Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** Year Odd Semester Examination, 2017

CE- 3111

Structural Analysis & Design - I

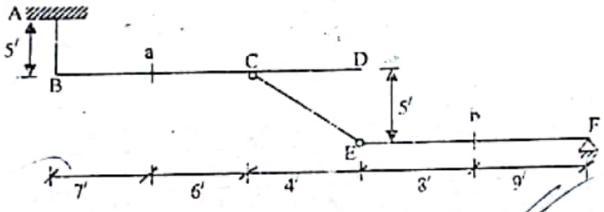
Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

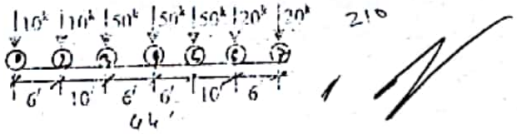
Q.1 (a) Define influence line. 1.50

(b) Draw influence line diagrams for V_a, V_b, M_a and M_b due to a unit load moves from B to D and E to F for the following structure shown below. 10.5

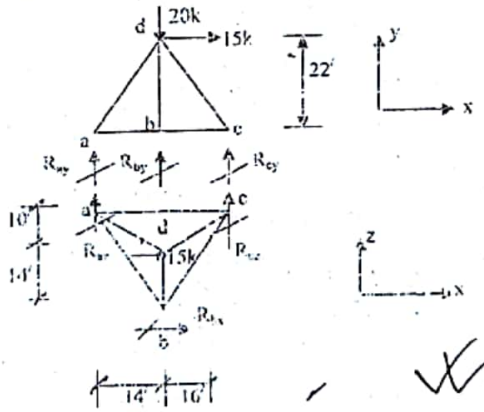


Q.2 (a) Deduce a criteria to obtain the position of wheel loads for the maximum shear at a section of simple supported beam. 3.00

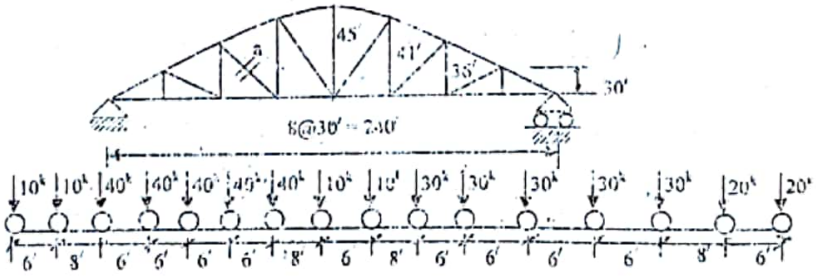
(b) For a simple span of 80 ft, calculate (i) the maximum moment at mid-span, and (ii) the absolute maximum moment due to the loading shown in figure below. 9.00



Q.3 Determine the reactions and bar forces of the space truss shown in figure below. 12.0

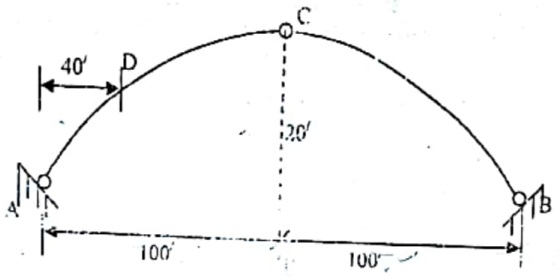


Q.4 Apply appropriate criteria to obtain the maximum tensile and compressive stress in a member 'a' due to the moving loads shown in figure below. 12.0

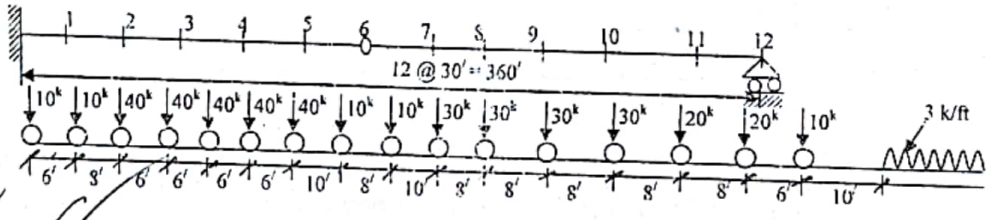


SECTION-B

Q.5 Draw influence lines for bending moment, shear force, and normal thrust at a section D of the following three hinged parabolic arch. Also obtain the maximum moment and shear at section D due H_{20} loading. 12.00

