

Time: 3-hour

Max. Marks: 80

N.B.

1. Question No. 1 is compulsory
2. Attempt any 3 Questions from the remaining.
3. All questions carry equal marks.
4. Figures in right indicate the maximum marks for those questions.
5. Assume suitable data if required and highlight the same.

- Q. 1** Attempt any four **20**
- a What are the different factors for the selection of construction equipment?
  - b Write a note on Light Detection and Ranging (Lidar) Technique for Railways/Highways alignments.
  - c Distinguish between conventional and modern formwork
  - d What is ground penetrating radar (GPR)? What is the use of the GPR system?
  - e Write a detailed note on the desalination process.
  - f Write briefly about the equipment required in the construction and operation of the seaport.
- Q. 2** a What is a windmill? Explain details about the installation and operation of windmills. **10**
- b What do you mean by incremental launching method? explain it with a suitable sketch. **10**
- Q. 3** a Write a detailed note on the limitations of Mivan, Doka and Modular shuttering. **10**
- b Enlist different methods of tunnelling in soft rock. State the various stages in the construction of tunnels along with the equipment required. **10**
- Q. 4** a Write a detailed note on various earthmoving, hoisting and hauling equipment. Explain their suitability and factors affecting their performance. **10**
- b Write a detailed note on equipment and techniques involved in setting up an atomic power station. **10**
- Q. 5** a Draw neat sketches of the “Jaw Crusher” and “Gyratory Crusher” and explain their work. **10**
- b Write short notes a) Equipment Suitability b) Cycle Time c) Balancing d) Ownership Cost **10**
- Q. 6** a Write a detailed note construction of the metro rail. Explain the process involved in the construction of metro railways. **10**
- b Describe in detail with a diagram about slip and jump formwork. **10**

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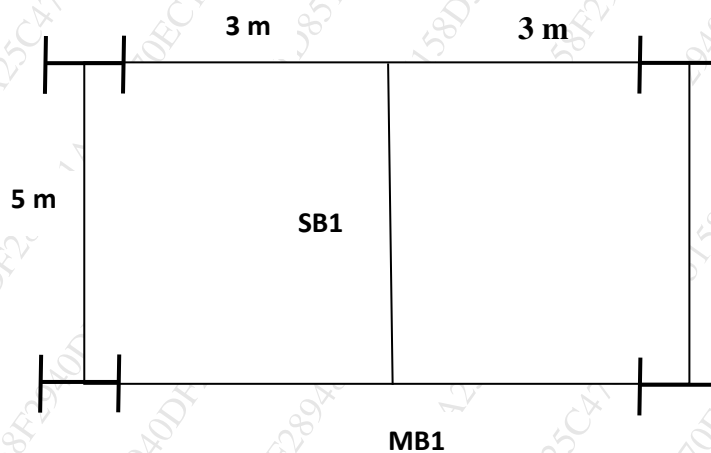


Time : 4 Hours

Marks : 80

- N.B**
1. Question No.1 is compulsory , attempt **any three** out of remaining questions.
  2. Draw neat and proportionate sketches wherever applicable.
  3. Use of IS 800:2007 and steel table is permitted .
  4. Assume suitable data if necessary and justify the same

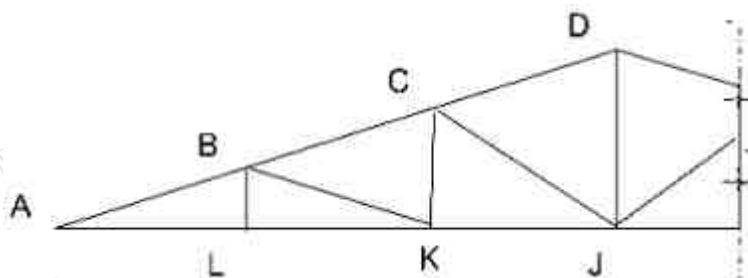
- Q 1 a)** The flooring system of an industrial shed is planned as shown in **fig.1** **32**  
 Design beam SB1 ,MB1 and beam to beam connection between them with top flange at same level . Use following data :  
 Thickness of slab -15 cm ,Thickness of wall -200 mm ,Height of wall is 1.3 m over beams ,Unit weight of concrete and brick wall is  $25 \text{ kN/m}^3$  and  $20 \text{ kN/m}^3$



