**3Hours**                                             **Max Marks 80**

Note 1. Question 1 is compulsory
    2. Attempt any Three out of five questions
    3. Assume any suitable data where ever required
    4. Figures to the right indicates full marks

| | | |
|---|---|---|
| **Q.1** | Attempt any **four** | |
| **a.** | List out difference between General shear failure and Local shear failure of shallow foundation. | **5** |
| **b.** | In a laboratory consolidation test, the void ratio of samples reduced from 0.85 to 0.73 as the pressure was increased from 1 to 2 kg/cm$^2$. If the permeability of soil be $3.3 \times 10^{-4}$cm/s find (i) coefficient of volume change (ii) coefficient of consolidation | **5** |
| **c.** | Explain the limitations of plate load test | **5** |
| **d.** | Explain with the expression Taylor's stability number and write its uses. | **5** |
| **e.** | A 30kN drop hammer was used to drive a R.C pile. it has free fall of 2.0 m. the average penetration recorded in the last few blows is 6mm/blow. Estimate the allowable load on pile according to Engineering news formula | **5** |
| **f.** | List out the difference between Rankines theory and Coulombs theory for lateral earth pressure theories | **5** |

| | | |
|---|---|---|
| **Q.2** | **a.** | A 2m thick layer of saturated clay lies in between two permeable layers. The clay has the following properties $w_L$=45% coefficient of permeability $2.8 \times 10^{-7}$cm/s, initial void ratio is 1.25 and initial effective over burden pressure at the middle of clay layer 2 kg/cm$^2$ and is likely increase to 4 kg/cm$^2$ due to construction of new building Determine (1) final void ratio of clay (2) settlement of proposed building (3) time required for 50% consolidation |
| | **b.** | Briefly explain anyone of the fitting methods for finding coefficient of consolidation |
| | **c.** | Explain the Merits and Demerits of Direct shear and triaxial shear test |

Marks: **10**, **5**, **5**

**Q3.**   **a.**                                                      **10**

| Sample No. | Cell Pressure (kg/cm$^2$) | Deviator stress at failure (kg/cm$^2$) | Pore pressure at failure(kg/cm$^2$) |
|---|---|---|---|
| 01 | 1.0 | 2.02 | 0.41 |
| 02 | 1.5 | 2.18 | 0.62 |
| 03 | 2.0 | 2.37 | 0.7 |

Find the shear parameters of soil considering (i) total stress (ii) effective stress and comment on the result

| | | |
|---|---|---|
| **b.** | Classify the piles based on load transfer mechanism and method of installation | **5** |
| **c.** | What is negative skin friction and derive the expression for it in single and group piles | **5** |

**Q4.**   **a.**   A retaining wall with a smooth vertical back has to retain a backfill of Cohesionless soil of height 5m above ground level. The soil has a void ratio of 0.83 and G=2.68. The water table is located at a depth of 2.5m below the top of backfill. The soil above the water table is 20% saturated having 'ϕ' above and below water table are found to be 32° and 28° respectively. Plot the variation of active earth pressure and find the magnitude and point of application of resultant thrust.   **10**

39EC756ECF51F839F7949701EF5E21B0

**b.** A cut has to be made at Mumbai city of 6.5m deep, inclined at an angle $35^0$ to the horizontal. **10** The possible slip surface has a radius equal to 13.5 m, and passing through the toe of cut slope and through the point 3 m away on the top ground from the edge of cut. The C.G of failure mass is 6m from the centre of failure circle. The properties of soil are $C=30$ kN/m$^2$, $\phi=15^0$ has $\gamma=17.5$ kN/m$^3$. Find the factor of safety that would be available in slip surface. Use friction circle method.

**Q5.** **a.** Check the stability of Concrete retaining wall with Cohesionless backfill having $\gamma=18$ kN/m$^3$ $\phi=38^0$ and wall friction $25^0$ **10**
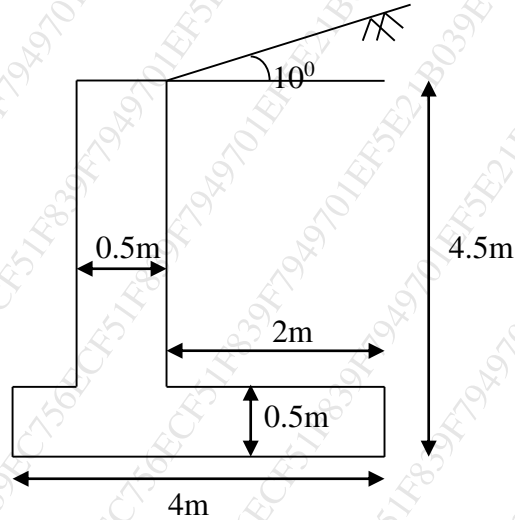