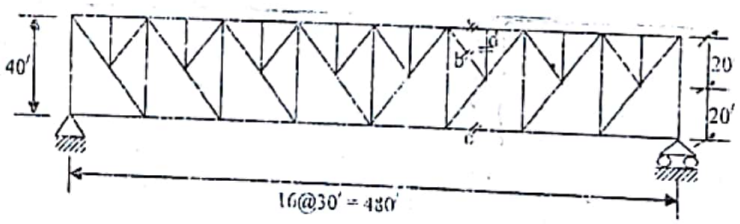


Q.6 Apply appropriate criteria to determine the position of moving loads and hence compute the maximum shear in the panel 4-5 and the maximum moment at the panel point 3. 12.00

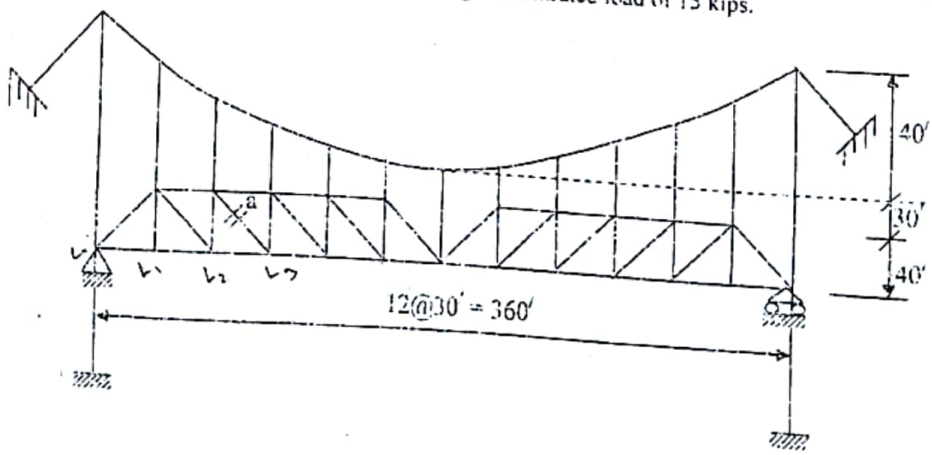


Q.7(a) Deduce the criteria for maximum stress in the upper chord of truss without vertical. 3.00

(b) Calculate the maximum stress in the member a, b, c and d of the following truss due to H_{15} loading. 9.00



Q.8 Draw influence lines for hanger tension, maximum cable tension and stress in the member 'a' of the following suspension bridge shown in figure. Find the maximum stress in the member 'a' if the bridge is subjected to a uniform load of 6 k/ft and a moving concentrated load of 15 kips. 12.00



Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering THIRD Year ODD Examination, 2017

CE 3121

Engineering Hydraulics

Full Marks: 72 **Time: 3 Hours**

N.B.- (i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) "The flow in most of the open channel is controlled by gravity effect" Explain. 3.00
(b) Classify the following open channel flow situations: 3.00
(i) Flow below a sluice gate, (ii) Flow from a main irrigation canal, (iii) Flow in a sewer.
(c) Distinguish between canal, chute and flume. Velocity distribution in a semi-circular channel of diameter $2R_o$ 6.00 follows the law of $\frac{u}{u_o} = \left(\frac{y}{R_o}\right)^{1/2}$ in which y is the distance normal to the surface at which the velocity is u and U_o is the velocity at centre of the semi-circle if $R_o = 2$ m and $U_o = 2$ m/sec, find U, α and β. Where U, α and β indicate usual meaning.

Q.2 (a) Write different conditions for critical state of flow. Draw a specific gravity curve and show the following: (i) 3.00 critical depth, (ii) alternate depth, (iii) sub-critical and super critical region.
(b) Show that at critical state of flow discharge is a maximum for a given specific energy. 3.00
(c) Applying the momentum principle and the continuity equation to the analysis of a submerged hydraulic jump 6.00 which occurs at the sluice outlet in a rectangular channel. Prove that $\frac{y_3}{y_2} = \sqrt{1 + 2F_2^2\left(1 - \frac{y_2}{y_3}\right)}$ where y_3 is the submerged depth, y_1 is height of sluice gate opening and y_2 is the tail water depth. $F_2^2 = q^2/gy_2^3$. q is the discharge per unit width of the channel.