**Fig.1**

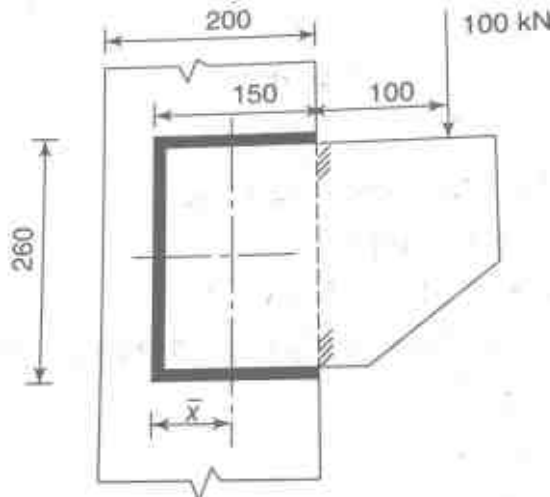
**OR**

- Q 1 b)** Find the panel point load for the given roof truss for DL,LL and WL and design member **AB,AL and BL** .The structure is situated in Mumbai industrial area with rise of  $\frac{1}{4}$  . (Refer Fig.2)Use following data : **32**  
 Span of Truss-24 m  
 Spacing of truss : 3 m  
 Self-weight of purlin -220 N/m  
 Weight of GI sheets-150 N/m<sup>2</sup>  
 $K_1=1.0, K_2=0.98 , K_3=1.0$  and  $(C_{pe}-C_{pi})= - 0.3$



**Fig.2**

- Q 2 a)** Design a column of effective length of 5.90 m and subjected to factored axial compressive load of 2000 kN. Provide channel section back to back connected by welded battens. Use Fe 410 grade steel. Sketch the connection details. **10**
- Q 2 b)** A bracket plate is welded to the flange of a column ISHB 200 as shown in **Fig 3** **06**. Calculate the size of the weld required to support a factored load of 100 kN. All dimensions in mm .



**Fig.3**

- Q 3 a)** Design a column (provide I section) to support a factored load of 1050 kN .The column has an effective length of 7.0 m with respect to z axis and 5.0 m with respect to y axis .Use steel of Grade Fe 410. **08**
- Q 3 b)** Design the base plate for an ISHB 350 column to carry a factored load of 1200 kN. Assume Fe 410 grade steel and M25 concrete. Use welded connections. **08**
- Q 4 a)** Calculate the Moment of resistance of a laterally unsupported beam ISLB 350 of Length 3.5 m **08**
- Q 4 b)** Explain web buckling and web Crippling **04**
- Q 4 c)** Explain block shear failure **04**
- Q 5** Design a welded plate girder for an effective span of 30 m and carrying an uniformly distributed load of 30 kN/m and two concentrated loads of 150 kN each acting at 10 m from both ends .The girder is simply supported at ends and fully restrained at both ends against lateral buckling through out the span .Assume load factor as 1.5 and  $f_y=250\text{Mpa}$  **16**

**Time-3 Hours**

**Total Marks: 80**

Note: 1) Question No.1 is compulsory

- 2) Attempt any three questions out of remaining five questions
- 3) Assume the suitable data if necessary and state the same.

**Q1 Attempt any four questions out of the following**

**(5x4=20)**

- a) What is population equivalent? Explain its importance in waste water treatment.
- b) Enlist the different layout of water distribution system? Explain with neat sketch Radial distribution system.
- c) Define air pollution? Give the natural sources of air pollution with suitable example.
- d) Explain with a suitable sketch working of roof top rain water harvesting
- e) Differentiate between one pipe system and two pipe plumbing system

**Q2 A) What is coagulation? Explain the procedure to determine the optimum dose of coagulant in the laboratory. (5)**

**B) A circular sewer is to have a slope of 1 in 200 and is to carry a flow of 800 lit/sec when flowing half full,  $N=0.013$ . Determine the size of the sewer required and velocity of the flow. (5)**

**C) Design the septic tank for hostel building of 300 students. The rate of water supply is 150 liters per capita per day and assume 80% water is converted to waste water. Assume any suitable data if required and draw the neat sketch. (10)**

**Q3 A) Explain the process of reverse osmosis. (5)**

**B) The results of 5day BOD test are as follows (5)**

- i) 5 ml waste in 300ml sample
- ii) Initial DO = 7.8 mg/l
- iii) Final DO = 4.8mg/l

Determine the 5day BOD of the sample and ultimate BOD. Take  $K= 0.15$ per day

**C) Draw the neat sketch of rapid sand filter with all its principle component and under drainage system and explain the function of each component. (10)**

