth	1. 4.0%
B. Water band macadum	2. 3.0%.
C. Thin bituminous	3. 2.5%
D. Cement concrete	4. 2.0%

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	1	4	3	2
(d)	3	2	1	4

16.341. Match list I with List II and select the correct answer by using the codes given below the lists :

List I (Type of road)	*List II (Width of carriage way)*
A. Single lane road	1. 7.0m
B. Two lanes road without Karbs	2. 7.5m
C. Two lanes with raised Karbs	3. 3.75m
D. Multi-lane pavements	4. 3.5 m per lane

Codes:

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	3	4	2	1
(d)	1	3	4	1

16.342. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Width of single lane carriage way	1. 0.45m
B. Minimum width of median of rural high ways	2. 1.5m
C. Width of median on long bridge	3. 5.0m
D. Kerb used as high speed barrier	4. 3.75m

Codes :

	A	B	C	
(a)	1	2	3	4
(b)	2	4	3	1
(c)	4	3	2	1
(d)	1	3	4	2

16.343. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Transverse slope at the horizontal curve	1. $\frac{Wv^2}{gR}$
B. The centrifugal force acting horizontally outwards the centre of gravity	2. 0.15
C. Coefficient of lateral friction	3. Superelevation
D. Equilibrium super-elevation	4. $\frac{V^2}{127R}$

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	4	2	1
(d)	1	4	3	2

16.344. Match list I with List II and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Mechanical widening	1. $\frac{V}{9.5\sqrt{R}}$
B. Total widening of road	2. $\frac{V}{9.5\sqrt{R}} + \frac{l^2}{2R}$
C. Radius of curve exceeding 300 m	3. No widening
D. Psychological widening	4. $\frac{(\text{wheel base})^2}{2R}$

Codes.

	A	B	C	D
(a)	1	3	4	2
(b)	2	3	1	4
(c)	4	2	3	1
(d)	1	3	2	4

16.345. Match list I with List II and select the correct answer by using the codes given below the lists

List I	*List II*
A. Length of transition curve based on design speed	1. $\frac{2.7V^2}{R}$
B. Length of transition curve for rolling terrain by Empirical formula	2. $\frac{Ls^2}{24R}$
C. Shift of the transition curve	3. $\frac{80}{(75+V)}$

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D. Centrifugal acceleration	4.	$\frac{0.0215V^3}{CR}$

Codes :

	A	B	C	D
(a)	3	4	2	1
(b)	1	4	2	3
(c)	1	3	4	2
(d)	4	1	2	3

16.346. Match list I with List II and choose the correct answer by using codes given below the lists:

List I	*List II*
A. General equation for stopping distance at level	1. $\left[0.278V.t + \frac{V^2}{284\,(f+0.001n)}\right]$
B. Length of parabolic curve	2. $\left[0.278Vt + \frac{V^2}{254\,(f-0.001n)}\right]$
C. Stopping distance on descending slope	3. $\left[0.278Vt + \frac{V^2}{254f}\right]$
D. Stopping distance on ascending slope	4. $\frac{NS^2}{(\sqrt{2H}+\sqrt{2h})^2}$

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	3	4	2	1
(d)	1	3	4	1

16.347. Match list I with List II and choose the correct answer by using codes given below the lists :

List I	*List II*
A. Length of summit curve exceeding overtaking sight distance	1. $\frac{NS^2}{4.4}$
B. Length of summit curve exceeding stopping sight distance	2. $2S - \frac{4.4}{N}$
C. Length of summit curve less than stopping sight distance	3. $\frac{Ns^2}{9.6}$
D. Length of summit curve less than overtaking	4. $2S - \frac{9.6}{N}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	3	4	3	2
(d)	1	2	4	1

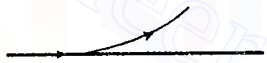
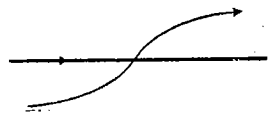
16.348. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Road vehicle)	*List II (Length)*
A. With two axles	1. 10.67 m
B. With more than two axles	2. 12.19m
C. Semi-trailor tractor	3. 15.24m
D. Tractor and trailor	4. 18.29m

Codes :

	A	B	C	D
(a)	3	4	2	1
(b)	1	2	3	4
(c)	1	4	3	2
(d)	2	3	4	1

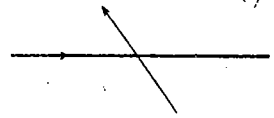
16.349. Match list I with List II and choose the correct answer by using codes given below the lists:

List I	*List II*
A.	1. Crossing left
B. 	2. Merging left
C.	3. Wearing left
D. 	4. Diverging left

Codes.

	A	B	C	D
(a)	1	4	3	2
(b)	2	4	1	3
(c)	2	3	1	4
(d)	3	4	1	2

16.350. Match list I with List II and choose the correct answer by using codes given below lists :

List I	*List II*
A.	1. Diverging right
B. 	2. Merging right

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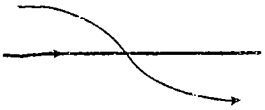
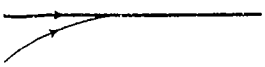
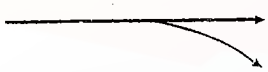
C.  3. Crossing right

D.  4. Weaving right

Codes.

	A	B	C	D
(a)	1	4	3	2
(b)	1	3	4	2
(c)	2	1	4	3
(d)	3	4	1	2

16.351. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A.	1. Merging left
B.	2. Merging right
C. 	3. Diverging left
D.	4. Diverging right

Codes:

	A	B	C	D
(a)	1	4	3	2
(b)	3	2	4	1
(c)	2	1	3	4
(d)	1	4	2	3

16.352. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Transfer of vehicle to adjacent traffic lane	1. Time head way
B. Crossing the path of adjacent lane with small angle in the same direction	2. Weaving
C. Time required to pass a point from head to head of vehicles	3. Lane change
D. Most hazardous traffic manoeuvring	4. Crossing at level

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	3	4	1	2
(d)	2	1	4	3

16.353. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Traffic volume	1. Vehicles per kilometre
B. Traffic density	2. Maximum number of vehicles per lane that pass a point per unit time
C. Traffic capacity	3. Vehicles per hour
D. Basic capacity	4. Maximum number of passenger cars that pass a point per hour

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	4	1	3	2
(d)	3	1	2	4

16.354. Match list I with List II and select the correct answer by using the codes given below the lists :

List I (Practical capacity)	*List II (Percentage decrease)*
A. The lane width of a two-lane rural road decreases to 3.0 m	1. 80%
B. The distance between the obstruction and the pavement is 1.85 m or more	2. 76%
C. The distance between the obstruction and the pavement is 0.75 m on one side	3. 100%
D. The distance between the obstruction and the pavement is 0.75 m on both sides	4. 96%

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	3	4	1
(c)	3	2	1	4
(d)	4	1	3	2

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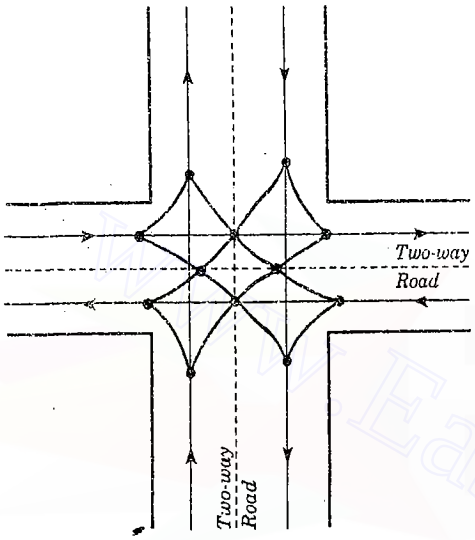
16.355. Refer to the figure and match list I with List II. Choose correct answer by using codes given below the lists:

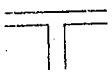
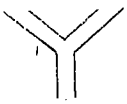
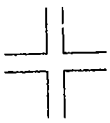
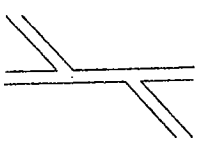
List I	*List II*
A. Merging conflicts	1. 4
B. Right angle crossing conflict	2. 4
C. Acute angle crossing conflict	3. 4
D. Diverging conflicts	4. 12



Codes:

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	4	1	2	3
(*c*)	4	1	3	2
(*d*)	1	4	2	3

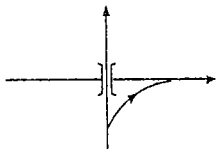
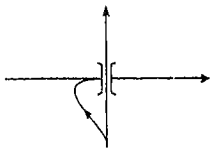
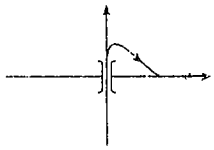
16.356. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. 	1. WYE
B. 	2. Cross
C. 	3. TEE
D. 	4. Skewed staggered

Codes :

	A	B	C	D
(*a*)	3	1	2	4
(*b*)	1	2	3	4
(*c*)	3	4	2	1
(*d*)	1	4	3	2

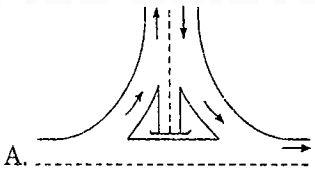
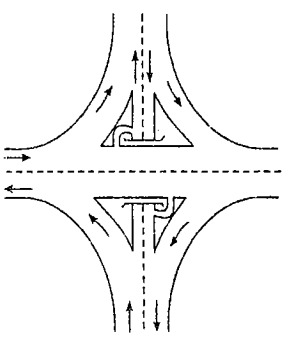
16.357. Match list I with List II and choose the correct answer by using codes given under the lists :

List I (Grade separated intersection)	*List II (Interchange ramp)*
A. 	1. Diverging right and merging right
B. 	2. Diverging right and merging left
C. 	3. Diverging left and merging right
D.	4. Diverging left and merging left

Codes :

	A	B	C	D
(*a*)	1	3	2	4
(*b*)	3	2	1	4
(*c*)	4	1	2	3
(*d*)	3	4	1	2

16.358. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. 	1. Partial clover leaf interchange
B. 	2. Full clover leaf interchange

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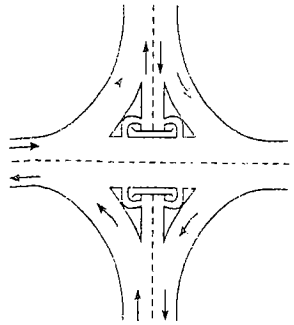
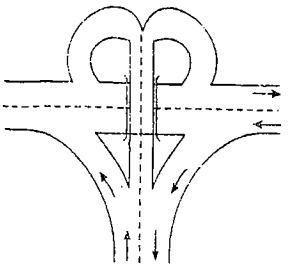
C.  Diamond interchange

D.  4. Tee-interchange

Codes :

	A	B	C	D
(a)	3	1	2	4
(b)	3	4	2	1
(c)	1	3	4	2
(d)	4	3	2	1

16.359 Pick up the correct definition from the following :
(a) The average number of vehicles per day passing on a section of the road during a year is called Average Daily Traffic (ADT)
(b) A traffic volume higher than the volume during most of the hours in a year, is called hourly volume
(c) The highest hourly traffic is called peak hour traffic
(d) The 30th highest hourly volume is taken as the design volume
(e) All the above

16.360 If the normal traffic growth is 50%, the generated traffic is 20%, the development traffic is 40%, according to an origin and destination survey on a section of State Highway in 1995 is 10,000 the future ADT (2000) is :
(a) 11050 (b) 15050
(c) 21100 (d) None of these.

16.361. The maximum number of passenger cars than can pass a given point on a road way during one hourunderthe most ideal roadway and traffic conditions, is called
(a) Possible capacity (b) Basic capacity
(c) Practical capacity (d) None of these.

16.362. Assuming the reaction time t for a speed of 80 km per hour, as 2.50 seconds, then, the reaction distance is
(a) 36 metres (b) 46 metres
(c) 56 metres (d) 66 metres

16.363. Pick up the correct statement from the following :
(a) Number of vehicles per lane per hour of the green light interval is called street capacity
(b) Reaction distance is equal to 0.28 Vt metres.
(c) The green light signal at the signalised junctions for main road is kept 30 secs.
(d) The number of cars passing any point on the road during one hour per lane is $\frac{V \times 1000}{\text{Spacing}}$.

16.364. The overall travel speed is obtained from the distance covered by overall travel time including
(a) running time
(b) all stops and delays on the road way
(c) excluding the delays due to stoppage off the roadway
(d) All the above.

16.365. Match List I with List II and select a suitable answer by using the codes given below the lists.

List I	*List II*
A. Right of way	1. The portions of the highway between the outer edge of the pavement and inside edge of slope
B. Carriag-way	2. The total width on which a formation is raised
C. Shoulders	3. Width of the highway between the boundary lines of the property abutting it
D. Formation width	4. The cambered surface.

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	1	2
(c)	2	3	4	1
(d)	4	1	2	3

16.366. On two lane highways where the width is ofthe order of 7 metres or more, the following type of road camber is suitable.
(a) simple parabolic camber
(b) single straight line on either side of the central line of road
(c) combination of a prabolic cap at the centre and straight line onthe sides
(d) two straigth lines on each side of the centre line.

16.367. The stopping sight distance in which a vehicle can be brought to a stop, depends upon:
(a) brake efficiency (b) grade of the road way
(c) speed of vehicles (d) All the above.

16.368. Match List I with List II and select a suitable answer by using the codes given below the lists:

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List I	*List II*
A. Braking distance	1. The minimum distance within which a vehicle movin with the design speed will overtake another vehicle moving in the same direction.
B. Reaction distance	2. The minimum distance travelled between the instant of applying brakes and stoppage of the vehicle
C. Stopping sigh distance	3. The minimum distance within which a vehicle movingwith design speed stops after reacting to the presence of obstruction
D. Overtaking sight distance	4. The distance travelled during the reaction time.

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	4	3	1
(*c*)	1	3	4	2
(*d*)	3	2	4	1

16.369. If the coefficient of friction and reaction time of the driver are respectively 0.4 and 2.5 secs and the design speed is 50 km per hour, the minimum sight distance to be provided is,

(*a*) 60 metres (*b*) 70 metres
(*c*) 50 metres (*d*) 65 metres

16.370. Pick up the correct statement from the following

(*a*) Braking distance $= \frac{V^2}{250\,\mu}$
(*b*) Reaction distance =0.28 Vt
(*c*) Stopping sight distance =(*a*) adn (*b*)
(*d*) All the above.

16.371. If V is speed of vehicle in metres/sec at the curve of radius R, then centifugal ratio is

(*a*) $\frac{V}{gR}$ (*b*) $\frac{V^2}{gR}$
(*c*) $\frac{V^3}{gR}$ (*d*) $\frac{1}{2}\frac{V^2}{gR}$

16.372. If the length of transition curve (L) is less than the sight distance (S) then, minimum offset from the obstructing building, is :

(*a*) $\frac{L\,(2S - L)}{8R}$ (*b*) $\frac{S\,(2L - S)}{8R}$
(*c*) $\frac{L\,(2S + L)}{8R}$ (*d*) $\frac{S\,(2S - L)}{4R}$

16.373. If the gradient of a sloping road is 1 in 30 then the camber to be provided is

(*a*) 1 in 30 (*b*) 1 in 40
(*c*) 1 in 50 (*d*) 1 in 60.

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17

Railways

17.1. The first Indian railway was laid in
(a) 1775 (b) 1804
(c) 1825 (d) 1853 (e) 1876.

17.2. For an effective administration, Indian railway system has been divided into
(a) four railway zones (b) six railway zones
(c) seven railway zones (d) eight railway zones
(e) nine railway zones.

17.3. Gauge of a permanent way, is
(a) minimum distance between running faces of rails
(b) minimum distance between outer faces of rails
(c) distance between centres of rails
(d) width of formation
(e) none of these.

17.4. Mr. W. Simms, the consulting Engineer to the Government of India recommended the gauge for Indian railways
(a) 1.435 m as adopted in England
(b) 1.800 m as per Indian conditions
(c) 1.676 m as a compromise gauge
(d) 1.000 m as a standard gauge.

17.5. In India, metre gauge permanent way was adopted in
(a) 1855 (b) 1860
(c) 1866 (d) 1871 (e) 1875.

17.6. Rail section first designed on Indian railways, was
(a) double headed (b) bull headed
(c) flat footed (d) (a) & (b)simultaneously.

17.7. Width of the top portion of a flat footed, rail, is
(a) 69.85 mm (b) 63.50 mm
(c) 66.77 mm (d) 136.52 mm
(e) none of these.

17.8. Charles Vignoles invented the flat footed rails in
(a) 1814 (b) 1836
(c) 1846 (d) 1856 (e) 1873.

17.9. Bull headed rails are generally provided on
(a) points and crossing (b) straight tangents
(c) curved tracks (d) metre gauge tracks
(e) none of these.

17.10. For holding a rail in position, no chairs are used for
(a) flat footed rails (b) bull headed rails
(c) double headed rails (d) both (a) and (b).

17.11. Rail section is generally designated by its
(a) total weight (b) total length
(c) weight per metre length (d) area of its cross-section.

17.12. Weight and cross section of the rails are decided on
(a) gauge of tracks (b) speed of trains
(c) spacing of sleepers (d) type of rails
(e) all the above.

17.13. On Broad Gauge main lines with maxi-mum traffic loads, the rail section preferred to, is
(a) 29.8 to 37.3 kg/m (b) 32.5 to 42.5 kg/cm
(c) 44.7 to 56.8 kg/m (d) none of these.

17.14. The main advantage of a long rail over short one, is
(a) it requires less number of rail fastenings
(b) it provides smooth running of trains
(c) it involves less maintenance cost
(d) it provides conform to passengers
(e) all the above.

17.15. On Indian Railways standard length of rails for B.G. track, is
(a) 33 ft (10.06 m) (b) 36 ft (10.97 m)
(c) 39 ft (11.89 m) (d) 42 ft (12.8 m).

17.16. On Indian Railways standard length of rails for M.G. track, is
(a) 33 ft (10.06 m) (b) 36 ft (10.97 m)
(c) 39 ft (11.89 m) (d) 42 ft (12.8 m).

17.17. 30 m long rails are used in
(a) India (b) Pakistan
(c) Russia (d) U.S.A. (e) U.K.

17.18. At a rail joint, the ends of adjoining rails, are connected with a pair of fish plates and
(a) 2 fish bolts (b) 4 fish bolts
(c) 6 fish bolts (d) 8 fish bolts.

17.19. Pick up the incorrect statement from the following :
(a) Ends of adjoining rails should be in true alignment
(b) Rail joints should be as strong as the rail section itself
(c) Rail joints should be elastic laterally as well as vertically
(d) Ends of adjoining rails butt against to give a continuity
(e) All the above.

17.20. Rail joint supported on a single sleeper, is known
(a) suspended rail joint (b) bridge rail joint
(c) supported rail joint (d) square rail joint.

17.21. Staggered rail joints are generally provided
(a) on curves (b) on tangents
(c) on bridges (d) in tunnels.

17.22. A welded rail joint is generally
(a) supported on a sleeper
(b) supported on a metal plate
(c) suspended (d) none of these.

17.23. Continuity of electric current across welded rail joints, is maintained by
(a) welding ends of a wire to each rail
(b) placing an insulated plate underneath the rails
(c) placing insulation in expansion gaps
(d) none of these.

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17.24. The tread of wheels is provided an outward slope of
(a) 1 in 10 (b) 1 in 15
(c) 1 in 20 (d) 1 in 25 (e) 1 in 30.

17.25. Wheels of a rolling stock are provided flanges on
(a) outer side (b) inner side
(c) both sides (d) neither side.

17.26. Distance between inner faces of the flanges, is kept
(a) equal to the gauge distance
(b) slightly less than the gauge distance
(c) slightly more than the gauge distance
(d) none of these.

17.27. Coning of wheels is provided
(a) to check lateral movement of wheels
(b) to avoid damage to inner faces of rails
(c) to avoid discomfort to passengers
(d) All the above.

17.28. Coning of wheels
(a) prevent lateral movement of wheels
(b) provide smooth running of trains
(c) avoid excessive wear of inner faces of rail
(d) all the above.

17.29. Rail tops of a track are placed
(a) horizontal
(b) at an inward slope of 1 in 20
(c) at an outward slope of 1 in 20
(d) at an outward slope of 1 in 30
(e) at an inward slope of 1 in 30.

17.30. Pick up the incorrect statement from the following. Required tilt of 1 in 20 is provided
(a) to the tops of rails
(b) at rail seats in bearing plates
(c) at rail seats in chairs
(d) at rail seats in metal sleepers.

17.31. For providing the required tilt of rails, adazing of wooden sleepers, is done for
(a) bull headed rails (b) double headed rails
(c) flat footed rails (d) any type of rails
(e) none of these.

17.32. On a single line track, 10 goods trains loaded with iron ore run from A to B and empty wagons return from B to A daily. Amount of creep of the rails will be
(a) zero
(b) more in the direction A to B
(c) more in the direction B to A
(d) none of these.

17.33. Anti-creep anchors are fixed to rails by
(a) wedging (b) spring grip
(c) clamping (d) all the above.

17.34. If L is length of a rail and R is the radius of a curve, the versine h for the curve, is

(a) $a = \frac{L}{4R}$ (b) $a = \frac{L^2}{4R}$
(c) $h = \frac{L^2}{8R}$ (d) $h = \frac{L^2}{16R}$
(e) $h = \frac{L^2}{6R}$.

17.35. Rails are bent to correct curvature if the degree of curve, is more than
(a) 1° (b) 2°
(c) 3° (d) 4° (e) 6°.

17.36. Maximum wheel base distance provided on Indian B.G. tracks, is
(a) 4.096 m (b) 5.096 m
(c) 6.096 m (d) 7.096 m
(e) none of these.

17.37. Widening of gauge is provided if degree of the curve, is
(a) 3° or less (b) 3° to $4\frac{1}{2}°$
(c) more than $4\frac{1}{2}°$ (d) none of these.

17.38. Check rails are provided on inner side of inner rails if sharpness of a B.G. curve, is more than
(a) 3° (b) 5°
(c) 6° (d) 8°.

17.39. Distance between the inner rail and check rail provided on sharp curve, is
(a) 40 mm (b) 42 mm
(c) 44 mm (d) 46 mm (e) 50 mm.

17.40. On Indian Railways, the approximate weight of a rail section is determined from the formula

(a) $\frac{\text{weight of the rail}}{\text{axial load of locomotive}} = \frac{1}{10}$
(b) $\frac{\text{weight of the rail}}{\text{axial load of locomotive}} = \frac{1}{410}$
(c) $\frac{\text{weight of the rail}}{\text{axial load of locomotive}} = \frac{1}{510}$
(d) $\frac{\text{weight of the rail}}{\text{axial load of locomotive}} = \frac{1}{610}$.

17.41. The rail section which is not used on Indian Broad Gauge tracks, is
(a) 35 R (b) 40 R
(c) 45 R (d) 55 R.

17.42. The rail section which is not used on Indian metre gauge tracks, is
(a) 25 R (b) 30 R
(c) 35 R (d) 40 R.

17.43. Bending of rail ends due to loose packing under a joint and loose fish Bolts, is known
(a) buckling (b) hogging
(c) creeping (d) none of these.

17.44. The rails get out of their original positions due to insufficient expansion gap. This phenomenon is known
(a) hogging (b) buckling
(c) creeping (d) none of these.

17.45. Pick up the incorrect statement from the following :
(a) Sleepers hold the rails at proper gauge on straights
(b) Sleepers provide stability to the permanent way
(c) Sleepers act as an elastic cushion between rails and ballast
(d) Sleepers transfer load of moving trains to ballast
(e) None of the these.

17.46. Pick up the incorrect statement from the following :
(a) Sleepers transfer the load of moving locomotive to the girders of the bridges

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(b) Sleepers act as a non-elastic medium bet-ween the rails and ballast
(c) Sleepers hold the rails at 1 in 20 tilt inward
(d) Sleepers hold the rails loose on curve.

17.47. The main function of sleepers, is
(a) to support rails
(b) to hold rails at correct gauge
(c) to distribute load from the rails to ballast
(d) all the above.

17.48. The factor for deciding the type of sleeper, is
(a) easy fixing and removal of rails
(b) provision of sufficient bearing area for rails
(c) initial and maintenance costs
(d) strength to act as a beam under loads
(e) all the above.

17.49. Regional Indian railways use different types of sleepers according to their
(a) availability (b) economy
(c) suitability (d) design
(e) all the above.

17.50. The sleepers which satisfy the requirements of an ideal sleeper, are
(a) cast iron sleepers (b) R.C.C. sleepers
(c) steel sleepers (d) wooden sleepers.

17.51. The life of a wooden sleeper depends upon
(a) quality of its timber (b) ability to resist decay
(c) resistance to weathering (d) all the above.

17.52. Best wood for wooden sleepers is
(a) chir (b) deodar
(c) sal (d) teak (e) shesham.

17.53. Wooden sleepers used on the girders of bridges, are generally made of
(a) sal (b) chir
(c) teak (d) deodar.

17.54. Burnettising is done for the preservation of
(a) wooden sleepers (b) rails
(c) ballast (d) none of these.

17.55. If n is length of a rail in metres, the number of sleepers per rail length generally varies from
(a) n to $(n + 2)$ (b) $(n + 2)$ to $(n + 4)$
(c) $(n + 3)$ to $(n + 6)$ (d) $(n + 4)$ to $(n + 5)$.

17.56. Minimum packing space provided bet-ween two sleepers, is between
(a) 20 to 25 cm (b) 25 to 30 cm
(c) 30 to 35 cm (d) 35 to 40 cm.

17.57. The standard dimensions of a wooden sleeper for a B.G. railway track are
(a) 2.74 m × 25 cm × 13 cm (b) 1.83 m × 20 cm × 11 cm
(c) 1.52 m × 15 cm × 10 cm (d) 1.75 cm × 20 cm × 12 cm
(e) none of these.

17.58. The standard dimensions of a wooden sleeper for M.G. railway track are
(a) 2.74 m × 25 cm × 13 cm (b) 1.83 m × 20 cm × 11 cm
(c) 1.52 m × 15 cm × 10 cm (d) 1.75 m × 20 cm × 12 cm
(e) none of these.

17.59. Pick up the correct statement from the following :
(a) Rails are directly laid over hard wooden sleepers and fixed with spikes
(b) Adzing is done on hard wooden sleepers
(c) Bearing plates are used on soft wooden sleepers
(d) Chairs are used for bull headed rails
(e) All the above.

17.60. Spacing of sleepers
(a) throughout the length of a rail is kept uniform
(b) near rail joints, is kept closer
(c) at the middle of rails, is kept closer
(d) none of these.

17.61. If S and H are strength and hardness index of a timber at 12% moisture content, the composite sleeper index, is
(a) $\frac{H + 10S}{20}$ (b) $\frac{S + 10H}{20}$
(c) $\frac{20S + H}{10}$ (d) $\frac{S + 20H}{10}$

17.62. Composite sleeper index determines
(a) number of sleepers per rail length
(b) suitability of wooden sleepers
(c) permissible stresses in steel sleepers
(d) none of these.

17.63. Minimum composite sleeper index for wooden sleepers used over bridge girders, is
(a) 1455 (b) 1355
(c) 1255 (d) 1155
(e) none of these.

17.64. Minimum composite sleeper index for wooden sleepers used in cross-overs, is
(a) 1152 (b) 1252
(c) 1352 (d) 1452 (e) none of these.

17.65. Top surface of steel sleepers, is
(a) kept level throughout
(b) provided a cant of 1 in 20 inward
(c) provided a cant of 1 in 20 outward
(d) none of these.

17.66. Steel sleepers are
(a) rectangular is cross section throughout
(b) hollow circular pipes
(c) 6 mm thick steel sheets with ends bent down
(d) 6 mm thick steel sheets with ends bent up.

17.67. Rails are fixed on steel sleepers
(a) by bearing plates (b) by dog spikes
(c) by keys in lugs or jaws (d) none of these.

17.68. To prevent creep in rails, the steel sleepers are fixed with rails by clips, bolts and
(a) one key (b) two keys
(c) three keys (d) four keys.

17.69. Main disadvantage of steel sleepers, is :
(a) it gets rusted quickly
(b) its lugs some times get broken
(c) its lugs some times get split
(d) all the above.

17.70. Cast iron sleeper, is
(a) pot sleeper (b) box sleeper
(c) Duplex sleeper (d) plate sleeper
(e) All the above.

17.71. Pot sleepers are in the form of
(a) a number of bowls connected together with a tie bar

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(b) two bowls placed under each rail and connected together with a tie bar
(c) two bowls placed under two rails and the one between the rails
(d) none of these.

17.72. Total effective bearing area of both the bowls of a pot sleeper, is
(a) slightly more than that of a wooden sleeper
(b) slightly less than that of a wooden sleeper
(c) equal to that of a wooden sleeper
(d) none of these.

17.73. For inspection and packing of ballast, each pot sleeper is provided with
(a) one hole (b) two holes
(c) three holes (d) four holes.

17.74. By interchanging gibs and cotters of a pot sleeper, gauge may be slackened by
(a) 1.2 mm (b) 2.2 mm
(c) 3.2 mm (d) 4.2 mm
(e) 5.0 mm.

17.75. Dimensions of a plate girder, are :
(a) 851 mm × 851 mm (b) 255 mm 254 mm
(c) 851 mm × 254 mm (d) 551 mm × 254 mm.

17.76. Pot sleepers are used if degree of the curve does not exceed
(a) 4° (b) 5°
(c) 6° (d) 7° (e) 8°.

17.77. A CST-9 sleeper consists of
(a) two inverted triangular pots on either side of rail seat
(b) a central plate with a projected key and box on the top of plate
(c) a tie bar and 4 cotters to connect two cast iron plates
(d) a single two way key provided on the gauge side to hold the rail to sleeper
(e) all the above.

17.78. The effective bearing area of all types of sleepers, is
(a) 0.40 m^2 (b) 0.42 m^2
(c) 0.44 m^2 (d) 0.46 m^2 (e) 0.50 m^2.

17.79. Monnier, the inventor of R.C.C., suggested the introduction of reinforced cement concert sleepers for the railways in
(a) 1857 (b) 1867
(c) 1877 (d) 1887 (e) 1897.

17.80. The main advantage of a cement concrete sleeper, is :
(a) its heavy weight which improves the track modulus
(b) its capacity to maintain gauge
(c) its suitability for track circuiting
(d) its flat bottom which is very suitable for modern track
(e) all the above.

17.81. A mono-block sleeper has
(a) square section (b) rectangular section
(c) trapezoidal section (d) semi-circular section
(e) none of these.

17.82. Pick up the correct section of a mono-block sleeper from those shown in Fig. 17.1.

17.83. On either side of the centre line of rails, a cant of 1 in 20 in the sleeper is provided for a distance of
(a) 150 mm (b) 165 mm

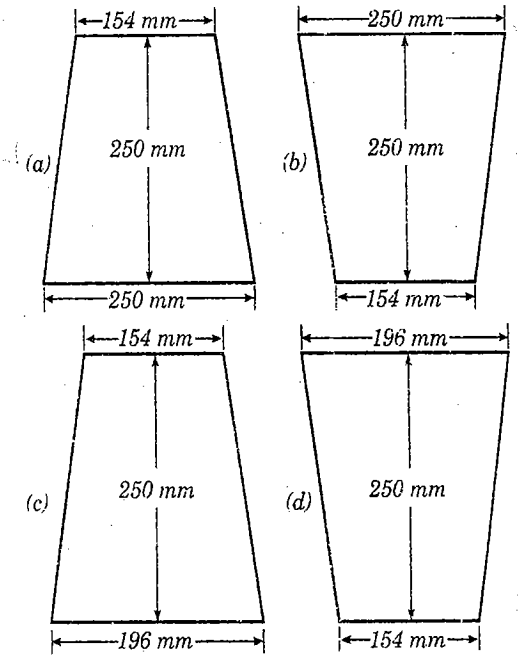

Fig. 17.1.

(c) 175 mm (d) 185 mm.

17.84. Each block of a two-block concrete sleeper is
(a) 722 mm × 295 mm × 271 mm and 215 kg in weight
(b) 250 mm × 154 mm × 196 mm and 260 kg in weight
(c) 525 mm × 350 mm × 275 mm and 280 kg in weight
(d) none of these.

17.85. Ballast packed below and around the sleepers to transfer the load from sleepers to formation, generally consists of
(a) broken stones (b) gravels
(c) moorum (d) all the above.