Q.3 (a) Uniform flow cannot occur (i) in a frictionless channel (ii) in a horizontal channel. Explain why? 3.00
(b) What are the factors affecting Manning's roughness co-efficient? Discuss briefly. 4.00
(c) A low dam 5 ft high having a board horizontal crest built with a rectangular channel 20 ft wide. Assuming that a depth 5.00 of 2.5 ft measured on the crest is the critical depth. Compute the discharge and depth of flow upstream from the dam.

Q.4 (a) Prove that the maximum discharge in a circular channel section is 0.95 times the diameter of the channel. 4.00
(b) Show that best hydraulic trapezoidal is one half of a hexagon. 3.00
(c) Design a canal to carry 50 m^3/sec of clear water through 3.0 mm gravel. (Angle of repose = 31°) on a slope 5.00 of 10^{-4}. The canal is to be trapezoidal in shape having side slope of 2H:1V. The average temperature = 20° C. $\nu = 10^{-6}$ m^2/sec. Given $\tau_c = 0.0485$. Use the Shield's method of analysis.

SECTION B

Q.5 (a) What do you mean by hydraulic jump and hydraulic drop? Explain how the hydraulic jumps are formed. 3.00
(b) Explain different types of hydraulic jumps depending upon the value of Froude number of the incoming flow. 3.00
(c) Sketch the possible flow profiles for the following and mention the type of profiles. (i) Profile after the change 6.00 in bottom slope from steep to mild, (ii) Profile in a canal joining two reservoirs (iii) Profile formed on the downstream side of an enlargement channel section.

Q.6 (a) What do you mean by impact of jet? Derive the equation for the force exerted by fluid jet on stationary flat 4.00 plate when plate is inclined at an angle θ to the jet.
(b) A jet of water moving with a velocity of 12 m/s impringes on concave shaped vanes to deflect the jet through 120° 6.00 when stationary. If the vane is moving with a velocity of 5 m/s, find the angle of jet so that there is no shock at inlet. What is the absolute velocity of the jet at exit both in magnitude and direction? Assume the vane to be symmetrical.

Q.7 (a) What do you understand by the tern "multistage pump"? Explain clearly the difference between a single 2.00 stage and a multistage centrifugal pump.
(b) From the first principles and writing down all steps of calculation, show that theoretical pressure rise through 3.00 the impeller of a centrifugal pump is given by $(V_f^2 + u_1^2 - V_{f1}^2 \operatorname{cosec}^2\varphi)/2g$ where, V_f = velocity of flow at inlet, V_{f1} = velocity of flow at outlet, u_1 = peripheral velocity of impeller at outlet and impeller angle at outlet = φ.
(c) A centrifugal pump has following characteristics: outer diameter of impeller = 800 mm, width of impeller vanes at 4.00 outlet = 100 mm, angle of impeller vanes at outlet = 40°. The impeller runs at 550 rpm and delivers 0.98 m^3/sec under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially at in inlet.

Q.8 (a) Draw a neat sketch of a reciprocating pump. Why is it called a positive displacement pump? 4.00
(b) What is an air vessel? Explain the function of air vessel in reciprocating pump. 3.00
(c) A single acting reciprocating pump, running at 60 rpm has a plunger diameter of 250 mm and a stroke of 500 5.00 mm. The delivery pipe is 100 mm diameter and 50 m long. If the motion of the pump is simple harmonic, find the power required to overcome friction of delivery pipe when: (a) no air vessel is fitted, (b) a large air vessel is fitted at the centre line of the pump.

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering **THIRD** Year **ODD** Semester Examination, 2017

CE 3131
Geotechnical Engineering-I

Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Explain why soils are compacted in the field. How is the degree of compaction ensured in the field? 3.00

(b) Listing the various factors that influence the compaction of soil, show their influence with illustrative sketches of compaction curves. 4.00

