

CE 3233
Geotechnical Engineering - II

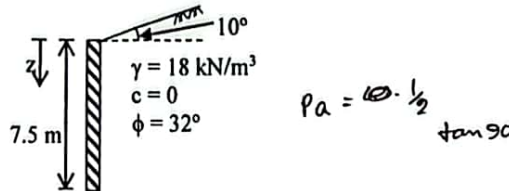
Full Marks: 72

Time: 3 Hours

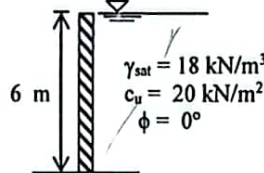
- N.B.:- (i) Answer any SIX questions, taking THREE from each section.
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SECTION-A

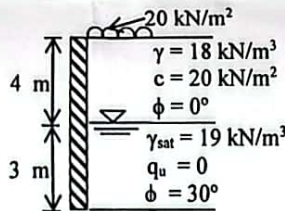
- Q.1 (a) Write short notes on: (i) Active earth pressure (ii) Passive earth pressure, and (iii) Earth pressure at rest 3.00
 (b) Derive the expression for critical unsupported height of a clayey backfill. 4.00
 (c) A retaining wall is shown in figure below. Calculate: (i) intensity of Rankine's active force at $z = 2, 4, 6$ and 7.5 m; (ii) Rankine's active earth force per meter of wall and also the location and direction of the resultant. 5.00



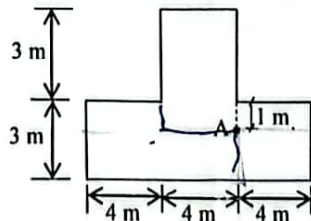
- Q.2 (a) Derive an expression for active earth pressure in a dry backfill with an inclined ground surface. 4.00
 (b) A retaining wall is shown in figure below. Compute: (i) the maximum depth of tensile crack (ii) the active force before the tensile crack and (iii) the active force after the tensile crack. 4.00



- (c) A retaining wall with the soil profile is shown in figure below. Determine the pressure on the wall if it is pushed towards the backfill. 4.00

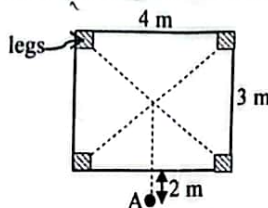


- Q.3 (a) Derive Boussinesq's equation for vertical stress at a point due to a load on the surface of an elastic media. 4.00
 (b) What do you understand by pressure bulb? Illustrate with sketches. 4.00
 (c) The plan of a foundation is shown in figure below. The uniform pressure on the soil is 45 kN/m^2 . Determine the vertical stress increment due to the foundation at a depth of 4 m below the point A. Use Newmark's solution. 4.00



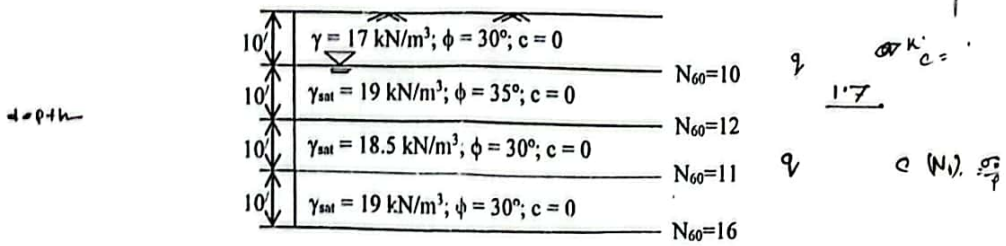
$$\frac{m n}{1 + m n} \times \frac{f + \frac{m n}{1 + m n}}{f + m n} + \sin^2 \left(\frac{m n}{1 + m n} \right)$$

- Q.4 (a) Describe the methods of computing the stress at a point below the corner of a rectangular load. 3.00
 (b) Draw the vertical stress distribution on a horizontal plane due to point load. The horizontal plane is located at 4 m below the ground surface and the value of point load is 100 kN . 4.00
 (c) The base of a tower is shown in figure below. The total load of the tower is 1000 kN , which is equally carried by the four legs. Compute the increase in the vertical stress in the soil caused at a point 5 m below each leg. Also compute the stress at a point A due to the tower at the same depth. 5.00