17.86. In permanent way, ballast
(a) transfers load from sleepers to the formation
(b) provides an elastic bed to the track
(c) provides a drainage of track
(d) all the above.

17.87. Packing of ballast is done
(a) near the ends of sleepers (b) on the shoulders
(c) under sleepers (d) between two rails.

17.88. Boxing of ballast is done
(a) under rails (b) at the rails
(c) in between two rails (d) in between two sleepers.

17.89. For flat bottom sleepers, maximum size of ballast, is
(a) 50 mm (b) 40 mm
(c) 33 mm (d) 25 mm (e) 20 mm.

17.90. For metal sleepers with rounded edges, maximum size of ballast, is
(a) 50 mm (b) 40 mm
(c) 30 mm (d) 25 cm (e) 20 mm.

17.91. For points and crossings, maximum size of ballast, is
(a) 50 mm (b) 40 mm
(c) 30 mm (d) 25 mm (e) 20 mm.

17.92. Sand may be used as ballast for
(a) wooden sleepers (b) steel sleepers
(c) cast iron sleepers (d) all the above.

17.93. To prevent percolation of water into formation, moorum is used as a blanket for
(a) black cotton soil (b) sandy soil
(c) clayey soil (d) all the above.

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17.94. Coal ash (or cinder) is used in initial stages of a new construction of railway for
(a) wooden sleepers (b) steel sleepers
(c) cast iron sleepers (d) none of these.

17.95. Best ballast contains stones varying in size from
(a) 1.5 cm to 3 cm (b) 2.0 cm to 4 cm
(c) 2.0 cm to 5 cm (d) 2.5 cm to 6 cm.

17.96. If w is width of sleepers, s is sleeper spacing and d is depth of ballast then
(a) $d = \frac{s - w}{2}$ (b) $d = \frac{s - w}{3}$
(c) $d = \frac{s - w}{4}$ (d) $d = \frac{s - w}{5}$
(e) $d = \frac{s - w}{10}$.

17.97. Minimum depth of ballast prescribed of B.G. trunk lines of Indian Railways, is
(a) 20 cm (b) 15 cm
(c) 25 cm (d) 30 cm (e) 35 cm.

17.98. For even distribution of load through ballast, load dispersal is assumed as
(a) 30° to the vertical (b) 45° to the vertical
(c) 60° to the vertical (d) none of these.

17.99. If sleeper density is M + 7 for 13 m rails, the minimum depth of ballast under wooden sleepers (25 cm × 13 cm), is
(a) 15 cm (b) 20 cm
(c) 25 cm (d) 30 cm (e) 36 cm.

17.100. An extra 7.5 cm ballast width is not provided on outer side on a curve, if its degree is
(a) 6° (b) 5°
(c) 4° (d) 3° (e) 2°.

17.101. Pick up the correct statement from the following :
(a) An extra width of 7.5 cm ballast is provided on outside a curve if track is laid with short welded rails
(b) An extra width of 7.5 cm ballast is provided on outside a curve sharper than 3° on B.G. and M.G. tracks
(c) An extra width of 15 cm ballast is provided on each shoulder if the track is laid with welded rails
(d) All the above.

17.102. The standard width of ballast for B.G. track in Indian Railways, is kept
(a) 3.35 m (b) 3.53 m
(c) 2.35 m (d) 2.53 m (e) none of these.

17.103. The standard width of ballast for M.G. track in Indian Railways, is kept
(a) 3.35 m (b) 3.53 m
(c) 2.30 m (d) 2.50 m (e) none of these.

17.104. The quantity of stone ballast required per metre tangent length, is
(a) 1.15 m^3 (b) 1.14 m^3
(c) 1.13 m^3 (d) 1.12 m^3 (e) 1.11 m^3.

17.105. Pick up the incorrect statement from the following :
(a) Fish plates fit the underside of the rail head
(b) Fish plates fit the top of the rail foot
(c) Fish plates fit the web of the rail section
(d) Cross sectional area of fish plates, is normally the same as that of the rail section.

17.106. The spike commonly used to fix rails to wooden sleepers in Indian railways, is
(a) dog spike (b) screw spike
(c) round spike (d) all the above.

17.107. Overall depth of a dog spike, is
(a) 120.6 mm (b) 155.90 mm
(c) 135 mm (d) 150 mm
(e) none of these.

17.108. Bearing plates are used to fix
(a) flat footed rails to the wooden sleepers
(b) double headed rails to the wooden sleepers
(c) bull headed rails to the wooden sleepers
(d) flat footed rails to the cast iron sleepers
(e) none of these.

17.109. The gradient on which an additonal engine is required to negotiate the gradient, is called
(a) momentum gradient (b) pusher gradient
(c) ruling gradient (d) steep gradient.

17.110. Minimum gradient in station yards is generally limited to
(a) 1 in 1000 (b) 1 in 750
(c) 1 in 500 (d) 1 in 400 (e) zero.

17.111. The grade compensation on B.G. tracks on Indian Railways, is
(a) 0.02% (b) 0.03%
(c) 0.04% (d) 0.05% (e) 0.06%.

17.112. Degree of a railway curve is defined as number of degrees subtended at the centre of a curve by an arc of
(a) 10 m (b) 15 m
(c) 20 m (d) 30.5 m (e) 30 m.

17.113. Safe speed (V) on a curve of radius 970 metres provided with two transition curves on Board Gauge track, is
(a) 112 km/hour (b) 122 km/hour
(c) 132 km/hour (d) 142 km/hour.

17.114. If G is gauge is metres, V is speed of trains in km/hour and R is radius of a curve in metres, the equilibrium super-elevation is
(a) $\frac{GV^2}{R}$ (b) $\frac{GV^2}{17R}$
(c) $\frac{GV^2}{127R}$ (d) $\frac{GV^2}{127R}$ (e) $\frac{G^2V^2}{125}$.

17.115. Maximum cant deficiency prescribed on Indian Board Gauge Railways, is
(a) 40 mm (b) 50 mm
(c) 75 mm (d) 100 mm (e) 25 mm.

17.116. If S is cant deficiency in centimetres and V is maximum permissible speed in km p.h., the maximum length of transition curves, is
(a) $\frac{S.V}{13.6}$ (b) $\frac{S.V}{19.8}$
(c) $\frac{S.V}{127}$ (d) $\frac{S.V}{16.8}$.

17.117. If a 0.7% upgrade meets a 0.65% downgrade at a summit and the permissible rate of change of grade per chain length is 0.10%, the length of the vertical curve, is
(a) 10 chains (b) 12 chains
(c) 14 chains (d) 16 chains.

17.118. Minimum length of a transition curve required for
(a) 2° curves for a maximum permissible speed of 135 km/hr, is 220 metres

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(b) 4° curves for a maximum permissible speed of 95 km/hr, is 220 metres
(c) 6° curves for a maximum permissible speed of 80 km/hr, is 220 metres
(d) All the above.

17.119. Arrangement made to divert the trains from one track to another, is known as
(a) railway point (b) railway crossing
(c) turnout (d) railway junction
(e) none of these.

17.120. Type of switch rails generally adopted for modern track, is
(a) straight switch (b) curved switch
(c) loose heel switch (d) bent switch.

17.121. Stock rails are
(a) parts of crossing (b) fitted against check rails
(c) fitted against tongue rails
(d) laid between heel of switch and nose of crossing.

17.122. Wing rails are provided
(a) near tongue rails (b) near check rails
(c) near stock rails (d) in crossing.

17.123. Heel divergency, the distance bet-ween the running faces of stock rail and gauge face of tongue rail, as recommended for Indian B.G. tracks, is
(a) 100 mm (b) 119 mm
(c) 125 mm (d) 155 mm (e) 135 mm.

17.124. The angle between the gauge faces of the stock rail and tongue rail, is called
(a) switch angle (b) angle of crossing
(c) angle of turnout (d) none of these.

17.125. If L_1 and L_2 are actual and theoretical lengths of a tongue rail, d is heel divergence and t is thickness of tongue rail at toe, the switch angle α is
(a) $\sin^{-1}\frac{d-t}{L_1}$ (b) $\tan^{-1}\frac{d-t}{L_1}$
(c) $\sin^{-1}\frac{d-t}{L_2}$ (d) $\tan^{-1}\frac{d-t}{L_2}$
(e) $\cot^{-1}\frac{d-t}{L_2}$.

17.126. If α is switch angle and R is radius of the turnout, the length of the tongue rail, is
(a) $R \sin \alpha$ (b) $R \tan \alpha$
(c) $R \sin \alpha/2$ (d) $R \tan \alpha/2$ (e) $R \cos \alpha/2$.

17.127. Pick up the correct statement from the following :
(a) Length of tongue rail should be greater than rigid wheel base of vehicle
(b) Stock rail should be longer than tongue rail
(c) Length of stock rail ahead of the toe should be a minimum of 1.65 m
(d) All the above.

17.128. To achieve best performance, the type of switch preferred to, is
(a) undercut switch (b) straight-cut switch
(c) overriding switch (d) both (a) and (b)
(e) none of these.

17.129. On Indian Railways, number of a crossing is defined as
(a) sine of angle of crossing
(b) consine of angle of crossing
(c) tangent of angle of crossing
(d) contangent of angle of crossing.

17.130. In a diamond crossing, number of noses are
(a) 2 (b) 3
(c) 4 (d) 6.

17.131. On Indian Railways, angle of crossing between gauge faces of Vee, is generally calculated by
(a) Cole's method (b) Centre line method
(c) Isosceles triangle method (d) both (a) and (b).

17.132. For calculating the length of curve lead (C.L.), the correct formula is
(a) C.L. = G. cot $\alpha/2$ (b) C.L. = $\sqrt{2IG}$
(c) C.L. = $2GN$ (d) all the above.

17.133. To design a cross-over between parallel tracks, the required components are :
(a) two switch points, two acute angle crossings and two check rails
(b) two switch points, two acute angle crossings and four check rails
(c) two switch points, two acute angle crossings and six check rails
(d) none of these.

17.134. A scissors cross-over consists of
(a) two pairs of points, four acute angle crossings and two obtuse angle crossings
(b) four pairs of points, four acute angle crossings and four obtuse angle crossings
(c) four pairs of points, six acute angle crossings and two obtuse angle crossings
(d) two pairs of points, six acute angle crossings and four obtuse angle crossings.

17.135. In railways a triangle is mainly provided for
(a) diverting trains from the main line to branch line
(b) crossing over between parallel tracks
(c) changing direction of engines through 180°
(d) shunting wagons in yards.

17.136. If D is distance between centres of two parallel tracks of gauge G, then, total length of cross-over (from the point of commencement to the point of termination) with an intermediate straight portion and N crossing, is given by
(a) $DN + G(N + \sqrt{1+N^2})$ (b) $DN + G(2N + \sqrt{1+N^2})$
(c) $DN + G(3N + \sqrt{1+N^2})$ (d) $DN + G(4N + \sqrt{1+N^2})$

17.137. If D is distance between centres of two parallel tracks of gauge G with entire curved leads and equal angles of crossing, total length of crossover, is
(a) $\sqrt{D(4R - 2G - D)}$ (b) $\sqrt{D(3R - 2G - D)}$
(c) $\sqrt{D(3R + 2G - D)}$ (d) $\sqrt{D(4 + 2G - D)}$.

17.138. If absolute levels of rails at the consecutive axles A, B, and C separated by 1.8 metres are 100.505 m, 100.530 m and 100.525 m respectively, the unevenness of rails, is
(a) 0.065 m (b) 0.055 m
(c) 0.045 m (d) 0.035 m.

17.139. On a straight railway track, absolute levels at point A on two rails are 100.550 m and 100.530 m and the absolute levels at point B 100 m apart are 100.585 m and 100.515 m respectively, the value of twist of rails per metre run, is
(a) 0.4 mm (b) 0.5 mm

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(c) 0.7 mm (d) 9.8 mm
(e) 1.0 mm.

17.140. If a is average number of peaks more than 10 mm of uneveness per kilometre, b is average number peaks more than 6 mm for gauge variation per kilometre and c is average number of peaks more than 2 mm twist per metre, then composite current recording index (I_c), as recommended by Indian Northern Railways, is
(a) $I_c = 10 - a - b - c/4$ (b) $I_c = 20 - a - b - c/4$
(c) $I_c = 30 - a - b - c/4$ (d) $I_c = 40 - a - b - c/4$.

17.141. Indian Railways detects the rail flow by
(a) Mitsubish Rail flow dector
(b) Soni Rail flow dector
(c) Audi-gauge Rail flow detector
(d) Kraut Kramer Rail flow detector.

17.142. In a railway track, permissible gauge with tolerance under loaded condition, is
(a) G + 0.1 mm (b) G + 1.5 mm
(c) G – 1.0 mm (d) G – 1.5 mm
(e) G – 20 mm.

17.143. Track construction involves preparation of
(a) subgrade (b) plate laying
(c) ballasting (d) all the above.

17.144. In Indian railways, plate laying is usually done by
(a) side method (b) telescopic method
(c) American method (d) all the above.

17.145. The place where a railway line and a road cross each other at the same level, is known as
(a) cross over (b) railway junction
(c) road junction (d) level crossing
(e) none of these.

17.146. According to Railway Board, no diamond crossing should be flatter than
(a) 1 in 6 (b) 1 in 8½
(c) 1 in 12 (d) 1 in 16.

17.147. The distance between the theoretical noses of crossing along the same rail, in case of diamond crossing, is
(a) $\frac{G}{\sin \frac{1}{2}F}$ (b) $\frac{G}{\sin F}$
(c) $\frac{G}{\tan F}$ (d) $\frac{G}{\cos F}$

17.148. The distance between theoretical nose of crossing and actual nose of crossing for practical purposes, is
(a) Nose thickness × tan α (b) Nose thickness × cot α
(c) Nose thickness × sin α (d) Nose thickness × cos α.

17.149. Pick up the correct statement from the following :
(a) The line which connects a number of parallel tracks, and also provides an access to main track, is called a gathering line
(b) With a diagonal gathering line, the length of the siding decreases with increase of its distance from main track
(c) To have sidings of same length, a diagonal line is laid at one end and a parallel gathering line at the other end
(d) For most economical layout of yards, the gathering lines are laid at the limiting angle
(e) All the above.

17.150. The spread between the point and splice rails at a distance of 4.25 m, is 50 cm. The size of the crossing is
(a) 1 in 6 (b) 1 in 8½
(c) 1 in 12 (d) 1 in 16.

17.151. The overall length of a turn out is the distance between the end of stock rail and
(a) heel of crossing (b) actual nose of crossing
(c) throat of crossing (d) toe of crossing.

17.152. Heel of crossing is the line joining
(a) ends of splice rail and point rail
(b) ends of lead rails butting the crossing
(c) ends of wing rails
(d) throat and actual nose of crossing.

17.153. The arrangement of rails which permit trains to cross another track and also to divert to the other track, is called
(a) diamond crossing
(b) diamond crossing with single slip
(c) diamond crossing with double slip
(d) cross over.

17.154. A scissors cross over consists of one diamond and
(a) one turn out (b) two turn outs
(c) three turn outs (d) four turn outs
(e) no turn out.

17.155. The lengths of the standard crossings in India for Broad gauge and Metre gauge tracks is same for
(a) 1 in $8\frac{1}{2}$ B.G. and, in 12 M.G.
(b) 1 in 12 B.G. and, 1 in 16 M.G.
(c) 1 in 12 B.G. and 1 in $8\frac{1}{2}$ M.G.
(d) 1 in 16 B.G. and 1 in 12 M.G.

17.156. Smitch diamond is provided if the angle of diamond is less than
(a) 2° (b) 4°
(c) 6° (d) 8°.

17.157. A triangle used for turning the face of locomotives, consists of
(a) three turn outs (b) one turn out & two splits
(c) two turn outs & one split (d) three splits.

17.158. A turn-in-curve is defined as
(a) a curve introduced between two straights
(b) a reverse curve
(c) a reverse curve introduced in continuity of a turn out
(d) a spiral transition curve.

17.159. If the standard length of a crossing is 480 cm, the number of crossing is
(a) 1 in 8½ of B.G. (b) 1 in 8½ of M.G.
(c) both (a) and (b) (d) none of these.

17.160. If the standard length of a B.G. crossing is 597 cm, the number of crossing, is
(a) 1 in 8 ½ (b) 1 in 12
(c) 1 in 16 (d) none of these.

17.161. To avoid the damage of nose of crossing, the wing rails are ramped so that nose of crossing remains at a lower level by
(a) 3 mm (b) 4 mm
(c) 5 mm (d) 6 mm.

17.162. The check rails are placed opposite the crossing so that
(a) it is symmetrically placed opposite nose of crossing
(b) its one-third length is ahead of the nose of crossing
(c) its two-third length is ahead of the nose of crossing

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(*d*) its three fourth length is ahead of the nose of crossing.

17.163. A wing rail is renewed or reconditioned if its maximum vertical wear is
(*a*) 9.5 m (*b*) 7.5 m
(*c*) 5.5 m (*d*) 5.0 m.

17.164. A kink is made in stock rails, ahead of the toe of switch at a distance of
(*a*) 10 cm (*b*) 15 cm
(*c*) 20 cm (*d*) 30 cm.

17.165. If the stock rails are B.H. rails, the type of switch generally provided, is
(*a*) articulated (*b*) undercut
(*c*) over riding (*d*) straight cut.

17.166. The type of switch generally used for B.G. and M.G. tracks, is
(*a*) articulated (*b*) undercut
(*c*) over riding (*d*) straight cut.

17.167. If D is the distance between parallel tracks G is the gauge and α is angle of crossings, the distance between theoretical noses of two crossings measured parallel to tracks, is
(*a*) $(D - G - G \sec \alpha) \cot \alpha$ (*b*) $(D - G + G \sec \alpha) \cot \alpha$
(*c*) $(D - G - G \sec \alpha) \tan \alpha$ (*d*) $(D + G + G \sec \alpha) \cot \alpha$.

17.168. If D is the distance between the parallel sidings and α is the angle of crossing, the distance between the noses of crossing measured parallel to the gathering line, is
(*a*) $D \tan \alpha$ (*b*) $D \cot \alpha$
(*c*) $D \sin \alpha$ (*d*) $D \cos \alpha$.

17.169. If D is the distance between the parallel sidings and α is the angle of crossing, the distance between the noses of crossing measured parallel to the main track, is
(*a*) $D \tan \alpha$ (*b*) $D \sec \alpha$
(*c*) D cosec α (*d*) $D \cot \alpha$.

17.170. If D is the distance between the parallel sidings and β is the limiting angle of crossings, the distance between the noses of crossing measured parallel to the main track, is
(*a*) $D \sin \beta$ (*b*) $D \cot \beta$
(*c*) $D \tan \beta$ (*d*) $D \sec \beta$.

17.171. The side of a rail diamond may be obtained by dividing the gauge of track by
(*a*) sine of acute crossing (*b*) consine of acute crossing
(*c*) tangent of acute crossing
(*d*) cotangent of acute crossing.

17.172. If G is gauge distance and α is crossing, the distance between the nose of acute crossing and nose of obtuse crossing of a rail diamond, measured along the rail not forming the diamond, is
(*a*) $G \cot \alpha$ (*b*) $G \tan \alpha$
(*c*) $G \sin \alpha$ (*d*) $G \cos \alpha$.

17.173. The difference in the lengths of two diagonals of a rail diamond is
(*a*) $\frac{2G}{\sin \alpha} [\cos \alpha/2 + \sin \alpha/2]$ (*b*) $\frac{2G}{\sin \alpha} [\cos \alpha/2 + \sin \alpha/2]$
(*c*) $\frac{2G}{\sin \alpha} [\sin \alpha/2 - \cos \alpha/2]$ (*d*) $\frac{2G}{\sin \alpha} [\tan \alpha/2 - \cot \alpha/2]$.

17.174. If S is the switch angle and α is diamond angle, r is the radius of slip, the distance between middle point slip and the nose of obtuse crossing, is

(*a*) $r\left[\sec\left(\frac{\alpha}{2} - S\right) - 1\right]$ (*b*) $r\left[\sec\left(S - \frac{\alpha}{2}\right) - 1\right]$
(*c*) $r\left[\sec\left(\frac{\alpha - S}{2}\right) - 1\right]$ (*d*) $r\left[\sec\left(\frac{\alpha - S}{2}\right) + 1\right]$

17.175. A triangle of railway consists of
(*a*) three turn outs
(*b*) one turn out and two diamonds
(*c*) two turn outs and one split
(*d*) one turn out, one split and one diamond.

17.176. In India the rails are manufactured by
(*a*) open hearth process (*b*) duplex process
(*c*) both (*a*) and (*b*) (*d*) neither (*a*) nor (*b*).

17.177. The weight of the rails depends upon
(*a*) gauge of the tracks (*b*) speed of trains
(*c*) spacing of sleepers (*d*) nature of traffic
(*e*) all the above.

17.178. In Indian railways, the ratio of axle load and weight of rail, is
(*a*) 312 (*b*) 412
(*c*) 512 (*d*) 600.

17.179. On B.G. tracks the distance of outer signal from station limit is kept
(*a*) 510 m (*b*) 520 m
(*c*) 530 m (*d*) 540 m
(*e*) 550 m.

17.180. Advantage of automatic signalling, is :
(*a*) increased safety (*b*) reduction in delays
(*c*) increase in track capacity (*d*) all the above.

17.181. Match list I with List II and select the correct answer by using codes given below the lists:

List I (Railway zone)	*List II (Head quarters)*
A. N.E.R.	1. Calcutta
B. E.R	2. Gorakhpur
C. S.C.R	3. Maligaon (Guwahati
D. N.E.F.R	4. Secunderabad

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	2	1	4	3
(*c*)	3	2	1	4
(*d*)	4	3	2	1

17.182. Match list I with List II and select the correct answer by using the codes given below the lists :

List I (Alignment)	*List II (Topography)*
A. Valley alignment	1. sags and summits in succession
B. Cross country alignment	2. On steep regular slope
C. Zig-zag alignment	3. One slope of valley
D. Switch back development	4. a slope with deep valleys

Codes :

	A	B	C	D
(*a*)	3	1	4	3
(*b*)	1	2	3	4
(*c*)	3	2	1	4
(*d*)	1	2	3	4

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17.183. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Formation width)	*List II (M.G.)*
A. Single line track on embarkment	1. 488 cm
B. Double line track on embarkment	2. 827 cm
C. Single line track in cutting	3. 84cm
D. Double line track in cutting	4. 427cm

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	2	3	4	1
(c)	1	3	4	2
(d)	1	2	3	4

17.184. The component parts of a permanent way are:
1. Ballast 2. Sleepers
3. Formation 4. Rails

Arrange the parts from top to bottom, using the codes given below :

Codes:
(a) 1, 2, 3, 4 (b) 4, 3, 2, 1
(c) 4, 2, 1, 3 (d) 1, 4, 2, 3

17.185. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Chemical composition)	*List II (Percentage)*
A. Carbon	1. 0.45 to 0.60
B. Silicon	2. 0.95 to 1.40
C. Sulphur	3. 0.06 (max.)
D. Maganese	4. 0.05 to 0.30

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	1	4	3	2
(d)	3	4	2	1

17.186. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Corrugated rails	1. The top surface gets worn out
B. Burrs	2. The projection of rail on gauge side
C. Wear of rails	3. The top surface develops alternate ridges and hollows
D. Flange bitten rails	4. Inner side of outer rail on the curve.

Codes:

	A	B	C	D
(a)	4	1	2	3
(b)	3	1	2	4
(c)	1	2	4	3
(d)	3	2	1	4

17.187. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Defect)	*List II (Cause)*
A. Crushed head	1. Excessive gap and loose fish plates
B. Split head	2. Manufacturing defect
C. Horizontal fissures	3. Skidding of wheel
D. Battered ends	4. Insufficient ballast packing under the joint sleeper

Codes :

	A	B	C	D
(a)	2	3	4	1
(b)	3	2	4	1
(c)	2	3	4	1
(d)	1	4	2	3

17.188. Consider the following statements :
Assertion A : Distorted alignment of the rail track is called buckling of rails
Reason : Insufficient expansion gaps, and ballast; Excessive creep and long welded rails
Codes :
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true.

17.189. Consider the following statements :
1. Treads of wheels of railway vehicles are given a slope 1 in 20 outwardly
2. Tops of rails are tilted inwards at a slope of 1 in 20 by adzing the wooden sleepers or with the help of canted bearing plates
3. Tops of rails is switches and crossings are not tilted

Of these statements:
(a) 1, 2, 3 are correct (b) 1, 2 are correct
(c) 1, 3 are correct (d) 2, 3 are correct.

17.190. Which of the following pairs is correctly matched:
1. Pole sleepers
2. Slab sleepers
3. Quarter sleepers
1. Sleepers may be obtained from tree trunk
2. Sleepers may be obtained from tree trunk
3. Sleepers may be obtained from trete trunk.
Select the correct answer using the codes given below :
Codes:
(a) 1, 2, 3 (b) 1, 3
(c) 2, 3 (d) 1, 2

17.191. Which of the following pairs is correctly matched ?
1. Ballast cushion 2. Crib ballast
3. Shoulder ballast 4. Shoulder width
The depth of ballast under the rails
The ballast between the sleepers
The ballast provided beyond the sleeper edge
The projected length of the ballast top beyond the sleeper edge.

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Select the correct answer using the codes given below :

Codes :

(a) 1, 3, 2, 4 correct (b) 2, 3, 4 correct
(c) 1, 2, 3 correct (d) 1, 4 correct.

17.192. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Ballast portion)	*List II (Function)*
A. Ballast cushion	1. Stability against centrifugal forces
B. Shoulder ballast	2. Provides resistance to the longitudinal track movement
C. Crib ballast	3. Provides resistance to the lateral movement of the track
D. Extra ballast on curves	4. For distribution of load on the formation

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	3	4
(c)	4	3	2	1
(d)	3	4	2	1

17.193. Which of the following pairs is correctly matched ?

1. Fish bolts used for fixing fish plates with rails in joints
2. Fang bolts used for fixing chairs with sleepers
3. Hook bolts used for fixing sleepers with bridge girders

Select the correct answer by using the following codes :

Codes:

(a) 1, 2, 3 correct (b) 1, 3 correct
(c) 2, 3 correct (d) 1, 2 correct.

17.194. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Chairs	1. Used on inner side of lower rail on sharp curves
B. Check rails	2. Used for holding double headed and bull headed rails
C. Gaurd rails	3. Used on long span bridges
D. Bearing plates	4. Used in between sleeper and flat footed rails

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	2	1	4
(c)	2	1	3	4
(d)	1	4	2	3

17.195. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Ruling gradient	1. steeper than ruling gradient followed by a falling gradient
B. Momentum gradient	2. maximum gradient permitted on a railway section
C. Pusher gradient	3. 1 in 1000 gradient provided for drainage
D. Station yard gradient	4. steeper gradient involving use of additional locomotives

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	4	3
(c)	2	3	1	4
(d)	1	4	2	3

17.196. Which of the following pairs is correctly matched ?

1. Grade compensation on B .G. track 0.04% per degree
2. Grade compensation on M.G. track 0.03% per degree
3. Grade compensation on N.G. track 0.01 % per degree

Select the correct answer using the codes given below :

Codes:

(a) 1, 2 and 3 (b) 1 and 2
(c) 2 and 3 (d) 1 and 3

17.197. Which of the following pairs for superelevation as per Indian Railways specification is correctly matched?

1. B.C. Track 165mm
2. M.G. track 102mm
3. N.G. track 76 mm

Select the correct answer using the codes given below :

Codes:

(a) 3 alone (b) 2 and 3
(c) 1and 3 (d) 1, 2 and 3

17.198. List I and II contain respectively terms and expressions related to equilibrium cant. Match the two lists and select the correct answer by using the codes given below the lists :

List I	*List II*
A. B.C. track	1. $e = 1.315 \frac{V^2}{R}$
B. M.G. Track	2. $e = 0.8 \frac{V^2}{R}$
C. N.G. track	3. $e = 0.6 \frac{V^2}{R}$
	4. $e = 0.5 \frac{V^2}{R}$
	5. $e = \frac{V^2}{R}$

Codes:

	A	B	C
(a)	1	3	5
(b)	1	2	3
(c)	2	4	5
(d)	1	3	4

17.199. Consider the following statements :

1. The shortage of the actual superelevation for high speed trains, is called cant deficiency.
2. The excess of the superelevation for low speed trains is called cant excess.

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3. The rate of increase or decrease of superelevation along a transition curve is called cant gradient
4. Negative superelevation occurs when a branch line diverges the main track. Of these statements:

(a) 1, 2 and 3 are correct.
(b) 2, 3 and 4 are correct.
(c) 1, 2 and 4 are correct.
(d) 1, 2, 3 and 4 are correct.

17.200. List I and II contain respectively terms and expressions related to horizontal railway curves. Match the two lists and select the correct answer by using the codes given below the lists :

List I	*List II*
A. Length of back tangent	1. $\frac{\pi R\Delta^\circ}{180^\circ}$
B. Length of curve	2. $2R \sin \frac{\Delta}{2}$
C. Length of long chord	3. $R \tan \frac{\Delta^\circ}{2}$
D. Length of moderndinate	4. $R \cos \frac{\Delta^\circ}{2}$

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	2	4
(c)	2	3	4	1
(d)	1	4	3	2

17.201. Match list I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Spiral angle	1. $\frac{L^2}{24R}$
B. Shift	2. $x = \frac{y^3}{6RL}$
C. Fronde's transition equation	3. $\frac{L}{2R}$ radians
D. Deflection angle for mid-point of the transition curve	4. $\frac{143.25L}{R}$ minutes

Codes:

	A	B	C	D
(a)	3	1	2	4
(b)	1	2	3	4
(c)	3	4	2	1
(d)	1	3	4	2

17.202. Which is the correct definition regardings points and crossing.

1. The rail of the V-s.haped portion of the crossing joined a little behind of nose of crossing is called splice rail.
2. The bent up rail of the crossing which is connected to the end of the crossing lead rail, is called wing rail
3. The rail of V-shaped portion of the crossing which extends upto nose of crossing is called point rail
4. The rail of the main line track against which tongue rail snugly fits is called stock rail

Select the correct answer using the codes given below :

Codes:
(a) 1, 2, 3, 4 (b) 2, 3, 4
(c) 3, 1, 2 (d) 1, 3, 4

17.203. Match list I with List II and select the correct answer by using codes given below the lists :

List I (Crossing)	*List II (Turn out)*
A. 1 in 6	1. station yards and sharp curves
B. 1 in 8½	2. Turnout of main line in station yards
C. 1 in 12	3. symmetrical split
D. 1 in 16	4. High speed turn outs

Codes.

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	3	1	2	4
(d)	1	2	4	3

17.204. Match List I with List II and select the correct answer by using codes given below the lists :

List I	*List II*
A. Diamond crossing	1. Two acute angles, two obtuse angles crossings, four special curved lead rails, four pairs of switches and four check rails
B. Square crossing	2. Two acute angle crossings, two obtuse angle crossings, two wing rails opposite obtuse angle crossing and four check rails
C. Cross overs	3. Two pairs of tongue rails, two acute angle crossings, a reverse curve and four check rails
D. Double slip diamond crossing	4. Four right angle crossings and a square shaped check rail.

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	3	4	2	1
(d)	1	4	3	2

17.205. List I and II contain respectively terms and expressions related to diamond crossing. Match the two lists and select the correct answer by using codes given below the lists:

List I	*List II*
A. Side of diamond	1. $G \sec \alpha$
B. Longer diagonal	2. $G \operatorname{cosec} \alpha$
C. Shorter diagonal	3. $G \sec \alpha/2$
	4. $G \operatorname{cosec} \alpha/2$

Codes :

	A	B	C
(a)	1	4	3
(b)	2	3	4
(c)	3	4	2
(d)	1	2	4

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17.206. The following are the component parts of a permanent way :

1. Rails
2. Ballast
3. Sleepers
4. Sub-grade

The correct sequence from the top to bottom is

(a)	1	2	3	4
(b)	2	4	1	3
(c)	1	3	2	4
(d)	4	1	3	2

17.207. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Broad gauge	1. 762 mm
B. Metre gauge	2. 1676 mm
C. Narrow gauge	3. 1000 mm
	4. 1524 mm

Codes :

	A	B	C
(a)	1	2	3
(b)	2	3	1
(c)	4	1	2
(d)	1	3	4

17.208. Pick upthe correct statement regarding the function of rails in a railway track from the following :

(a) To provide a continuous and level surfac
(b) To provide strength, durability and lateral guidance tothe track
(c) To trnasmit the axle load to the sleepers
(d) All the above.

