(Time: 3 Hours) **(Total Marks:80)**

N.B:

1. **Question No:1 is compulsory**
2. **Attempt any three questions from the remaining five questions.**
3. **Figures to the right indicates full marks**

Q 1 **(20)**

a Classify the following equipments as Standard & Special Equipment :
Skip and hoist arrangement, Concrete placing boom, Needle Vibrator, Air Compressor,Tower crane,Ladder trencher.

b Discuss the advantages offered by Scraper over other hauling equipments.

c Draw a neat sketch/flowchart showing the components of a RMC plant.

d Along-with the purpose,list the equipments required for constructing diaphragm-wall.

Q 2 **(20)**

a List the various components of a Tunnel boring machine and explain how it is used to excavate a curved alignment of a tunnel. **10**

b Discuss any one method of controlled demolition of buildings and State the precautions to be taken while planning & executing the demolition process. **10**

Q 3 **(20)**

a State the advantages of prefabricated housing system. **07**

b Write a detailed note on desalination process. **07**

c Enlist the advantages offered by Slip form work. **06**

Q 4 **(20)**

a Discuss the suitability of Cut and Cover method of tunnelling. **08**

b Explain range diagram with respect to tower crane and concrete placing boom. **07**

c Describe the concept of Magnetic Levitation. **05**

Q 5

a Write a detailed note on Jumbo machine used for drilling & blasting. **10**

b Enlist various stone crushing equipments and describe hammer-mill in detail. **10**

Q 6 **(20)**

a Describe the process of laying a Railway track using a Track Laying Machine. **10**

b Enlist the practical difficulties faced while constructing : **10**

i. Tunnel using NATM. ii) trench using wheel trencher.

****

(4 Hours) **(Total Marks: 80)**

N.B. 1. Question **No. 01 is compulsory.**
attempt any **three** out of the remaining four questions.
2. Draw neat and proportionate **sketches** whenever necessary.
3. Use of **IS 800 and steel tables** is permitted.
4. Assume **suitable data** if necessary, and justify the same.
5. Use steel of **grade Fe410** and bolts of **grade 4.6.**

Q1 **Answer the following**

A Design a laterally supported beam SB1 and MB1 using appropriate ISMB sections and beam to beam connection between them, Assuming the top flange of the beam is embedded in the slab. The Flooring plan is as Shown , Design flooring system for the following data, Thickness of Slab = 150mm, the thickness of wall = 200mm, Height of wall = 1.2m over all beams, Unit weight of brick wall and concrete is 20KN/m^3 and 25KN/m^3 **32**

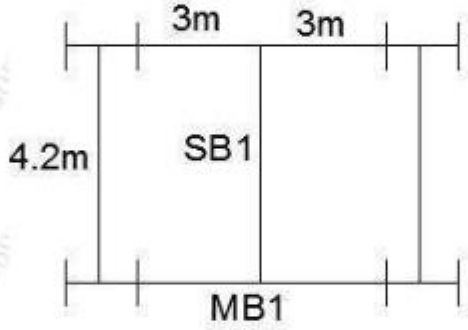


Fig. 1(A)

B Find Panel point load for a given roof truss for DL, LL and WL and design member AB, AL and BL. Considering truss to be constructed in the industrial area of Mumbai. The angle at joint A is 20^0. Assume K1 = 1.0, K2 = 0.98, K3 = 1.0, and (C_{pe}- C_{pi}) = -0.5, Spacing between trusses 6m ; The Span of truss = 16m **32**
Wt. of GI Sheet - 200 N/m^2
Self-weight of Purlin – 220 N/m

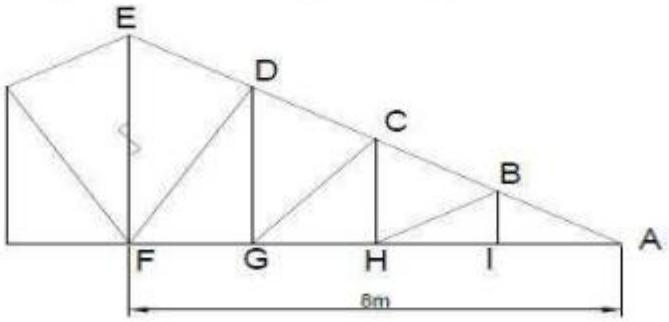


Fig. 1(B)

Q2

A Design a laced column 5 m long to carry factored axial load of 1200 kN. The column is restrained in position but not in direction at both the ends. Use 2 channel section placed as back to back. Draw neat sketch showing details of connection. Use 18 mm diameter bolts . **10**

