

Time: 3 Hours

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

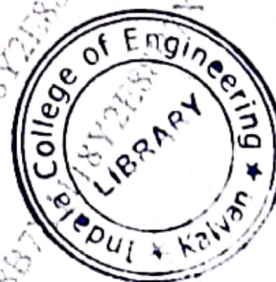
- Q.1** Attempt All the questions
- a. Classify the Shear test based on Drainage condition 05
 - b. A soil mass is retained by a smooth vertical wall of 5m height. The soil has a bulk unit weight of 20 kN/m^3 and angle of internal friction is 16° . The top of the soil is level with the top of wall. If the surface carries uniformly distributed load of 4.5 kN/m^2 . Determine total passive thrust on the wall and point of application. 05
 - c. Explain initial, Primary and secondary consolidation 05
 - d. What is the method of Improving Stability of Slope. 05
- Q.2**
- a. A 4m square footing is located in dense sand at a depth of 2m determine safe bearing pressure when water table is located at base of footing Take unit weight of soils 18 kN/m^3 , saturated unit weight 20 kN/m^3 , $N_c=37.2$, $N_q=22.5$ and $N_\gamma=19.7$ use Terzaghi Equation 05
 - b. Differentiate Between Rankine's and Coulomb's earth pressure Theory 05
 - c. Direct shear test was conducted on sand gave a failure shear stress of 80 kN/m^2 when Normal stress was 170 kN/m^2 . Draw Mohr's Circle and Mohr's Envelope and Find Principal Stresses at failure and Orientation of principal Planes 10
- Q.3**
- a. A 5.5 m high retaining wall retains soil having angle of internal friction 30° , unit weight of 18 kN/m^3 and cohesion 6 kN/m^2 . Determine the Rankine active pressure on the wall before the formation of crack 05
 - b. Explain plate load test and highlights its limitation 05
 - c. A Circular foundation is to be designed for total load of 675 kN , if the load is inclined at angle of 18° to the vertical. Determine the width of foundation take unit weight of soils is 19 kN/m^3 , angle of internal friction is 30° , cohesion 10 kN/m^2 with $FOS=3$ and depth of foundation is 1.5 m use Vesic equation 10
- Q.4**
- a. Define Compression index and Coefficient of volume change. in a consolidation test void ratio decreased from 0.60 to 0.50 when the load was changed from 60 kN/m^2 to 110 kN/m^2 . compute Compression index and Coefficient of Volume change 05
 - b. Differentiate between general, local and punching shear failure 05
 - c. A retaining wall 7m high Retains sand with angle of internal friction is 30° and unit weight of 24 kN/m^3 up to depth of 3.5m from top, from 3.5m to 7m the material is cohesive soil with cohesion is 20 kN/m^2 and angle of internal friction 20° and unit weight of cohesive soil is 18 kN/m^3 . A uniform Surcharge of 110 kN/m^2 acts on top of soil. Determine the total active thrust on the wall and point of application 10

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- Q.5 a. Explain briefly pile load test 05
- b. A concrete pile 400mm diameter is deep in dense sand for a depth of 10m estimate safe load for the pile. Consider the following properties for the sand angle of internal friction is 30° , unit weight is 16 kN/m^3 , Coefficient of friction between sand and pile is 0.7 and coefficient of earth pressure is 1. Take FOS=2.5 05
- c. A compressible layer is expected to have total settlement of 16 cm under a given loading. It settles by 4 cm at the end of two months, After the application of load increment how many months will be required to reach settlements of 8.5 cm? what will be settlements in 20 months. Assume double drainage in all case 10
- Q.6 a. What is the basis on which the dynamic formula is derived? Mention two well-known Dynamic formula and also explain symbol involved. 05
- b. A canal with depth of 5m has bank with slope 1:1, The properties of soil are cohesion = 20 kN/m^2 , Void ratio 0.7, Specific gravity of soils 2.6 and angle of internal friction = 15° . Calculate factor of Safety with respect to cohesion-When canal runs full 05
- c. A group of 16 pile arrange in a square pattern diameter of each pile is 600mm and center to center distance is 1.1m. The length of pile is 16m Estimate the safe load of the group pile as shown in figure with FOS =2.5 10



ICOE / Lib / TE / Civil / Sem VI / WRE / 17/05/2024

(3 HRS)

(Total Marks 80)

Note: - 1. Q.No.1 is compulsory.