17.209. Which one of the following rails is called Vignole rail?

(a) flat footed
(b) double headed
(c) bull headed
(d) none of these.

17.210. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Gauge)	*List II (Standard rail length)*
A. B.G.	1. 12 m
B. M.G.	2. 13 m
C. N.G.	3. 30 m
	4. 12 m

Codes :

	A	B	C
(a)	2	1	4
(b)	4	2	1
(c)	3	1	2
(d)	1	3	2

17.211. Pick up the corret statement from the following:

(a) The weighted average of speeds of various trains is called the equilibrium speed of trains
(b) The superelevation provided on the basis of equilibrium speed is called quilibrium cant
(c) The projections of metal beyond the original section ofthe rail on the gauge side are called burrs.
(d) The hammered down and flattende rail end is called a crippled end
(e) All the above.

17.212. Match List I with List II and select a correct answer by using the codes given below the lists :

List I (Joint)	*List II (Specification)*
A. Suspended	1. Supported on a sleeper
B. Supported	2. Supported over a metal plate
C. Bridge	3. Suspened at the centre of two adjacent sleepers
D. Square	4. Opposite each other

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	3	4	2	1
(c)	3	1	2	4
(d)	4	3	1	2

17.213. The treads of wheels of railway vehicles are provided

(a) a 1 in 20 slope outward
(b) a 1 in 20 slope inward
(c) a 1 in 30 slope inward
(d) a 1 in 30 slope outward

17.214. Match List I with List II and select a correct answer by using the codes given below the lists :

List I	*List II*
A. Fish plates	1. Used to fasten the sleepers with girder
B. Dog bolls	2. Used to fix rails on sleepers
C. Spikes	3. The fixtures used to join the ends of adacent rails
D. Chairs	4. Used to hold double headed rail onthe sleepers

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	1	2	4
(d)	2	4	1	3

17.215. Pick up the correct statement from the following

(a) Grade compensation on B.G. track is 0.04% per degre
(b) Indian Railways accepts degree of curve as $\frac{1750}{R}$ where R is the radius of the curve
(c) The maximum degree of curves on B.G., is 10°
(d) Indian Railaysrecommends the equilibrium super elevation on B.G track as $1.315 \frac{V^2}{R}$ where V is the velocity of train
(e) All the above.

17.216. In a facing direction,the railway locomotive move over the following points.

1. Throat
2. Heel of crossing
3. Toe of crossing
4. Actual nose of crossing
5. Wing rails
6. Point rails

The correct sequence is :

(a)	1	2	3	4	5	6
(b)	2	3	5	6	4	1
(c)	3	5	1	4	6	2
(d)	5	1	3	6	2	4

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21

Theory of Structures

21.1. A body is said to be in equilibrium if
(*a*) it moves horizontally (*b*) it moves vertically
(*c*) it rotates about its C.G. (*d*) none of these.

21.2. If ΣH and ΣV are the algebraic sums of the forces resolved horizontally and vertically respectively, and ΣM is the algebraic sum of the moments of forces about any point, for the equilibrium of the body acted upon
(*a*) $\Sigma H = 0$ (*b*) $\Sigma V = 0$
(*c*) $\Sigma M = 0$ (*d*) all the above.

21.3. The forces acting normally on the cross section of a bar shown in Fig. 21.1 introduce
(*a*) compressive stress
(*b*) tensile stress
(*c*) shear stress
(*d*) none of these.

Fig. 21.1

21.4. The forces acting normally on the cross section of a bar shown in Fig. 21.2 introduce
(*a*) compressive stress (*b*) tensile stress
(*c*) shear stress (*d*) none of these.

Fig. 21.2

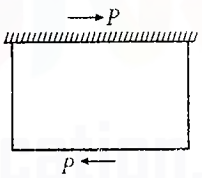

Fig. 21.3.

21.5. The forces acting on the bar as shown in Fig. 21.3 introduce
(*a*) compressive stress (*b*) tensile stress
(*c*) shear stress (*d*) none of these.

21.6. Stress may be defined as
(*a*) force per unit length (*b*) force per unit volume
(*c*) force per unit area (*d*) none of these.

21.7. Stress may be expressed in Newtons
(*a*) per millimetre square (N/mm^2)
(*b*) per centimetre square (N/cm^2)
(*c*) per metre square (N/m^2)
(*d*) none of these.

21.8. A material is said to be perfectly elastic if
(*a*) it regains its original shape on removal of the load
(*b*) It regains its original shape partially on removal of the load
(*c*) it does not regain its original shape at all
(*d*) none of these.

21.9. A road of uniform cross-section A and length L is deformed by δ, when subjected to a normal force P. The Young's Modulus E of the material, is
(*a*) $E = \frac{P \cdot \delta}{A \cdot L}$ (*b*) $E = \frac{A \cdot \delta}{P \cdot L}$
(*c*) $E = \frac{P \cdot L}{A \cdot \delta}$ (*d*) $\frac{P \cdot A}{L \cdot \delta}$
(*e*) $E = \frac{A \cdot L}{P \cdot \delta}$.

21.10. At yield point of a test piece, the material
(*a*) obeys Hooke's law
(*b*) behaves in an elastic manner
(*c*) regains its original shape on removal of the load
(*d*) undergoes plastic deformation.

21.11. The ratio of lateral strain to axial strain of a homogeneous material, is known
(*a*) Yield ratio (*b*) Hooke's ratio
(*c*) Poisson's ratio (*d*) Plastic ratio.

21.12. A_b and A_c are the cross sections of bronze and copper bars of equal length. σ_b, σ_c are their respective stresses due to load P. If P_b and P_c are the loads shared by them,
(*a*) $\frac{\sigma_b}{\sigma_c} = \frac{E_b}{E_c}$ (*b*) $P = P_b + P_c$
(*c*) $P = A_b \sigma_b + A_c \sigma_b$ (*d*) all the above
where E_b and E_c are their modulii.

21.13. A compound bar consists of two bars of equal length. Steel bar cross-section is 3500 mm^2 and that of brass bar is 3000 mm^2. These are subjected to a compressive load 100,000 N. If E_b = 0.2 MN/mm^2 and E_b = 0.1 MN/mm^2, the stresses developed are :
(*a*) $\sigma_b = 10\ N/mm^2$, $\sigma_s = 20\ N/mm^2$
(*b*) $\sigma_b = 8\ N/mm^2$, $\sigma_s = 16\ N/mm^2$
(*c*) $\sigma_b = 6\ N/mm^2$, $\sigma_s = 12\ N/mm^2$
(*d*) $\sigma_b = 5\ N/mm^2$, $\sigma_s = 10\ N/mm^2$.

21.14. If a concrete column 200 × 200 mm in cross-section is reinforced with four steel bars of 1200 mm^2 total cross-sectional area. Calculate the safe load for the column if permissible stress in concrete is 5 N/mm^2 and E_s is 15 E_c
(*a*) 264 MN (*b*) 274 MN
(*c*) 284 MN (*d*) 294 MN
(*e*) None of these.

21.15. Two bars, one of steel and the other of copper having areas of cross-sections A_s and A_c, coefficient of expansion α_s

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and α_c and Young's Modulii E_s and E_s are rigidly connected together at the ends and subjected to temperature change of $t°$. If the length of the bars initially is L, the final extension δ of the two bars at $t°$ temperature is given by

(a) $\delta = Lt \times \dfrac{(\alpha_c E_c A_c + \sigma_s E_s A_s)}{E_c A_c + E_s A_s}$

(b) $\delta = Lt + \dfrac{(\alpha_c E_c A_c + \alpha_s E_s A_s)}{E_c A_c + E_s A_s}$

(c) $\delta = Lt - \dfrac{(\alpha_c E_c A_c + \alpha_s E_s A_s)}{E_c A_c + E_s A_s}$

(d) $\delta = Lt \times \dfrac{(\alpha_c E_c A_c + \sigma_s E_s A_s)}{E_c A_c - E_s A_s}$.

21.16. A steel rod of sectional area 250 sq. mm connects two parallel walls 5 m apart. The nuts at the ends were tightened when the rod was heated to 100°C. If $\alpha_{steel} = 0.000012/C°$, $E_{steel} = 0.2$ MN/mm^2, the tensile force developed at a temperature of 50°C, is

(a) 80 N/mm^2 (b) 100 N/mm^2
(c) 120 N/mm^2 (d) 150 N/mm^2.

21.17. The ratio of shear stress and shear strain of an elastic material, is

(a) Modulus of Rigidity (b) Shear Modulus
(c) Young's Modulus (d) Modulus of Elasticity
(e) both (a) and (b).

21.18. A load of 1960 N is raised at the end of a steel wire. The minimum diameter of the wire so that stress in the wire does not exceed 100 N/mm^2 is :

(a) 4.0 mm (b) 4.5 mm
(c) 5.0 mm (d) 5.5. mm
(e) 6.0 mm.

21.19. The normal component of a force inclined through θ° is obtained by multiplying the force by

(a) sin θ (b) cos θ
(c) tan θ (d) sin θ cos θ
(e) sin^2 θ.

21.20. The tangential component of stress on an plane inclined θ° to the direction of the force, may be obtained by multiplying the normal stress by

(a) sin θ (b) cos θ
(c) tan θ (d) sin θ cos θ
(e) sin^2 θ.

21.21. The ratio of tangential and normal components of a stress on an inclined plane through θ° to the direction of the force, is :

(a) sin θ (b) cos θ
(c) tan θ (d) cos θ
(e) sec θ.

21.22. The normal and tangential components of stress on an inclined plane through θ° to the direction of the force, will be equal if θ is

(a) 45° (b) 30°
(c) 60° (d) 90°.

21.23. If the normal stresses due to longitudinal and transverse loads on a bar are σ_1 and σ_2 respectively, the tangential component of the stress on an inclined plane through θ°, the longitudinal load is

(a) $\sigma_1 \sin\theta + \sigma_2 \cos\theta$ (b) $\sigma_1 \sin\theta^2 + \sigma_2 \cos^2\theta$
(c) $(\sigma_1 - \sigma_2)\dfrac{\sin 2\theta}{2}$ (d) $(\sigma_1 + \sigma_2)\dfrac{\sin 2\theta}{2}$

21.24. If normal stresses due to longitudinal and transverse loads on a bar are σ_1 and σ_2 respectively, the normal component of the stress on an inclined plane θ° to the longitudinal load, is

(a) $\sigma_1 \sin\theta \times \sigma_2 \cos\theta$ (b) $\sigma_1 \sin^2\theta + \sigma_2 \cos^2\theta$
(c) $(\sigma_1 - \sigma_2)\dfrac{\sin 2\theta}{2}$ (d) $(\sigma_1 + \sigma_2)\dfrac{\sin 2\theta}{2}$.

21.25. The locus of the end point of the resultant of the normal and tangential components of the stress on an inclined plane is

(a) circle (b) parabola
(c) ellipse (d) straight line.

21.26. Principal planes are subjected to

(a) normal stresses only
(b) tangential stresses only
(c) normal stresses as well as tangential stresses
(d) none of these.

21.27. A steel bar 5 m × 50 mm is loaded with 250,000 N. If the modulus of elasticity of the material is 0.2 MN/mm^2 and Poisson's ratio is 0.25, the change in the volume of the bar is

(a) 1.125 cm^3 (b) 2.125 cm^3
(c) 3.125 cm^3 (d) 4.125 cm^2.

21.28. If E, N, K and $1/m$ are modulus of elasticity, modulus of rigidity. Bulk modulus and Poisson ratio of the material, the following relationship holds good

(a) $E = 3K\left(1 - \dfrac{2}{m}\right)$ (b) $E = 2K\left(1 + \dfrac{1}{m}\right)$

(c) $\dfrac{3}{2}K(1 - 2/m) = N\left(1 + \dfrac{1}{m}\right)$ (d) all the above.

21.29. A bar l metre long and having its area of cross-section A, is subjected to a gradually applied tensile load W. The strain energy stored in the bar is

(a) $\dfrac{WL}{2AE}$ (b) $\dfrac{WL}{AE}$
(c) $\dfrac{W^2 L}{AE}$ (d) $\dfrac{W^2 L}{2AE}$.

21.30. The ratio of the stresses produced by a suddenly applied load and by a gradually applied load on a bar, is

(a) $\dfrac{1}{4}$ (b) $\dfrac{1}{2}$
(c) 1 (d) 2
(e) 3.

21.31. The strain energy due to volumetric strain

(a) is directly proportional to the volume
(b) is directly proportional to the square of exerted pressure
(c) is inversely proportional to Bulk modulus
(d) all the above.

21.32. A material which obeys Hook's law, is subjected to direct stress σ_0. At its elastic limit, the following statement is true,

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(a) Strain is equal to $\frac{\sigma_0}{E}$

(b) Maximum shear stress = $\frac{\sigma_0}{2}$

(c) Strain energy = $\frac{\sigma_0^2}{2E} \times$ volume

(d) Shear strain energy = $\frac{\sigma_0}{6N} \times$ volume

(e) All the above.

21.33. A material may fail if
(a) maximum principal stress exceeds the direct stress σ_0
(b) maximum strain exceeds $\frac{\sigma_0}{E}$
(c) maximum shear stress exceeds $\frac{\sigma_0}{2}$
(d) total strain energy exceeds $\frac{\sigma_0^2}{2E} \times$ volume
(e) all the above.

21.34. Maximum strain theory for the failure of a material at the elastic limit, is known as
(a) Guest's or Trecas' theory (b) St. Venant's theory
(c) Rankine's theory (d) Haig's theory
(e) Von Mises's theory.

21.35. Maximum shear stress theory for the failure of a material at the elastic limit, is known
(a) Guest's or Trecas' theory (b) St. Venant's theory
(c) Rankine's theory (d) Haig's theory
(e) Von Mises's theory.

21.36. Maximum principal stress theory for the failure of a material at elastic point, is known
(a) Guest's or Trecas' theory (b) St. Venant's theory
(c) Rankine's theory (d) Haig's theory
(e) Von Mises's theory.

21.37. Total strain energy theory for the failure of a material at elastic limit, is known
(a) Guest's or Trecas' theory (b) St. Venant's theory
(c) Rankine's theory (d) Haig's theory
(e) Von Mises's theory.

21.38. Shear strain energy theory for the failure of a material at elastic limit, is due to
(a) Rankine (b) Guest or Trecas
(c) St. Venant (d) Haig
(e) Von Mises.

21.39. Gradually applied static loads do not change with time their
(a) magnitude (b) direction
(c) point of application (d) all the above.

21.40. The S.F. diagram of a loaded beam shown in Fig. 21.4 is that of

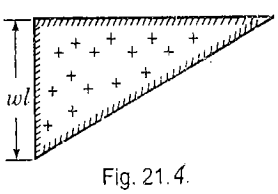

Fig. 21.4.

(a) a simply supported beam with isolated central load
(b) a simply supported beam with uniformly distributed load
(c) a cantilever with an isolated load at the free end
(d) a cantilever with a uniformly distributed load.

21.41. The maximum bending moment for a simply supported beam with a uniformly distributed load w/unit length, is
(a) $\frac{wl}{2}$ (b) $\frac{wl^2}{4}$
(c) $\frac{wl^2}{8}$ (d) $\frac{wL^2}{12}$.

21.42. A simply supported beam carries a varying load from zero at one end and w at the other end. If the length of the beam is a, the shear force will be zero at a distance x from least loaded point where x is
(a) $\frac{a}{2}$ (b) $\frac{a}{3}$
(c) $\frac{a}{\sqrt{3}}$ (d) $\frac{a\sqrt{3}}{2}$.

21.43. A simply supported beam carries varying load from zero at one end and w at the other end. If the length of the beam is a, the maximum bending moment will be
(a) $\frac{wa}{27}$ (b) $\frac{wa^2}{27}$
(c) $\frac{w^2 a}{\sqrt{27}}$ (d) $\frac{wa^2}{9\sqrt{3}}$.

21.44. A simply supported beam which carries a uniformly distributed load has two equal overhangs. To have maximum B.M. produced in the beam least possible, the ratio of the length of the overhang to the total length of the beam, is
(a) 0.207 (b) 0.307
(c) 0.407 (d) 0.508.

21.45. Pick up the correct statement from the following :
(a) For a uniformly distributed load, the shear force varies linearly
(b) For a uniformly distributed load, B.M. curve is a parabola
(c) For a load varying linearly, the shear force curve is a parabola
(d) For a load varying linearly, the B.M. curve is a cubic parabola
(e) All the above.

21.46. The point of contraflexure is the point where
(a) B.M. changes sign (b) B.M. is maximum
(c) B.M. is minimum (d) S.F. is zero.

21.47. The general expression for the B.M. of a beam of length l is $M = \frac{wl}{2}x - \frac{wx^2}{2}$, the beam carries
(a) a uniformly distributed load w/unit length
(b) a load varying linearly from zero at one end to w at the other end
(c) an isolated load at mid span
(d) none of these.

21.48. By applying the static equations *i.e.* $\Sigma H = 0$, $\Sigma V = 0$ and $\Sigma M = 0$, to a determinate structure, we may determine
(a) supporting reactions only (b) shear forces only
(c) bending moments only (d) internal forces only
(e) all the above.

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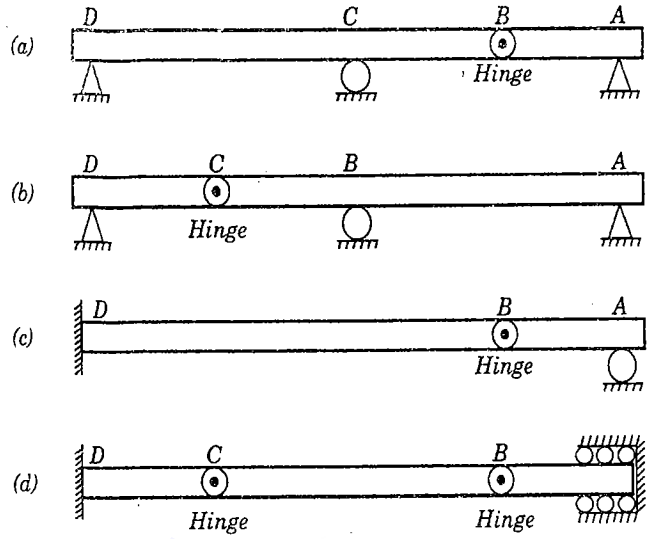
21.49. From the structures shown in Fig. 21.5, pick up the determinate structure



(e) all the above.

Fig. 21.5.

21.50. Pick up the indeterminate structure from those shown in Fig. 21.6

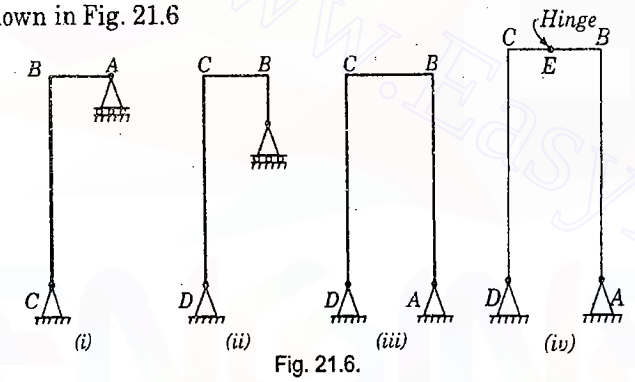


Fig. 21.6.

(a) figure (*i*) (b) figure (*ii*)
(c) figure (*iii*) (d) figure (*iv*).

21.51. The reaction for the support *B* of a compound beam loaded as shown in Fig. 21.7, is

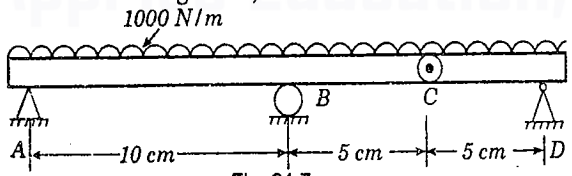


Fig. 21.7.

(a) 5000 N (b) 10,000 N
(c) 1250 N (d) 15,000 N
(e) 1750 N.

21.52. The B.M. at the hinge *C* of the loaded beam shown in Fig. 21.7 is

(a) maximum (b) zero
(c) 25000 Nm (d) 5000 Nm.

21.53. If *M*, *I*, *R*, *E*, *F*, and *Y* are the bending moment, moment of inertia, radius of curvature, modulus of elasticity stress and the depth of the neutral axis at section, then

(a) $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$ (b) $\frac{I}{M} = \frac{R}{E} = \frac{F}{Y}$

(c) $\frac{M}{I} = \frac{E}{R} = \frac{E}{Y}$ (d) $\frac{M}{I} = \frac{E}{R} = \frac{Y}{F}$.

21.54. At any point of a beam, the section modulus may be obtained by dividing the moment of inertia of the section by

(a) depth of the section
(b) depth of the neutral axis
(c) maximum tensile stress at the section
(d) maximum compressive stress at the section
(e) none of these.

21.55. The assumption in the theory of bending of beams, is

(a) material is homogeneous
(b) material is isotropic
(c) Young's modulus is same in tension as well as in compression
(d) each layer is independent to expand or to contract
(e) all the above.

21.56. The moment of inertia of a rectangular section of width *B* and depth *D* about an axis passing through *C.G.* and parallel to its width is

(a) $\frac{BD^2}{6}$ (b) $\frac{BD^3}{6}$

(c) $\frac{BD^3}{12}$ (d) $\frac{B^2D}{6}$

(e) $\frac{DB^2}{12}$.

21.57. The moment of inertia of a circular section about any diameter *D*, is

(a) $\frac{\pi D^2}{64}$ (b) $\frac{\pi D^4}{32}$

(c) $\frac{\pi D^3}{64}$ (d) $\frac{\pi D^4}{64}$.

21.58. The ratio of the section modulus of a square section of side *B* and that of a circular section of diameter *D*, is

(a) $\frac{2\pi}{15}$ (b) $\frac{3\pi}{16}$

(c) $\frac{3\pi}{8}$ (d) $\frac{\pi}{16}$.

21.59. If I_X and I_Y are the moments of inertia of a section about *X* and *Y* axes, the polar moment of inertia of the section, is

(a) $\frac{I_x + I_y}{2}$ (b) $\frac{I_X - I_Y}{2}$

(c) $I_X + I_Y$ (d) $\frac{I_x}{I_y}$.

21.60. In case of principal axes of a section

(a) sum of moment of inertia is zero
(b) difference of moment inertia is zero
(c) product of moment of inertia is zero
(d) none of these.

21.61. The locus of the moment of inertia about inclined axes to the principal axis, is

(a) straight line (b) parabola
(c) circle (d) ellipse.

21.62. The radius of gyration of a section of area *A* and least moment of inertia *I* about the centroidal axis, is

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(a) $\frac{A}{I}$ (b) $\frac{I}{A}$

(c) $\sqrt{\frac{I}{A}}$ (d) $\sqrt{\frac{A}{I}}$.

21.63. The radius of gyration of a rectangular section (depth D, width B) from a centroidal axis parallel to the width is

(a) $\frac{D}{2}$ (b) $\frac{D}{\sqrt{3}}$

(c) $\frac{D}{2\sqrt{3}}$ (d) $\frac{D}{4\sqrt{3}}$.

21.64. The moment of inertia of a triangular section (height h, base b) about its base, is

(a) $\frac{bh^2}{12}$ (b) $\frac{b^2h}{12}$

(c) $\frac{bh^3}{12}$ (d) $\frac{b^3h}{12}$.

21.65. The ratio of moments of inertia of a triangular section about its base and about a centroidal axis parallel to its base, is

(a) 1.0 (b) 1.5
(c) 2.0 (d) 2.5
(e) 3.0.

21.66. For a strongest rectangular beam cut from a circular log, the ratio of the width and depth, is

(a) 0.303 (b) 0.404
(c) 0.505 (d) 0.606
(e) 0.707.

21.67. For beams of uniform strength, if depth is constant,

(a) width $b \propto M$ (b) width $b \propto \sqrt{M}$

(c) width $b \propto 3\sqrt{M}$ (d) width $b \propto \frac{1}{M}$.

21.68. For beams of uniform strength if breadth is constant,

(a) depth $d \propto M$ (b) depth $d \propto \sqrt{M}$

(c) depth $d \propto 3\sqrt{M}$ (d) depth $d \propto \frac{1}{M}$.

21.69. Keeping the depth d constant, the width of a cantilever of length l of uniform strength loaded with a uniformly distributed load w varies from zero at the free end and

(a) $\frac{2w}{\sigma d^2} \times l^2$ at the fixed end (b) $\frac{3w}{\sigma d} \times l^2$ at the fixed end

(c) $\frac{3w}{\sigma d^2} \times l^2$ at the fixed end (d) $\frac{5w}{\sigma d} \times l^2$ at the fixed end.

21.70. Keeping breadth constant, depth of a cantilever of length l of uniform strength loaded with uniformly distributed load w varies from zero at the free end and

(a) $\frac{2w}{\sigma b} \times l$ at the fixed end

(b) $\sqrt{\frac{3w}{\sigma b} \times l}$ at the fixed end

(c) $\sqrt{\frac{2w}{\sigma b} \times l}$ at the fixed end

(d) $\frac{3w}{\sigma b} \times l$ at the end fixed end.

21.71. Beams composed of more than one material, rigidly connected together so as to behave as one piece, are known as

(a) Compound beams (b) Indeterminate beams
(c) Determinate beams (d) Composite beams.

21.72. A steel plate $d \times b$ is sandwiched rigidly between two timber joists each $D \times B/2$ in section. The moment of resistance of the beam for the same maximum permissible stress σ in timber and steel will be

(a) $\sigma\left(\frac{BD^2 + mbd^2}{6D}\right)$ (b) $\sigma\left(\frac{BD^3 + mbd^3}{6D}\right)$

(c) $\sigma\left(\frac{BD^2 + mbd^3}{4D}\right)$ (d) $\left(\frac{BD^2 + mbd^2}{4D}\right)$

where Young's modulus of steel is m times that of the timber.

21.73. A composite beam is composed of two equal strips one of brass and other of steel. If the temperature is raised

(a) steel experiences tensile force
(b) brass experiences compressive force
(c) composite beam gets subjected to a couple
(d) composite beam bends (e) All the above.

21.74. The maximum magnitude of shear stress due to shear force F on a rectangular section of area A at the neutral axis, is

(a) $\frac{F}{A}$ (b) $\frac{F}{2A}$

(c) $\frac{3F}{2A}$ (d) $\frac{2F}{3A}$.

21.75. The ratio of maximum and average shear stresses on a rectangular section, is

(a) 1 (b) 1.25
(c) 1.5 (d) 2.0
(e) 2.5.

21.76. The ratio of maximum shear stress to average shear stress of a circular beam, is

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$

(c) $\frac{3}{4}$ (d) $\frac{4}{3}$ (d) 1.0.

21.77. A bar of square section of area a^2 is held such that its one of its diameters is vertical. The maximum shear stress will develop at a depth h where h is

(a) $\frac{2\sqrt{3}}{4}$ (b) $\frac{3\sqrt{2}}{4}$

(c) $\frac{2}{\sqrt{3}}$ (d) $\frac{\sqrt{3}}{4}$.

21.78. Pick up the correct statement from the following :

(a) The bending stress in a section is zero at its neutral axis and maximum at the outer fibres
(b) The shear stress is zero at the outer fibres and maximum at the neutral axis
(c) The bending stress at the outer fibres, is known as principal stress
(d) The planes of principal stresses are inclined at 45° to the neutral plane
(e) All the above.

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21.79. The total strain energy of a beam of length L, having moment of inertia of its section I, when subjected to a bending moment M, is

(a) $\frac{M^2}{EI}\delta_x$ (b) $\frac{M^2}{2EI}\delta_x$

(c) $\int_0^L \frac{M^2}{2EI}\delta_x$ (d) $\int_0^L \frac{M^2}{EI}\delta_x$.

21.80. A steel bar 20 mm in diameter simply supported at its ends over a total span of 40 cm carries a load at its centre. If the maximum stress induced in the bar is limited to $\frac{480}{\pi}$ N/mm^2, the bending strain energy stored in the bar, is

(a) 411 N mm (b) 511 N mm

(c) 611 N mm (d) 711 N mm.

21.81. A lift of weight W is lifted by a rope with an acceleration f. If the area of cross-section of the rope is A, the stress in the rope is

(a) $W\left(1+\frac{f}{G}\right)/A$ (b) $\left(1-\frac{g}{f}\right)/A$

(c) $W\left(2+\frac{f}{g}\right)/A$ (d) $W\left(2+\frac{g}{f}\right)/A$

(e) $\left(\frac{1}{2}+\frac{f}{g}\right)A$.

21.82. A cantilever of length L is subjected to a bending moment M at its free end. If EI is the flexural rigidity of the section, the deflection of the free end, is

(a) $\frac{ML}{EI}$ (b) $\frac{ML}{2EI}$

(c) $\frac{ML^2}{2EI}$ (d) $\frac{ML^2}{3EI}$.

21.83. The maximum deflection due to a load W at the free end of a cantilever of length L and having flexural rigidity EI, is

(a) $\frac{WL^2}{2EI}$ (b) $\frac{WL^2}{3EI}$

(c) $\frac{WL^3}{2EI}$ (d) $\frac{WL^3}{3EI}$.

21.84. The maximum deflection due to a uniformly distributed load w/unit length over entire span of a cantilever of length l and of flexural rigidly EI, is

(a) $\frac{wl^3}{3EI}$ (b) $\frac{wl^4}{3EI}$

(c) $\frac{wl^4}{8EI}$ (d) $\frac{wl^4}{12EI}$.

21.85. The ratio of the deflections of the free end of a cantilever due to an isolated load at 1/3rd and 2/3rd of the span, is

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$

(c) $\frac{3}{7}$ (d) $\frac{2}{5}$.

21.86. The maximum deflection of a simply supported beam of span L, carrying an isolated load at the centre of the span ; flexural rigidity being EI, is

(a) $\frac{WL^3}{3EI}$ (b) $\frac{EL^3}{8EI}$

(c) $\frac{WL^3}{24EI}$ (d) $\frac{WL^3}{48EI}$.

21.87. The ratio of the maximum deflections of a simply supported beam with a central load W and of a cantilever of same length and with a load W at its free end, is

(a) $\frac{1}{8}$ (b) $\frac{1}{10}$

(c) $\frac{1}{12}$ (d) $\frac{1}{14}$

(e) $\frac{1}{16}$.

21.88. A simply supported beam A carries a point load at its midspan. An other identical beam B carries the same load but uniformly distributed over the entire span. The ratio of the maximum deflections of the beams A and B, will be

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$

(c) $\frac{5}{8}$ (d) $\frac{8}{5}$

(e) $\frac{3}{5}$.

21.89. A cantilever of length 2 cm and depth 10 cm tapers in plan from a width 24 cm to zero at its free end. If the modulus of elasticity of the material is 0.2×10^6 N/mm^2, the deflection of the free end, is

(a) 2 mm (b) 3 mm

(c) 4 mm (d) 5 mm

(e) 6 mm.

21.90. A rolled steel joist is simply supported at its ends and carries a uniformly distributed load which causes a maximum deflection of 10 mm and slope at the ends of 0.002 radian. The length of the joist will be,

(a) 10 m (b) 12 m

(c) 14 m (d) 16 m

(e) 18 m.

21.91. A simply supported rolled steel joist 8 m long carries a uniformly distributed load over it span so that the maximum bending stress is 75 N/mm^2. If the slope at the ends is 0.005 radian and the value of $E = 0.2 \times 10^6$ N/mm^2, the depth of the joist, is

(a) 200 mm (b) 250 mm

(c) 300 mm (d) 350 mm

(e) 400 mm.

21.92. A simply supported uniform rectangular bar breadth b, depth d and length L, carries an isolated load W at its mid-span. The same bar experiences an extension e under same tensile load. The ratio of the maximum deflection to the elongation, is

(a) $\frac{L}{d}$ (b) $\frac{d}{2d}$

(c) $\left(\frac{L}{2d}\right)^2$ (d) $\left(\frac{L}{3d}\right)^2$.

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21.93. The deflection of a uniform circular bar of diameter d and length l, which extends by an amount e under a tensile pull W, when it carries the same load at its mid-span, is

(a) $\frac{el}{2d}$ (b) $\frac{e^2l}{3d^2}$

(c) $\frac{el^2}{3d^2}$ (d) $\frac{e^{1/2}}{3d^2}$.