**b.** Explain the assumptions and failure zones described by Terzaghi for shallow foundations **5**
**c.** Explain types of slope failures. **5**

**Q6.** **a.** Derive relationship between the Principal stresses at failure using Mohr-Coulomb failure **10** criterion.
**b.** Discuss Culmann's method for the determination of active earth pressure **10**

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**(Duration: 3 Hours)**        **[Total Marks: 80]**

**N.B.: 1) Q.1 is COMPULSORY**
    **2) Attempt any THREE out of remaining questions**
    **3) Assume any data if required stating clearly**

**Q.1**     Attempt any **four**

(a) Define Irrigation and explain the necessity, benefits and Ill effects of irrigation in India    **[05]**

(b) Explain the term Aquifer, Aquiclude, Aquitard, and Perched Aquifer.    **[05]**

(c) Explain ill effects of water logging    **[05]**

(d) Explain the term Base period, Duty & Delta. Derive the relation between them    **[05]**

(e) What is meant by Canal fall or drops? Why are canal drops provided in canal system.    **[05]**

**Q.2**     (a) Explain storage zones of reservoir.    **[10]**

(b) Table below gives the necessary data about the crop, their duty and area under each crop, commended by a canal taking off from a storage tank. Taking a time factor for the canal to be 0.65 and capacity factor 0.8. Calculate the design discharge required at the head of the canal.    **[10]**

| Crop | Base period (days) | Duty at the field (ha/cumec) | Area under each crop (Ha) |
|------|-------------------|------------------------------|---------------------------|
| wheat | 120 | 1800 | 4800 |
| suagarcane | 360 | 800 | 5600 |
| Cotton | 200 | 1400 | 2400 |
| rice | 120 | 900 | 3200 |
| vegetables | 120 | 700 | 1400 |

**Q.3**     (a) What is hydrograph? Draw a single peaked hydrograph and explain its components.    **[10]**

(b) Find out the ordinates of a storm hydrograph resulting from a 3 hour storm with rainfall of 3, 4.5, 1.5 cm during subsequent 3 hours intervals. The ordinates of unit hydrograph are given below in the table below:    **[10]**

| Hours | 0 | 03 | 06 | 09 | 12 | 15 | 18 | 21 | 24 | 03 | 6 | 09 | 12 |
|-------|---|----|----|----|----|----|----|----|----|----|---|----|----|
| Ordinates UH (cumecs) | 0 | 90 | 200 | 350 | 450 | 350 | 260 | 190 | 130 | 80 | 10 | 20 | 0 |

Assume an initial loss of 5 mm, infiltration index of 5 mm / hour and base flow of 2 cumec.

**Q.4**     (a) Derive an expression for the steady state discharge of well fully penetrating into an unconfined aquifer.    **[10]**

**42701**          **Page 1 of 2**

(b) Fig shows the section of gravity dam (non-overflow section) built of concrete. Calculate (neglecting earthquake effects). 1) The max vertical stress at heel & toe of the dam. 2) The major principal stress at toe of the dam. 3) Intensity of shear stress on horizontal plane. **[10]**
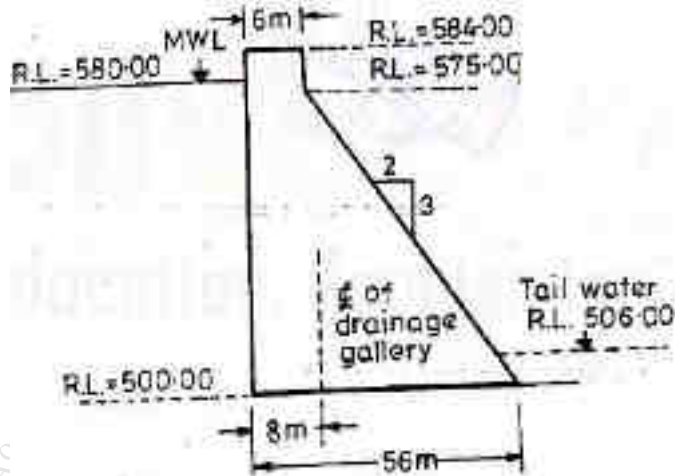


**Q.5** (a) Design an irrigation channel in alluvial soil according to Laceys silt theory given following data: - slope of the channel = 1: 5000, lacey's silt factors = 0.9, Channel side slope – ½ : 1. **[10]**

(b) Explain in details modes of failures of Gravity dam **[10]**

**Q.6** (a) What is Bhandara Irrigation? What are the advantages and disadvantages **[05]**

(b) Compare the Kennedy's theory and Lacey's theory. **[05]**

(c) What is runoff? What are the factors that affect the runoff from a catchment area? **[05]**

(d) What is meant by Canal lining? What are its advantages and disadvantages? **[05]**

----------------------

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

**N.B.: 1. Q.1 is compulsory**. Attempt **any three** questions **out of the remaining**.
    **2.** Figures to the right indicate full marks.
    **3.** Assume suitable data wherever required.