2. Attempt any three questions out of remaining five questions.

3. Assume any data if required stating clearly

- Q.1 (a) Define Irrigation and explain the necessity, benefits and ill effects of irrigation in India [5]
 (b) Explain the term Aquifer, Aquiclude, Aquitard, and Perched Aquifer. [5]
 (c) Explain ill effects of water logging [5]
 (d) Explain the term Base period, Duty & Delta. Derive the relation between them. [5]
 (e) What is meant by cross drainage works? Explain any one. [5]
- Q.2 (a) Explain the mass curve of demand and supply for 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 |
| sugarcane | 360 | 800 | 5600 |
| Cotton | 200 | 1300 | 2400 |
| rice | 120 | 900 | 3200 |
| vegetables | 120 | 700 | 1400 |

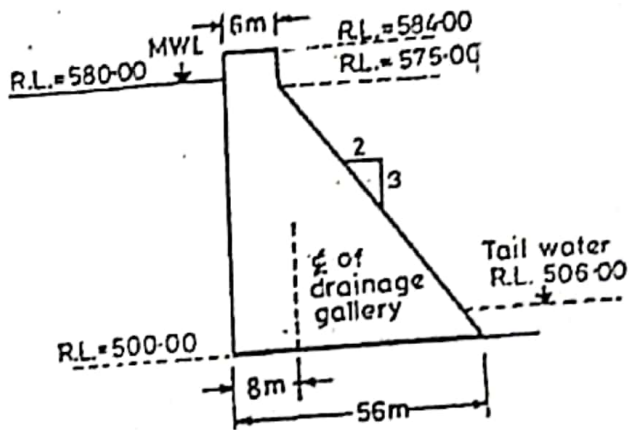
- Q.3 (a) What is hydrograph? Draw a single peaked hydrograph and explain its components. [10]
 (b) Find out the ordinates of a storm hydrograph resulting from a 3 hour storm with rainfall of 3, 4.5, 1.5 cm during subsequent 3 hours intervals. The ordinates of unit hydrograph are given below in the table 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 |

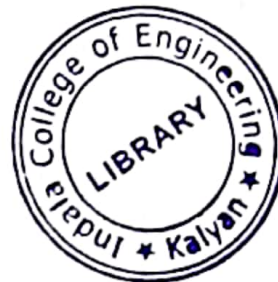
Assume an initial loss of 5 mm, infiltration index of 5 mm / hour and base flow of 2 cumec.

- Q.4 (a) Derive an expression for the steady state discharge of well fully penetrating into an unconfined aquifer. [10]
 (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 Lacey's silt theory given following data: = slope of the channel = 1: 5000, lacey's silt factors = 0.9, Channel side slope = $\frac{1}{2} : 1$. [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 [5]
 (b) Compare the Kennedy's theory and Lacey's theory. [5]
 (c) What is runoff? What are the factors that affect the runoff from a catchment area? [5]
 (d) What is meant by Canal lining? What are its advantages and disadvantages? [5]



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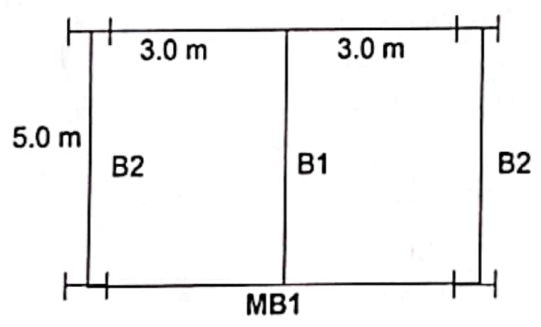
(4 Hr)

[Maximum Marks - 80]