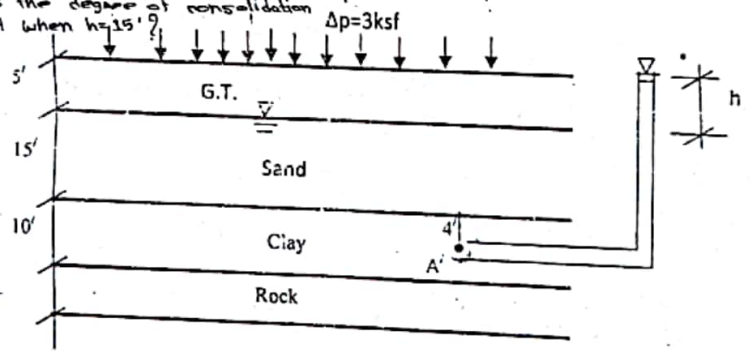
(c) A soil in the borrow pit has a water content of 11.7% and the dry density of 16.65 kN/m^3. If 2070 m^3 of soil is excavated from it and compacted in an embankment at a porosity of 0.33, calculate the compacted volume of the embankment that can be constructed out of this volume of soil. 5.00

Q.2 (a) Define the terms 'Compression Index', 'coefficient of consolidation', and 'coefficient of compressibility', and indicate their units and symbols. 3.00

(b) Define preconsolidation pressure. In what ways in its determination important in soil engineering practice? 4.00

(c) The soil profile and loading condition are given in the following figure. 5.00

1. How high will the water rise in the piezometer?
2. What is the degree of consolidation at point A when h=15'?



Q.3 (a) Show that at full saturation the moisture content is $w_{sat} = \dfrac{n\gamma_w}{\gamma_{sat} - n\gamma_w}$ 4.00

(b) Define soil texture and soil structure. What are the various terms used to describe these properties of the soil? 3.00

(c) A soil sample has a unit weight of 105 pcf and a saturation of 50% when its saturation is increased to 75%, its unit weight raises to 112.7 pcf. Determine the void ratio and the specific gravity of this soil. 5.00

Q.4 (a) Explain the Mohr-Coulomb strength envelope. 3.00

(b) What are the three standard triaxial shear tests with respect to drainage conditions? Explain with reasons the situation for which each test is to be preferred. 4.00

(c) For a clean sand, Prove that $\theta = 45^0 + \varphi/2$ using Mohr's circle. A failure test on this sand shows that σ_1=11.5 ksf and σ_3=3.2 ksf at failure. Find the angle φ for this sand. 5.00

SECTION B

Q.5 (a) State and explain Darcy's law, Prove that discharge velocity is proportional to seepage velocity. 4.00

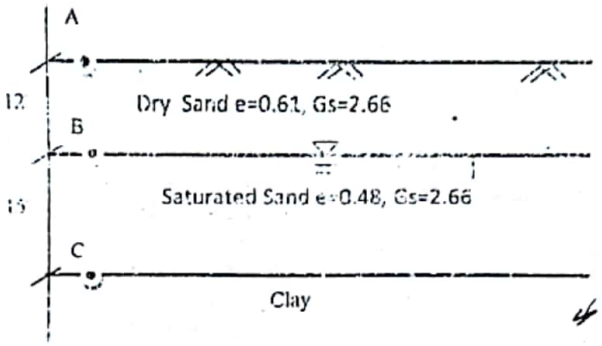
(b) Briefly explain any one method of field permeability measurement. 4.00

(c) Find the capilary rise of water into clean glass tube of 1 mm diameter. Where the surface tension per unit length of perimeter is 75dynes/cm and assume for clean glass tube and water, $\alpha = 0$. 4.00

Q.6(a) What is particle size distribution curve? Write the uses of it. Also draw the qualitative diagram of it and show the D_{10} on the curve. 4.0

(b) Define plasticity chart. How can you ascertain whether the soil is organic or inorganic from this chart? Explain with sketch. 4.00

(c) A soil profile is shown in figure below. (i) Calculate the total pressure, pore water pressure and effective stress at points A, B, and C. (ii) How high should the groundwater table rise so that the effective stress at C is 2000lb/ft^2? Assume γ_{sa} same for both layers. 4.00



Q.7(a) Define consolidation and distinguish between true's degree of consolidation and average degree of consolidation. 3.00

(b) Derive the basic differential equation of Tarzaghis consolidation theory with assumptions. 4.00

(c) A clay layer in the field is 15 ft thick and is drained at the top only. Under a given surcharge, the estimated consolidation settlement is 10 inch. 5.00

(i) What is the average degree of consolidation for the clay when the settlement is 3 inch.

(ii) If the average value of C_v for the pressure range is 0.0005 in /sec, how long will it take place for 50% consolidation to occur?