**Q.1**                                                                                   **20**
  **a**  Differentiate between: Standard & Special Equipment.
  **b**  Discuss the advantages & disadvantages offered by Doka shuttering system.
  **c**  Draw a neat sketch/flowchart showing the various components of a Hydro power plant.
  **d**  Describe the various Civil engg applications of LIDAR technique.

**Q.2**
  **a**  Discuss the various factors to be considered while selecting construction equipment.                                                                         **08**
  **b**  Mention the various applications of Air compressor in Construction industry.     **06**
  **c**  Enlist the various stone crushing equipment and explain the working of cone crusher.                                                                               **06**

**Q.3**
  **a**  With the help of schematic sketch, explain the working of Vertical shaft sinking machine                                                                           **10**
  **b**  Describe Cut and Cover method of tunneling and discuss its suitability.          **10**

**Q.4**
  **a**  Draw a neat labelled sketch of a Tower crane. State the benefits that they offer for high rise construction.                                                        **10**
  **b**  Discuss any two methods of controlled demolition of buildings.                   **10**

**Q.5**
  **a**  Explain incremental launching method of bridge construction.                     **08**
  **b**  Describe the various types of construction involved in setting up a fuel station. **06**
  **c**  List the equipments required for construction of an Airport with the purpose they serve.                                                                            **06**

**Q.6**
  **a**  Describe the EM and ED systems of Maglev.                                        **08**
  **b**  Discuss the advantages & disadvantages of Prefab housing system.                 **08**
  **c**  What are the applications of BIM in Metro construction project?                  **04**

----------------------------

**42847**                              **Page 1 of 1**

**( 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 5R principle in solid waste management.         **05**

    **b)** Explain the importance of particulate matter in the air and how it affects the air quality.         **05**

    **c)** What are the techniques used to control noise pollution?         **05**

    **d)** .What are the factors affecting water demands?         **05**

    **e)** Define BOD .The BOD of a waste water incubated for one day at $30\,^{\circ}C$ has been found to be 160mg/lit. What will be the 5 day $20\,^{\circ}C$ BOD? $K_D = 0.1$ at $20\,^{\circ}C$.         **05**

**2.**   **a)** What are the physical characteristics of water? Give the details of water borne diseases.         **10**

    **b)** Explain separate, combined and partially combined sewerage system. Explain the necessity of drop manhole in sewer design.         **10**

**3.**   **a)** Draw the neat sketch of rapid sand filter and explain it's working.         **10**

    **b)** Differentiate between activated sludge process and trickling filter for sewage treatment.         **10**

**4.**   **a)** The maximum daily demand of WTP is 12MLD. Design the dimension of suitable sedimentation tank if surface overflow rate is 12 $m^3$/day/$m^2$ .Assume velocity of flow 25 cm/minute and detention period of 4 hours.         **10**

    **b)** Design activated sludge treatment plant for the following data.
        Sewage flow- 1.5MLD
        Avg $BOD_5$ of $_{raw}$ sewage- 275 mg/lit.
        MLSS concentration in aeration tank = 4000mg/l
        Suspended solids in the effluent - 175mg/lit.
        Volume aeration tank = 180 $m^3$
        Calculate 1) BOD loading in in Kg/day
        2)F/M ratio
        3) Aeration period
        4)sludge age         **10**

**42967**                            **Page 1 of 2**

5.  a) Explain the process of hardness removal by ion exchange method    **10**

   b) Design septic tank for the small colony of 250 persons.    **6+4**
      Given data
      Sewage/capita/day=150lit
      Desludging period=2 years
      Length: width=3:1.
      Explain any one method used for disposal of septic tank effluent.

6.      Write a short note on    **20**
   a) Self-purification of stream
   b) Rain water harvesting
   c) Break point chlorination
   d) Difference between one pipe and two pipe system