21.94. The ratio of the length and diameter of a simply supported uniform circular beam which experiences maximum bending stress equal to tensile stress due to same load at its mid span, is

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$

(c) $\frac{1}{2}$ (d) $\frac{1}{3}$

(e) 1.0.

21.95. The ratio of the length and depth of a simply supported rectangular beam which experiences maximum bending stress equal to tensile stress, due to same load at its mid span, is

(a) $\frac{1}{2}$ (b) $\frac{2}{3}$

(c) $\frac{1}{4}$ (d) $\frac{1}{3}$.

21.96. A truss containing j joints and m members, will be a simple truss if

(a) $m = 2j - 3$ (b) $j = 2m - 3$

(c) $m = 3j - 2$ (d) $j = 3m - 2$.

21.97. A compound truss may be formed by connecting two simple rigid frames, by

(a) two bars (b) three bars

(c) three parallel bars

(d) three bars intersecting at a point.

21.98. m_1 and m_2 are the members of two individual simple trusses of a compound truss. The compound truss will be rigid and determinate if

(a) $m = m_1 + m_2$ (b) $m = m_1 + m_2 + 1$

(c) $m = m_1 + m_2 + 2$ (d) $m = m_1 + m_2 + 3$.

21.99. The forces in the members of simple trusses, may be analysed by

(a) graphical method (b) method of joints

(c) method of sections (d) all the above.

21.100. In the truss shown in Fig. 21.8, the force in member BC is

(a) 100 t compressive (b) 100 t tensile

(c) zero (d) indeterminate.

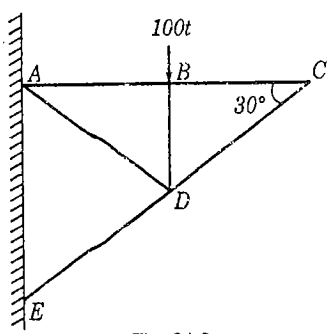

Fig. 21.8.

21.101. In the truss shown in Fig. 21.8, the force in member DC is

(a) 100 t compressive (b) 100 t tensile

(c) zero (d) indeterminate.

21.102. In the truss shown in Fig. 21.8, the force in member BD is

(a) 100 t compressive (b) 100 t tensile

(c) zero (d) indeterminate.

21.103. For determining the force in the member AB of the truss shown in Fig. 21.9 by method of sections, the section is made to pass through AB, AD and ED and the moments are taken about

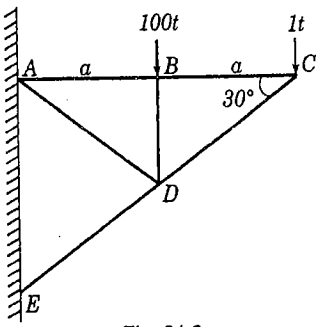

Fig. 21.9.

(a) joint C (b) joint B

(c) joint D (d) joint A.

21.104. In the truss (Fig. 21.10), the force in the member AC is

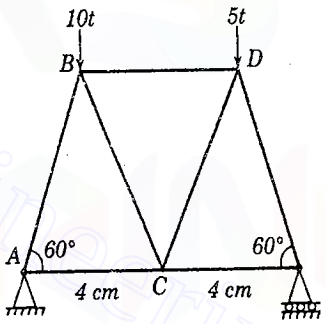

Fig. 21.10.

(a) 6.25 t compressive (b) 8.75 t tentile

(c) $\frac{8.75}{\sqrt{3}}$ t tensile (d) $\frac{8.75}{\sqrt{3}}$ t compressive.

21.105. To determine the force in BD of the truss shown in Fig. 21.10, a section is passed through BD, CD and CE, and the moments are taken about

(a) A joint (b) B joint

(c) C joint (d) D joint.

21.106. The force in AC of the truss shown in Fig. 21.11, is

(a) 5t tension (b) 4t tension

(c) 4t compression (d) 5t compression

(e) None of these.

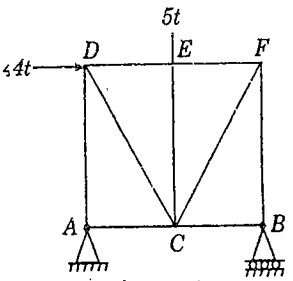

Fig. 21.11.

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21.107. The force in EC of the truss shown in Fig. 21.11, is
(a) zero (b) $5t$ tension
(c) $5t$ compression (d) $4t$ tension
(e) None of these.

21.108. The force in BC of the truss shown in Fig. 21.11, is
(a) $4t$ tension (b) $4t$ compression
(c) $5t$ tension (d) $5t$ compression.

21.109. The force in BF of the truss shown in Fig. 21.11, is
(a) $4t$ tension (b) $4t$ compression
(c) $4.5t$ tension (d) $4.5t$ compression
(e) zero.

21.110. The force in AD of the truss shown in Fig. 21.11, is
(a) $4.0t$ compression (b) $3.0t$ compression
(c) $0.5t$ compression (d) $0.5t$ tension
(e) zero.

21.111. The force in CD of the truss shown in Fig. 21.12, is
(a) $3t$ compression
(b) $3t$ tension
(c) zero
(d) $1.5t$ compression
(e) $1.5t$ tension.

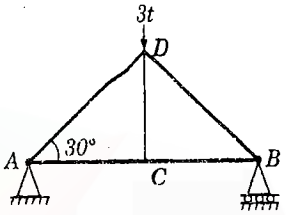

Fig. 21.12.

21.112. The force in BC of the truss shown in Fig. 21.12, is
(a) $3.0t$ compression (b) $3.0t$ tension
(c) $\frac{3\sqrt{3}}{2}\,t$ tension (d) $\frac{3\sqrt{3}}{2}\,t$ compression
(e) None of these.

21.113. The degree of indeterminacy of the frame (Fig. 21.13), is
(a) zero
(b) 1
(c) 2
(d) 3.

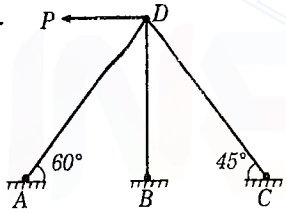

Fig. 21.13.

21.114. The degree of indeterminacy of the frame (Fig. 21.14), is
(a) 1
(b) 2
(c) 3
(d) zero.

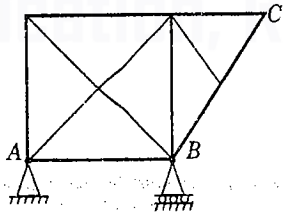

Fig. 21.14.

21.115. In the cable shown in Fig. 21.15, the minimum tension occurs at

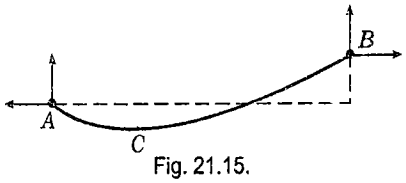

Fig. 21.15.

(a) A (b) B
(c) C (d) between A and C
(e) between B and C.

21.116. In a shaft, the shear stress is not directly proportional to
(a) radius of the shaft (b) angle of twist
(c) length of the shaft (d) modulus of rigidity.

21.117. Pick up the incorrect statement from the following:
The torsional resistance of a shaft is directly proportional to
(a) modulus of rigidity
(b) angle of twist
(c) reciprocal of the length of the shaft
(d) moment of inertia of the shaft section.

21.118. If D and d are external and internal diameters of circular shaft respectively, its polar moment of inertia, is
(a) $\frac{\pi}{2}(D^4 - d^4)$ (b) $\frac{\pi}{4}(D^4 - d^4)$
(c) $\frac{\pi}{64}(D^4 - d^4)$ (d) $\frac{\pi}{32}(D^4 - d^4)$.

21.119. A shaft rotating *N.R.M.* under a torque T, transmits a power
(a) $\frac{T\pi N}{30}$ Newton metres/sec (b) $\frac{T\pi N}{30}$ Newton metres/min
(c) $\frac{T\pi N}{60}$ Newton metres/min (d) $\frac{T\pi N}{60}$ Newton metres/sec

21.120. If a solid shaft (diameter 20 cm, length 400 cm, $N = 0.8 \times 10^5$ N/mm^2) when subjected to a twisting moment produces maximum shear stress of 50 N/mm^2, the angle of twist in radians, is
(a) 0.001 (b) 0.002
(c) 0.0025 (d) 0.003
(e) 0.005.

21.121. For permissible shear stress f_s, the torque transmitted by a thin tube of mean diameter D and wall thickness t, is
(a) $\frac{\pi D^2}{2}\,t\,f_s$ (b) $\frac{\pi D}{2}\,t\,f_s$
(c) $\pi D^2\,t\,f_s$ (d) $\frac{\pi D^2 t^2}{4}\,f_s$.

21.122. A shaft subjected to a bending moment M and a torque T, experiences
(a) maximum bending stress = $\frac{32\,M}{\pi d^3}$
(b) maximum shear stress = $\frac{16\,T}{\pi d^3}$
(c) both (a) and (b)
(d) neither (a) nor (b).

21.123. A shaft is subjected to bending moment M and torque T simultaneously. The ratio of the maximum bending stress to maximum shear stress developed in the shaft, is
(a) $\frac{M}{T}$ (b) $\frac{T}{M}$
(c) $\frac{2M}{T}$ (d) $\frac{2T}{M}$.

21.124. Pick up the correct statement from the following:
(a) The bending moment which when acting alone would produce the maximum stress equal to the major principal stress caused by combined bending and torsion, is called equivalent bending moment
(b) $M_{eg} = (M\sqrt{M^2 + r^2})$ where letters carry their usual meanings

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(c) $T_{cp} = \sqrt{m^2 + T^2}$ where letters carry their usual meanings

(d) The torque which when acting alone would produce maximum shear stress equal to the maximum shear stress caused by the combined bending and torsion, is called equivalent torque

(e) All the above.

21.125. If the strain energy stored per unit volume in a hollow shaft subjected to a pure torque when t attains maximum shear stress f_s is $\frac{17}{64}\frac{f_s}{N}$, the ratio of inner diameter to outer diameter, is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{1}{4}$ (d) $\frac{1}{5}$.

21.126. Pick up the correct statement from the following :

(a) A wire wound in spiral form, is called a helical spring

(b) The pitch of a close coil spring, is very small

(c) The angle made by the coil with horizontal, is called the angle of helix

(d) In the open coil helical spring, the angle of helix is comparatively large

(e) All the above.

21.127. The greatest load which a spring can carry without getting permanently distorted, is called

(a) stiffness (b) prof resilience

(c) proof stress (d) proof load.

21.128. The load on a spring per unit deflection, is called

(a) stiffness (b) proof resilience

(c) proof stress (d) proof load.

21.129. The strain energy stored in a spring when subjected to greatest load without being permanently distorted, is called

(a) stiffness (b) proof resilience

(c) proof stress (d) proof load.

21.130. A close coil helical spring of mean diameter D consists of n coils of diameter d. If it carries an axial load W, the energy stored in the spring, is

(a) $\frac{4WD^2n}{d^4N}$ (b) $\frac{4W^2Dn}{d^4N}$

(c) $\frac{4W^2D^3n}{d^4N}$ (d) $\frac{4W^2D^3n^2}{d^4N}$

where N is the modulus of rigidity.

21.131. For the close coil helical spring of Q. 21.130, the maximum deflection is

(a) $\frac{WD^3n}{d^4N}$ (b) $\frac{2WD^3n}{d^4N}$

(c) $\frac{4W^2D^3n}{d^4N}$ (d) $\frac{6WD^2n}{d^4N}$

(e) $\frac{8WD^3n}{d^4N}$.

21.132. The stiffness of the close coil helical spring of Q. 21.130, is

(a) $\frac{d^4N}{8D^3n}$ (b) $\frac{d^4N}{4D^3n}$

(c) $\frac{4D^3n}{d^4n}$ (d) $\frac{8D^3n}{d^4n}$.

21.133. A close coil helical spring when subjected to a moment M having its axis along the axis of the helix

(a) it is subjected to pure bending

(b) its mean diameter will decrease

(c) its number of coils will increase

(d) all the above.

21.134. A spring of mean radius 40 mm contains 8 action coils of steel (N = 80000 N/mm^2), 4 mm in diameter. The clearance between the coils being 1 mm when unloaded, the minimum compressive load to remove the clearance, is

(a) 25 N (b) 30 N

(c) 35 N (d) 40 N.

21.135. Flat spiral springs

(a) consist of uniform thin strips

(b) are supported at outer end

(c) are wound by applying a torque

(d) are used in clock-work mechanism

(e) all the above.

21.136. A rectangular column ($b \times d$) shown in Fig. 21.16 carries a load P acting at a distance e from its centre of gravity along the principal axis parallel to side b. It experiences

(a) an axial stress $\frac{P}{bd}$

(b) a tensile stress $\frac{P_c}{Z_t}$ at extreme fibre due to bending

(c) a compressive stress $\frac{P_c}{Z_t}$ at extreme fibre due to compression

(d) combined stress $\frac{P}{A} \pm \frac{P_c}{I} Y$ at a distance y from the axis of bending

(e) All the above.

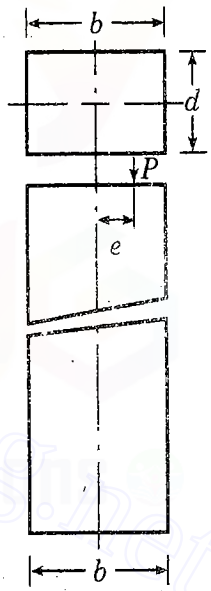

Fig. 21.16.

21.137. Pick up the correct statement from the following :

(a) The moment of inertia is calculated about the axis about which bending takes place

(b) If tensile stress is less than axial stress, the section experiences compressive stress

(c) If tensile stress is equal to axial stress, the section experiences compressive stress

(d) If tensile stress is more than axial stress, some portion of the section experiences a tensile stress

(e) All the above.

21.138. A rectangular column shown in Fig. 21.17 carries a load P having eccentricities e_x and e_y along X and Y axes. The stress at any point (x, y) is

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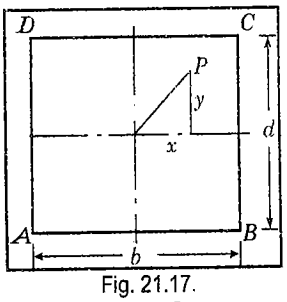

Fig. 21.17.

(a) $\frac{P}{bd}\left[1+\frac{12e_y \cdot y}{d^2}+\frac{12e_x \cdot x}{d^2}\right]$

(b) $P\left[1+\frac{6e_y \cdot y}{b}+\frac{6e_x \cdot x}{b}\right]$

(c) $\frac{P}{bd}\left[1+\frac{6e_y \cdot y}{d}+\frac{6e_x \cdot x}{b}\right]$

(d) $\frac{P}{bd}\left[1+\frac{e_y \cdot y}{d}+\frac{e_x \cdot x}{d}\right]$.

21.139. A square column carries a load P at the centroid of one of the quarters of the square. If a is the side of the main square, the combined bending stress will be

(a) $\frac{P}{a^2}$ (b) $\frac{2P}{a^2}$

(c) $\frac{3P}{a^2}$ (d) $\frac{4P}{a^2}$.

21.140. The area of the core of a column of cross sectional area A, is

(a) $\frac{1}{3}A$ (b) $\frac{1}{6}A$

(c) $\frac{1}{12}A$ (d) $\frac{1}{18}A$.

21.141. The ratio of the area of cross-section of a circular section to the area of its core, is

(a) 4 (b) 8

(c) 12 (d) 16.

21.142. The eccentricity (e) of a hollow circular column, external diameter 25 cm, internal diameter 15 cm for an eccentric load 100 t for non-development of tension, is

(a) 2.75 cm (b) 3.00 cm

(c) 3.50 cm (d) 4.25 cm

(e) 5.0 cm.

21.143. A short column (30 cm × 20 cm) carries a load P_1 at 4 cm on one side and another load P_2 at 8 cm on the other side along a principal section parallel to longer dimension. If the extreme intensity on either side is same, the ratio of P_1 to P_2 will be

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$

(c) $\frac{8}{5}$ (d) $\frac{5}{8}$.

21.144. Co-efficient of wind resistance of a circular surface, is

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$

(c) $\frac{2}{3}$ (d) $\frac{3}{2}$.

21.145. A masonry dam (density = 20,000 N/m^3) 6 m high, one metre wide at the top and 4 m wide at the base, has vertical water face. The minimum stress at the base of the dam when the reservoir is full, will be

(a) 75 N/m^2 (b) 750 N/m^2

(c) 7500 N/m^2 (d) 75000 N/m^2.

21.146. Pick up the correct statement from the following

(a) The structural member subjected to compression and whose dimensions are small as compared to its length is called a *strut*

(b) The vertical compression members, are generally known as *columns* or *stanchions*

(c) Deflection in lateral direction of a long column, is generally known as *buckling*

(d) All the above.

21.147. Slenderness ratio of a long column, is

(a) area of cross-section divided by radius of gyration

(b) area of cross-section divided by least radius of gyration

(c) radius of gyration divided by area of cross-section

(d) length of column divided by least radius of gyration.

21.148. $P=\frac{\pi^2 EI}{L^2}$ is the equation for Euler's crippling load if

(a) both the ends are fixed

(b) both the ends are hinged

(c) one end is fixed and other end is free

(d) one end is fixed and other end is hinged.

21.149. $P=\frac{4\pi^2 EI}{L^2}$ is the equation of Euler's crippling load if

(a) both at the ends are fixed

(b) both the ends are hinged

(c) one end is fixed and other end is free

(d) one end is fixed and other end is hinged.

21.150. $P=\frac{\pi^2 EI}{4L^2}$ is the equation of Euler's crippling load, if

(a) both the ends are fixed

(b) both the ends are hinged

(c) one end is fixed and other end is free

(d) one end is fixed and other end is hinged.

21.151. The equivalent length of a column of length L having one end fixed and the other end free, is

(a) $2L$ (b) L

(c) $\frac{L}{2}$ (d) $\frac{L}{\sqrt{2}}$.

21.152. The equivalent length is of a column of length L having both the ends fixed, is

(a) $2L$ (b) L

(c) $\frac{L}{2}$ (d) $\frac{L}{\sqrt{2}}$.

21.153. The equivalent length of a column of length L, having both the ends hinged, is

(a) $2L$ (b) L

(c) $\frac{L}{2}$ (d) $\frac{L}{\sqrt{2}}$.

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21.154. The equivalent length of a column of length L, having one end fixed and other end hinged, is
(a) $2L$ (b) L
(c) $\frac{L}{2}$ (d) $\frac{L}{\sqrt{2}}$.

21.155. The ratio of crippling loads of a column having both the ends fixed to the column having both the ends hinged, is
(a) 1 (b) 2
(c) 3 (d) 4.

21.156. For calculating the allowable stress of long columns. The empirical formula $\sigma_0 = \frac{\sigma_y}{n}\left(1 - a\frac{l}{r}\right)$, is known as
(a) Straight line formula (b) Parabolic formula
(c) Perry's formula (d) Rankine's formula.

21.157. For calculating the allowable stress of long columns $\sigma_0 = \frac{\sigma_y}{n}\left[1 - a\left(\frac{l}{r}\right)^2\right]$ is the empirical formula, known as
(a) Straight line formula (b) Parabolic formula
(c) Perry's formula (d) Rankine's formula.

21.158. For calculating the permissible stress of long columns $\sigma_0 = \frac{\sigma_y}{1 + a\,(l/r)^2}$ is the empirical formula, known as
(a) Straight line formula (b) Parabolic formula
(c) Perry's formula (d) Rankine's formula.

21.159. The equation of a parabolic arch of span l and rise h, is given by
(a) $y = \frac{h}{l^2}x(1-x)$ (b) $y = \frac{2h}{l^2}x(1-x)$
(c) $y = \frac{3h}{l^2}x(1-x)$ (d) $y = \frac{4h}{l^2}x(1-x)$.

21.160. The horizontal deflection of a parabolic curved beam of span 10 m and rise 3 m when loaded with a uniformly distributed load 1 t per horizontal length, is
(a) $\frac{50}{EI_c}$ (b) $\frac{100}{EI_c}$
(c) $\frac{150}{EI_c}$ (d) $\frac{200}{EI_c}$
(e) $\frac{250}{EI_c}$
where I_c is the M.I. at the crown, which varies as the slope of the arch.

21.161. A three hinged arch is generally hinged at its supports and
(a) at one quarter span (b) at the crown
(c) any where in the rib (d) none of these.

21.162. An isolated load W is acting at a distance a from the left hand support, of a three hinged arch of span $2l$ and rise h hinged at the crown, the horizontal reaction at the support, is
(a) $\frac{Wa}{h}$ (b) $\frac{Wa}{2h}$
(c) $\frac{2W}{ha}$ (d) $\frac{2h}{Wa}$.

21.163. The vertical reaction for the arch of Q. 21.162, is
(a) $\frac{Wa}{2l}$ (b) $\frac{Wl}{a}$
(c) $\frac{Wa}{l}$ (d) $\frac{Wa^2}{2l}$.

21.164. For determining the support reactions at A and B of a three hinged arch, points B and C are joined and produced to intersect the load line at D and a line parallel to the load line through A at D'. Distances AD, DD' and AD' when measured were 4 cm, 3 cm and 5 cm respectively. The angle between the reactions at A and B is
(a) 30° (b) 45°
(c) 60° (d) 90°.

21.165. If a three hinged parabolic arch, (span l, rise h) is carrying a uniformly distributed load w/unit length over the entire span,
(a) horizontal thrust is $wl^2/8h$
(b) S.F. will be zero throughout
(c) B.M. will be zero throughout
(d) all the above.

21.166. Pick up the correct statement for the three hinged parabolic arch shown in Fig. 21.18

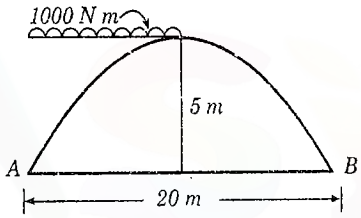

Fig. 21.18.

(a) The horizontal thrust is 5000 N
(b) The slope at the loaded quarter points is $\tan^{-1} 1/2$
(c) The normal thrust is $1500\sqrt{5}$ N
(d) The shear force is zero
(e) All the above.

21.167. The maximum B.M. due to an isolated load in a three hinged parabolic arch, (span l, rise h) having one of its hinges at the crown, occurs on either side of the crown at a distance
(a) $\frac{l}{4}$ (b) $\frac{h}{4}$
(c) $\frac{l}{2\sqrt{3}}$ (d) $\frac{l}{3\sqrt{2}}$

21.168. The ratio of circumferential stress to the longitudinal stress in the walls of a cylindrical shell, due to flowing liquid, is
(a) $\frac{1}{2}$ (b) 1
(c) $1\frac{1}{2}$ (d) 2.

21.169. Pick up the correct statement from the following :
(a) Hoop strain of the walls of a cylinder due to liquid is $\frac{pd}{2tE}\left[1 - \frac{1}{2m}\right]$
(b) Longitudinal strain in the walls of a cylinder due to liquid is $\frac{pd}{2tE}\left[\frac{1}{2} - \frac{1}{m}\right]$

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(c) Volumetric change in the cylinder due to liquid is $\frac{pd}{2tE}\left[\frac{5}{2}-\frac{2}{m}\right]$

(d) All the above.

21.170. Pick up the correct statement from the following :

(a) The point of intersection of the bending axis with the cross section of the beam, is called shear centre

(b) For I sections, the shear centre coincides with the centroid of the cross section of the beam

(c) For channels, the shear centre does not concide its centroid

(d) Bending loads should pass through the shear centre to avoid twisting

(e) All the above.

21.171. Shear centre of a half circular section of radius r and of constant thickness, lies at a distance of x from the centre where x is

(a) $\frac{r}{\pi}$ (b) $2\frac{r}{\pi}$

(c) $3\frac{r}{\pi}$ (d) $4\frac{r}{\pi}$.

21.172. A steel rod 1 metre long having square cross section is pulled under a tensile load of 8 tonnes. The extension in the rod was 1 mm only. If $E_{steel} = 2 \times 10^6$ kg/cm^2, the side of the rod, is

(a) 1 cm (b) 1.5 cm

(c) 2 cm (d) 2.5 cm.

21.173. The deflection curve for the portal frame shown in Fig. 21.19 is

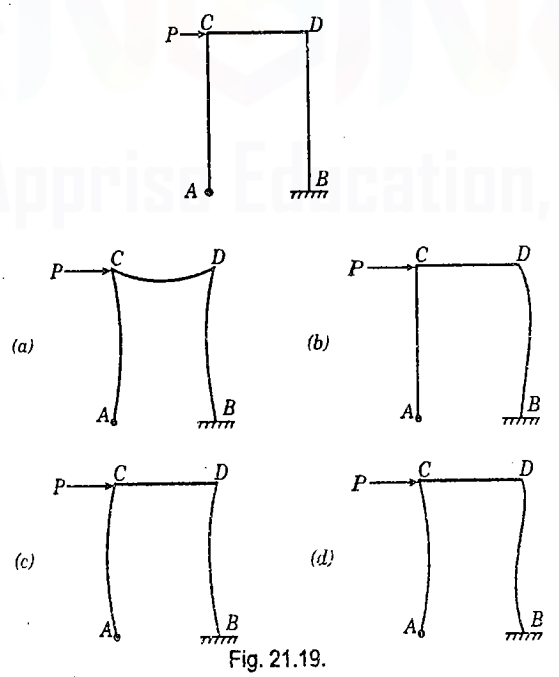

Fig. 21.19.

21.174. A concentrated load P is supported by the free end of a quadrantal ring AB whose end B is fixed. The ratio of the vertical to horizontal deflections of the end A, is

(a) π (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{4}$.

21.175. A three hinged arch of span l and rise h carries a uniformly distributed load ω per unit run as shown in Fig. 21.20. The horizontal thrust H, is

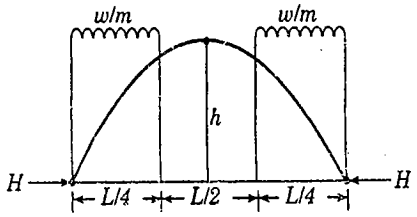

Fig. 21.20.

(a) $\frac{wl^2}{8}h$ (b) $\frac{wl^2}{24}h$

(c) $\frac{wl^2}{16}h$ (d) $\frac{wl^2}{32}h$.

21.176. A three hinged arch of span 20 m and rise 5 m is loaded as shown in Fig. 21.21. The horizontal thrust H, is

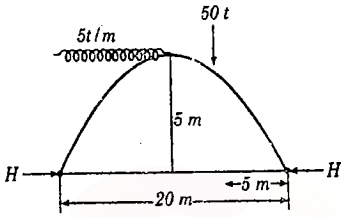

Fig. 21.21.

(a) 50 t (b) 75 t

(c) 100 t (d) 125 t

(e) 150 t.

21.177. There are two hinged semicircular arches A, B and C of radii 5 m, 7.5 m and 10 m respectively and each carries a concentrated load W at their crowns. The horizontal thrust at their supports will be in the ratio of

(a) 1 : 1 1/2 : 2 (b) 2 : 1 1/2 : 1

(c) 1 : 1 : 2 (d) none of these.

21.178. The horizontal thrust on the ends of a two hinged semicircular arch of radius R carrying

(a) a uniformly distributed load w per unit run over its right half span, is $\frac{2}{3}\frac{wR}{\pi}$

(b) a uniformly distributed load w per unit run over its entire span is $\frac{4}{3}\frac{wR}{\pi}$

(c) a distributed load varying from zero at the left end to w per unit horizontal run at the right end, is $\frac{2}{3}\frac{wR}{\pi}$

(d) all the above.

21.179. A two hinged parabolic arch of span l and rise h carries a load varying from zero at the left end to w per unit run at the right end. The horizontal thrust is

(a) $\frac{wl^2}{4h}$ (b) $\frac{wl^2}{8h}$

(c) $\frac{wl^2}{12h}$ (d) $\frac{wl^2}{16h}$.

21.180. The locus of reaction of a two hinged semi-circular arch, is

(a) straight line (b) parabola

(c) circle (d) hyperbola.

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21.181. In plastic analysis, the shape factor for rectangular section, is
(a) 1.4 (b) 1.5
(c) 1.6 (d) 1.7.

21.182. In plastic analysis, the shape factor for a triangular section, is
(a) 1.5 (b) 1.34
(c) 2.34 (d) 2.5.

21.183. In plastic analysis, the shape factor for a circular section, is
(a) 1.5 (b) 1.6
(c) 1.7 (d) 1.75.

21.184. Pick up the correct statement from the following :
(a) In a loaded beam, the moment at which the first yield occurs is called yield moment
(b) In a loaded beam, the moment at which the entire section of the beam becomes fully plastic, is called plastic moment
(c) In a fully plastic stage of the beam, the neutral axis divides the section in two sections of equal area
(d) The ratio of plastic moment to the yield moment, is called shape factor
(e) All the above.

21.185. In case of a simply supported rectangular beam of span L and loaded with a central load W, the length of elasto-plastic zone of the plastic hinge, is
(a) $\frac{L}{2}$ (b) $\frac{L}{3}$
(c) $\frac{L}{4}$ (d) $\frac{L}{5}$
(e) $\frac{L}{8}$.

21.186. In case of a simply supported I-section beam of span L and loaded with a central load W, the length of elasto-plastic zone of the plastic hinge, is
(a) $\frac{L}{2}$ (b) $\frac{L}{3}$
(c) $\frac{L}{4}$ (d) $\frac{L}{5}$
(e) none of these.

21.187. If Q is load factor, S is shape factor and F is factor of safety in elastic design, the following :
(a) $Q = S + F$ (b) $Q = S - F$
(c) $Q = F - S$ (d) $Q = S \times F$
(e) $Q = \frac{S}{F}$.

21.188. The maximum height of a masonry dam of a triangular section whose base width is b and specific gravity s, is
(a) $b\sqrt{s}$ (b) $b \cdot s$
(c) $\sqrt{bs}$ (d) $s\sqrt{b}$
(e) $\frac{b}{\sqrt{s}}$.

21.189. The yield moment of a cross section is defined as the moment that will just produce the yield stress in
(a) the outer most fibre of the section
(b) the inner most fibre of the section
(c) the neutral fibre of the section
(d) the fibre everywhere.

21.190. The shape factor of standard rolled beam section varies from
(a) 1.10 to 1.20 (b) 1.20 to 1.30
(c) 1.30 to 1.40 (d) 1.40 to 1.50.

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23

Estimating and Costing

23.1. The most reliable estiamte is
(a) Detailed estimate (b) Preliminary estimate
(c) Plinth area estimate (d) Cube rate estimate
(e) None of these.

23.2. Pick up the item of work not included in the plinth area estimate
(a) Wall thickness (b) Room area
(c) Verandah area (d) W.C. area
(e) Courtyard area.

23.3. Due to change in price level, a revised estimate is prepared if the sanctioned estimate exceeds
(a) 2.0% (b) 2.5%
(c) 4.0% (d) 5.0%.

23.4. The main factor to be considered while preparing a detailed estimate, is
(a) Quantity of the materials
(b) Availability of materials
(c) Transportation of materials
(d) Location of site and local labour charges
(e) All the above.

23.5. Pick up the correct statement from the following :
(a) The incidental expenses of a miscellaneous character which could not be predicted during preparation of the estimate, is called contingencies
(b) Additional supervising staff engaged at work site, is called work charged establishment
(c) Detailed specifications specify qualities, quantities and the proportions of materials to be used for a particular item
(d) The cost per unit at which the article can be procured, from the open market at a given time, is called 'market rate'
(e) All the above.

23.6. For the construction of buildings, the subheads of the estimate are
(a) Earthwork, Concrete work, Brick work
(b) Brickwork, Stone work, Roofing
(c) Brickwork Flooring, Wood work, Steel work
(d) Plastering or pointing, finishing, water supply and sanitary work
(e) All the above.

23.7. Pick up the incorrect statement from the following :
(a) The built up covered area at the floor level of any storey of a building is called *plinth area*
(b) The usable covered area of the rooms of any storey of a building is called *carpet area*
(c) The carpet area of a building along with area of its kitchen, pantry, store, lavatory, bath room and glazed verandah, is called floor area
(d) None of these.

23.8. The plinth area of a building includes
(a) area of the walls at the floor level
(b) area of stair cover
(c) internal shaft for sanitary installations up to 2 sq m. in area
(d) lift and wall including landing
(e) area of cantilevered porch.