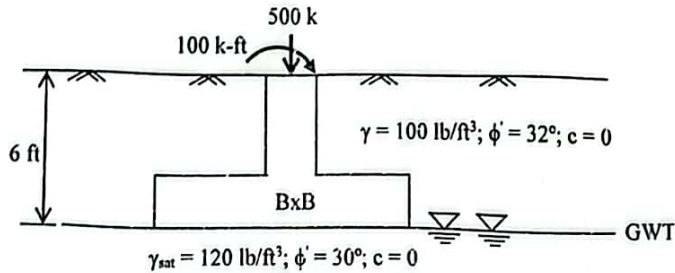


SECTION-B

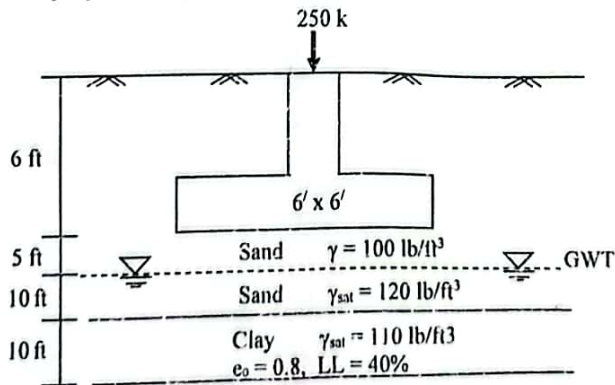
- Q.5 (a) What do you understand by site investigation? What are the different purposes for which site investigation are done? 4.00
- (b) Describe the split-spoon sampler. What is its use? Draw a typical cross-section of split-spoon sampler. 4.00
- (c) The soil profile is shown in figure below. Compute the corrected SPT value using Skempton's relationship. 4.00
The soil is overconsolidated coarse sand.



- Q.6 (a) What do you understand by disturbed and undisturbed soil samples? How do you obtain undisturbed soil sample from field? 4.00
- (b) How will you modify the bearing capacity equation for various locations of GWT? 2.00
- (c) A square footing is shown in figure below. Use FS = 3, and determine the size of the footing. 6.00



- Q.7 (a) Differentiate between finite and infinite slopes. 2.00
- (b) How do you find the factor of safety of a finite slope using Bishop's method of slices? 5.00
- (c) Differentiate between rigid footing and flexible footing. 2.00
- (d) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00
- Q.8 (a) What are the different types of settlement occur below a foundation? Explain each of them. 3.00
- (b) What are the causes of differential settlement of foundation? Mention the allowable settlement values of various structures. 3.00
- (c) Calculate the primary and secondary consolidation settlement of the foundation as shown in figure below. 6.00
The clay is normally consolidated. Use the weighted average method to calculate the average increase of effective pressure in the clay layer. Use $C_a = 0.0004$ and $t_2/t_1 = 10000$.



CE 3205
Transportation 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) Briefly discuss, how the following factors affect the road safety: 6.00
 (i) Driver's fatigue, (ii) Driver's impatience and (iii) Driver's home worries mind
- (b) Discuss some well-known traffic management measures. 4.00
- Q.2 (a) Calculate the running speed, when travel distance = 90 km, travel time = 70 minutes and delay = 15 minutes. 2.00
- Q.2 (b) Write short notes on: 4.50
 (i) Design hourly volume, (ii) Channelized intersection, and (iii) Collision diagram.
- (b) Design a lighting system, having given the following data: (i) Mounting height = 9 m (ii) Lamp size = 7500 lumens, and (iii) Coefficient of utilization = 0.44 for ratio of 2. Find the spacing required between lighting units to provide an average lux of 5.0. 3.50
- (c) List the common type of (i) Traffic Signs (ii) Parking System 2.50
- (d) Calculate the traffic density, when traffic volume = 400 vehicles/hr and traffic speed = 50 km/hr. 1.50
- Q.3 (a) Point out some safety measures for regulating the safe movement of (i) Motor cyclists & (ii) Pedestrians. 5.00
- (b) Illustrate the grade separated road intersection. Draw a neat sketch of a full clover leaf intersection with flow. 4.00
- (c) List the desirable properties of aggregates and bitumen for road construction. 1.50
- (d) Calculate the theoretical maximum capacity for a traffic lane at design speed of 80 km/hr. 1.50
- Q.4 (a) Explain the rules to determine the upper and lower values of speed limits for regulation of mixed traffic. 2.00
- (b) An isolated signal with pedestrian indications is to be installed at right-angled intersection with Road-1 of 18 m wide and Road-2 of 12 m wide. The peak hourly volume for each lane of Road-1 and Road-2 are 275 PCU and 225 PCU, respectively. The approach speeds are 55 kmph and 40 kmph for Road-1 and Road-2, respectively. Design the timings of traffic and pedestrian signals on the basis of 'Pedestrian Crossing Time'. 7.00
- (c) Briefly discuss the major three detrimental effects of traffic on our surroundings. 3.00