(iii) If the 15 ft clay layer is drained on both sides, how long will it take place for 50% consolidation to occur ? Assume time factor is 0.197 for 50% consolidation.

Q.8(a) Define flow nets? Write the properties and applications of flow nets. 4.00

(b) Define the soils consistency limits. 3.00

(c) The plastic limit of a soil is 25% and its plasticity index is 8%. When the soil is dried from its state at plastic limit, the volume change is 25% of its volume at plastic limit. Similarly, the corresponding volume change from the liquid limit to dry state is 34% of its volume at liquid limit. Determine the shrinkage limit and the shrinkage ratio. 5.00

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RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering THIRD Year ODD Examination, 2017

CE 3115

Reinforced Concrete - I

Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
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(iv) Assume reasonable value for any data missing.

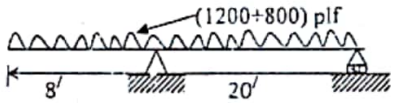
SECTION-A

Q.1 (a) What is a transformed RC section? Explain with reference to cracked and uncracked section. 3.00

(b) A rectangular beam has the following properties: b = 12 inch, h = 20 inch, d = 17.5 inch. The beam is reinforced with 3#8 bars. If f'_c = 4000 psi, f_y = 60,000 psi, (modulus of rupture = 4000 psi) calculate (i) cracking moment of the section and moment on whether the beam has cracked or not for a 30 k-ft imposed moment, (ii) the stresses in steel and concrete when the section is subjected to a moment of 40 k-ft. (iii) the nominal moment capacity. 9.00

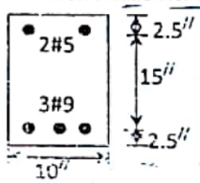
Q.2 (a) Write the sources of uncertainty in the analysis, design and construction of reinforced concrete structures. 3.00

(b) Design the overhanging beam shown in figure to support a live load of 1200 plf and a dead load of 800 plf including its self weight using f'_c = 3000 psi, f_y = 50,000 psi. 9.00



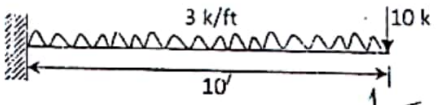
Q.3 (a) What is the balanced steel ratio ρ_b? Why does the ACI code recommend a maximum steel ratio less than ρ_b? 3.00

(b) Compute the stress in the compression steel and ultimate moment for the beam section shown in figure below. f'_c = 5000 psi, f_y = 60,000 psi. 9.00



Q.4 (a) Show with neat sketches the following cracks in RC beam and slab. (i)Shear crack, (ii) Flexural cracks. (iii) Bond cracks. 3.00

(b) Design the cantilever beam shown in figure below for shear. Assume b = 10 inch, h = 20 inch, d = 17.5 inch, f'_c = 3 ksi, ρ = 1.5% and f_y = 50 ksi. Follow USD method. Draw longitudinal and cross section of the beam 9.00



SECTION B

Q.5 (a) Derive an expression for flexural bond stress. 3.00

(b) Design a continuous one-way slab for a clear span of 17 ft to support a live load of 100 psf. Use f'_c = 3000 psi, f_y = 60,000 psi. Assume the beam width 12 inch. 9.00

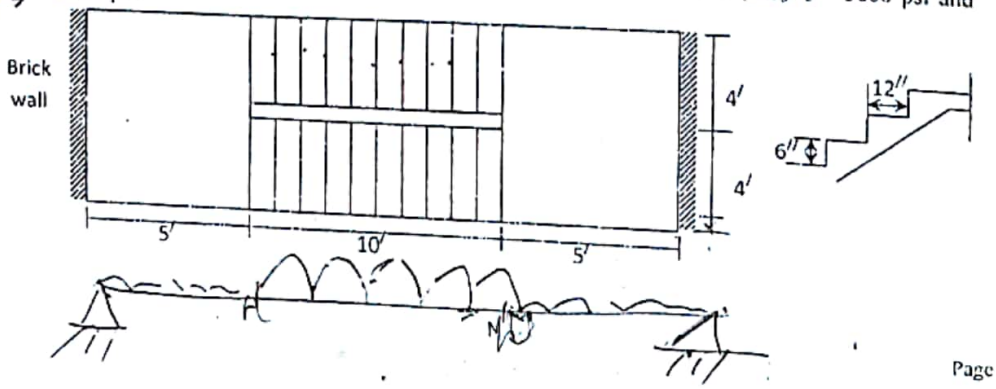
Q.6 (a) Mention the differences and advantages of designing beams as T-beams compared to rectangular beams. 3.00