**Q4 A) Explain the natural forces of self-purification of stream. (5)**

**B) Explain in detail the 5R's of municipal solid waste management. (5)**

**C) Explain the different forms of chlorine use in treating the water supply (10)**

- Q5 A) Why the removal of iron and manganese is important from water? (5)
- B) Explain the importance of dewatering of sludge in waste water treatment (5)
- C) A high rate activated sludge process with an aeration tank volume of  $175 \text{ m}^3$  has an applied load of 1.5MLD with an average BOD of 250mg/l and suspended solids of 160mg/l. The mix liquor in aeration tank held at 4000mg/l. calculate (10)
- i) BOD loading in Kg/ha-m
  - ii) F/M ratio
  - iii) aeration period
  - iv) sludge age
- Q6 A) Differentiate between water carriage system and conservancy system. (5)
- B) write a short note on water borne diseases. (5)
- C) The maximum daily demand of water purification plant has been estimated as 10 MLD. Design the dimension of suitable sedimentation tank. Assuming detention Period of 4 hours and velocity of flow 20cm/minute. (10)
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(3Hours)

Max Marks=80

- Note**
1. Question 1 is compulsory
  2. Attempt any 4 out of six questions
  3. Assume any suitable data where ever required

- Q.1** Attempt any **four**
- a.** A soil sample has a compression index of 0.3. If the void ratio at a stress of 1.4kg/m<sup>2</sup> is 0.5. Compute the void ratio if the stress is increased to 2kg/m<sup>2</sup> **05**
  - b.** A sample of dry cohesionless soil was tested in a triaxial machine. If the angle of shearing resistance was 36° and the confining pressure is 100 kN/m<sup>2</sup>, determine the deviator stress at which the sample failed. **05**
  - c.** A vertical cut is made in a clay deposit with cohesion = 30kN/m<sup>2</sup>, angle of internal friction = 0°, bulk density = 16kN/m<sup>3</sup>. Find the maximum height of the cut which can be temporarily supported. Take  $S_n = 0.261$  for slope angle and angle of internal friction equal to 90° and 0° respectively. **05**
  - d.** What are assumptions of Rankine's theory? Derive the expression for active and passive pressure. **05**
  - e.** Differentiate between the general shear failure and local shear failure. How the ultimate bearing capacity in local shear is determined. **05**
- Q.2**
- a.** Describe various types of pile foundations **05**
  - b.** Explain with a neat sketch different types of slope failures? **05**
  - c.** How would you estimate the load carrying capacity of a pile in cohesionless soils. A concrete pile 30cm in diameter is driven into a medium dense sand with angle of internal friction = 35°, bulk density = 21kN/m<sup>3</sup>, lateral earth pressure coefficient = 1.0 and  $\tan \delta = 0.70$  for a depth of 8.0m. Estimate the safe load taking a FOS = 2.50. Take  $N_q = 60$ . **10**
- Q.3**
- a.** What are different types of earth pressure. Explain with a neat diagram the variation of earth pressure with the wall movement. **05**
  - b.** Derive a relationship between the principal stresses at failure using Mohr-Coulomb failure criterion. **05**
  - c.** A square footing fails by general shear in a cohesionless soil under an ultimate load of 7500kN. The footing is placed at a depth of 2m below ground level. Given angle of internal friction = 35° and bulk density = 17.25kN/m<sup>3</sup>, determine the size of the footing if the water table is at a great depth. For  $\phi = 35^\circ$ ,  $N_q = 41.4$  and  $N_\gamma = 42.4$ . **10**
- Q.4**
- a.** Discuss the effect of water table on the bearing capacity of the soil. **05**
  - b.** What is negative skin friction? What is its effect on the pile? **05**
  - c.** A smooth rigid retaining wall 6m high carries a uniform surcharge load of 12kN/m<sup>2</sup>. The backfill is clayey sand with the following properties: bulk density = 16.0kN/m<sup>3</sup>, angle of internal friction = 25° and cohesion = 6.5kN/m<sup>2</sup>. Determine the passive earth pressure and its location. Also draw the pressure diagram. **10**