SECTION-B

- Q.5 (a) Write short notes on: (i) Traffic, (ii) Transport, (iii) Transportation, and (iv) Road user. 4.00
- (b) What are the different elements of transport? Discuss them briefly. 4.00
- (c) Explain the necessity and objects of highway planning. 4.00
- Q.6 (a) Explain with sketches the various factors controlling the alignment of roads. 4.00
- (b) What are the factors on which the geometric design of highway depend? Explain briefly. 4.00
- (c) Calculate the minimum sight distance required to avoid a head-on collision of two cars approaching from the opposite directions at 80 and 70 kmph. Assume a reaction time of 2.5 seconds, coefficient of frictions of 0.4, and a brake efficiency of 50%, in either case. 4.00
- Q.7 (a) Write short notes on: (i) Camber, (ii) Kerbs, (iii) Right of way, (iv) Frontage road. 4.00
- (b) Derive an expression for calculating the OSD on a highway. 4.00
- (c) A valley curve is formed by a descending grade of 1 in 25 meeting an ascending grade of 1 in 30. Design the length of valley curve to fulfill both comfort condition and headlight sight distance requirements for a design speed of 80 kmph. Assume allowable rate of change of centrifugal acceleration = 0.6 m/sec³. 4.00
- Q.8 (a) Derive an expression for finding the SSD at level and at grades. 4.00
- (b) Define 'Superelevation'? Write down the steps for practical design of superelevation. 4.00
- (c) Find the total width of a pavement on a horizontal curve for a new national highway to be aligned along a rolling terrain with a ruling minimum radius. Assume ruling design speed = 80 kmph, normal pavement width = 7.0 m, number of lanes = 2, wheel base of the truck = 6 m, coefficient of friction = 0.15, and maximum value of superelevation = 7%. 4.00

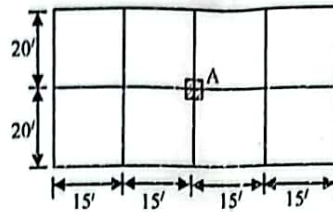
Full marks: 72

Time: 3 Hours

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SECTION-A

- Q.1 (a) Why are corner reinforcements provided in two-way slab? 2.00
 (b) An isolated corner slab about 15 × 15 ft. Design the slab for live load of 125 psf. Use $f'_c = 3000$ psi and $f_y = 50000$ psi. 10.00
- Q.2 (a) Write short notes on: (i) Short column (ii) Slender column (iii) Tied column and spiral column 3.00
 (b) Define slenderness ratio. 'Spiral column can support more loads than tied column' Explain the statement. 3.00
 (c) Design a tied column for a five-storied building as shown in figure below using the following information: 6.00
 (i) slab thickness = 5"; (ii) LL on the floor = 100 psf; (iii) Size of the beam = 12" × 18" on both direction;
 (iv) $f'_c = 4000$ psi and $f_y = 60000$ psi. Follow USD method.

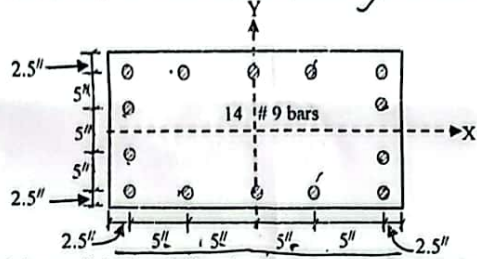


$$\rho/p_a = \frac{M_x}{M_y} +$$

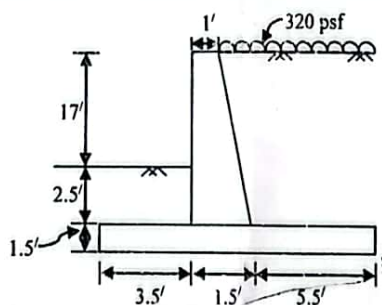
$$\rho_a = 0.34 \rho_{gm}$$

$$\rho_a = 0.34 f'_c A_g (1 + \rho_{gm})$$

- Q.3 (a) Explain the functions of lateral reinforcement used in R.C. column. 2.00
 (b) A column section is shown in figure below. Verify the capacity of the section if $P = 230$ k, $M_x = 1020$ k-inch, $M_y = 1400$ k-inch, $f'_c = 3$ ksi, and $f_y = 60$ ksi. Use (i) Reciprocal load method (ii) Bresler equation. 10.00