**************

<div align="center">(4 Hr)</div> <div align="right">[Maximum Marks - 80]</div>

**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.**

**Q.1 a** Design laterally supported beams B1 and MB1 using appropriate ISMB sections **32**
and beam-to-beam connections between them, assuming the top flange of the beam
is embedded in the slab. The flooring plan is as shown, Design flooring systems for
the following data,
- The thickness of the Slab - is 150 mm
- The thickness of the wall - 230 mm.
- Height of wall over all beams - 1.1m
- Unit weight - (Concrete-25 N/mm$^3$ , Brick Wall - 20 N/mm$^3$)
- All beams are laterally restrained.
- All columns are ISHB 400 @ 61.2 kg/m
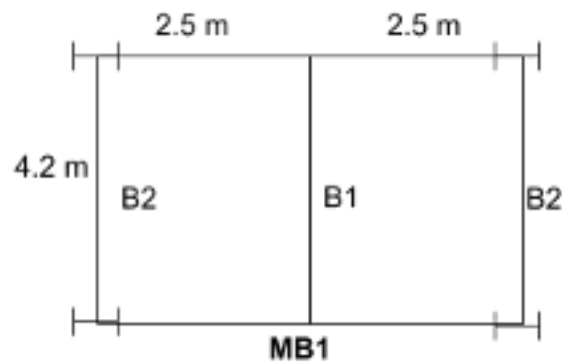


**OR**

**Q.1 b** Find the panel point load for a given roof truss for DL, LL, and WL and design **32**
members AB, AL, and BL. Considering the truss to be constructed in the industrial
area of Mumbai. The angle at joint A is 15°.
Assume $K_1 = 1.0$, $K_2 = 0.98$, $K_3 = 1.0$, and $(C_{pe} - C_{pi}) = -0.5$,
- Spacing between trusses - 5.2 m; the span of truss - 16.0 m
- wt of GI sheets - 200 N/m$^2$
- Self-weight of Purlin - 250 N/m



<div align="right">**PTO**</div>

**42304**
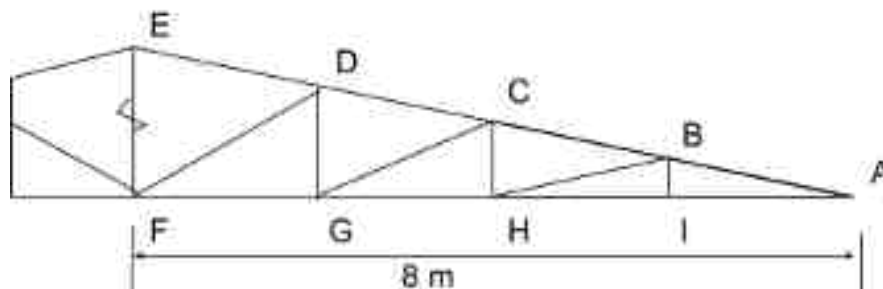
**Q.2** **a)** A column ISHB 300 @ 576.8 N/m; carries a factored axial load of 2000 kN. **10**
Calculate ONLY the size and thickness of **the gusseted base**, assuming M20
concrete grade.
*(Design of gusset base 08 marks, detailed drawing - 02 marks)*

**b)** A column ISHB 300 @ 618 N/m; used as a column with an effective height **06**
of 4.5m to support the load from the beam, Determine the design capacity of
the column in kN.

**Q.2** **a)** **Design a built-up column** with two channel sections that are placed face to **10**
face to support a factored axial compressive load of 1600 kN; if the effective
length of the column is 5.2 m, design a suitable bolted laced connection,
provide all checks, and draw a detailed diagram.
*(Design of column 08 marks; detailed drawing - 02 marks)*

**b)** A column consists of ISHB 300 @ 576.8 N/m carrying a factored load of **06**
1000 kN. Design a **rectangular slab base**, considering the M15 concrete
grade. *(Design of gusset base 04 marks, detailed drawing - 02 marks)*

**Q.4** **a)** Design a bolted bracket connection with an eccentricity of 200 mm from the **08**
web of the column.
The thickness of the bracket plate is 12 mm, and the diameter of the bolts is
24 mm. (Fig.4.a) The column is of ISHB 300 @ 618 N/m; and carries an end
reaction of 380 kN due to factored load.


(Fig.4.a)
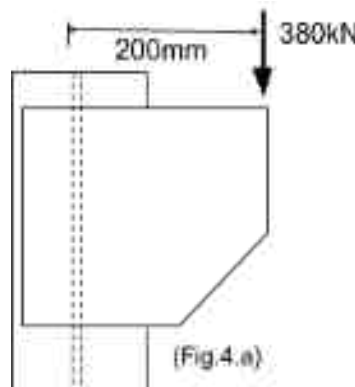
**b)** An ISLB 300 @ 369.7 N/m is used as a laterally unsupported beam for the **08**
span of 4.2 m. Determine the design bending strength ($M_d$), and also
determine the **safe UDL** that can be applied over a beam.

**Q.5** **a)** Calculate the cross-section, provide a check for shear buckling and design **16**
bending strength, assuming the plate girder is laterally supported throughout
without intermediate stiffeners. Design simply supported welded plate girder
for span 30 m which is subjected to a UDL of 60 kN/m over the span,
excluding the self-weight of the plate girder.

**END...**

**42304**