B Design a slab base for a column ISHB 400 subjected to an factored axial compressive load of 850 kN where the load is transferred to the base plate by direct bearing of column flanges. The base rests on concrete pedestal of grade M20 **06**

Q3

A A Column ISHB 300@576.83 N/m strengthened with two cover plates of size 350 x 20mm to carry factored axial load of 2000kN, calculate Size, Thickness required for the **Gusset base** assuming M20 concrete grade and 24mm bolt diameter, draw diagrams showing all details. **10**

B A column ISHB 350 @ 710 N/m; used as a column with an effective height of 5.2m to support the load from the beam, Determine the design capacity of the column in kN. **06**

Q4

A A column of ISHB 300 @ 618N/m carries factored end reaction of 180kN due to a Beam. **Design Welded bracket connection** with an eccentricity of 150 mm from web of column, the thickness of bracket plate is 12mm, and Provide welding on 3 sides of bracket plate. **08**

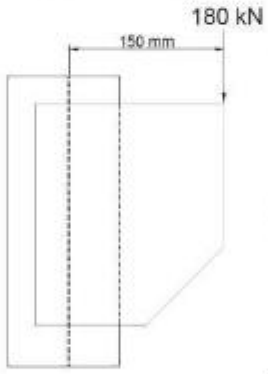


Fig. 4(A)

B Design a laterally unsupported beam of effective span 5 m and subjected to maximum bending moment of 600 kN-m and maximum shear force of 210 kN use steel of grade Fe 410. **08**

Q5 A simply supported welded plate girder of span 14 m is subjected to DL of 22 kN/m and LL of 20 kN/m excluding self weight, it is also subjected to two point load of 550 kN at 4 m from both the supports. The girder is simply supported at the ends and fully restrained at both the ends against lateral buckling throughout the span . Design the cross-section, provide a check for shear buckling, and design bending strength, Assume Load factor as 1.5 and fy=250 Mpa. **16**

(3 Hours) [Total Marks : 80]

Notes :

1. Question No **ONE** is **Compulsory**.
2. Answer any **THREE** from remaining.
3. Draw **FIGURES** wherever necessary. Figures to the right indicate full marks.
4. **WRITE** proper question / sub question numbers on the left margin allotted in answer sheet.
5. Each Question carries **EQUAL** marks.
6. **ASSUME** any additional data if necessary and state it clearly.

1. Attempt (Any 4)

a) Explain the factors affecting the location of intake structure. **05**

b) Explain with neat sketch function of intercepting trap. **05**

c) Explain physical characteristics of water. **05**

d) Explain how our body protect us from particulate matter in air pollution. **05**

e) What is rain harvesting? Explain with neat sketch roof top rain water harvesting **05**

f) Explain the 5R principle of solid waste management. **05**

2. a) i) The BOD of a waste water incubated for two days at 30 ° C has been found to be 210mg/lit. What will be the 5 day BOD at 20 ° C ? K_D =0.15 at 20 ° C. **05**

ii) Explain any one method to control noise pollution. **05**

b) What are the advantages of aeration process? Explain types of aeration systems. **10**

3. a) i) Explain with neat sketch oxygen sag curve? **5**

ii) Determine the velocity of flow and discharge flowing through sewer of diameter 0.45m flowing half full laid at gradient of 1:250. Take N=0.013 **5**

b) What is the carbonate hardness and non-carbonate hardness of water? Give the advantages of iron and manganese removal from water. **10**

4. a) The maximum daily demand of WTP is 5MLD. Design the dimension of suitable sedimentation tank if surface overflow rate is 500 lit/hr/m^2. Assume velocity of flow 20 cm/minute and detention period of 4 hours. **10**

b) What are the component (appurtances) of sewerage system. Explain the function of each unit. **10**

5. a) Explain role of monochloramine, dichloramine and trichloramine in water treatment. **10**

b) i)Design septic tank for the small colony of 200 persons. The rate of water supply is 150 lit/capita/day. Assuming the desludging period of 12 month and length to width ratio 3:1. **6+4**

ii) Differentiate between aerobic and anaerobic treatment process

6. i) What is SVI? Explain the process to calculate SVI in laboratory. **5x4**

ii) Explain the role of oxidation pond in sewage treatment process.

iii) Explain the function of under drainage system in rapid sand filter.

iv) Determine the efficiency of trickling filter for following data

a) Sewage flow -4MLD b) BOD of raw sewage – 280mg/l c)BOD removal in PST – 30% d)Effluent desired – 30mg/l

---

Time: 3 hrs **Marks: 80**

Note:

1. **No.1 is compulsory**
2. **Solve any 3 questions out of remaining 5 questions.**
3. **Draw neat sketches wherever required**
4. **Assume suitable data wherever necessary**

Q.1 Attempt the following **(5*4=20 Marks)**

a) Enlist the Assumption made in Terzaghi one dimensional consolidation theory.
b) Explain i) Active ii) Passive iii) At rest condition in the earth pressure against retaining wall.
c) List out the assumption made by Terzaghi bearing Capacity Theory.
d) State and explain different factor of safety used in stability analysis of slopes.