(b) The T-beam and slab system of a building are made of beams spaced at 8 ft with an effective span of 25 ft. For the beam h_f = 4.5 inch, b_w = 12 inch and h = 23 inch. The slab is subjected to a live load of 180 psf. Design the beam if f'_c = 3000 psi and f_y = 50,000 psi. 9.00

Q.7 (a) Explain the term bond. Derive an expression for spacing of vertical stirrup. 3.00

(b) Design a beam on a 20 ft simple span to support a DL = 1 k/ft and LL = 1.8 k/ft. Assume the section to be 12 × 16 inch, f'_c = 4000 psi, and f_y = 60,000 psi. 9.00

Q.8 Design the stair shown in figure below by WSD method if live load = 100 psf, f'_c = 3000 psi and f_s = 20,000 psi. 12.00



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CE 140022

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering THIRD Year ODD Examination, 2017

CE 3141

Environmental Engineering - I

Full Marks: 72 **Time: 3 Hours**

N.B.:-
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

MNB

SECTION-A

Q.1 (a) What is intake? Write down the considerations for design of an intake. 4.00
(b) Write down the desirable quality of pressure pipes in water supply system. 4.00
(c) Explain the causes of corrosion of metal pressure pipes. 4.00

Q.2 (a) Discuss the various forces acting on pipes for water supply. 4.00
(b) Write down the principle of particle settling in water. Discuss the different types of settling in plain sedimentation process. 4.00
(c) A settling tank is designed to remove spherical particles of 0.80 mm diameter with specific gravity 1.20 from the at 22°C. Determine the removal of spherical discrete particles of 0.40 mm diameter with specific gravity 1.2 by this tank. Assume ideal settling conditions. 4.00

Q.3 (a) Write down the principle of coagulation. Also write down the factors influencing coagulation and dosage of coagulants. 5.00
(b) What is pressure filter? Write down the advantages and disadvantages of pressure filter. 3.00
(c) Compare the contact times necessary to obtain 99.99% kill of bacteria in water under the following conditions: (i) Free chlorine residual of 0.15 mg/l and $k = 1.1\times10^{-4}$ per second. (ii) Combined chlorine residual of 2 mg/l with $k = 1.2\times10^{-5}$ per second. 4.00

Q.4 (a) Briefly discuss the various methods for the removal of Manganese from water. 4.50
(b) What is the difference between unaccounted-for water and non-revenue water? 3.00
(c) Write down the controlling measures of water losses. 4.50

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SECTION B

Q.5 (a) What is environmental engineering? Discuss the objectives of sanitation. 3.00
(b) Enumerates and explain briefly the essential elements of a water supply system for a city with the help of neat sketches. 5.00
(c) Enumerate the factors to be considered in planning a municipal water supply system. 4.00

Q.6 (a) What are the problems encountered in the operation and maintenance of PSF? 3.50
(b) Discuss the usefulness of SST and VSST under conditions in the coastal area of Bangladesh. 4.50
(c) Design a strainer for 38 mm diameter tubewell to be operated by a No. 6 handpump at the rate of 50 lpm slot no. 10 strainer having a 45% open area to be used. The entrance velocity should be around 0.01 m/sec. 4.00

Q.7 (a) Write short notes on (i) Infiltration galleries (ii) Springs (iii) Artesian wells. 4.50
(b) Deduce mathematic expressions for yield of artesian as well as ordinary wells. 3.00
(c) A 150 mm diameter tubewell produces 100 lps with a drawdown of 3 m and a circle of influence of 120 m in diameter. The static depth of water in the well is 40 m. Calculate the coefficient of permeability of the aquifer in which the tubewell is sunk. 4.50

Q.8 (a) Explain the problems in groundwater development in Bangladesh. 4.00
(b) What is the potential for rainwater harvesting in Bangladesh? What are the advantages and disadvantages of rainwater harvesting in Bangladesh? 4.00
(c) Calculate the rainwater available for a family having a roof area of 20 m^2 in the central region of Bangladesh, where rainfall intensity is 2.0 m per year. Assume a runoff coefficient of 0.75. 4.00