- Q.4 Design a cantilever retaining wall (upto stability check) as shown in figure below with $\phi = 30^\circ$, $f = 0.05$, $\gamma = 120$ pcf, allowable soil pressure = 8000 psf, $f'_c = 3$ ksi and $f_y = 50$ ksi. 12.00



SECTION-B

- Q.5 (a) Define flat slab. List the advantages of flat slab. 3.00
 (b) Design an interior panel of flat slab 24 ft by 24 ft for a total load of 280 psf including self-weight of slab. Use $f'_c = 3$ ksi and $f_y = 60$ ksi. 9.00
- Q.6 (a) Describe the guidelines for establishing axes of rotation and yield lines. 4.00
 (b) Show that a concentrated load 'P' acts on a circular reinforced concrete slab at the center is independent of the radius 'r' of that circular slab. Assume the collapse load is 'P'. 4.00
 (c) Briefly explain the concept of collapse mechanism with example. 4.00
- Q.7 (a) Draw pressure diagram for eccentrically loaded footing. 2.00
 (b) A 15-inch concrete wall supports a dead load of 12 kips/ft and a live load of 10 kips/ft. The allowable bearing pressure of soil is 4.5 kips/ft² at the level of the bottom of the footing, which is 3.5 ft below grade. Design a footing for this wall using $f'_c = 4000$ psi and $f_y = 60000$ psi. 10.00
- Q.8 (a) Define foundation. What are the measures to be taken to limit settlement? 3.00
 (b) Design a square slab footing to support concentric column dead load of 400 kips and live load of 300 kips. The column size is 20 inch square. Allowable soil bearing pressure is 5000 psf. Given $f'_c = 3500$ psi and $f_y = 50000$ psi. 9.00

CE 3213
Structural Analysis & Design -II

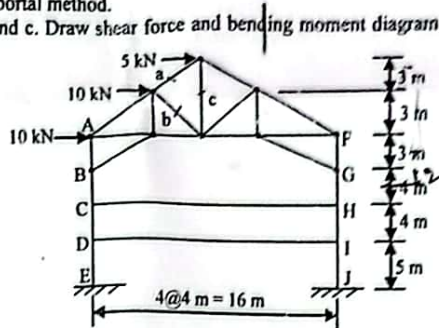
Full marks: 72

Time: 3 Hours

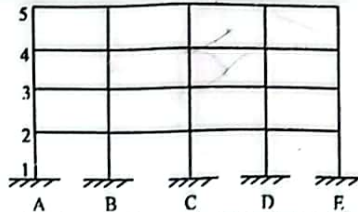
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SECTION-A

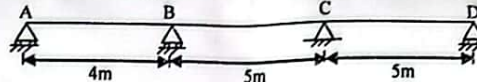
- Q.1 (a) Write down the assumptions made in the portal method. 2.00
 (b) Determine the stresses in members a, b and c. Draw shear force and bending moment diagram for the members AE and CH as shown in figure below. 10.00



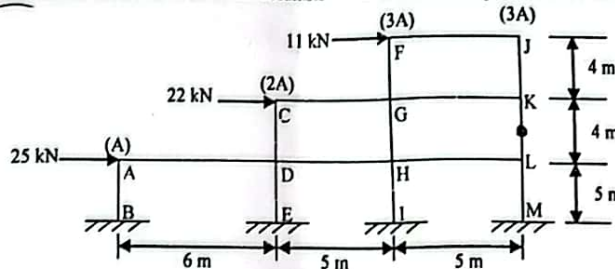
- Q.2 (a) Draw qualitative influence line for maximum negative moment at the left end of the span C4-D4 as shown in figure below. Also, locate the position of live load to find the maximum negative moment at that end. 4.00



- (b) Compute the ordinates influence line at center of each span for the moment at C of the continuous beam shown in figure below. Also, draw the influence line diagram. EI is constant throughout the length of the beam. 8.00