Q.2a) A cut has to be made 12 m deep inclined at an angle of 35^0 to the horizontal. A possible circular failure surface has radius 20.2m and is passing through the toe of the cut slope and through a point 4m away on the top ground from the edge of the cut, whose center of gravity of the failure mass is at a distance of 9.4 m from the center of failure circle. The properties of soil are C = 30 KN/m^2, $\phi=15^0$, Υ = 20 KN/m^3. Determine Factor of Safety that would be available on the said failure surface for the cut. Use Friction Circle Method. **10M**

Q.2b) Following result were obtained from consolidated un-drained test (CU) on normally consolidated clay. Plot strength envelope in terms of effective stress and determine shear strength parameter. **10M**

Cell pressure in KN/m^2	Deviator Stress in KN/ m^2	Pore Pressure in KN/ m^2
250	150	120
500	300	250
750	455	350

Q.3a) A group of 9 piles arranged in square pattern with diameter and length of each pile as 35cm and 8m respectively is used as foundation in soft clay. Take C=60 KN/m^2 and pile spacing is 120 cm center to center. Find the load capacity of the group Assume Bearing Capacity Factor N_c = 9, α =0.75 and FOS=2.5 **10M**

Q.3b) Explain Spring Analog for Terzaghi Primary Consolidation of Soil. **10M**

Q.4a) A 3m wide Strip footing is located in dense sand at a depth of 2m determine a) Ultimate Bearing Pressure. B) Net Ultimate Bearing Pressure. C) Net Safe Bearing Pressure D) Safe bearing pressure

For The following case
1) Without water Table
2) Water table at the ground surface.

Take Unit weight of soils 18 KN/m^3. Saturated unit weight 20 KN/m^3, Nc=37.2, Nq=22.5 and Nγ =19.7 use Terzaghi Equation. **10M**

Q.4b) Explain Types of Pile foundation on the basis of Functions, Materials and Composition. **10M**

Q.5a) A retaining wall 6.5m high Retains sand with angle of internal friction is 30^0 and unit weight of 22 KN/m^3 up to depth of 4 m from top, from 4m to 6.5m the material is cohesive soil with cohesion is 20 KN/m^2 and angle of internal friction 20^0 and unit weight of cohesive soil is 18 KN/m^3. A uniform Surcharge of 100 KN/m^2 acts on top of soil. Determine the total active thrust on the wall and point of application. **10M**

Q.5b) Derive the relationship between σ_1, σ_3, C and ϕ. **10M**

Q.6a) Write a short note on types of slope failure. **05M**

Q.6b) Explain Factor affecting Bearing Capacity of soil. **05M**

Q.6c) Discuss the merit and demerit in direct shear test and Triaxial test. **05M**

Q.6d) A Retaining wall 4 m high with vertical back support cohesive soil, backfill having unit weight 20 KN/m^3 and angle of internal friction as zero Calculate i) Depth of Tension Crack. ii) Maximum possible unsupported depth of excavation. iii) Active thrust on the wall and point of application **05M**

****

Duration: 3hours **Total marks: 80**

Q.1 is COMPULSORY
Attempt any THREE out of remaining questions
Assume suitable data wherever required.

Q.1 Attempt **any FOUR** of the following **(20)**

A. Write a short note on sprinkler irrigation. Also mention its advantage and disadvantages.
B. Describe the various types of earthen dams
C. Define the following: aquifer, aquifuge, aquiclude, cone of depression and drawdown.
D. Write a short note on zones of reservoir?
E. Compare the Kennedy's and Lacey's theories.
F. Write a short note on canal falls.