- Q.5 a.** A group of 9 piles with 3 piles in a row was driven into a soft clay extending from ground level to a great depth. The diameter and the length of the piles were 30cm and 10m respectively. The unconfined compressive strength of the clay is 70kPa. If the piles were placed 90cm centre to centre, compute the allowable load on the pile group on the basis of shear failure criterion for a factor of safety of 2.5. Assume  $\alpha = 1.0$ . **10**
- b.** Find the factor of a slope of infinite extent having a slope angle =  $25^\circ$ . The slope is made of cohesionless soil with angle of internal friction =  $30^\circ$ . Also, determine critical height of the slope if it is made of clay having effective cohesion =  $30\text{kN/m}^2$ , effective angle of internal friction =  $20^\circ$ , void ratio = 0.65 and specific gravity = 2.7 under following conditions (1) when the soil is dry (2) when water seeps parallel to the surface of the slope and (3) when the slope is submerged. **10**
- Q.6 a.** A soil sample has a compression index of 0.3. If the void ratio at a stress of  $1.4\text{kg/cm}^2$  is 0.5, compute (1) void ratio if the stress is increased to  $2\text{kg/cm}^2$  and (2) settlement of a soil strata 4m thick. **10**
- b.** A cylindrical sample of soil having a cohesion of  $80\text{kN/m}^2$  and an angle of internal friction of  $20^\circ$  is subjected to a cell pressure of  $100\text{kN/m}^2$ . Determine (1) deviator stress at which sample fails, (2) angle made by the failure plane with the axis of the sample. **10**

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**Time: 3-hour**

**Max. Marks: 80**

Please Note:

1. All questions carry **equal** marks
2. Question **one** is **compulsory**
3. Attempt any **three** out of remaining questions
4. **Assume** suitable data if required and **state** if clearly.

- Q1 ATTEMPT ANY FOUR 20**
- a) Define offshore structures. How they differ from land structures.
  - b) Write a short note on 'Offshore environment.
  - c) Write a short note on Tension Leg Platforms (TLP)
  - d) Write a short note on Hydrostatic analysis of offshore structures.
  - e) What are Buoys and Mooring systems?
- Q2**
- a) Explain the different types of loads acting on offshore structures. **10**
  - b) Write a note on ocean environmental monitoring. **10**
- Q3**
- a) Explain Construction and launching of offshore structures. **10**
  - b) Explain structural design to resist hydrodynamic forces on structures. **10**
- Q4**
- a) Explain offshore project management. **10**
  - b) Explain Scaling laws & Model testing. **10**
- Q5**
- a) Explain deep water installations. **10**
  - b) What are the offshore site investigations? **10**
- Q6**
- a) What are the Challenges in Deepwater testing? **10**
  - b) Explain offshore site investigations **10**

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(3 Hours)

Total marks: 80

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

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

- A. Write a short note on irrigation, its benefits and drawbacks.
- B. Describe in brief about ring basin method.
- C. Write a short note on various methods of calculating missing rainfall.
- D. Define the following: aquifer, aquifuge, aquiclude, drawdown, cone of depression
- E. Describe the various components of hydrograph and hyetographs with neat diagrams.

Q.2. A.i. Explain any one of the automatic rain gauges with the help of a diagram (05)

A.ii. Define Precipitation. Explain in detail any one type of precipitation (05)

B. The ordinates of 8-h unit hydrograph for a drainage basin are given below. Obtain 24- hr UH by S-curve method. (10)

<b>Time (hours)</b>	0	4	8	12	16	20	24	28	32	36	40
<b>Ordinates of 8-h UH</b>	0	5.5	13.5	26.5	45	82	162	240	231	165	112

Q.3. A i. Explain in detail the various zones of storage in a reservoir, also draw a neat diagram for the same. (05)

A ii. Define spillways and their types (05)

B. Describe in detail the various modes of failure of a gravity dam (10)

Q.4. A. i. Write a short note on Well Interference. (05)

A.ii. Describe in brief about the canal escapes (05)

Q4.B. A gravity well has a diameter of 60cm. The depth of water in the well is 40m before the pumping started. When pumping is being done at the rate of 2000 lpm, the drawdown in a well 10m away is 4m and in another well 20m away is 2m. Determine (a) Radius of zero drawdown, (b) co-efficient of permeability, (c) drawdown in the well. (10)

Q5. A.i. Differentiate between elementary & practical profile of gravity dam (05)

A.ii. What are the various forces acting on a gravity dam? (05)

B. Design the practical profile of a gravity dam from the following data:

Reduced Level of base of Dam is 1600m

Reduced Level of F. R. L. = 1625m,

Specific Gravity of masonry = 2.5.

Safe compressive stress for masonry = 1500 kPa.

Height of waves = 1m.

Assume any suitable data if required and state the same clearly. (10)

Q.6. A. Design an irrigation channel to carry a discharge of 14 cumecs. Take  $N=0.0225$  and critical velocity ratio as 1.05. Assume  $B/D = 5.7$ . Assume any suitable data, if required and state the same clearly. (10)

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

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