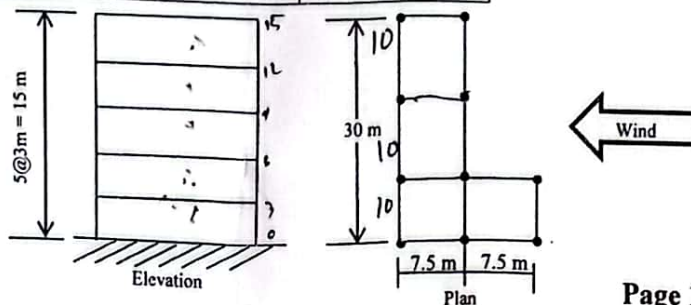


- Q.3 Analyze the building frame shown in figure below using cantilever method. Draw shear force and bending moment diagrams of all members. Cross sectional area of all columns are shown at the top of each column. 12.00



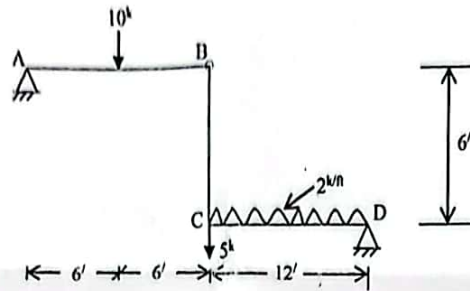
- Q.4 Compute the design force and earthquake load at each floor level for the following five story building with the given data (as per BNBC). Seismic zone coefficient = 0.075, structure importance coefficient = 1.00, response modification coefficient = 8.00, structural type coefficient = 0.040, site coefficient for soil characteristics = 1.50, seismic dead load = 2100 kN/floor, velocity to pressure conversion coefficient = 47.2×10^{-6} , basic wind speed = 155 km/hr, and pressure coefficient = 1.45. 12.00

z (meter)	Coefficient C_z	Coefficient G_s
0.0 - 4.5	0.368	1.654
6.0	0.415	1.592
9.0	0.497	1.511
12.0	0.565	1.457
15.0	0.624	1.418

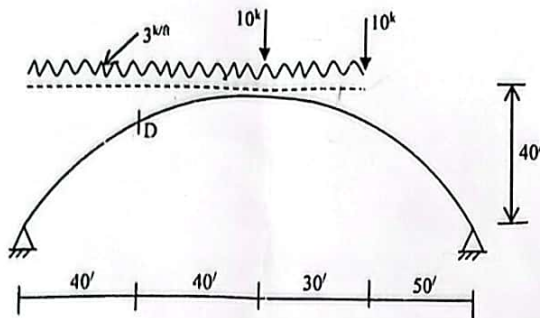


SECTION-B

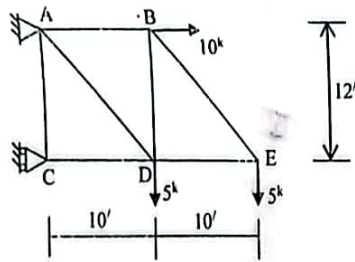
- Q. 5 Calculate vertical deflection at 'C' and rotational deflection θ_{ic} for the frame shown below. $E = 30 \times 10^3$ ksi, and $I = 200$ in⁴. 12.00



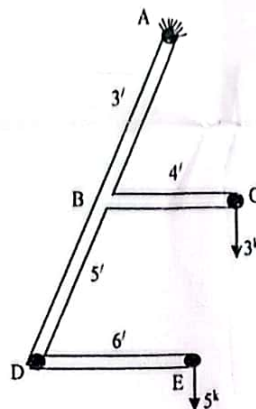
- Q. 6 Find the position and magnitude of maximum bending moment. Calculate shear force and normal thrust at 'D'. 12.00



- Q. 7 Find the vertical deflection of 'E' and rotational deflection of member 'AB' for the truss shown below. Cross-sectional area of each member is 3 in². $E = 30 \times 10^3$ ksi. 12.00



- Q. 8 The pipe bracket shown below, having $\angle ABC$, $\angle CBD$, $\angle BDE$ 90° angle each, and located in horizontal plane. Find (i) vertical deflection at 'E', (ii) rotational deflection of 'E' about DE axis. $I = 15$ in⁴, $E = 30 \times 10^3$ ksi, and $G = 12000$ ksi. 12.00



DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering THIRD Year EVEN SEMESTER Examination, 2020