23.9. Carpet area does not include the area of
(a) the walls along with doors and other openings
(b) verandah, corridor and passage
(c) bath room and lavatory
(d) kitchen and pantry
(e) All the above.

23.10. The floor area includes the area of the balcony up to
(a) 100% (b) 75%
(c) 50% (d) 25%.

23.11. Pick up the correct statement from the following :
(a) The estimated value of the work excluding the amount for contigencies, work charged establishment, tool and plants, is called *work value*
(b) The actual expenditure involved to complete a work including incidental, establishment and travelling charges, is called actual cost
(c) The formal acceptance by the administrative department for incurring an expenditure on the work, is called administrative approval
(d) The order of a competent authority sanctioning a properly detailed estimate of the cost of a work of construction or repair is called technical sanction
(e) All the above.

23.12. While estimating the qualities for the construction of a building, the correct metric unit is
(a) Metre for length (b) Cubic metre for area
(c) Square metres for volume (d) Kilogram for weight
(e) Litre for capacity (f) All the above.

23.13. According to Indian Standards Institute, the actual size of modular bricks is
(a) 23 cm × 11.5 cm × 7.5 cm (b) 25 cm × 13 cm × 7.5 cm
(c) 19 cm × 9 cm × 9 cm (d) 20 cm × 10 cm × 10 cm.

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23.14. The order of booking dimensions is
(*a*) Length, breadth, height (*b*) Breadth, length, height
(*c*) Height, breadth, length (*d*) None of these.

23.15. The rate of payment is made for 100 cu m (per % cu m) in case of
(*a*) Earth work in excavation
(*b*) Rock cutting
(*c*) Excavation in trenches for foundation
(*d*) Earth work in filling the plinth
(*e*) All the above.

23.16. The brick work is not measured in cu m in case of
(*a*) One or more than one brick wall
(*b*) Brick work in arches
(*c*) Reinforced brick work
(*d*) Half brick wall.

23.17. The brick work is measured in sq metre, in case of
(*a*) Honey comb brick work
(*b*) Brick flat soling
(*c*) Half brick walls or the partition
(*d*) All the above.

23.18. The measurement is made in square metre in case of
(*a*) Cement concrete in foundation
(*b*) R.C.C. structure
(*c*) Hollow concrete block wall
(*d*) Concrete fencing posts
(*e*) None of these.

23.19. The measurement is not made in square metres in case of
(*a*) D.P.C. (Damp proof course) (*b*) Form works
(*c*) Concrete Jaffries (*d*) R.C. Chhajja.

23.20. The measurement is made for stone work in square metre in case of
(*a*) Wall facing (*b*) Columns, lintels, copings
(*c*) Building work (*d*) Dressed stones in Chajjas
(*e*) (*a*) and (*d*) of the above.

23.21. The unit of measurement is per quintal for the following :
(*a*) Collapsible gates with rails
(*b*) Rolling shutters
(*c*) Expanded metal wire netting
(*d*) M.S. reinforcement of R.C.C. works.

23.22. The area is measured correct to the nearest
(*a*) 0.01 sqm (*b*) 0.02 sqm
(*c*) 0.03 sqm (*d*) 0.04 sqm
(*e*) 0.05 sqm.

23.23. The volume is measured correct to the nearest
(*a*) 0.01 cum (*b*) 0.02 cum
(*c*) 0.03 cum (*d*) 0.04 cum
(*e*) 0.05 sum.

23.24. The weight of an item is measured correct to nearest
(*a*) 0.25 kg (*b*) 0.50 kg
(*c*) 0.75 kg (*d*) 1.00 kg
(*e*) 5 kg.

23.25. Pick up the correct statement from the following :
(*a*) Bricks are paid per thousand
(*b*) Cement is paid per 50 kg bag
(*c*) Lime is paid per quintal
(*d*) Brick aggregates is paid per cum
(*e*) All the above.

23.26. While preparing a detailed estimate
(*a*) Dimension should be measured correct to 0.01 m
(*b*) Area should be measured correct to 0.01 sqm
(*c*) Volume should be measured correct to 0.01cum
(*d*) All the above.

23.27. Pick up the correct statement regarding the centre line method of estimating a building
(*a*) Product of the centre line of the walls and area of cross-section of any item, gives total quantity of the item
(*b*) The centre line is worked out separately for different sections of walls of a building
(*c*) The centre line length is reduced by half the layer of main wall joining the partition wall
(*d*) All the above.

23.28. The 'centre line method' is specially adopted for estimating
(*a*) Circular buildings
(*b*) Hexagonal buildings
(*c*) Octagonal buildings
(*d*) Other geometrical shaped buildings
(*e*) All the above.

23.29. In long and short wall method of estimation, the length of long wall is the centre to centre distance between the walls and
(*a*) breadth of the wall
(*b*) half breadth of wall on each side
(*c*) one fourth breadth of wall on each side
(*d*) None of these.

23.30. Referring of Fig. 23.1, pick up the correct statement from the following :

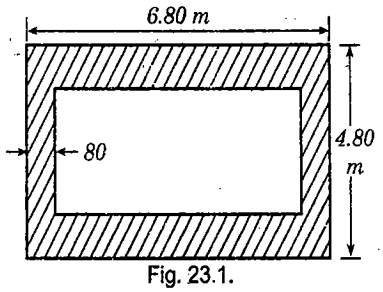

Fig. 23.1.

(*a*) The total length of centre line of four walls is 20 m
(*b*) Length of long wall out-to-out is 6.80 m
(*c*) Length of short walls in-to-in is 3.20 m
(*d*) All the above.

23.31. If tensile stress of a steel rod of diameter D is 1400 kg/cm^2 and bond stress is 6 kg/cm^2, the required bond length of the rod is
(*a*) 30 D (*b*) 40 D

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(c) 50 D (d) 53 D
(e) 59 D.

23.32. Pick up the correct statement from the following :
(a) The bent up bars at a support resist the negative bending moment
(b) The bent up bars at a support resist the sharing force
(c) The bending of bars near supports is generally at 45°
(d) All the above.

23.33. The total length of a cranked bar through a distance (d) at 45° in case of a beam of effective length L, is
(a) $L + 0.42\,d$ (b) $L + 2 \times 0.42\,d$
(c) $L - 0.42\,d$ (d) $L - 2 \times 0.4\,d$.

23.34. While estimating a reinforced cement structure, the omitted cover of concrete is assumed
(a) at the end of reminforcing bar, not less than 25 mm or twice the diameter of the bar
(b) in thin slabs, 12 mm minimum or diameter of the bar whichever is more
(c) for reinforcing longitudinal bar in a beam 25 mm minimum or diameter of the largest bar which is more
(d) All the above.

23.35. The damp proof course (D.P.C.) is measured in
(a) Cub. m (b) Sq m
(c) Metres (d) None of these.

23.36. The rate of an item of work depends on
(a) Specifications of works (b) Specifications of materials
(c) Proportion of mortar (d) Method of construction
(e) All the above.

23.37. The expected out turn of brick work in cement mortar in foundation and plinth per mason per day, is
(a) 1.00 m^3 (b) 1.25 m^3
(c) 1.50 m^3 (d) 1.75 m^3.

23.38. The expected out turn of half brick partition wall per mason per day is
(a) 1.5 m^3 (b) 2.0 m^3
(c) 4.0 m^2 (d) 5.0 m^2.

23.39. The expected out turn of cement concrete 1 : 2 : 4 per mason per day is
(a) 1.5 m^3 (b) 2.5 m^3
(c) 3.5 m^3 (d) 5.0 m^3.

23.40. The expected out turn of 12 mm plastering with cement mortar is
(a) 2.5 sq m (b) 4.0 sq m
(c) 6.0 sq m (d) 8.0 sq m
(e) 10 sq m.

23.41. The expected out turn of 2.5 cm cement concrete floor per manson per day
(a) 2.5 sqm (b) 5.0 sqm
(c) 7.5 sqm (d) 10 sqm.

23.42. The expected out turn for earth work in excavation in ordinary soil per mazdoor per day is
(a) 1.00 cum (b) 2.00 cum
(c) 3.00 cum (d) 4.00 cum.

23.43. Pick up the correct statement from the following :
(a) All pipes and fittings are classified according to their diameters
(b) The diameter of the pipes is the nominal diameter of internal bore
(c) All pipes are measured along the centre line of the pipes in metres
(d) Lead caulked joints are enumerated separately
(e) All the above.

23.44. Pick up the correct statement in case of water supply.
(a) Pipes laid in trenches and pipes fixed to walls are measured separately
(b) Cutting through walls and floors are included with the item
(c) Pipes are classified according to their sizes and quality
(d) In laying pipes, the method of jointing and fixing is specifically specified
(e) All the above.

23.45. Size, capacity and materials need be specified for
(a) Bib-cocks (b) Stop-cocks
(c) Ferrules (d) Ball valves
(e) All the above.

23.46. In case of laying gullies, siphons, intercepting traps, the cost includes
(a) Setting and laying (b) Bed concreting
(c) Connection to drains (d) All of these.

23.47. Cost of fittings and their fixing is specified for the following sanitary fittings
(a) Water closets (b) Flushing pipes
(c) Lavatary basins (d) Sinks
(e) All the above.

23.48. The cost of the earthwork in excavation for the surface drain of cross-section shown in Fig. 23.2 for a total length of 5 metres @ Rs. 450% cum, is

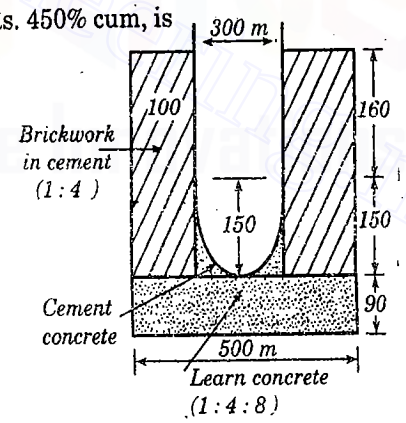

Fig. 23.2.

(a) Rs. 400 (b) Rs. 425
(c) Rs. 450 (d) Rs. 500.

23.49. The quantity of lean concrete (1 : 4 : 8) for the surface drain mentioned in Q. 23.48 is
(a) 0.225 cum (b) 0.230 cum
(c) 0.235 cum (d) 0.240 cum.

23.50. The surface area of the brick wall of 10 cm thickness of the drain specified in Q. 23.48 is
(a) 2.1 sq m (b) 2.5 sq m
(c) 2.7 sq m (d) 3.1 sq m.

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23.51. As per Indian Standard Specifications, the peak discharge for domestic purposes per capita per minute, is taken
(*a*) 1.80 litres for 5 to 10 users (*b*) 1.20 litres for 15 users
(*c*) 1.35 for 20 users (*d*) All the above.

23.52. The detention period in a septic tank is assumed
(*a*) 20 minutes (*b*) 25 minutes
(*c*) 30 minutes (*d*) 40 minutes.

23.53. The minimum width of a septic tank is taken
(*a*) 70 cm (*b*) 75 cm
(*c*) 80 cm (*d*) 90 cm.

23.54. Pick up the correct statement from the following :
(*a*) In a gully trap, a water seal of 6 to 7.5 cm is provided
(*b*) The gully trap collects waste water from the kitchen, sink, wash basins, etc.
(*c*) The gully trap disconnects the sullage drain from the main drainage system
(*d*) The grating provided over gully traps is 23 cm square.

23.55. The trap which is provided to disconnect the house drain from the street sewer is called
(*a*) Master trap (*b*) Intercepting trap
(*c*) Interception manhole (*d*) Intercepter chamber
(*e*) All the above.

23.56. Pick up the incorrect statement regarding a master trap from the following :
(*a*) It is provided in between the lower end of the house drain and the street sewer
(*b*) It is provided a cleaning eye at the top of the trap
(*c*) The height of fresh air inlet pipe fixed vertically with wall is 3 m
(*d*) The mica flap valve which opens inwards only, is fitted at the top of the inlet pipe
(*e*) The water seal is less than that of ordinary traps.

23.57. The inspection pit or chamber is a manhole provided in a base drainage system
(*a*) at every change of direction
(*b*) at every change of gradient
(*c*) at every 30 m intervals
(*d*) at the point where vertical soil pipe joins the house drain
(*e*) All the above.

23.58. The slope of the oultet of '*P* trap' below the horizontal is kept
(*a*) 8° (*b*) 10°
(*c*) 12° (*d*) 14°.

23.59. Anti-siphonage pipe is connected to
(*a*) Main soil pipe
(*b*) Bottom of *P* trap W.C.
(*c*) Top of *P* trap W.C.
(*d*) Side of water closet.

23.60. The value of '*C*' of Indian type W.C. shown in Fig. 23.3 is
(*a*) 400 mm
(*b*) 450 mm
(*c*) 500 mm (*d*) 550 mm.

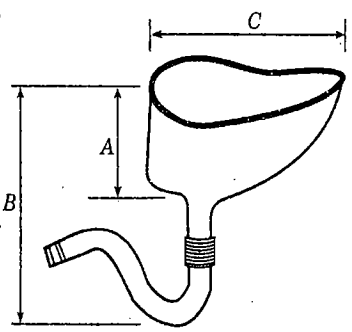

Fig. 23.3.

23.61. The value of '*A*' of Indian type W.C. shown in Fig. 23.3 is :
(*a*) 25 cm (*b*) 30 cm
(*c*) 40 cm (*d*) 45 cm.

23.62. The value of '*B*' of Indian type W.C. shown in Fig. 23.3 is :
(*a*) 45 cm (*b*) 50 cm
(*c*) 30 cm (*d*) 25 cm.

23.63. The height of the sink of wash basin above floor level is kept
(*a*) 60 cm (*b*) 70 cm
(*c*) 75 cm to 80 cm (*d*) 80 cm.

23.64. The diameter of a domestic sewer pipe laid at gradient 1 in 100 is recommended
(*a*) 100 mm (*b*) 150 mm
(*c*) 200 mm (*d*) 175 mm.

23.65. Pick up the correct statement from the following :
(*a*) In order to check up the average depth of excavation 'Dead mans' are left at the mid-widths of borrow pit
(*b*) The earthwork calculation in excavation is made from the difference in levels obtained with a level
(*c*) The earth work in excavation to form the road embankment includes the formation of correct profile and depositing the soil in layers
(*d*) All the above.

23.66. Pick up the incorrect statement from the following :
(*a*) Lead is the average horizontal straight distance between the borrow pit and the place of spreading soil
(*b*) The lead is calculated for each block of the excavated area
(*c*) The unit of lead is 50 m for a distance upto 500 m
(*d*) The unit of lead is 1 km where the lead exceeds 2 km

23.67. The cross-sections for a highway is taken at
(*a*) right angle to the centre line
(*b*) 30 metres apart
(*c*) intermediate points having abrupt change in gradient
(*d*) the starting end points of the curves
(*e*) All the above.

23.68. If B is the width of formation, d is the height of the embankment, side slope S : 1, for a highway with no transverse slope, the area of cross-section is
(*a*) $B \div d + Sd$ (*b*) $Bd + Sd^2$
(*c*) $B \times d - Sd^{1/2}$ (*d*) $\frac{1}{2}(Bd + Sd^2)$.

23.69. If the formation level of a highway has a uniform gradient for a particular length, and the ground is also having a longitudinal slope, the earthwork may be calculated by
(*a*) Mid-section formula (*b*) Trapezoidal formula
(*c*) Prismoidal formula (*d*) All the above.

23.70. In the mid-section formula
(*a*) The mean depth is the average of depths of two consecutive sections
(*b*) The area of mid-sections is calculated by using mean depth

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(c) The area of mid-section is the average area of the two consecutive sections

(d) The volume of the earth work is calculated by multiplying the mid-section area by the distance between the two original sections

(e) The volume of the earth work is calculated by multiplying the mid-section area by the distance between the two sections

(f) (a), (b) and (e) of the above.

23.71. The assumption on which the trapezoidal formula for volumes is based, is

(a) The end sections are parallel planes

(b) The mid-area of a pyramid is half the average area of the ends

(c) The volume of the prismoidal is over-estimted and hence a prismoidal correction is applied

(d) All the above.

23.72. The correct prismoidal formula for volume is

(a) D [first area + last area + Σ Even area + 2Σ odd areas]

(b) $\frac{D}{3}$ [first area + last area + 4Σ Even area + 2Σ odd areas]

(c) $\frac{D}{3}$ [first area + last area + 2Σ Even area + 4Σ odd areas]

(d) $\frac{D}{6}$ [first area + last area + 2Σ Even area + 4Σ odd areas].

23.73. The area of a sloping surface of a protective embankment of mean height d, side slopes S : 1 and length L is

(a) $d \times d \times s$ (b) $\sqrt{d^2 \times (ds)^2}$

(c) $L.D\sqrt{1+s^2}$ (d) $2Ld\sqrt{1+s^2}$.

23.74. The reduced levels of points, 30 metres apart along the longitudinal section of a road portion between chainages 5 and 9 are shown in Fig. 23.4. If there is a uniform up-gradient of the road 120 in 1, the chainage of the point with no filling or cutting is

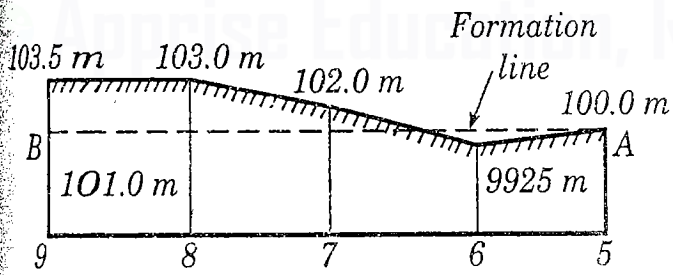

Fig. 23.4.

(a) (6 + 15) chains (b) (6 + 12) chains

(c) (6 + 18) chains (d) None of these.

23.75. The ground surface slopes 1 in 50 along a proposed railway embankment 150 m in length. The height of the embankment at zero chainage is 0.5 m, the width is 11 m and side slopes 2 : 1. If the falling gradient of the embankment is 1 in 150, the quantity of the earthwork calculated by prismoidal formula, is

(a) 3250 m^3 (b) 3225 m^3

(c) 3275 m^3 (d) 3300 m^3.

23.76. The cross-section of a road partly in banking and partly in cutting is shown in Fig. 23.5. The area of the shaded portion is

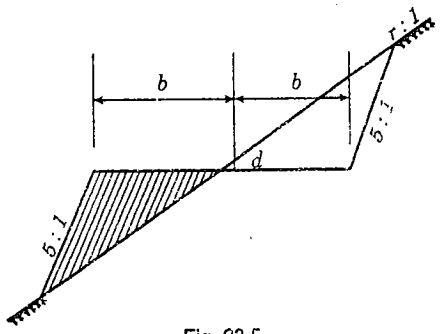

Fig. 23.5.

(a) $\frac{1}{3} \times \frac{(b-rd)^2}{r-s}$ (b) $\frac{1}{3} \times \frac{(b-rd)^2}{r-s}$

(c) $\frac{1}{2} \times \frac{(b+rd)^2}{r-s}$ (d) $\frac{1}{3} \times \frac{(b-rd)^2}{r-5}$.

23.77. The area of the cross-section of a road fully in banking shown in Fig. 23.6, is

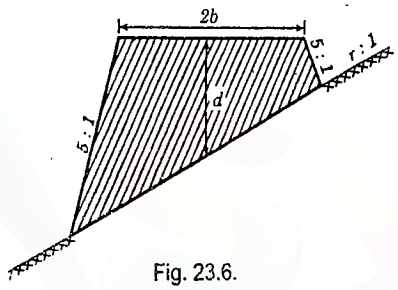

Fig. 23.6.

(a) $\frac{sb^2 + r^2(2bd + Sd)^2}{r^2 - S^2}$ (b) $\frac{Sb^2 + r^2(2bd - Sd^2)}{r^2 - s^5}$

(c) $\frac{sb^2 + r^2(2bd + sd^2)}{r-s}$ (d) $\frac{Sb^2 + r^2(2bd + Sd^2)}{r-s}$.

23.78. Pick up the correct statement from the following :

(a) If the bed level is above N.S.L. the canal is called fully in baking and the berms are designed as 3 d where d is full supply depth of water (F.S.D.)

(b) Area of canal in cutting = $BD + Sd^2$ where B = bed width, d = depth of cutting and S is the side slope

(c) Area of the bank of canal = $B_1d_1 + Sd_1^2$ where B_1, d_1 and S are the width of bank, height of the bank above N.S.L. and side slope respectively

(d) If F.S.L. is above N.S.L the canal is called partly in cutting and partly in filling and berms are designed as $2d$ where d is full supply depth

(e) All the above.

23.79. A portion of an embankment having a uniform up-gradient 1 in 500 is circular with radius 1000 m of the centre line. It subtends 180° at the centre. If the height of the bank is 1 m at the lower end, and side slopes 2 : 1, the earth work involved.

(a) 26,000 m^3 (b) 26,500 m^3

(c) 27,000 m^3 (d) 27,500 m^3.

23.80. A cement concrete road is 1000 m long, 8 m wide and 15 cm thick over the sub-base of 10 cm thick gravel. The box cutting in road crust is

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(a) 500 m^3 (b) 1000 m^3
(c) 1500 m^3 (d) 2000 m^3.

23.81. The cubic content of concrete (1 : 2 : 4) for the road specified in Q. 23.80 is
(a) 300 m^3 (b) 600 m^3
(c) 900 m^3 (d) 1200 m^3.

23.82. Berms are provided in canals if these are
(a) fully in excavation
(b) partly in excavtion and partly in embankment
(c) fully in embankment
(d) All the above.

23.83. The cross-sectional area of the embankment of a canal fully in embankment (Fig. 23.7) is

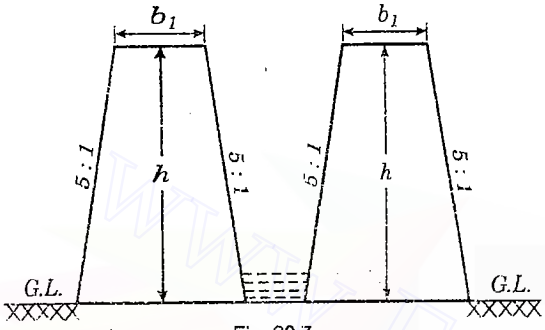

Fig. 23.7.

(a) $\frac{1}{2}(b_1 + b_2)\,h$ (b) $(b_1 + b_2)\,h + Sb^2$
(c) $(b_1 + b_2) + 2\,Sh^2$ (d) $2[(b_1 + b_2)\,(b + Sh^2)]$.

23.84. According to ISI method of measurement, the order of the sequence is
(a) Length, breadth, height (b) Breadth, length, height
(c) Height, length, breadth (d) None of these.

23.85. Pick up the incorrect statement from the following :
(a) Dimensions are measured to the nearest 0.01 m
(b) Areas are measured to the nearest 0.01 sq. m
(c) Cubic contents are measured to the nearest 0.1 cm m
(d) Weights are measured to the nearest 0.001 tonnes

23.86. The following item of earth work is not measured separately.
(a) Setting out of works (b) Site clearence
(c) dead men (d) Steps in deep exavaction
(e) All the above.

23.87. Pick up the correct statement from the following :
(a) The earth work of cutting in trenches or borrow pits in fairly uniform ground is measured with the help of average depths of the dead men
(b) The earth work in trenches or borrow pits in irregular ground is measured by taking the difference in levels before and after completion of work
(c) The earth work in trenches or borrow pits, where neither *a* nor *b* is feasible, are measured from the fillings after deduction of voids
(d) All the above.

23.88. The excavation exceeding 1.5 m in width and 10 sq. m in plan area with a depth not exceeding 30 cm, is termed as
(a) Excavation (b) Surface dressing
(c) Cutting (d) Surface excavation.

23.89. Pick up the excavation where measurements are made in square metres for payment.
(a) Ordinary cuttings up to 1 m
(b) surface dressing up to 15 cm depths
(c) Surface excavation up to 30 cm depths
(b) Both (b) and (c)
(e) Both (a) and (b).

23.90. The concrete work for the following part of the building of specified thickness is measured in square metres
(a) Root slabs (b) Floors
(c) D.P.C. (d) Wall panels
(e) All the above.

23.91. Pick up the incorrect statement from the following :
(a) No deduction is made for the volume occupied by reinforement
(b) No deduction is made for the openings upto 0.1 sq. m
(c) No deduction is made for volumes occupied by pipes, not exceeding 100 sq. cm in cross-section
(d) No deductions are made for the ends of dissimilar structures up to 500 sq. cm cross-sectional area
(e) None of these.

23.92. Brick walls are measured in sq. m if the thickness of the wall is
(a) 10 cm (b) 15 cm
(c) 20 cm (d) None of these.

23.93. The item of the brick structure measured in sq. m, is
(a) Reinforced brick work (b) Broken glass coping
(c) Brick edging (d) Brick work in arches

23.94. Pick up the item whose weight is added to the weight of respective item, is
(a) Cleats (b) Brackets
(c) Bolts (d) Distance separators
(e) All the above.

23.95. The item of steel work which is measured in sq. m, is
(a) Collapsible gates (b) Rolling shutters
(c) Steel doors (d) Ventilators and glazing
(e) All the above.

23.96. Pick up the correct statement from the following :
(a) Pointing is measured in sq. m
(b) Plastering is measured in sq. m
(c) Glazing is measured in sq. m
(d) Striking is measured in sq. m
(e) All the above.

23.97. For 12 mm thick cement plastering 1 : 6 on 100 sq. m new brick work, the quantity of cement required, is
(a) 0.200 m^3 (b) 0.247 m^3
(c) 0.274 m^3 (d) 0.295 m^3.

23.98. For 100 sq. m cement concrete (1 : 2 : 4) 4 cm thick floor, the quantity of cement required, is
(a) 0.90 m^3 (b) 0.94 m^3
(c) 0.98 m^3 (d) 1.00 m^3.

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24

Tunnelling

24.1. The tunnels, the artificial underground passages are constructed for :
(*a*) highways (*b*) railways
(*c*) sewerage (*d*) water supply project
(*e*) All the above.

24.2. Match list I with list II and select a correct answer by using the codes given below the lists :

List I (Tunnel)	*List II (Specification)*
A. Babylon	1. length 6 km ; cross-section 3 m × 1.8 m
B. Rome	2. in 1949
C. High way	3. Length 900 m ; cross-section tunnel Hungary 3.6 m × 4.5 m
D. Ist Railway tunnel	4. Length 350 m ;

Codes :

	A	B	C	D
(*a*)	1	2	3	4
(*b*)	4	2	3	1
(*c*)	3	1	4	2
(*d*)	2	4	1	3.

24.3. The following tunnels were constructed in different countries for different purposes :
1. Emperor Claudius built the first Roman tunnel
2. The first highway tunnel was constructed in Hungary
3. The first underground railway tunnel was constructed in Great Britain
4. The first navigational tunnel was constructed in France.

The correct chronological development of these tunnels is:
(*a*) 4 1 3 2 (*d*) 1 4 2 3
(*c*) 2 3 1 4 (*d*) 3 2 4 1.

24.4. For highways, tunnelling is preferred to if the open cut exceeds :
(*a*) 10 metres depth (*b*) 15 metres depth
(*c*) 20 metres depth (*d*) 25 metres depth.

24.5. In case of railways,
(*a*) a detour round the hill is preferred
(*b*) a open cut is preferred
(*c*) tunnelling is preferred
(*d*) All the above.

24.6. A tunnel is found more advantageous as compared to the alternate routes because it :
(*a*) remains free from snow
(*b*) reduces the cost by reducing the route distance
(*c*) reduces the maintenance cost
(*d*) avoids interference with surface rights
(*e*) All the above.

24.7. For initial surveys of tunnels, the following activities are involved :
1. Marking portal point with concrete pillars on the ground
2. Marking tunnel obligatory points on the topographical maps
3. Preliminary setting of the tunnel on the topographical Survey of India maps
3. Driving lines between the fixed obligatory points.

The correct sequence of the activities is :
(*a*) 3 2 4 1 (*b*) 1 2 3 4
(*c*) 4 3 1 2 (*d*) 2 4 3 1.

24.8. Pick up the correct statement from the following :
(*a*) The topographical maps of the Survey of India are useful in the mountainous region for tunnelling.
(*b*) The height point on the ridge is fixed with the help of reciprocal ranging
(*c*) The accuracy of 1 in 10,000 is required for planimetric control
(*d*) 1 second theodolite is used for angular measurement to achieve an angular error of 15 $\sqrt{N}$ where N is number of angles
(*e*) All the above.

24.9. Which one of the following statements is not correct in respect of setting of an inclined tunnel :
(*a*) Reference points are constructed at every 300 m.
(*b*) The alignment is fixed from upper/lower apex point.
(*c*) The level of the invert at the heading is marked by a tape.
(*d*) Reference points are constructed on the roof of tunnels
(*e*) None the above.

24.10. For transferring the tunnel alignment through shafts, we adopt the following steps :
1. Hanging two or more plumb lines in the shaft
2. Determining the bearing of the plumb lines *i.e.* plumb plane
3. Suspending a 35 kg weight by each plumb line
4. Immersing the weights of both the plumb lines in the buckets containing water

The correct sequence of steps is :

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(a) 1 2 3 4 (b) 4 3 2 1
(c) 1 3 2 4 (d) 2 1 4 3.

24.11. For B.G. single track, the section of the tunnel must have a width
(a) 4.2 m to 4.5 m (b) 4.5 m to 4.8 m
(c) 4.9 m to 5.5 m (d) 5.5 m to 5.8 m.

24.12. For B.G. single track railway, the height of the tunnel above top of rails should be
(a) 5.5 m to 5.8 m (b) 5.8 m to 6.2 m
(c) 6.7 m to 7.3 m (d) 7.3 m to 7.5 m.

24.13. The difference of heights of the tunnels above rail tops of BG and MG tracks is kept
(a) 0.30 m (b) 0.45 m
(c) 0.60 m (d) 0.75 m.

24.14. For tunnels exceeding 300 m in length, the grade should be provided below
(a) 50% of the ruling gradient
(b) 60% of the ruling gradient
(c) 75% of the ruling gradient
(d) 80% of the ruling gradient.

24.15. The advantages of providing a pair of tunnels as compared to only one large highway tunnel is :
(a) economy in cost of construction
(b) avoidance of head on collisions
(c) provision of separate exit and entrance of two traffic streams
(d) facility in carrying out repairs
(e) All the above.

24.16. Match list I with list II and select the suitable answer by using the codes given below the lists :

List I	*List II*
A. Firm ground	1. Needs special treatment before excavation
B. Soft ground	2. Reasonable period available for providing conventional supports
C. Running ground	3. Conventional supports cannot be installed

Codes :

	A	B	C
(a)	1	2	3
(b)	2	3	1
(c)	3	2	1
(d)	2	1	3.

24.17. Which one of the following methods is generally adopted for tunnelling in firm ground
(a) Full face method
(b) Top heading and benching method
(c) Drift method
(d) All the above.

24.18. Match list I with list II and select a suitable answer by using the codes given below the lists :

List I
A. Full face method
B. Top heading and benching
C. Drift method

List II
1. Large sized tunnel
2. Small sized tunnel
3. Average sized tunnel

Codes :

	A	B	C
(a)	1	2	3
(b)	3	2	1
(c)	1	3	2
(d)	2	3	1.

24.19. For full face method, the excavation to be done is generally divided into
(a) two sections (b) three sections
(c) four sections (d) five sections.

24.20. In the Fig. 24.1 drill holes, heading, mucking and benching are mumbered as 1, 2, 3, 4.

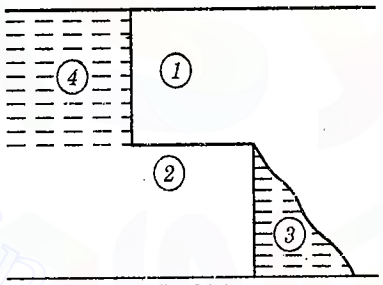

Fig. 24.1.

The correct sequence is :
(a) 4 1 2 3 (b) 1 2 3 4
(c) 4 1 3 2 (d) 3 4 1 3.

24.21. Forepoling method is generally adopted for tunnelling in :
(a) soft ground (b) firm ground
(c) running ground (d) None of these.

24.22. Railway tunnels, are generally
(a) polycentric (b) rectangular
(c) parabolic (d) circular
(e) none of these.

24.23. In case of drift method of tunnelling, the drift may be excavated at
(a) the centre (b) the bottom
(c) the top (d) the side
(e) All of the above.