Q.2. A.i. Explain any one recording type rain gauge, along with a neat diagram **(05)**
A.ii. Define runoff and explain the factors affecting runoff **(05)**
B. The ordinates of 8-h unit hydrograph for a drainage basin are given below.
Obtain 24- hr UH **(10)**

Time (hours)	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76
Ordinates of 8-h UH	0	6	15	30	18	75	153	199	207	144	98	56	37	29	22	17	14	9	3	0

Q.3. A.i Define duty and delta. Derive the relation between duty, delta and base period **(05)**
A.ii. Write a short note on drip irrigation. **(05)**

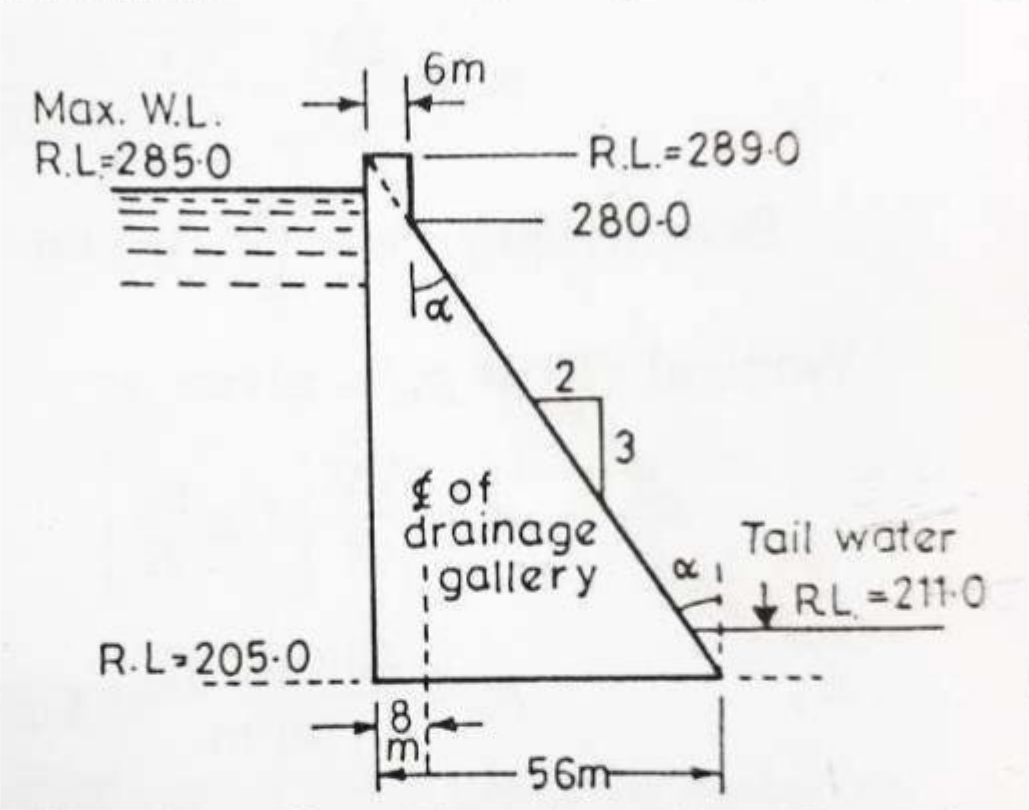
B. The culturable command area for a distributor is 15000 hectares. The intensity of irrigation for Rabi crop is 40% and for Kharif crop is 15%. If the total water requirement of the two crops are 37.5cm and 120cm and their periods of growth are 160 days and 140 days respectively. Determine the outlet discharge from average demand considerations. Also determine the peak demand discharge assuming that the kor water depth for two crops are 13.5cm and 19cm and their kor periods are 4 weeks and 2 weeks respectively. **(10)**

Q.4. A. i. Differentiate between open well and tube well **(5)**
A.ii. Write a short note on aquifer tests **(5)**

Q4.B. A 30 cm diameter well penetrates 25m below the static watertable. After 24hrs of pumping at 5400 litres/min, the water level in a test well 90 m away is lowered by 0.53 m and in a well 30m away is lowered by 1.11m What is the transmissibility of the aquifer? Also calculate the drawdown in the main well. **(10)**

Q5.A. Explain in detail the various forces acting on a gravity dam. Also draw a neat diagram **(10)**

Q5.B. For the gravity dam shown in figure, calculate the (i) maximum vertical stresses at the heel and toe of dam (ii) major principal stress at the toe of dam (iii) the intensity of shear stress on a horizontal plane near the toe **(10)**



Q.6. A. (i) Describe spillways, their purpose and their types **(05)**

A (ii) Define canal lining, water logging, head regulator, canal escapes and reservoir sedimentation. **(05)**

B. Describe with the help of sketches various types of Cross Drainage Work. **(10)**

****