CE 3221
Hydrology

Full Marks: 72

Time: 3 Hours

- N.B.:-
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SECTION-A

- Q.1 (a) What are the basic data required for hydrological studies? Explain 'hydrologic equation'. 4.00
- (b) Describe different correlations of rainfall records with diagram. How can you represent rainfall data graphically? 4.00
- (c) A semicircle of diameter 20 km with an equilateral triangle of side 20 km below its diameter is a close approximation to a river basin. The position coordinates of 5 rain gauge stations A, B, C, D and E located within the basin with respect to a coordinate axes system whose x-axis and origin are coincident with diameter and centre of the circle are (5, 5), (-5, 5), (-5, -5), (5, -5) and (0, 0) km respectively. If the rainfall record at these rain gauges are 85, 92, 77, 80 and 105 mm respectively, determine the average depth of rainfall using Thiessen polygon method. 4.00
- Q.2 (a) What is evapotranspiration? Enumerate the factors affecting evapotranspiration. 3.00
- (b) 'A fan-shaped catchment produces greater flood intensity' - Justify the statement. 3.00
- (c) How can you determine infiltration by double ring infiltrometer? 3.00
- (d) Determine the return period (recurrence interval T) of a flood, which has a 10% risk of being flooded (i) in the next 100 years, and (ii) in the next 50 years. 3.00
- Q.3 (a) Explain briefly the method of stream gauging by area-velocity method. 3.00
- (b) How can you adjust stage-discharge rating curve? Explain with neat sketch. 3.00
- (c) Distinguish between MPF and PMP. 3.00
- (d) The following data are obtained by stream gauging of a river: 3.00
- | | | |
|------------------------------------|------|------|
| Main gauge staff reading (m): | 9.6 | 9.6 |
| Auxiliary gauge staff reading (m): | 9.32 | 8.63 |
| Discharge (cumec): | 4.50 | 8.45 |
- What should be the discharge when the main gauge reads 9.6 and the auxiliary gauge reads 9.02 m.
- Q.4 (a) Write short notes on: (i) Intermittent and perennial streams, and (ii) Isochrones. 4.00
- (b) Discuss the steps of derivation of unit hydrograph. 3.00
- (c) The design storm of a water shed has the depths of rainfall of 4.9 and 3.9 cm for the consecutive 1-hr periods. The 1-hr UG can be approximated by triangle of base 6 hr with a peak of 100 cumec occurring after 2 hr from the beginning. Compute the flood hydrograph assuming an average loss rate of 9 mm/hr and constant base flow of 10 cumec. What is the area of water shed and its coefficient of runoff? 5.00

SECTION B

- Q.5 (a) Define 'ground water'. How much do we depend on ground water? Write down advantages of ground water over surface water. 4.00
- (b) Explain the movement of ground water and factors affecting the flow of ground water. 4.00
- (c) Water is flowing through a vertical plane, which width is 3 times greater than height. The gradient of pressure is 880 m horizontal to 2.20 m vertical. If the discharge flowing through the fine sand is 8.50×10^{-3} m³/s and hydraulic conductivity of fine sand is 5 m/day. Find the dimension of the vertical plane. 4.00
- Q.6 (a) Distinguish between: (i) specific yield and specific capacity, and (ii) Aquifer and aquiclude. 3.00
- (b) Write down Dupuit-Forchheimer assumptions for ground water movement. Derive steady static discharge equation for an artesian aquifer. 5.00
- (c) In an artesian aquifer of 8 m thick a 10 cm diameter well is pumped at a constant rate of 100 litres/minute. The steady state drawdown observed in two wells located at 10 m and 50 m distances from the centre of the well are 3 m and 0.05 m respectively. Compute the transmissibility and the hydraulic conductivity of the aquifer. 4.00
- Q.7 (a) Write short notes on: (i) Advantages of open wells, (ii) Storage co-efficient. 3.00
- (b) Describe the design of well screen, selection of screen material and design of slot size for deep tubewell. 4.00
- (c) From analysis of a boring data for constructing a deep tubewell in RUET, it was found that the coarse sand layer lies between 120 to 148 ft from the ground level. If the desired discharge is 900 lpm, diameter of well is 18 cm, then find the length of screen and check the entrance velocity for (i) when artesian aquifer, and (ii) when water table aquifer. 5.00
- Q.8 (a) Define flood routing. Describe the identification of areas for ground water recharge and quality of source water. 4.00
- (b) Classify artificial recharge. Describe most suitable recharge method of ground water for Bangladesh. 4.00
- (c) When 3.68 million m³ of water was pumped out from an unconfined aquifer of 6.2 km² areal extent, the water table was observed to go down by 2.6 m. What is the specific yield of the aquifer? During a monsoon season if the water table of the same aquifer goes up by 10.8 m, what is the volume of recharge? 4.00

The End