24.24. The following operations are generally employed for tunnelling in hard rock.
1. Removing ground water,
2. Loading holes and firing the explosive
3. Setting up and drilling
4. Grouting and lining
5. Removing muck
6. Ventilation and removing explosion dust

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The correct sequence is :
(a) 3 2 6 5 1 4
(b) 3 4 6 1 5 2
(c) 4 1 2 3 6 5
(d) 5 4 2 1 3 6.

24.25. Which one of the following methods of tunnelling does not require the use of time bearing :
(a) Linear plate method (b) Shield method
(c) Compressed air method
(d) Mechanical tunneler *i.e.* mole method
(e) All the these.

24.26. The length of the needle beam used in needle beam method of tunnelling is usually
(a) 2 m to 4 m (b) 2.5 m to 6 m
(c) 4 m to 7 m (d) 5 m to 6 m.

24.27. Which one of the following statements is not correct with regard to heading and henching method of tunnelling
(a) Driving of tunnel is done in two portions of its section
(b) Driving the top portion is done in advance of the bottom portion
(c) After driving the top portion 3 m to 3.5 m holes are drilled into the head and bench.
(d) The holes in head and bench are loaded together with explosive for blasting.
(e) Firing of head holes is done just before the bench holes are fired.

24.28. Which one of the following statements is not correct for heading and benching method of tunnelling ?
(a) Drilling and mucking can be done simultaneously
(b) Benching provides a plateform for working on heading
(c) Removal of muck from the heading is very easy
(d) None of these.

24.29. The following operations are required for tunnelling in rocky terrain :
1. Removing the foul gases
2. Marking the tunnel profile
3. Setting up and drilling
4. Checking misfire
5. Mucking
The correct sequence is :
(a) 1 2 3 4 5 (b) 2 3 5 4 1
(c) 4 2 1 3 5 (d) 2 3 1 4 5.

24.30. Pick up the correct statement regarding drilling a tunnel from the following :
(a) Holes are drilled by pneumatically operated rock drills
(b) One drill is required for each 4 to 5 m^2 force area
(c) The diameter of the bore hole at the deepest point should be 6 mm more than the diameter of the cartridge
(d) All of the above.

24.31. The most commonly adopted pattern of cut holes is :
(a) horizontal wedge cut (b) pyramid cut
(c) fan cut (d) V-cut
(e) All the above.

24.32. The cut of a tunnel face is shown in Fig. 24.2. This is called

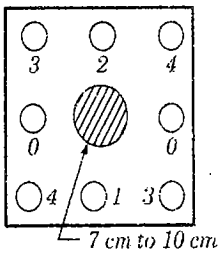

Fig. 24.2.

(a) Michigan cut
(b) Burn cut
(c) Fan cut
(d) Horizontal cut.

24.33. Match list I with list II and select a suitable answer by using the codes given below the lists :
List I

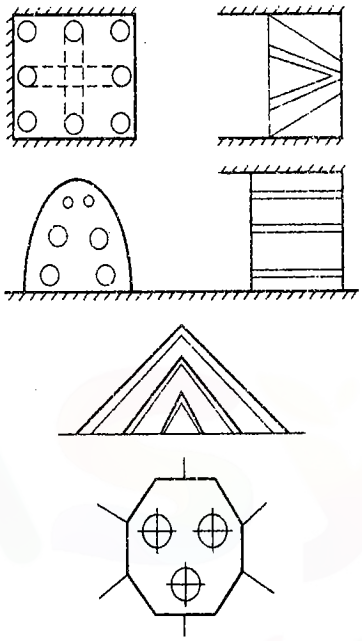

Fig. 24.3.

List II
1. Burn cut 2. V-cut
3. Pyramid cut 4. Horizontal cut
Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	3	4	2	1
(d)	4	2	3	1.

24.34. To attain the required shape of the tunnel section, we use :
(a) easers (b) trimmers
(c) cut holes (d) chisels.

24.35. Pick up the explosive used for tunnelling in soft rocks from the following :
(a) blasting gelatine (b) special gelatine
(c) ammonia dynamite (d) semi-gelatine.

24.36. Match list I with list II and select a suitable answer by using the codes given below the codes :

List I (Not more than)	*List II (Gas)*
A. 0.01%	1. Hydrogen sulphide
B. 0.50%	2. Carbon monoxide

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C. 0.003% 3. Nitrogen fumes

D. 0.001% 4. Methane

Codes :

	A	B	C	D
(a)	1	2	3	4
(b)	2	4	3	1
(c)	4	1	2	3
(d)	1	3	4	2.

24.37. Pick up the correct statement from the following during tunnel excavation,

(a) Oxygen should not be less than 19.5%
(b) Carbondioxide should not be more than 0.5%
(c) Hydrogen sulphide should not be more than 0.001%
(d) Carbon mono-oxide should not be more than 0.01%
(e) All of the above.

24.38. The concentration of the dust particles of the size 0.5 to 5 microns adjacent to the working face should not be more than

(a) 200 particles/cm^3 (b) 250 particles/cm^3
(c) 300 particles/cm^3 (d) 450 particles/cm^3
(e) 400 particles/cm^3.

24.39. Which one of the following linings is suitable for shield driven tunnels particularly in the subaqueous regions :

(a) Brick lining (b) stone lining
(c) timber line (d) cast iron lining
(e) concrete lining.

24.40. Concrete lining is provided concurrently with the driving operation in case of

(a) rock terrain (b) soft rock
(c) running soil (d) none of these.

24.41. High pressure grouting is generally restored for concreting in the lining if the rock strata is :

(a) highly fissured
(b) poor
(c) likely to get seepage of water
(d) All of the above.

24.42. The method of draining in the tunnels, is generally known as

(a) foredrainage (b) dewatering
(c) permanent drainage (d) All of the above.

24.43. Which one of the following methods is adopted for permanent drainage of tunnels :

(a) provision of longitudinal drains
(b) continuous open drains
(c) concrete lining
(d) grouting with cement or chemicals
(e) All the above.

24.44. Pick up the mechanical ventilation method used for tunnels from the following :

(a) blowing fresh air by ducts to the face of tunnel
(b) exhausting foul air by ducts from the face of the tunnel and permitting fresh air through the tunnel
(c) blowing fresh air and exhausting foul air by ducts
(d) all the above.

24.45. For hauling muck from the tunnel, the following type of muck-car is used :

(a) muck box (b) balle-ship
(c) side dump car (d) U-bottom
(e) All of these.

24.46. In the wooded bulk-head, used for mucking in steep grade tunnels,

(a) one opening is provided
(b) two openings are provided
(c) three openings are provided
(d) no opening is provided.

24.47. Which one of the following methods is generally used for the layout of the muck-car tracks

(a) the grass hopper method
(b) passing track method
(c) the cherry picker
(d) California crossing
(e) Dixon conveyor
(f) All the above.

24.48. An overhead track on a large truss frame is required in case of car changer by

(a) the grass hopper method
(b) the passing track method
(c) California crossing method
(d) Dixon conveyor method.

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ANSWERS

1. BUILDING MATERIALS

1. (b)	2. (a)	3. (c)	4. (d)	5. (c)	6. (c)	7. (b)	8. (d)
9. (c)	10. (a)	11. (d)	12. (a)	13. (b)	14. (c)	15. (d)	16. (e)
17. (c)	18. (b)	19. (b)	20. (b)	21. (c)	22. (d)	23. (a)	24. (a)
25. (a)	26. (d)	27. (a)	28. (b)	29. (a)	30. (b)	31. (d)	32. (a)
33. (c)	34. (c)	35. (c)	36. (b)	37. (a)	38. (b)	39. (a)	40. (a)
41. (d)	42. (c)	43. (a)	44. (c)	45. (d)	46. (a)	47. (d)	48. (b)
49. (b)	50. (b)	51. (c)	52. (d)	53. (a)	54. (d)	55. (c)	56. (d)
57. (b)	58. (d)	59. (c)	60. (b)	61. (c)	62. (c)	63. (b)	64. (d)
65. (c)	66. (a)	67. (a)	68. (d)	69. (b)	70. (c)	71. (b)	72. (b)
73. (e)	74. (e)	75. (e)	76. (d)	77. (e)	78. (d)	79. (d)	80. (c)
81. (e)	82. (b)	83. (a)	84. (a)	85. (c)	86. (b)	87. (b)	88. (c)
89. (c)	90. (b)	91. (a)	92. (a)	93. (c)	94. (e)	95. (c)	96. (d)
97. (b)	98. (a)	99. (e)	100. (b)	101. (a)	102. (c)	103. (b)	104. (a)
105. (e)	106. (d)	107. (c)	108. (c)	109. (d)	110. (b)	111. (c)	112. (d)
113. (d)	114. (b)	115. (c)	116. (d)	117. (d)	118. (d)	119. (d)	120. (b)
121. (a)	122. (d)	123. (b)	124. (c)	125. (b)	126. (b)	127. (c)	128. (c)
129. (d)	130. (a)	131. (c)	132. (d)	133. (c)	134. (d)	135. (d)	136. (c)
137. (a)	138. (b)	139. (a)	140. (d)	141. (d)	142. (e)	143. (d)	144. (e)
145. (d)	146. (b)	147. (a)	148. (d)	149. (a)	150. (b)	151. (c)	152. (e)
153. (e)	154. (e)	155. (a)	156. (a)	157. (c)	158. (b)	159. (d)	160. (d)
161. (e)	162. (c)	163. (e)	164. (e)	165. (d)	166. (c)	167. (d)	168. (e)
169. (c)	170. (b)	171. (c)	172. (a)	173. (e)	174. (d)	175. (c)	176. (b)
177. (d)	178. (c)	179. (d)	180. (d)	181. (c)	182. (d)	183. (d)	184. (d)
185. (d)	186. (d)	187. (e)	188. (c)	189. (d)	190. (c)	191. (d)	192. (d)
193. (a)	194. (b)	195. (b)	196. (c)	197. (c)	198. (d)	199. (b)	200. (e)
201. (d)	202. (a)	203. (e)	204. (e)	205. (e)	206. (b)	207. (d)	208. (d)
209. (a)	210. (b)	211. (c)	212. (a)	213. (c)	214. (d)	215. (a)	216. (e)
217. (e)	218. (d)	219. (c)	220. (a)	221. (e)	222. (b)	223. (e)	224. (c)
225. (a)	226. (d)	227. (e)	228. (a)	229. (b)	230. (d)	231. (c)	232. (a)
233. (b)	234. (d)	235. (d)	236. (e)	237. (a)	238. (b)	239. (a)	240. (b)
241. (c)	242. (d)	243. (c)	244. (d)	245. (a)	246. (d)	247. (a)	248. (b)
249. (c)	250. (d)	251. (e)	252. (d)	253. (a)	254. (b)	255. (c)	256. (e)
257. (b)	258. (e)	259. (a)	260. (d)	261. (e)	262. (c)	263. (b)	264. (d)
265. (a)	266. (a)	267. (b)	268. (c)	269. (a)	270. (b)	271. (c)	272. (b)
273. (d)	274. (c)	275. (b)	276. (c)	277. (c)	278. (d)	279. (e)	280. (a)
281. (d)	282. (a)	283. (d)	284. (d)	285. (e)	286. (c)	287. (a)	288. (b)
289. (e)	290. (b)	291. (d)	292. (e)	293. (d)	294. (d)	295. (e)	296. (d)
297. (a)	298. (e)	299. (a)	300. (e)	301. (c)	302. (d)	303. (b)	304. (c)
305. (e)	306. (d)	307. (d)	308. (a)	309. (e)	310. (d)	311. (d)	312. (e)
313. (d)	314. (c)	315. (d)	316. (c)	317. (b)	318. (a)	319. (b)	320. (b)
321. (d)	322. (d)	323. (a)	324. (d)	325. (a)	326. (c)	327. (a)	328. (e)
329. (b)	330. (d)	331. (d)	332. (c)	333. (d)	334. (e)	335. (d)	336. (b)
337. (a)	338. (e)	339. (a)	340. (a)	341. (d)	342. (c)	343. (e)	344. (e)
345. (b)	346. (a)	347. (e)	348. (b)	349. (c)	350. (e)	351. (d)	352. (d)
353. (e)	354. (e)	355. (d)	356. (e)	357. (d)	358. (d)	359. (c)	360. (d)
361. (c)	362. (d)	363. (c)	364. (e)	365. (e)	366. (e)	367. (e)	368. (e)
369. (d)	370. (e)	371. (c)	372. (b)	373. (d)	374. (e)	375. (b)	376. (b)
377. (d)	378. (e)	379. (d)	380. (e)	381. (b)	382. (e)	383. (d)	384. (d)
385. (e)	386. (a)	387. (d)	388. (d)	389. (e)	390. (a)	391. (a)	392. (a)
393. (a)	394. (a)	395. (a)	396. (a)	397. (a)	398. (a)	399. (a)	400. (a)
401. (a)	402. (d)	403. (a)	404. (a)	405. (a)	406. (a)	407. (a)	408. (a)
409. (d)	410. (a)	411. (b)	412. (c)	413. (a)	414. (a)	415. (c)	416. (a)

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417. (a)	418. (a)	419. (a)	420. (a)	421. (a)	422. (c)	423. (a)	424. (d)
425. (a)	426. (c)	427. (b)	428. (a)	429. (b)	430. (c)	431. (d)	432. (a)
433. (c)	434. (d)	435. (a)	436. (a)	437. (a)	438. (b)	439. (a)	440. (a)
441. (a)	442. (b)	443. (c)	444. (a)	445. (c)	446. (d)	447. (b)	448. (a)
449. (a)	450. (e)	451. (a)	452. (c)	453. (d)	454. (c)	455. (c)	456. (b)
457. (d)	458. (b)	459. (b)	460. (e)	461. (c)	462. (a)	463. (e)	464. (b)
465. (e)	466. (c)	467. (e)	468. (c)	469. (b)	470. (a)	471. (c)	472. (b)
473. (c)	474. (c)	475. (c)	476. (b)	477. (a)	478. (d)	479. (c)	480. (c)
481. (e)	482. (a)	483. (b)					

2. BUILDING CONSTRUCTION

1. (d)	2. (b)	3. (c)	4. (d)	5. (c)	6. (d)	7. (c)	8. (b)
9. (b)	10. (b)	11. (e)	12. (e)	13. (c)	14. (e)	15. (d)	16. (d)
17. (c)	18. (d)	19. (e)	20. (b)	21. (e)	22. (b)	23. (e)	24. (b)
25. (c)	26. (c)	27. (d)	28. (c)	29. (b)	30. (c)	31. (b)	32. (a)
33. (c)	34. (b)	35. (d)	36. (e)	37. (e)	38. (e)	39. (a)	40. (d)
41. (b)	42. (b)	43. (d)	44. (d)	45. (b)	46. (b)	47. (b)	48. (b)
49. (e)	50. (b)	51. (a)	52. (b)	53. (d)	54. (a)	55. (d)	56. (c)
57. (d)	58. (a)	59. (a)	60. (b)	61. (d)	62. (b)	63. (c)	64. (c)
65. (c)	66. (c)	67. (d)	68. (b)	69. (b)	70. (c)	71. (d)	72. (b)
73. (d)	74. (b)	75. (d)	76. (a)	77. (e)	78. (b)	79. (b)	80. (a)
81. (c)	82. (c)	83. (b)	84. (c)	85. (d)	86. (b)	87. (a)	88. (d)
89. (a)	90. (b)	91. (a)	92. (a)	93. (e)	94. (d)	95. (a)	96. (b)
97. (c)	98. (b)	99. (b)	100. (d)	101. (c)	102. (d)	103. (a)	104. (d)
105. (c)	106. (c)	107. (c)	108. (c)	109. (b)	110. (a)	111. (d)	112. (c)
113. (b)	114. (a)	115. (b)	116. (a)	117. (a)	118. (a)	119. (a)	120. (c)
121. (c)	122. (d)	123. (a)	124. (c)	125. (b)	126. (d)	127. (a)	128. (b)
129. (a)	130. (a)	131. (b)	132. (b)	133. (b)	134. (c)	135. (d)	136. (c)
137. (a)	138. (d)	139. (c)	140. (c)	141. (b)	142. (c)	143. (c)	144. (c)
145. (c)	146. (c)	147. (b)	148. (c)	149. (b)	150. (a)	151. (a)	152. (a)
153. (c)	154. (d)	155. (b)	156. (b)	157. (c)	158. (d)	159. (b)	160. (d)
161. (b)	162. (b)	163. (b)	164. (d)	165. (c)	166. (b)	167. (b)	168. (c)
169. (b)	170. (c)	171. (b)	172. (b)	173. (a)	174. (d)	175. (c)	176. (a)
177. (c)	178. (b)	179. (d)	180. (d)	181. (d)	182. (b)	183. (c)	184. (b)
185. (e)	186. (a)	187. (c)	188. (b)	189. (c)	190. (d)	191. (c)	192. (e)
193. (d)	194. (a)	195. (a)	196. (b)	197. (d)	198. (d)	199. (d)	200. (d)
201. (d)	202. (e)	203. (c)	204. (e)	205. (d)	206. (d)	207. (d)	208. (d)
209. (c)	210. (d)	211. (c)	212. (c)	213. (e)	214. (e)	215. (a)	216. (e)
217. (d)	218. (c)	219. (d)	220. (d)	221. (e)	222. (d)	223. (d)	224. (c)
225. (e)	226. (e)	227. (e)	228. (d)	229. (b)	230. (b)	231. (b)	232. (a)
233. (d)	234. (c)	235. (a)	236. (d)	237. (c)	238. (a)	239. (e)	240. (e)
241. (c)	242. (b)	243. (e)	244. (a)	245. (e)	246. (c)	247. (c)	248. (b)
249. (d)	250. (a)	251. (d)	252. (d)	253. (b)	254. (b)	255. (d)	256. (c)
257. (d)	258. (b)	259. (d)	260. (b)	261. (c)	262. (e)	263. (d)	264. (e)
265. (d)	266. (d)	267. (a)	268. (c)	269. (a)	270. (c)	271. (a)	272. (a)
273. (a)	274. (a)	275. (a)	276. (a)	277. (a)	278. (a)	279. (a)	280. (a)
281. (a)	282. (a)	283. (a)	284. (d)	285. (a)	286. (c)	287. (b)	288. (b)
289. (b)	290. (c)	291. (c)	292. (d)	293. (a)	294. (a)	295. (a)	296. (d)
297. (a)	298. (a)	299. (b)	300. (c)	301. (a)	302. (b)	303. (a)	304. (b)
305. (c)	306. (a)	307. (b)	308. (c)	309. (b)	310. (a)	311. (a)	312. (c)
313. (a)	314. (b)	315. (c)	316. (c)	317. (b)	318. (c)	319. (a)	320. (c)
321. (b)	322. (a)	323. (b)	324. (a)	325. (d)	326. (c)	327. (c)	328. (c)
329. (b)	330. (b)	331. (d)	332. (d)	333. (a)	334. (d)	335. (b)	336. (e)
337. (c)	338. (c)						

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3. SURVEYING

1. (d)	2. (c)	3. (b)	4. (a)	5. (c)	6. (b)	7. (b)	8. (c)
9. (c)	10. (b)	11. (c)	12. (c)	13. (a)	14. (c)	15. (a)	16. (c)
17. (a)	18. (a)	19. (a)	20. (a)	21. (a)	22. (b)	23. (a)	24. (a)
25. (b)	26. (a)	27. (b)	28. (a)	29. (b)	30. (c)	31. (a)	32. (c)
33. (b)	34. (d)	35. (d)	36. (a)	37. (c)	38. (c)	39. (b)	40. (d)
41. (c)	42. (d)	43. (a)	44. (a)	45. (a)	46. (b)	47. (d)	48. (b)
49. (c)	50. (a)	51. (a)	52. (b)	53. (d)	54. (a)	55. (c)	56. (c)
57. (d)	58. (a)	59. (b)	60. (d)	61. (a)	62. (d)	63. (a)	64. (b)
65. (c)	66. (c)	67. (b)	68. (a)	69. (c)	70. (d)	71. (c)	72. (e)
73. (c)	74. (c)	75. (c)	76. (d)	77. (b)	78. (d)	79. (c)	80. (c)
81. (c)	82. (d)	83. (a)	84. (b)	85. (d)	86. (b)	87. (b)	88. (c)
89. (b)	90. (b)	91. (b)	92. (c)	93. (c)	94. (a)	95. (a)	96. (b)
97. (c)	98. (c)	99. (a)	100. (d)	101. (a)	102. (c)	103. (a)	104. (d)
105. (d)	106. (c)	107. (c)	108. (c)	109. (b)	110. (a)	111. (c)	112. (c)
113. (c)	114. (d)	115. (b)	116. (b)	117. (c)	118. (b)	119. (a)	120. (b)
121. (c)	122. (d)	123. (c)	124. (c)	125. (c)	126. (b)	127. (b)	128. (b)
129. (c)	130. (d)	131. (c)	132. (c)	133. (a)	134. (d)	135. (c)	136. (c)
137. (c)	138. (c)	139. (c)	140. (d)	141. (a)	142. (a)	143. (c)	144. (d)
145. (c)	146. (c)	147. (a)	148. (c)	149. (a)	150. (b)	151. (d)	152. (b)
153. (b)	154. (a)	155. (a)	156. (c)	157. (a)	158. (d)	159. (b)	160. (a)
161. (d)	162. (c)	163. (b)	164. (a)	165. (b)	166. (b)	167. (a)	168. (e)
169. (a)	170. (b)	171. (c)	172. (c)	173. (c)	174. (c)	175. (a)	176. (b)
177. (a)	178. (a)	179. (b)	180. (d)	181. (c)	182. (c)	183. (a)	184. (b)
185. (a)	186. (b)	187. (d)	188. (d)	189. (b)	190. (b)	191. (a)	192. (b)
193. (b)	194. (d)	195. (a)	196. (b)	197. (c)	198. (c)	199. (d)	200. (c)
201. (c)	202. (e)	203. (c)	204. (e)	205. (e)	206. (e)	207. (c)	208. (c)
209. (c)	210. (b)	211. (b)	212. (d)	213. (a)	214. (e)	215. (a)	216. (e)
217. (d)	218. (e)	219. (d)	220. (b)	221. (b)	222. (e)	223. (a)	224. (c)
225. (e)	226. (d)	227. (d)	228. (e)	229. (d)	230. (a)	231. (a)	232. (a)
233. (b)	234. (b)	235. (b)	236. (a)	237. (c)	238. (d)	239. (c)	240. (b)
241. (e)	242. (d)	243. (d)	244. (e)	245. (d)	246. (e)	247. (d)	248. (b)
249. (c)	250. (b)	251. (a)	252. (c)	253. (b)	254. (a)	255. (b)	256. (d)
257. (c)	258. (a)	259. (c)	260. (b)	261. (a)	262. (a)	263. (a)	264. (c)
265. (b)	266. (a)	267. (b)	268. (b)	269. (a)	270. (b)	271. (b)	272. (b)
273. (c)	274. (d)	275. (c)	276. (c)	277. (c)	278. (e)	279. (c)	280. (d)
281. (b)	282. (d)	283. (d)	284. (c)	285. (d)	286. (c)	287. (d)	288. (e)
289. (c)	290. (a)	291. (d)	292. (c)	293. (e)	294. (a)	295. (d)	296. (b)
297. (d)	298. (c)	299. (b)	300. (d)	301. (d)	302. (d)	303. (d)	304. (d)
305. (d)	306. (c)	307. (c)	308. (d)	309. (a)	310. (d)	311. (e)	312. (a)
313. (c)	314. (e)	315. (e)	316. (e)	317. (d)	318. (d)	319. (e)	320. (d)
321. (c)	322. (d)	323. (b)	324. (d)	325. (d)	326. (a)	327. (e)	328. (e)
329. (e)	330. (b)	331. (a)	332. (d)	333. (d)	334. (d)	335. (d)	336. (d)
337. (a)	338. (d)	339. (d)	340. (a)	341. (c)	342. (d)	343. (c)	344. (c)
345. (e)	346. (b)	347. (a)	348. (a)	349. (d)	350. (c)	351. (e)	352. (c)
353. (d)	354. (e)	355. (d)	356. (c)	357. (d)	358. (d)	359. (e)	360. (d)
361. (a)	362. (a)	363. (d)	364. (a)	365. (c)	366. (d)	367. (c)	368. (e)
369. (d)	370. (c)	371. (b)	372. (d)	373. (b)	374. (d)	375. (a)	376. (c)
377. (d)	378. (a)	379. (b)	380. (a)	381. (d)	382. (a)	383. (a)	384. (a)
385. (a)	386. (a)	387. (a)	388. (b)	389. (a)	390. (a)	391. (a)	392. (a)
393. (a)	394. (a)	395. (a)	396. (a)	397. (a)	398. (b)	399. (a)	400. (a)
401. (a)	402. (a)	403. (a)	404. (b)	405. (b)	406. (a)	407. (a)	408. (a)
409. (a)	410. (a)	411. (a)	412. (a)	413. (a)	414. (a)	415. (d)	416. (a)
417. (c)	418. (a)	419. (b)	420. (a)	421. (a)	422. (c)	423. (a)	424. (a)
425. (a)	426. (c)	427. (a)	428. (a)	429. (b)	430. (c)	431. (c)	432. (d)
433. (b)	434. (c)	435. (a)	436. (d)	437. (c)	438. (b)	439. (a)	440. (b)

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441. (e) 442. (c) 443. (a) 444. (a) 445. (a) 446. (c) 447. (a) 448. (e)
449. (b) 450. (d) 451. (d) 452. (c) 453. (d) 454. (a) 455. (c) 456. (c)
457. (b) 458. (b) 459. (a) 460. (b) 461. (d) 462. (e) 463. (d) 464. (e)
465. (b) 466. (c) 467. (e) 468. (b) 469. (d) 470. (e) 471. (d) 472. (c)
473. (d) 474. (a) 475. (c) 476. (c) 477. (d) 478. (c) 479. (c) 480. (a)
481. (b) 482. (b)

4. ADVANCED SURVEYING

1. (d) 2. (b) 3. (d) 4. (e) 5. (c) 6. (a) 7. (b) 8. (b)
9. (d) 10. (c) 11. (e) 12. (d) 13. (c) 14. (d) 15. (c) 16. (e)
17. (b) 18. (a) 19. (e) 20. (e) 21. (b) 22. (c) 23. (c) 24. (e)
25. (d) 26. (c) 27. (d) 28. (b) 29. (e) 30. (c) 31. (b) 32. (c)
33. (e) 34. (c) 35. (a) 36. (b) 37. (d) 38. (e) 39. (a) 40. (e)
41. (e) 42. (b) 43. (a) 44. (a) 45. (a) 46. (b) 47. (c) 48. (d)
49. (c) 50. (c) 51. (c) 52. (b) 53. (a) 54. (b) 55. (c) 56. (c)
57. (e) 58. (c) 59. (d) 60. (b) 61. (d) 62. (d) 63. (e) 64. (d)
65. (d) 66. (e) 67. (e) 68. (a) 69. (d) 70. (b) 71. (c) 72. (d)
73. (b) 74. (a) 75. (a) 76. (d) 77. (c) 78. (c) 79. (d) 80. (a)
81. (a) 82. (b) 83. (d) 84. (c) 85. (c) 86. (a) 87. (c) 88. (a)
89. (a) 90. (b) 91. (d) 92. (e) 93. (b) 94. (b) 95. (b) 96. (e)
97. (c) 98. (b) 99. (a) 100. (a) 101. (c) 102. (d) 103. (d) 104. (e)
105. (a) 106. (b) 107. (d) 108. (d) 109. (a) 110. (c) 111. (e) 112. (c)
113. (d) 114. (e) 115. (b) 116. (e) 117. (c) 118. (c) 119. (d) 120. (c)
121. (d) 122. (a) 123. (c) 124. (a) 125. (b) 126. (d) 127. (d) 128. (b)
129. (a) 130. (c) 131. (c) 132. (d) 133. (e) 134. (d) 135. (b) 136. (a)
137. (b) 138. (a) 139. (c) 140. (e) 141. (b) 142. (a) 143. (a) 144. (b)
145. (c) 146. (e) 147. (e) 148. (e) 149. (a) 150. (e) 151. (b) 152. (e)
153. (c) 154. (d) 155. (d) 156. (b) 157. (a) 158. (e) 159. (e) 160. (e)
161. (c) 162. (d) 163. (e) 164. (e) 165. (c) 166. (e) 167. (d) 168. (e)
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177. (c) 178. (d) 179. (a) 180. (c) 181. (a) 182. (b) 183. (e) 184. (a)
185. (c) 186. (c) 187. (c) 188. (c) 189. (b) 190. (d) 191. (b) 192. (d)
193. (b) 194. (c) 195. (c) 196. (c) 197. (e) 198. (d) 199. (d) 200. (d)
201. (b) 202. (a) 203. (d) 204. (d) 205. (d) 206. (d) 207. (a) 208. (d)
209. (d) 210. (a) 211. (a) 212. (e) 213. (d) 214. (a) 215. (e) 216. (e)
217. (d) 218. (b) 219. (a) 220. (a) 221. (a) 222. (a) 223. (a) 224. (a)
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233. (a) 234. (d) 235. (c) 236. (b) 237. (b) 238. (c) 239. (a) 240. (a)
241. (a) 242. (d) 243. (d) 244. (d) 245. (a) 246. (b) 247. (d) 248. (a)
249. (c) 250. (b) 251. (a) 252. (d) 253. (c) 254. (d) 255. (c) 256. (d)
257. (a) 258. (b) 259. (a) 260. (c) 261. (c) 262. (a) 263. (a) 264. (a)
265. (c) 266. (b) 267. (e) 268. (b) 269. (d) 270. (d)

5. APPLIED MECHANICS

1. (b) 2. (c) 3. (b) 4. (d) 5. (d) 6. (b) 7. (d) 8. (d)
9. (c) 10. (b) 11. (a) 12. (e) 13. (a) 14. (b) 15. (c) 16. (c)
17. (e) 18. (c) 19. (d) 20. (c) 21. (e) 22. (d) 23. (b) 24. (c)
25. (c) 26. (d) 27. (c) 28. (e) 29. (c) 30. (d) 31. (e) 32. (c)
33. (b) 34. (b) 35. (c) 36. (c) 37. (c) 38. (d) 39. (c) 40. (e)
41. (d) 42. (b) 43. (d) 44. (c) 45. (b) 46. (c) 47. (c) 48. (c)
49. (c) 50. (c) 51. (a) 52. (b) 53. (d) 54. (a) 55. (d) 56. (c)
57. (d) 58. (c) 59. (b) 60. (d) 61. (a) 62. (c) 63. (d) 64. (c)
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81. (a) 82. (b) 83. (c) 84. (b) 85. (c) 86. (a) 87. (b) 88. (b)
89. (d) 90. (b) 91. (c) 92. (c) 93. (c) 94. (d) 95. (e) 96. (d)

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97. (c) 98. (b) 99. (c) 100. (c) 101. (b) 102. (b) 103. (b) 104. (b)
105. (d) 106. (c) 107. (a) 108. (b) 109. (a) 110. (c) 111. (a) 112. (b)
113. (c) 114. (c) 115. (b) 116. (d) 117. (b) 118. (b) 119. (b) 120. (b)
121. (d) 122. (a) 123. (d) 124. (a) 125. (b) 126. (b) 127. (a) 128. (b)
129. (a) 130. (d) 131. (d) 132 (a) 133. (c) 134. (c) 135. (b) 136. (b)
137. (d) 138. (a) 139. (b) 140. (c) 141. (c) 142. (d) 143. (b) 144. (c)
145. (d) 146. (d) 147. (c) 148. (c) 149. (c) 150. (c) 151. (d) 152. (b)
153. (b) 154. (c) 155. (d) 156. (c) 157. (d) 158. (c) 159. (a) 160. (a)
161. (b) 162. (d) 163. (a) 164. (d) 165. (b) 166. (b) 167. (a) 168. (b)
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177. (d) 178. (d) 179. (b) 180. (c) 181. (b) 182. (c) 183. (b) 184. (b)
185. (a) 186. (b) 187. (b) 188. (b) 189. (b) 190. (a) 191. (b) 192. (d)
193. (c) 194. (d) 195. (b) 196. (c) 197. (c) 198. (b) 199. (b) 200. (c)
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209. (d) 210. (d) 211. (b) 212. (a) 213. (d) 214. (c) 215. (a) 216. (b)
217. (b) 218. (a) 219. (b) 220. (b) 221. (b) 222. (b) 223. (c) 224. (c)
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233. (b) 234. (d) 235. (a) 236. (a) 237. (d) 238. (a) 239. (d) 240. (d)
241. (c) 242. (c) 243. (e) 244. (d) 245. (c) 246. (d) 247. (c) 248. (a)
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257. (b) 258. (c) 259. (c) 260. (a) 261. (c) 262. (e) 263. (d) 264. (e)
265. (c) 266. (d) 267. (c) 268. (c) 269. (e) 270. (c) 271. (a) 272. (b)
273. (d) 274. (d) 275. (b) 276. (a) 277. (a) 278. (a) 279. (a) 280. (a)
281. (c) 282. (b) 283. (d) 284. (a) 285. (a) 286. (c) 287. (a) 288. (a)
289. (b)

6. STRENGTH OF MATERIALS

1. (b) 2. (b) 3. (a) 4. (a) 5. (a) 6. (a) 7. (d) 8. (c)
9. (a) 10. (c) 11. (c) 12. (e) 13. (c) 14. (b) 15. (b) 16. (b)
17. (b) 18. (c) 19. (c) 20. (b) 21. (c) 22. (d) 23. (c) 24. (a)
25. (e) 26. (a) 27. (b) 28. (a) 29. (b) 30. (a) 31. (e) 32. (a)
33. (a) 34. (a) 35. (c) 36. (b) 37. (b) 38. (c) 39. (a) 40. (c)
41. (c) 42. (a) 43. (e) 44. (c) 45. (b) 46. (a) 47. (a) 48. (b)
49. (c) 50. (c) 51. (d) 52. (b) 53. (b) 54. (d) 55. (a) 56. (d)
57. (d) 58. (d) 59. (e) 60. (a) 61. (d) 62. (d) 63. (a) 64. (d)
65. (e) 66. (c) 67. (a) 68. (d) 69. (b) 70. (a) 71. (c) 72. (c)
73. (d) 74. (d) 75. (b) 76. (d) 77. (c) 78. (d) 79. (b) 80. (d)
81. (c) 82. (a) 83. (b) 84. (d) 85. (b) 86. (b) 87. (a) 88. (c)
89. (b) 90. (c) 91. (a) 92. (d) 93. (d) 94. (c) 95. (a) 96. (c)
97. (d) 98. (d) 99. (a) 100. (b) 101. (c) 102. (d) 103. (b) 104. (a)
105. (d) 106. (b) 107. (d) 108. (b) 109. (a) 110. (d) 111. (d) 112. (c)
113. (b) 114. (c) 115. (c) 116. (b) 117. (c) 118. (c) 119. (a) 120. (a)
121. (d) 122. (a) 123. (a) 124. (a) 125. (d) 126. (b) 127. (a) 128. (b)
129. (c) 130. (e) 131. (b) 132. (b) 133. (e) 134. (d) 135. (d) 136. (b)
137. (d) 138. (e) 139. (e) 140. (b) 141. (b) 142. (c) 143. (d) 144. (b)
145. (c) 146. (a) 147. (b) 148. (c) 149. (d) 150. (b) 151. (c) 152. (a)
153. (d) 154. (d) 155. (b) 156. (c) 157. (b) 158. (a) 159. (b) 160. (c)
161. (d) 162. (c) 163. (a) 164. (b) 165. (b) 166. (c) 167. (a) 168. (b)
169. (d) 170. (c) 171. (c) 172. (b) 173. (c) 174. (a) 175. (a) 176. (b)
177. (d) 178. (c) 179. (a) 180. (a) 181. (a) 182. (a) 183. (b) 184. (a)
185. (e) 186. (a) 187. (b) 188. (b) 189. (c) 190. (a) 191. (d) 192. (e)
193. (b) 194. (d) 195. (d) 196. (e) 197 (e) 198. (b) 199. (a) 200. (a)
201. (b) 202. (d) 203. (a) 204. (a) 205. (b) 206. (a) 207. (d) 208. (d)
209. (a) 210. (d) 211. (d) 212. (b) 213. (a) 214. (c) 215. (a) 216. (a)
217. (a) 218. (c) 219. (b) 220. (e) 221. (d) 222. (b) 223. (c) 224. (a)
225. (c) 226. (a) 227. (a) 228. (a) 229. (b) 230. (c) 231. (c) 232. (c)

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233. (d) 234. (a) 235. (c) 236. (c) 237. (a) 238. (c) 239. (a) 240. (a)
241. (a) 242. (a) 243. (a) 244. (b) 245. (a) 246. (a) 247. (b) 248. (a)
249. (c) 250. (d) 251. (c) 252. (c) 253. (a) 254. (a) 255. (a) 256. (d)
257. (b) 258. (c) 259. (a) 260. (a) 261. (b) 262. (b) 263. (a) 264. (a)
265. (a) 266. (a) 267. (d) 268. (e) 269. (a) 270. (c) 271. (c) 272. (e)
273. (c) 274. (d) 275. (d) 276. (e) 277. (c) 278. (d) 279. (d) 280. (c)
281. (c) 282. (a) 283. (c) 284. (a)

7. HYDRAULICS

1. (d) 2. (b) 3. (a) 4. (c) 5. (d) 6. (d) 7. (d) 8. (d)
9. (c) 10. (c) 11. (e) 12. (a) 13. (a) 14. (c) 15. (c) 16. (c)
17. (c) 18. (c) 19. (c) 20. (c) 21. (d) 22. (e) 23. (b) 24. (a)
25. (c) 26. (d) 27. (a) 28. (b) 29. (c) 30. (d) 31. (a) 32. (d)
33. (d) 34. (c) 35. (d) 36. (d) 37. (c) 38. (c) 39. (c) 40. (b)
41. (b) 42. (b) 43. (d) 44. (b) 45. (a) 46. (c) 47. (c) 48. (d)
49. (d) 50. (b) 51. (b) 52. (a) 53. (b) 54. (b) 55. (b) 56. (a)
57. (c) 58. (e) 59. (b) 60. (c) 61. (c) 62. (a) 63. (d) 64. (d)
65. (d) 66. (b) 67. (c) 68. (c) 69. (b) 70. (a) 71. (a) 72. (b)
73. (a) 74. (b) 75. (b) 76. (b) 77. (c) 78. (c) 79. (d) 80. (c)
81. (c) 82. (c) 83. (e) 84. (e) 85. (c) 86. (d) 87. (d) 88. (d)
89. (c) 90. (e) 91. (b) 92. (d) 93. (e) 94. (d) 95. (d) 96. (c)
97. (d) 98. (c) 99. (d) 100. (d) 101. (a) 102. (c) 103. (c) 104. (c)
105. (c) 106. (b) 107. (d) 108. (a) 109. (d) 110. (b) 111. (b) 112. (e)
113. (a) 114. (d) 115. (d) 116. (d) 117. (c) 118. (c) 119. (a) 120. (a)
121. (c) 122. (d) 123. (a) 124. (b) 125. (a) 126. (b) 127. (b) 128. (b)
129. (b) 130. (c) 131. (c) 132. (d) 133. (b) 134. (c) 135. (d) 136. (b)
137. (b) 138. (c) 139. (d) 140. (b) 141. (c) 142. (b) 143. (a) 144. (c)
145. (d) 146. (c) 147. (e) 148. (d) 149. (b) 150. (a) 151. (c) 152. (d)
153. (a) 154. (c) 155. (b) 156. (c) 157. (e) 158. (b) 159. (a) 160. (c)
161. (b) 162. (c) 163. (c) 164. (d) 165. (d) 166. (b) 167. (d) 168. (d)
169. (c) 170. (b) 171. (d) 172. (d) 173. (b) 174. (b) 175. (b) 176. (c)
177. (e) 178. (a) 179. (d) 180. (a) 181. (c) 182. (e) 183. (d) 184. (e)
185. (d) 186. (d) 187. (c) 188. (a) 189. (b) 190. (b) 191. (b) 192. (a)
193. (a) 194. (d) 195. (d) 196. (b) 197. (a) 198. (c) 199. (a) 200. (d)
201. (d) 202. (c) 203. (a) 204. (c) 205. (c) 206. (c) 207. (b) 208. (c)
209. (c) 210. (c) 211. (e) 212. (b) 213. (d) 214. (b) 215. (a) 216. (c)
217. (b) 218. (a) 219. (d) 220. (a) 221. (c) 222. (b) 223. (a) 224. (d)
225. (a) 226. (b) 227. (a) 228. (c) 229. (d) 230. (c) 231. (a) 232. (a)
233. (d) 234. (d) 235. (e) 236. (b) 237. (d) 238. (b) 239. (d) 240. (b)
241. (b) 242. (c) 243. (c) 244. (a) 245. (a) 246. (b) 247. (c) 248. (b)
249. (a) 250. (c) 251. (c) 252. (d) 253. (d) 254. (b) 255. (d) 256. (d)
257. (d) 258. (d) 259. (d) 260. (c) 261. (e) 262. (a) 263. (c) 264. (c)
265. (b) 266. (d) 267. (b) 268. (a) 269. (a) 270. (d) 271. (d) 272. (d)
273. (b) 274. (e) 275. (b) 276. (a) 277. (b) 278. (a) 279. (b) 280. (b)
281. (b) 282. (d) 283. (c) 284. (a) 285. (b) 286. (d) 287. (d) 288. (a)
289. (b) 290. (d) 291. (b) 292. (b) 293. (b) 294. (d) 295. (c) 296. (d)
297. (a) 298. (c) 299. (b) 300. (a) 301. (c) 302. (b) 303. (b) 304. (b)
305. (a) 306. (c) 307. (c) 308. (b) 309. (d) 301. (d) 311. (b) 312. (a)
313. (a) 314. (a) 315. (b) 316. (c) 317. (b) 318. (c) 319. (b) 320. (c)
321. (b) 322. (b) 323. (c) 324. (a) 325. (c) 326. (c) 327. (b) 328. (c)
329. (d) 330. (c) 331. (a) 332. (b) 333. (a) 334. (b) 335. (b) 336. (c)
337. (b)

8. WATER RESOURCES ENGINEERING

1. (b) 2. (d) 3. (e) 4. (d) 5. (c) 6. (d) 7. (d) 8. (e)
9. (e) 10. (e) 11. (d) 12. (c) 13. (c) 14 (b) 15. (d) 16. (a

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17. (d)	18. (e)	19. (e)	20. (e)	21. (e)	22. (e)	23. (e)	24. (d)
25. (e)	26. (c)	27. (d)	28. (e)	29. (a)	30. (e)	31. (d)	32. (e)
33. (b)	34. (a)	35. (c)	36. (a)	37. (e)	38. (a)	39. (a)	40. (b)
41. (b)	42. (a)	43. (e)	44. (b)	45. (c)	46. (d)	47. (a)	48. (c)
49. (a)	50. (d)	51. (d)	52. (c)	53. (b)	54. (e)	55. (b)	56. (b)
57. (e)	58. (e)	59. (d)	60. (e)	61. (c)	62. (e)	63. (d)	64. (d)
65. (b)	66. (b)	67. (a)	68. (e)	69. (e)	70. (b)	71. (c)	72. (d)
73. (e)	74. (a)	75. (a)	76. (b)	77. (e)	78. (b)	79. (d)	80. (e)
81. (d)	82. (e)	83. (c)	84. (c)	85. (e)	86. (d)	87. (b)	88. (a)
89. (d)	90. (d)	91. (d)	92. (a)	93. (b)	94. (d)	95. (c)	96. (c)
97. (a)	98. (d)	99. (e)	100. (b)	101. (e)	102. (e)	103. (e)	104. (c)
105. (d)	106. (e)	107. (c)	108. (c)	109. (c)	110. (e)	111. (e)	112. (d)
113. (e)	114. (d)	115. (b)	116. (d)	117. (e)	118. (e)	119. (c)	120. (d)
121. (e)	122. (c)	123. (e)	124. (d)	125. (d)	126. (d)	127. (c)	128. (b)
129. (e)	130. (c)	131. (b)	132 (a)	133. (c)	134. (d)	135. (d)	136. (d)
137. (e)	138. (e)	139. (a)	140. (c)	141. (c)	142. (c)	143. (b)	144. (e)
145. (b)	146. (c)	147. (c)	148. (a)	149. (b)	150. (a)	151. (e)	152. (d)

9. ENVIRONMENTAL ENGINEERING

1. (d)	2. (d)	3. (d)	4. (d)	5. (a)	6. (b)	7. (c)	8. (e)
9. (d)	10. (d)	11. (c)	12. (d)	13. (d)	14 (a)	15. (b)	16. (c)
17. (d)	18. (e)	19. (d)	20. (d)	21. (b)	22. (d)	23. (c)	24. (c)
25. (a)	26. (d)	27. (d)	28. (a)	29. (d)	30. (e)	31. (c)	32. (b)
33. (d)	34. (b)	35. (a)	36. (d)	37. (d)	38. (a)	39. (b)	40. (c)
41. (b)	42. (c)	43. (a)	44. (a)	45. (c)	46. (d)	47. (c)	48. (d)
49. (c)	50. (b)	51. (d)	52. (e)	53. (b)	54. (d)	55. (d)	56. (e)
57. (c)	58. (a)	59. (d)	60. (c)	61. (a)	62. (d)	63. (a)	64. (c)
65. (c)	66. (b)	67. (c)	68. (c)	69. (d)	70. (d)	71. (a)	72. (d)
73. (b)	74. (d)	75. (e)	76. (e)	77. (e)	78. (e)	79. (d)	80. (d)
81. (d)	82. (c)	83. (d)	84. (e)	85. (d)	86. (c)	87. (b)	88. (e)
89. (c)	90. (c)	91. (c)	92. (e)	93. (a)	94. (e)	95. (e)	96. (a)
97. (b)	98. (c)	99. (c)	100. (d)	101. (b)	102. (e)	103. (a)	104. (a)
105. (a)	106. (c)	107. (c)	108. (c)	109. (e)	110. (d)	111. (c)	112. (a)
113. (e)	114. (e)	115. (d)	116. (c)	117. (b)	118. (e)	119. (a)	120. (c)
121. (e)	122. (c)	123. (b)	124. (d)	125. (a)	126. (b)	127. (c)	128. (e)
129. (b)	130. (b)	131. (d)	132. (d)	133. (e)	134. (c)	135. (e)	136. (e)
137. (e)	138. (b)	139. (a)	140. (c)	141. (b)	142. (d)	143. (a)	144. (a)
145. (d)	146. (a)	147. (c)	148. (c)	149. (e)	150. (d)	151. (e)	152. (a)
153. (b)	154. (d)	155. (c)	156. (c)	157. (d)	158. (e)	159. (d)	160. (d)
161. (b)	162. (d)	163. (b)	164. (e)	165. (a)	166. (d)	167. (d)	168. (b)
169. (c)	170. (a)	171. (a)	172. (c)	173. (a)	174. (d)	175. (d)	176. (e)
177. (e)	178. (a)	179. (c)	180. (e)	181. (b)	182. (b)	183. (d)	184. (e)
185. (d)	186. (a)	187. (b)	188. (c)	189. (b)	190. (c)	191. (a)	192. (d)
193. (a)	194. (e)	195. (e)	196. (b)	197. (a)	198. (c)	199. (b)	200. (b)
201. (c)	202. (b)	203. (b)	204. (a)	205. (b)	206. (b)	207. (a)	208. (d)
209. (c)	210. (c)	211. (d)	212. (c)	213. (b)	214. (d)	215. (c)	216. (b)
217. (b)	218. (b)	219. (d)	220. (c)	221. (b)	222. (b)	223. (d)	224. (d)
225. (d)	226. (d)	227. (c)	228. (d)	229. (e)	230. (c)	231. (d)	232. (d)
233. (b)	234. (c)	235. (d)	236. (a)	237. (d)	238. (a)	239. (a)	240. (d)
241. (c)	242. (b)	243. (c)	244. (d)	245. (d)	246. (a)	247. (d)	248. (c)
249. (d)	250. (b)	251. (a)	252. (a)	253. (c)	254. (a)	255. (d)	256. (d)
257. (b)	258. (b)	259. (a)	260. (c)	261. (d)	262. (c)	263. (d)	264. (b)
265. (d)	266. (d)	267. (c)	268. (a)	269. (d)	270. (a)	271. (a)	272. (a)
273. (a)	274. (c)	275. (d)	276. (c)	277. (a)	278. (d)	279. (a)	280. (d)
281. (d)	282. (d)	283. (c)	284. (d)	285. (d)	286. (b)	287. (b)	288. (a)

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289. (c) 290. (c) 291. (b) 292. (b) 293. (a) 294. (d) 295. (b) 296. (d)
297. (d) 298. (a) 299. (e) 300. (d) 301. (c) 302. (d) 303. (d) 304. (d)
305. (b) 306. (d) 307. (e) 308. (b) 309. (c) 310. (c) 311. (d) 312. (a)
313. (b) 314. (a) 315. (a) 316. (c) 317. (a) 318. (c) 319. (a) 320. (a)
321. (a) 322. (b) 323. (c) 324. (d) 325. (b) 326. (d) 327. (a) 328. (a)
329. (c) 330. (b) 331. (c) 332. (a) 333. (c) 334. (a) 335. (d) 336. (a)
337. (c) 338. (a) 339. (c) 340. (b) 341. (d) 342. (c) 343. (d) 344. (e)
345. (c) 346. (e) 347. (d) 348. (a) 349. (b) 350. (d) 351. (c) 352. (d)
353. (d) 354. (c) 355. (b) 356. (d) 357. (b) 358. (c) 359. (b) 360. (a)
361. (d) 362. (d) 363. (d) 364. (b) 365. (a) 366. (e) 367. (a) 368. (b)
369. (d) 370. (b) 371. (d) 372. (d) 373. (b) 374. (a) 375. (d) 376. (b)
377. (c) 378. (d) 379. (c) 380. (a) 381. (d) 382. (c) 383. (d) 384. (d)
385. (a) 386. (c) 387. (d) 388. (b) 389. (a) 390. (a) 391. (c) 392. (d)
393. (d) 394. (c) 395. (c) 396. (d) 397. (a) 398. (c)

10. HYDROLOGY

1. (e) 2. (a) 3. (e) 4. (d) 5. (d) 6. (d) 7. (d) 8. (d)
9. (a) 10. (d) 11. (e) 12. (a) 13. (d) 14. (c) 15. (e) 16. (e)
17. (e) 18. (e) 19. (e) 20. (e) 21. (c) 22. (c) 23. (d) 24. (e)
25. (a) 26. (e) 27. (b) 28. (c) 29. (c) 30. (a) 31. (c) 32. (d)
33. (e) 34. (e) 35. (d) 36. (a) 37. (c) 38. (b) 39. (e) 40. (e)
41. (c) 42. (c) 43. (e) 44. (e) 45. (c) 46. (d) 47. (e) 48. (d)
49. (b) 50. (a) 51. (a) 52. (e) 53. (d) 54. (c) 55. (c) 56. (b)
57. (d) 58. (c) 59. (d) 60. (d) 61. (e) 62. (d) 63. (d) 64. (e)
65. (c) 66. (e) 67. (a) 68. (b) 69. (d) 70. (c) 71. (c) 72. (c)
73. (d) 74. (d) 75. (e) 76. (e) 77. (d) 78. (e) 79. (d) 80. (b)
81. (b) 82. (b) 83. (b) 84. (a) 85. (c) 86. (c) 87. (e) 88. (d)
89. (d) 90. (e) 91. (e) 92. (e) 93. (e) 94. (a) 95. (d) 96. (a)
97. (d) 98. (b) 99. (d) 100. (d) 101. (b) 102. (b) 103. (d) 104. (d)
105. (c) 106. (d) 107. (e) 108. (c) 109. (c) 110. (c) 111. (d) 112. (b)
113. (c) 114. (c) 115. (e) 116. (d) 117. (c) 118. (c) 119. (e) 120. (e)
121. (c) 122. (b) 123. (d) 124. (e) 125. (d) 126. (e) 127. (e) 128. (d)
129. (c) 130. (d) 131. (e) 132. (d) 133. (d) 134. (c) 135. (a) 136. (a)
137. (e) 138. (e) 139. (e) 140. (d) 141. (e) 142. (a) 143. (e) 144. (d)
145. (c) 146. (e) 147. (e) 148. (e) 149. (e) 150. (d) 151. (c) 152. (d)
153. (a) 154. (e) 155. (d) 156. (d) 157. (e) 158. (e) 159. (e) 160. (e)
161. (e) 162. (d) 163. (e) 164. (d) 165. (e) 166. (c) 167. (e) 168. (e)
169. (e) 170. (e) 171. (d) 172. (a) 173. (c) 174. (c) 175. (d) 176. (e)
177. (d) 178. (c) 179. (b) 180. (c) 181. (c) 182. (e) 183. (d) 184. (a)
185. (c) 186. (e) 187. (a) 188. (e) 189. (c) 190. (b) 191. (e) 192. (d)
193. (d) 194. (d) 195. (e) 196. (d) 197. (d) 198. (d) 199. (d) 200. (e)
201. (e) 202. (d) 203. (e) 204. (d) 205. (d) 206. (c) 207. (e) 208. (e)
209. (d) 210. (b) 211. (c) 212. (b) 213. (d) 214. (b) 215. (c) 216. (c)
217. (d) 218. (b) 219. (d) 220. (a) 221. (c) 222. (e) 223. (c) 224. (a)
225. (d) 226. (b) 227. (e) 228. (d) 229. (c) 230. (b) 231. (c) 232. (a)
233. (a) 234. (d) 235. (b) 236. (c) 237. (a) 238. (d) 239. (d) 240. (d)
241. (a) 242. (d) 243. (b) 244. (c) 245. (c) 246. (c) 247. (e) 248. (d)
249. (d) 250. (d) 251. (d) 252. (d) 253. (b) 254. (a) 255. (e) 256. (b)
257. (a) 258. (c) 259. (b) 260. (d) 261. (a) 262. (b) 263. (a) 264. (a)
265. (a) 266. (c) 267. (d) 268. (c) 269. (d) 270. (d) 271. (d) 272. (e)
273. (a) 274. (a) 275. (c) 276. (e) 277. (b) 278. (a) 279. (a) 280. (c)
281. (d) 282. (a) 283. (b) 284. (b) 285. (a) 286. (e) 287. (a) 288. (b)
289. (d) 290. (d) 291. (b) 292. (b) 293. (e) 294. (b) 295. (d) 296. (b)
297. (c) 298. (d) 299. (a) 300. (d) 301. (d) 302. (c) 303. (d) 304. (e)
305. (d) 306. (c) 307. (c) 308. (b) 309. (c) 310. (a) 311. (d) 312. (d)
313. (d) 314. (e) 315. (c) 316. (e) 317. (c) 318. (d) 319. (d) 320. (c)

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321. (a)	322. (c)	323. (a)	324. (e)	325. (e)	326. (c)	327. (d)	328. (d)
329. (c)	330. (a)	331. (a)	332. (c)	333. (c)	334. (e)	335. (b)	336. (c)
337. (c)	338. (a)	339. (d)	340. (a)	341. (c)	342. (d)	343. (d)	344. (d)
345. (b)	346. (e)	347. (a)	348. (a)	349. (a)	350. (a)	351. (d)	352. (a)
353. (a)	354. (b)	355. (c)	356. (c)	357. (a)	358. (c)	359. (d)	360. (a)
361. (b)	362. (a)	363. (c)	364. (d)	365. (b)	366. (e)	367. (b)	368. (e)
369. (d)	370. (d)	371. (d)	372. (e)	373. (c)	374. (a)	375. (c)	376. (e)
377. (d)	378. (d)	379. (d)	380. (a)	381. (d)	382. (a)	383. (b)	384. (a)
385. (e)	386. (d)	387. (d)	388. (e)	389. (a)	390. (d)	391. (d)	392. (a)
393. (a)	394. (c)	395. (c)	396. (a)	397. (d)	398. (a)	399. (b)	400. (a)
401. (b)	402. (c)	403. (b)	404. (c)	405. (c)	406. (c)	407. (d)	408. (b)
409. (d)	410. (c)	411. (b)	412. (c)	413. (a)	414. (d)	415. (d)	416. (d)

11. SOIL MECHANICS AND FOUNDATION ENGINEERING

1. (b)	2. (d)	3. (d)	4. (e)	5. (e)	6. (d)	7. (d)	8. (c)
9. (c)	10. (d)	11. (a)	12. (d)	13. (d)	14. (a)	15. (a)	16. (d)
17. (e)	18. (d)	19. (c)	20. (c)	21. (a)	22. (b)	23. (c)	24. (d)
25. (d)	26. (a)	27. (a)	28. (d)	29. (c)	30. (c)	31. (b)	32. (b)
33. (a)	34. (d)	35. (a)	36. (c)	37. (c)	38. (d)	39. (b)	40. (c)
41. (e)	42. (e)	43. (d)	44. (e)	45. (d)	46. (a)	47. (c)	48. (d)
49. (c)	50. (e)	51. (c)	52. (d)	53. (a)	54. (a)	55. (c)	56. (e)
57. (b)	58. (b)	59. (a)	60. (c)	61. (a)	62. (b)	63. (b)	64. (b)
65. (e)	66. (d)	67. (b)	68. (a)	69. (b)	70. (d)	71. (d)	72. (b)
73. (b)	74. (b)	75. (a)	76. (c)	77. (e)	78. (d)	79. (a)	80. (d)
81. (d)	82. (c)	83. (d)	84. (c)	85. (c)	86. (d)	87. (d)	88. (d)
89. (d)	90. (e)	91. (a)	92. (e)	93. (c)	94. (c)	95. (b)	96. (c)
97. (d)	98. (d)	99. (c)	100. (c)	101. (c)	102. (b)	103. (d)	104. (e)
105. (d)	106. (b)	107. (b)	108. (d)	109. (c)	110. (e)	111. (b)	112. (d)
113. (b)	114. (c)	115. (c)	116. (c)	117. (a)	118. (e)	119. (a)	120. (c)
121. (d)	122. (a)	123. (b)	124. (b)	125. (e)	126. (b)	127. (c)	128. (b)
129. (c)	130. (a)	131. (e)	132. (c)	133. (c)	134. (b)	135. (c)	136. (d)
137. (d)	138. (b)	139. (d)	140. (e)	141. (c)	142. (e)	143. (a)	144. (e)
145. (d)	146. (d)	147. (c)	148. (d)	149. (d)	150. (a)	151. (b)	152. (a)
153. (c)	154. (d)	155. (c)	156. (a)	157. (d)	158. (c)	159. (c)	160. (b)
161. (a)	162. (d)	163. (d)	164. (d)	165. (b)	166. (b)	167. (b)	168. (d)
169. (c)	170. (e)	171. (e)	172. (d)	173. (b)	174. (d)	175. (a)	176. (c)
177. (a)	178. (b)	179. (d)	180. (a)	181. (e)	182. (c)	183. (d)	184. (a)
185. (d)	186. (b)	187. (c)	188. (c)	189. (d)	190. (b)	191. (b)	192. (d)
193. (d)	194. (e)	195. (e)	196. (a)	197. (b)	198. (c)	199. (d)	200. (d)
201. (c)	202. (b)	203. (a)	204. (b)	205. (c)	206. (a)	207. (c)	208. (c)
209. (d)	210. (a)	211. (e)	212. (a)	213. (c)	214. (c)	215. (d)	216. (a)
217. (c)	218. (c)	219. (d)	220. (e)	221. (e)	222. (d)	223. (e)	224. (b)
225. (e)	226. (e)	227. (e)	228. (d)	229. (c)	230. (e)	231. (e)	232. (d)
233. (a)	234. (b)	235. (c)	236. (e)	237. (a)	238. (d)	239. (e)	240. (b)
241. (c)	242. (d)	243. (c)	244. (d)	245. (c)	246. (c)	247. (c)	248. (b)
249. (c)	250. (b)	251. (a)	252. (c)	253. (d)	254. (d)	255. (c)	256. (c)
257. (d)	258. (a)	259. (e)	260. (e)	261. (e)	262. (d)	263. (e)	264. (e)
265. (c)	266. (c)	267. (d)	268. (b)	269. (d)	270. (c)	271. (d)	272. (e)
273. (e)	274. (d)	275. (a)	276. (b)	277. (c)	278. (a)	279. (d)	280. (c)
281. (b)	282. (c)	283. (c)	284. (d)	285. (b)	286. (c)	287. (b)	288. (c)
289. (d)	290. (c)	291. (c)	292. (d)	293. (b)	294. (c)	295. (c)	296. (a)
297. (b)	298. (b)	299. (c)	300. (b)	301. (c)	302. (a)	303. (a)	304. (c)
305. (c)	306. (a)	307. (c)	308. (c)	309. (c)	310. (c)	311. (d)	312. (d)
313. (d)	314. (a)	315. (b)	316. (c)	317. (c)	318. (b)	319. (d)	320. (d)
321. (c)	322. (d)	323. (c)	324. (d)	325. (d)	326. (a)	327. (b)	328. (e)
329. (e)	330. (e)	331. (c)	332. (c)	333. (b)	334. (d)	335. (c)	336. (b)
337. (d)							

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12. CONCRETE TECHNOLOGY

1. (e)	2. (d)	3. (e)	4. (d)	5. (d)	6. (a)	7. (a)	8. (c)
9. (d)	10. (e)	11. (c)	12. (a)	13. (e)	14. (d)	15. (a)	16. (d)
17. (d)	18. (d)	19. (a)	20. (a)	21. (e)	22. (d)	23. (d)	24. (b)
25. (b)	26. (e)	27. (c)	28. (c)	29. (c)	30. (b)	31. (c)	32. (d)
33. (c)	34. (e)	35. (a)	36. (e)	37. (b)	38. (c)	39. (b)	40. (a)
41. (e)	42. (c)	43. (d)	44. (d)	45. (e)	46. (c)	47. (e)	48. (c)
49. (c)	50. (d)	51. (d)	52. (e)	53. (c)	54. (e)	55. (b)	56. (b)
57. (c)	58. (c)	59. (d)	60. (b)	61. (a)	62. (e)	63. (e)	64. (e)
65. (e)	66. (a)	67. (d)	68. (b)	69. (e)	70. (d)	71. (d)	72. (d)
73. (d)	74. (b)	75. (e)	76. (e)	77. (a)	78. (e)	79. (d)	80. (e)
81. (d)	82. (e)	83. (c)	84. (e)	85. (e)	86. (a)	87. (d)	88. (c)
89. (c)	90. (b)	91. (e)	92. (d)	93. (e)	94. (e)	95. (b)	96. (e)
97. (c)	98. (d)	99. (e)	100. (e)	101. (c)	102. (c)	103. (e)	104. (e)
105. (e)	106. (e)	107. (c)	108. (e)	109. (b)	110. (b)	111. (c)	112. (e)
113. (c)	114. (a)	115. (e)	116. (e)	117. (d)	118. (e)	119. (e)	120. (e)
121. (e)	122. (c)	123. (d)	124. (d)	125. (a)	126. (e)	127. (d)	128. (e)
129. (e)	130. (c)	131. (d)	132. (c)	133. (a)	134. (d)	135. (d)	136. (e)
137. (a)	138. (c)	139. (d)	140. (b)	141. (e)	142. (e)	143. (b)	144. (d)
145. (b)	146. (e)	147. (d)	148. (d)	149. (d)	150. (e)	151. (d)	152. (d)
153. (b)	154. (c)	155. (b)	156. (d)	157. (e)	158. (c)	159. (d)	160. (d)
161. (e)	162. (e)	163. (e)	164. (e)	165. (e)	166. (e)	167. (a)	168. (a)
169. (e)	170. (b)	171. (c)	172. (e)	173. (e)	174. (a)	175. (d)	176. (d)
177. (a)	178. (d)	179. (c)	180. (d)	181. (d)	182. (a)	183. (e)	184. (e)
185. (a)	186. (a)	187. (a)	188. (a)	189. (c)	190. (d)	191. (c)	192. (d)
193. (d)	194. (a)	195. (d)	196. (d)	197. (b)	198. (d)	199. (e)	200. (e)
201. (e)	202. (b)	203. (a)	204. (d)	205. (a)	206. (c)	207. (c)	208. (b)
209. (b)	210. (e)	211. (a)	212. (b)	213. (c)	214. (d)	215. (e)	216. (a)
217. (d)	218. (a)	219. (c)	220. (d)	221. (d)	222. (e)	223. (e)	224. (d)
225. (e)	226. (e)	227. (d)	228. (c)	229. (a)	230. (a)	231. (e)	232. (b)
233. (e)	234. (d)	235. (a)	236. (b)	237. (a)	238. (e)	239. (a)	240. (c)
241. (e)	242. (a)	243. (d)	244. (e)	245. (b)	246. (b)	247. (c)	248. (d)
249. (e)	250. (a)	251. (b)	252. (d)	253. (d)	254. (c)	255. (a)	256. (d)
257. (b)	258. (b)	259. (e)	260. (e)	261. (a)	262. (d)	263. (a)	264. (c)
265. (d)	266. (a)	267. (d)	268. (c)	269. (b)	270. (c)	271. (d)	272. (c)
273. (b)	274. (c)	275. (d)	276. (d)	277. (b)	278. (d)	279. (a)	280. (c)
281. (d)	282. (b)	283. (a)	284. (c)	285. (d)	286. (b)	287. (a)	

13. R.C.C. STRUCTURE DESIGN

1. (e)	2. (c)	3. (b)	4. (b)	5. (d)	6. (d)	7. (d)	8. (c)
9. (b)	10. (d)	11. (b)	12. (d)	13. (d)	14. (a)	15. (e)	16. (d)
17. (b)	18. (c)	19. (a)	20. (d)	21. (c)	22. (a)	23. (d)	24. (d)
25. (a)	26. (b)	27. (c)	28. (a)	29. (d)	30. (a)	31. (e)	32. (e)
33. (c)	34. (c)	35. (b)	36. (c)	37. (d)	38. (d)	39. (c)	40. (a)
41. (b)	42. (d)	43. (e)	44. (d)	45. (d)	46. (d)	47. (c)	48. (c)
49. (d)	50. (d)	51. (a)	52. (c)	53. (d)	54. (c)	55. (c)	56. (c)
57. (d)	58. (d)	59. (d)	60. (d)	61. (c)	62. (c)	63. (b)	64. (b)
65. (d)	66. (d)	67. (d)	68. (e)	69. (c)	70. (b)	71. (e)	72. (d)
73. (c)	74. (d)	75. (b)	76. (c)	77. (c)	78. (c)	79. (b)	80. (c)
81. (a)	82. (d)	83. (e)	84. (c)	85. (c)	86. (e)	87. (c)	88. (d)
89. (a)	90. (b)	91. (d)	92. (d)	93. (c)	94. (d)	95. (c)	96. (d)
97. (c)	98. (a)	99. (e)	100. (a)	101. (e)	102. (b)	103. (c)	104. (c)
105. (c)	106. (c)	107. (c)	108. (b)	109. (c)	110. (c)	111. (b)	112. (d)
113. (a)	114. (c)	115. (d)	116. (d)	117. (b)	118. (b)	119. (d)	120. (c)
121. (c)	122. (d)	123. (d)	124. (d)	125. (d)	126. (b)	127. (c)	128. (c)
129. (a)	130. (b)	131. (c)	132. (b)	133. (c)	134. (a)	135. (c)	136. (b)

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137. (b)	138. (b)	139. (d)	140. (b)	141. (e)	142. (b)	143. (d)	144. (b)
145. (c)	146. (b)	147. (e)	148. (d)	149. (d)	150. (c)	151. (b)	152. (c)
153. (d)	154. (b)	155. (d)	156. (c)	157. (d)	158. (e)	159. (e)	160. (a)
161. (a)	162. (c)	163. (b)	164. (c)	165. (c)	166. (b)	167. (c)	168. (d)
169. (a)	170. (b)	171. (c)	172. (d)	173. (c)	174. (d)	175. (b)	176. (e)
177. (a)	178. (d)	179. (e)	180. (d)	181. (d)	182. (c)	183. (d)	184. (d)
185. (d)	186. (d)	187. (a)	188. (c)	189. (c)	190. (e)	191. (e)	192. (b)
193. (b)	194. (c)	195. (d)	196. (d)	197. (d)	198. (d)	199. (d)	200. (e)
201. (d)	202. (a)	203. (c)	204. (c)	205. (e)	206. (c)	207. (c)	208. (d)
209. (b)	210. (b)	211. (b)	212. (d)	213. (c)	214. (d)	215. (d)	216. (c)
217. (e)	218. (b)	219. (b)	220. (e)	221. (b)	222. (c)	223. (d)	224. (d)
225. (a)	226. (a)	227. (a)	228. (a)	229. (d)	230. (c)	231. (d)	232. (d)
233. (c)	234. (c)	235. (c)	236. (c)	237. (c)	238. (c)	239. (c)	240. (b)
241. (c)	242. (c)	243. (b)	244. (a)	245. (a)	246. (a)	247. (d)	248. (d)
249. (a)	250. (c)	251. (c)	252. (c)	253. (b)	254. (d)	255. (e)	256. (d)
257. (d)	258. (d)	259. (d)	260. (a)	261. (d)	262. (c)	263. (a)	264. (c)
265. (b)	266. (d)	267. (b)	268. (a)	269. (a)	270. (a)	271. (e)	272. (c)
273. (e)	274. (a)	275. (a)	276. (a)	277. (a)	278. (a)	279. (c)	280. (e)
281. (b)	282. (a)	283. (c)	284. (d)	285. (b)	286. (b)	287. (a)	288. (c)
289. (b)	290. (a)	291. (a)	292. (a)	293. (a)	294. (d)	295. (d)	296. (c)
297. (b)	298. (a)	299. (a)	300. (c)	301. (a)	302. (a)	303. (a)	304. (c)
305. (b)	306. (c)	307. (e)	308. (a)	309. (c)	310. (a)	311. (b)	312. (b)
313. (a)	314. (c)	315. (a)	316. (c)	317. (a)	318. (a)	319. (b)	320. (a)
321. (a)	322. (a)	323. (a)	324. (c)	325. (e)	326. (c)	327. (e)	328. (b)
329. (c)	330. (d)	331. (e)	332. (a)	333. (c)	334. (a)	335. (b)	336. (b)
337. (d)	338. (b)	339. (d)	340. (c)	341. (b)	342. (b)	343. (c)	344. (e)
345. (d)	346. (b)	347. (d)	348. (b)	349. (b)	350. (e)	351. (e)	352. (d)
353. (c)	354. (b)	355. (d)	356. (b)	357. (d)	358. (d)	359. (c)	360. (b)
361. (e)	362. (b)	363. (b)	364. (d)	365. (d)	366. (d)	367. (c)	368. (a)
369. (d)	370. (d)	371. (d)	372. (d)	373. (c)	374. (c)	375. (b)	

14. STEEL STRUCTURE DESIGN

1. (b)	2. (d)	3. (d)	4. (b)	5. (d)	6. (b)	7. (b)	8. (d)
9. (c)	10. (d)	11. (a)	12. (d)	13. (c)	14. (c)	15. (b)	16. (a)
17. (c)	18. (a)	19. (b)	20. (e)	21. (c)	22. (b)	23. (c)	24. (c)
25. (b)	26. (c)	27. (e)	28. (b)	29. (e)	30. (d)	31. (e)	32. (e)
33. (a)	34. (d)	35. (d)	36. (e)	37. (b)	38. (a)	39. (c)	40. (d)
41. (d)	42. (c)	43. (b)	44. (d)	45. (b)	46. (e)	47. (d)	48. (b)
49. (a)	50. (b)	51. (c)	52. (e)	53. (a)	54. (b)	55. (c)	56. (c)
57. (a)	58. (d)	59. (a)	60. (d)	61. (d)	62. (d)	63. (c)	64. (d)
65. (d)	66. (b)	67. (b)	68. (b)	69. (c)	70. (c)	71. (d)	72. (c)
73. (b)	74. (c)	75. (c)	76. (a)	77. (a)	78. (a)	79. (c)	80. (a)
81. (a)	82. (a)	83. (d)	84. (d)	85. (d)	86. (b)	87. (e)	88. (c)
89. (c)	90. (b)	91. (b)	92. (e)	93. (b)	94. (d)	95. (c)	96. (b)
97. (a)	98. (e)	99. (b)	100. (d)	101. (b)	102. (e)	103. (c)	104. (d)
105. (d)	106. (d)	107. (c)	108. (b)	109. (d)	110. (c)	111. (d)	112. (e)
113. (e)	114. (c)	115. (a)	116. (b)	117. (a)	118. (c)	119. (c)	120. (c)
121. (d)	122. (b)	123. (d)	124. (c)	125. (c)	126. (c)	127. (d)	128. (b)
129. (a)	130. (a)	131. (a)	132. (a)	133. (d)	134. (b)	135. (a)	136. (a)
137. (b)	138. (b)	139. (b)	140. (d)	141. (b)	142. (c)	143. (b)	144. (d)
145. (b)	146. (a)	147. (b)	148. (c)	149. (d)	150. (c)	151. (d)	152. (c)
153. (d)	154. (c)	155. (c)	156. (d)	157. (d)	158. (c)	159. (b)	160. (a)
161. (d)	162. (b)	163. (c)	164. (e)	165. (e)	166. (b)	167. (c)	168. (d)
169. (a)	170. (d)	171. (a)	172. (d)	173. (c)	174. (e)	175. (b)	176. (d)
177. (d)	178. (c)	179 (c)	180. (d)	181. (d)	182. (b)	183. (c)	184. (c)
185. (d)	186. (e)	187. (e)	188. (d)	189. (c)	190. (c)	191. (d)	192. (b)

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193. (c) 194. (b) 195. (b) 196. (a) 197 (a) 198. (a) 199. (c) 200. (e)
201. (d) 202. (c) 203. (b) 204. (c) 205. (d) 206. (a) 207. (e) 208. (c)
209. (c) 210. (e) 211. (c) 212. (c) 213. (d) 214. (b) 215. (c) 216. (e)
217. (e) 218. (a) 219. (d) 220. (d) 221. (e) 222. (b) 223. (c) 224. (d)
225. (d) 226. (d) 227. (d) 228. (c) 229. (d) 230. (d) 231. (b) 232. (e)
233. (c) 234. (d) 235. (d) 236. (d) 237. (c) 238. (c) 239. (c) 240. (c)

15. IRRIGATION

1. (a) 2. (c) 3. (c) 4. (d) 5. (d) 6. (d) 7. (d) 8. (d)
9. (e) 10. (c) 11. (d) 12. (b) 13. (a) 14. (d) 15. (a) 16. (a)
17. (a) 18. (c) 19. (c) 20. (b) 21. (e) 22. (d) 23. (d) 24. (d)
25. (e) 26. (d) 27. (d) 28. (b) 29. (d) 30. (e) 31. (d) 32. (b)
33. (c) 34. (c) 35. (d) 36. (d) 37. (d) 38. (c) 39. (c) 40. (c)
41. (c) 42. (c) 43. (c) 44. (e) 45. (b) 46. (d) 47. (d) 48. (d)
49. (b) 50. (d) 51. (b) 52. (c) 53. (b) 54. (b) 55. (c) 56. (c)
57. (d) 58. (d) 59. (c) 60. (d) 61. (e) 62. (e) 63. (b) 64. (c)
65. (a) 66. (d) 67. (d) 68. (d) 69. (b) 70. (d) 71. (c) 72. (b)
73. (a) 74. (a) 75. (b) 76. (d) 77. (a) 78. (d) 79. (e) 80. (e)
81. (c) 82. (d) 83. (d) 84. (c) 85. (c) 86. (a) 87. (d) 88. (e)
89. (d) 90. (c) 91. (b) 92. (c) 93. (d) 94. (d) 95. (b) 96. (e)
97. (d) 98. (c) 99. (a) 100. (c) 101. (c) 102. (b) 103. (b) 104. (c)
105. (e) 106. (d) 107. (e) 108. (b) 109. (e) 110. (a) 111. (b) 112. (c)
113. (e) 114. (c) 115. (b) 116. (c) 117. (d) 118. (a) 119. (b) 120. (b)
121. (b) 122. (c) 123. (c) 124. (d) 125. (c) 126. (d) 127. (d) 128. (e)
129. (a) 130. (b) 131. (e) 132. (c) 133. (d) 134. (c) 135. (d) 136. (a)
137. (d) 138. (a) 139. (b) 140. (a) 141. (c) 142. (d) 143. (d) 144. (c)
145. (a) 146. (e) 147. (a) 148. (b) 149. (b) 150. (b)

16. HIGHWAY ENGINEERING

1. (e) 2. (d) 3. (c) 4. (c) 5. (d) 6. (c) 7. (d) 8. (a)
9. (e) 10. (b) 11. (a) 12. (a) 13. (a) 14. (b) 15. (b) 16. (b)
17. (b) 18. (a) 19. (b) 20. (d) 21. (d) 22. (d) 23. (c) 24. (e)
25. (a) 26. (d) 27. (c) 28. (b) 29. (c) 30. (b) 31. (b) 32. (c)
33. (b) 34. (e) 35. (a) 36. (d) 37. (d) 38. (c) 39. (c) 40. (a)
41. (e) 42. (c) 43. (c) 44. (b) 45. (c) 46. (b) 47. (d) 48. (c)
49. (b) 50. (d) 51. (d) 52. (d) 53. (d) 54. (b) 55. (e) 56. (b)
57. (c) 58. (c) 59. (d) 60. (c) 61. (c) 62. (b) 63. (e) 64. (a)
65. (e) 66. (d) 67. (d) 68. (c) 69. (c) 70. (c) 71. (a) 72. (d)
73. (e) 74. (d) 75. (d) 76. (a) 77. (a) 78. (c) 79. (b) 80. (a)
81. (b) 82. (c) 83. (c) 84. (a) 85. (c) 86. (c) 87. (d) 88. (b)
89. (c) 90. (b) 91. (d) 92. (d) 93. (c) 94. (d) 95. (c) 96. (c)
97. (d) 98. (c) 99. (b) 100. (e) 101. (c) 102. (b) 103. (a) 104. (e)
105. (b) 106. (c) 107. (e) 108. (b) 109. (d) 110. (b) 111. (e) 112. (c)
113. (d) 114. (a) 115. (b) 116. (c) 117. (b) 118. (b) 119. (e) 120. (d)
121. (d) 122. (c) 123. (d) 124. (d) 125. (a) 126. (b) 127. (c) 128. (a)
129. (b) 130. (d) 131. (d) 132. (b) 133. (c) 134. (e) 135. (a) 136. (a)
137. (e) 138. (d) 139. (b) 140. (a) 141. (d) 142. (e) 143. (d) 144. (b)
145. (b) 146. (b) 147. (c) 148. (d) 149. (d) 150. (d) 151. (b) 152. (b)
153. (c) 154. (b) 155. (d) 156. (a) 157. (a) 158. (c) 159. (c) 160. (c)
161. (a) 162. (b) 163. (b) 164. (a) 165. (c) 166. (d) 167. (b) 168. (c)
169. (d) 170. (c) 171. (c) 172. (d) 173. (c) 174. (e) 175. (c) 176. (c)
177. (d) 178. (d) 179. (c) 180. (d) 181. (c) 182. (d) 183. (b) 184. (b)
185. (a) 186. (c) 187. (d) 188. (e) 189. (b) 190. (c) 191. (d) 192. (a)
193. (b) 194. (d) 195. (c) 196. (d) 197. (b) 198. (a) 199. (c) 200. (e)
201. (d) 202. (d) 203. (e) 204. (a) 205. (d) 206. (b) 207. (c) 208. (e)
209. (c) 210. (c) 211. (c) 212. (d) 213. (a) 214. (b) 215. (d) 216. (a)

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217. (e)	218. (e)	219. (d)	220. (e)	221. (e)	222. (d)	223. (d)	224. (e)
225. (d)	226. (d)	227. (d)	228. (a)	229. (c)	230. (c)	231. (a)	232. (b)
233. (a)	234. (b)	235. (c)	236. (d)	237. (e)	238. (c)	239. (d)	240. (d)
241. (c)	242. (a)	243. (d)	244. (c)	245. (c)	246. (b)	247. (d)	248. (c)
249. (c)	250. (d)	251. (b)	252. (b)	253. (c)	254. (b)	255. (d)	256. (b)
257. (c)	258. (c)	259. (c)	260. (e)	261. (b)	262. (c)	263. (d)	264. (c)
265. (e)	266. (e)	267. (b)	268. (d)	269. (d)	270. (c)	271. (a)	272. (d)
273. (a)	274. (d)	275. (a)	276. (c)	277. (a)	278. (c)	279. (d)	280. (b)
281. (a)	282. (b)	283. (c)	284. (d)	285. (a)	286. (b)	287. (e)	288. (a)
289. (a)	290. (d)	291. (c)	292. (a)	293. (d)	294. (a)	295. (b)	296. (d)
297. (a)	298. (a)	299. (a)	300. (c)	301. (e)	302. (e)	303. (d)	304. (d)
305. (d)	306. (b)	307. (c)	308. (e)	309. (d)	310. (d)	311. (e)	312. (d)
313. (e)	314. (c)	315. (d)	316. (b)	317. (b)	318. (d)	319. (c)	320. (e)
321. (e)	322. (d)	323. (e)	324. (e)	325. (c)	326. (d)	327. (e)	328. (a)
329. (b)	330. (a)	331. (c)	332. (a)	333. (c)	334. (a)	335. (d)	336. (b)
337. (a)	338. (b)	339. (d)	340. (a)	341. (a)	342. (c)	343. (b)	344. (c)
345. (d)	346. (c)	347. (b)	348. (b)	349 (b)	350. (b)	351. (b)	352. (b)
353. (d)	354. (b)	355. (a)	356. (a)	357. (a)	358. (a)	359. (e)	360. (c)
361. (b)	362. (c)	363. (e)	364. (d)	365. (b)	366. (d)	367. (d)	368. (b)
369. (a)	370. (d)	371. (b)	372. (a)	373. (d)			

17. RAILWAYS

1. (d)	2. (e)	3. (a)	4. (c)	5. (d)	6. (a)	7. (c)	8. (b)
9. (a)	10. (a)	11. (c)	12. (e)	13. (c)	14. (e)	15. (d)	16. (c)
17. (d)	18. (b)	19. (e)	20. (c)	21. (a)	22. (c)	23. (d)	24. (c)
25. (b)	26. (c)	27. (d)	28. (d)	29. (b)	30. (a)	31. (c)	32. (b)
33. (d)	34. (c)	35. (d)	36. (c)	37. (c)	38. (d)	39. (c)	40. (c)
41. (b)	42. (d)	43. (b)	44. (b)	45. (e)	46. (b)	47. (d)	48. (e)
49. (e)	50. (d)	51. (d)	52. (d)	53. (c)	54. (a)	55. (c)	56. (c)
57. (a)	58. (b)	59. (e)	60. (c)	61. (b)	62. (b)	63. (a)	64. (c)
65. (b)	66. (c)	67. (c)	68. (d)	69. (d)	70. (e)	71. (b)	72. (c)
73. (b)	74. (c)	75. (c)	76. (a)	77. (e)	78. (d)	79. (c)	80. (e)
81. (c)	82. (a)	83. (c)	84. (a)	85. (d)	86. (d)	87. (c)	88. (b)
89. (a)	90. (b)	91. (d)	92. (c)	93. (a)	94. (a)	95. (c)	96. (a)
97. (c)	98. (b)	99. (b)	100. (d)	101. (d)	102. (a)	103. (c)	104. (e)
105. (c)	106. (d)	107. (a)	108. (a)	109. (b)	110. (e)	111. (c)	112. (d)
113. (c)	114. (c)	115. (d)	116. (a)	117. (c)	118. (d)	119. (c)	120. (b)
121. (c)	122. (d)	123. (e)	124. (a)	125. (a)	126. (d)	127. (d)	128. (c)
129. (d)	130. (d)	131. (a)	132. (d)	133. (b)	134. (c)	135. (c)	136. (c)
137. (a)	138. (a)	139. (b)	140. (d)	141. (d)	142. (b)	143. (d)	144. (b)
145. (d)	146. (b)	147. (a)	148. (b)	149. (e)	150. (b)	151. (a)	152. (a)
153. (c)	154. (d)	155. (a)	156. (c)	157. (c)	158. (c)	159. (c)	160. (b)
161. (a)	162. (c)	163. (a)	164. (b)	165. (d)	166. (c)	167. (a)	168. (b)
169. (c)	170. (b)	171. (a)	172. (a)	173. (a)	174. (a)	175. (c)	176. (c)
177. (e)	178. (c)	179. (d)	180. (d)	181. (b)	182. (a)	183. (c)	184. (c)
185. (c)	186. (d)	187. (b)	188. (a)	189. (a)	190. (a)	191. (a)	192. (c)
193. (a)	194. (c)	195. (b)	196. (b)	197. (d)	198. (b)	199. (d)	200. (b)
201. (a)	202. (a)	203. (c)	204. (b)	205. (a)	206. (c)	207. (b)	208. (d)
209. (a)	210. (a)	211. (e)	212. (c)	213. (a)	214. (c)	215. (e)	216. (c)
217. (a)							

18. AIR PORT ENGINEERING

1. (c)	2. (d)	3. (e)	4. (c)	5. (d)	6. (e)	7. (c)	8. (d)
9. (a)	10. (d)	11. (a)	12. (d)	13. (a)	14. (c)	15. (d)	16. (d)
17. (b)	18. (e)	19. (e)	20. (e)	21. (e)	22. (d)	23. (b)	24. (d)
25. (b)	26. (c)	27. (e)	28. (a)	29. (c)	30. (d)	31. (e)	32. (a)

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33. (d) 34. (e) 35. (d) 36. (b) 37. (a) 38. (d) 39. (d) 40. (e)
41. (c) 42. (e) 43. (e) 44. (d) 45. (e) 46. (b) 47. (c) 48. (b)
49. (d) 50. (d) 51. (a) 52. (b) 53. (d) 54. (a) 55. (d) 56. (c)
57. (c) 58. (e) 59. (a) 60. (e) 61. (a) 62. (e) 63. (c) 64. (e)
65. (a)

19. PERT& CPM

1. (c) 2. (a) 3. (b) 4. (a) 5. (c) 6. (c) 7. (e) 8. (e)
9. (e) 10. (d) 11. (d) 12. (b) 13. (e) 14. (e) 15. (e) 16. (e)
17. (a) 18. (e) 19. (d) 20. (c) 21. (e) 22. (a) 23. (e) 24. (d)
25. (a) 26. (b) 27. (a) 28. (b) 29. (b) 30. (a) 31. (b) 32. (d)
33. (d) 34. (a) 35. (a) 36. (a) 37. (d) 38. (e) 39. (e) 40. (c)
41. (d) 42. (e) 43. (d) 44. (c) 45. (d) 46. (c) 47. (e) 48. (b)
49. (d) 50. (c) 51. (c) 52. (a) 53. (e) 54. (a) 55. (c) 56. (b)
57. (c) 58. (e) 59. (e) 60. (d) 61. (c) 62. (b) 63. (d) 64. (e)
65. (c) 66. (d) 67. (b) 68. (e) 69. (d) 70. (d) 71. (c) 72. (b)
73. (e) 74. (c) 75. (e) 76. (e) 77. (e) 78. (a) 79. (c) 80. (e)
81. (e) 82. (e) 83. (d) 84. (c) 85. (b) 86. (e) 87. (a) 88. (d)
89. (c) 90. (b) 91. (b) 92. (e) 93. (b) 94. (e) 95. (d) 96. (c)
97. (a) 98. (d) 99. (d) 100. (e) 101. (e) 102. (e) 103. (e) 104. (a)
105. (e) 106. (d) 107. (a) 108. (d) 109. (c) 110. (c) 111. (c) 112. (c)
113. (c) 114. (b) 115. (d) 116. (d)

20. S.I. UNITS

1. (c) 2. (c) 3. (e) 4. (e) 5. (b) 6. (a) 7. (b) 8. (c)
9. (b) 10. (d) 11. (e) 12. (a) 13. (b) 14. (c) 15. (c) 16. (d)
17. (e) 18. (d) 19. (a) 20. (d) 21. (c) 22. (b) 23. (d) 24. (b)
25. (c) 26. (e) 27. (b) 28. (e) 29. (b) 30. (b) 31. (a) 32. (b)
33. (e) 34. (d) 35. (b)

21. THEORY OF STRUCTURES

1. (d) 2. (d) 3. (a) 4. (b) 5. (c) 6. (c) 7. (a) 8. (a)
9. (c) 10. (d) 11. (c) 12. (d) 13. (a) 14. (c) 15. (a) 16. (c)
17. (e) 18. (c) 19. (d) 20. (e) 21. (c) 22. (a) 23. (c) 24. (b)
25. (c) 26. (a) 27. (c) 28. (d) 29. (d) 30. (d) 31. (d) 32. (e)
33. (e) 34. (b) 35. (a) 36. (c) 37. (d) 38. (e) 39. (d) 40. (d)
41. (c) 42. (c) 43. (d) 44. (a) 45. (e) 46. (a) 47. (a) 48. (e)
49. (e) 50. (c) 51. (d) 52. (b) 53. (c) 54. (b) 55. (e) 56. (c)
57. (d) 58. (b) 59. (c) 60. (c) 61. (d) 62. (c) 63. (c) 64. (c)
65. (e) 66. (e) 67. (a) 68. (b) 69. (c) 70. (b) 71. (d) 72. (b)
73. (e) 74. (c) 75. (c) 76. (d) 77. (b) 78. (e) 79. (c) 80. (c)
81. (a) 82. (d) 83. (d) 84. (c) 85. (b) 86. (d) 87. (e) 88. (d)
89. (d) 90. (d) 91. (e) 92. (c) 93. (c) 94. (c) 95. (b) 96. (a)
97. (b) 98. (d) 99. (d) 100. (c) 101. (c) 102. (a) 103. (c) 104. (d)
105. (c) 106. (b) 107. (c) 108. (e) 109. (d) 110. (c) 111. (c) 112. (c)
113. (b) 114. (c) 115. (c) 116. (c) 117. (d) 118. (d) 119. (a) 120. (c)
121. (a) 122. (c) 123. (c) 124. (e) 125. (c) 126. (e) 127. (d) 128. (a)
129. (b) 130. (c) 131. (e) 132. (a) 133. (a) 134. (c) 135. (e) 136. (e)
137. (e) 138. (a) 139. (c) 140. (d) 141. (d) 142. (d) 143. (c) 144. (c)
145. (c) 146. (d) 147. (d) 148. (b) 149. (a) 150. (c) 151. (a) 152. (c)
153. (b) 154. (d) 155. (d) 156. (a) 157. (b) 158. (d) 159. (d) 160. (d)
161. (c) 162. (b) 163. (a) 164. (d) 165. (d) 166. (e) 167. (c) 168. (d)
169. (d) 170. (e) 171. (d) 172. (c) 173. (d) 174. (b) 175. (d) 176. (e)
177. (c) 178. (d) 179. (d) 180. (a) 181. (b) 182. (c) 183. (c) 184. (e)
185. (b) 186. (d) 187. (d) 188. (a) 189. (a) 190. (a)

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22. STRUCTURAL DESIGN SPECIFICATIONS

1. (c)	2. (c)	3. (c)	4. (c)	5. (e)	6. (a)	7. (d)	8. (a)
9. (d)	10. (d)	11. (c)	12. (d)	13. (d)	14. (d)	15. (a)	16. (e)
17. (d)	18. (b)	19. (d)	20. (c)	21. (c)	22. (c)	23. (d)	24. (e)
25. (a)	26. (c)	27. (e)	28. (b)	29. (c)	30. (b)	31. (c)	32. (b)
33. (b)	34. (a)	35. (d)	36. (d)	37. (c)	38. (c)	39. (d)	40. (d)
41. (e)	42. (c)	43. (c)	44. (e)	45. (d)	46. (c)	47. (c)	48. (c)
49. (c)	50. (d)	51. (c)	52. (c)	53. (a)	54. (a)	55. (d)	56. (e)
57. (c)	58. (d)	59. (e)	60. (d)	61. (d)	62. (b)	63. (e)	64. (d)
65. (d)	66. (c)	67. (e)	68. (d)	69. (e)	70. (c)	71. (c)	72. (d)
73. (b)	74. (d)	75. (c)	76. (d)	77. (c)	78. (e)	79. (d)	80. (e)
81. (d)	82. (b)	83. (a)	84. (b)	85. (a)	86. (d)	87. (c)	88. (d)
89. (c)	90. (d)	91. (b)	92. (a)	93. (d)	94. (d)	95. (c)	96. (a)
97. (b)	98. (a)	99. (c)	100. (c)	101. (c)	102. (b)	103. (d)	104. (d)
105. (d)	106. (c)	107. (c)	108. (a)	109. (c)	110. (e)	111. (a)	112. (d)
113. (e)	114. (c)	115. (a)	116. (c)	117. (d)	118. (e)	119. (d)	120. (e)
121. (a)	122. (b)	123. (c)	124. (c)	125. (c)	126. (a)	127. (e)	128. (d)
129. (d)	130. (e)	131. (d)	132. (d)	133. (c)	134. (e)	135. (c)	136. (a)
137. (c)	138. (e)	139. (d)	140. (e)	141. (d)	142. (c)	143. (e)	144. (c)
145. (e)	146. (e)	147. (d)	148. (d)	149. (c)	150. (b)		

23. ESTIMATING AND COSTING

1. (a)	2. (e)	3. (d)	4. (e)	5. (e)	6. (e)	7. (d)	8. (e)
9. (e)	10. (c)	11. (e)	12. (e)	13. (c)	14. (a)	15. (e)	16. (d)
17. (d)	18. (e)	19. (d)	20. (e)	21. (d)	22. (a)	23. (a)	24. (d)
25. (e)	26. (d)	27. (d)	28. (e)	29. (b)	30. (d)	31. (e)	32. (d)
33. (b)	34. (d)	35. (b)	36. (e)	37. (b)	38. (d)	39. (d)	40. (d)
41. (c)	42. (c)	43. (e)	44. (e)	45. (e)	46. (d)	47. (e)	48. (c)
49. (a)	50. (d)	51. (d)	52. (c)	53. (b)	54. (b)	55. (e)	56. (e)
57. (e)	58. (d)	59. (c)	60. (c)	61. (b)	62. (a)	63. (c)	64. (b)
65. (d)	66. (d)	67. (e)	68. (b)	69. (d)	70. (f)	71. (d)	72. (b)
73. (c)	74. (b)	75. (b)	76. (a)	77. (a)	78. (e)	79. (c)	80. (d)
81. (d)	82. (b)	83. (c)	84. (a)	85. (c)	86. (e)	87. (d)	88. (d)
89. (d)	90. (e)	91. (e)	92. (c)	93. (b)	94. (e)	95. (e)	96. (e)
97. (c)	98. (b)						

24. TUNNELLING

1. (e)	2. (c)	3. (b)	4. (b)	5. (c)	6. (e)	7. (a)	8. (e)
9. (e)	10. (a)	11. (c)	12. (c)	13. (c)	14. (c)	15. (e)	16. (b)
17. (d)	18. (d)	19. (b)	20. (c)	21. (a)	22. (a)	23. (e)	24. (a)
25. (e)	26. (d)	27. (e)	28. (c)	29. (d)	30. (d)	31. (e)	32. (a)
33. (c)	34. (b)	35. (c)	36. (b)	37. (e)	38. (d)	39. (d)	40. (a)
41. (d)	42. (d)	43. (e)	44. (d)	45. (e)	46. (b)	47. (f)	48. (a)

25. DOCKS AND HARBOURS

1. (d)	2. (d)	3. (a)	4. (b)	5. (c)	6. (a)	7. (c)	8. (d)
9. (c)	10. (a)	11. (d)	12. (c)	13. (d)	14. (b)	15. (e)	16. (b)
17. (e)	18. (d)	19. (c)	20. (d)	21. (d)	22. (c)	23. (d)	24. (b)
25. (b)	26. (e)	27. (e)	28. (d)	29. (a)	30. (d)	31. (e)	32. (e)
33. (d)	34. (d)	35. (d)	36. (d)	37. (d)	38. (c)	39. (d)	40. (e)
41. (d)	42. (e)	43. (c)	44. (c)	45. (c)	46. (e)	47. (e)	48. (e)
49. (a)	50. (b)	51. (a)	52. (b)	53. (c)	54. (d)	55. (d)	56. (d)
57. (e)	58. (b)	59. (e)	60. (e)	61. (d)	62. (e)	63. (a)	64. (a)
65. (d)	66. (c)	67. (d)	68. (a)	69. (d)	70. (c)		

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