Date: - 15-05-2024

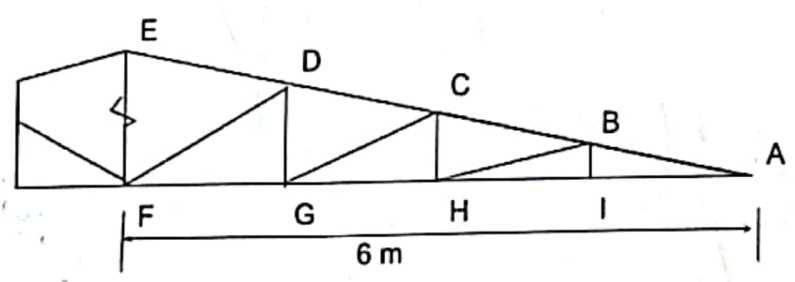
- N.B. 1. Question No. 01 is compulsory, attempt any three out of the remaining four questions.
 2. Draw neat and proportionate sketches whenever necessary.
 3. Use of IS 800 and steel tables is permitted.
 4. Assume suitable data if necessary, and justify the same.
 5. Use steel of grade Fe410 and bolts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

- Q.1 a For the following flooring system, design laterally supported beams B1 and MB1 using appropriate ISMB sections, also design a beam-to-beam connections between them, assuming the top flange of the beam is embedded in the slab. Design flooring systems for the following data,
 - The thickness of the Slab - is 150 mm
 - The thickness of the wall - 200 mm.
 - Height of wall over all beams - 1.2m
 - Unit weight - (Concrete-25 kN/m³, Brick Wall - 20 kN/m³)
 - All beams are laterally restrained.
 - All columns are ISHB 350 @ 661.2 N/m



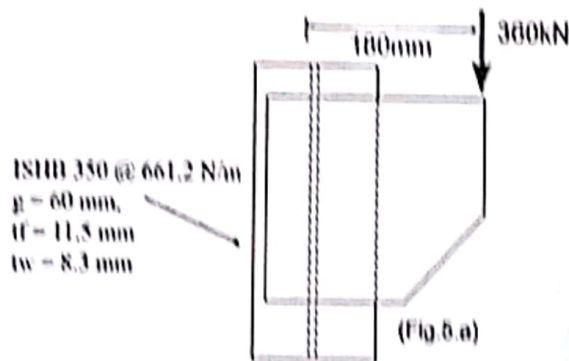
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- Q.1 b Find the panel point load for a given roof truss for DL, LL, and WL and design members AB, AL, and BL. Considering the truss to be constructed in the industrial area of Bhopal. The angle at joint A is 20°. Assume $K_1 = 1.0$, $K_2 = 0.98$, $K_3 = 1.0$, and $(C_{pe} - C_{pi}) = -0.3$,
 - Spacing between trusses - 5.0 m; the span of truss - 12.0 m
 - wt of GI sheets - 180 N/m².
 - Self-weight of Purlin - 200 N/m, Assume suitable data.
 - The Basic wind Speed of Bhopal 'Vb' = 39 m/s



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- Q.2 a) A column ISHB 350 @ 661.2 N/m carries a factored axial load of 1000 kN. Calculate the size and thickness for the bolted gusseted base, also calculate the number of bolts required if bolt diameter = 20 mm, assume M30 grade of concrete. (Design of gusset base (15 marks), detailed drawing = 02 marks) 10
- b) Determine the design capacity of the column section in kN for the section ISHB 350 @ 661.2 N/m, used as a column with an effective height 4.0 m. 06
- Q.3 a) Design a built-up column with two channel sections that are placed face to face to support a factored axial compressive load of 1450 kN. If the effective length of the column is 4.2 m, design a suitable bolted laced connection, provide all checks, and draw a detailed diagram. (Design of column (15 marks), detailed drawing = 02 marks) 10
- b) A column consists of ISHB 350 @ 661.2 N/m carrying a factored load of 1100 kN. Design a rectangular slab base, considering the M15 concrete grade. Don't design connections. (Design of base (04 marks), detailed drawing = 02 marks) 06
- Q.4 Design a simply supported welded plate girder for span 30 m which is subjected to a UDL of 80 kN/m over the span, excluding the self-weight of the plate girder. i) Design the cross-section and classify, ii) provide check for shear buckling iii) Provide check for design bending strength, iv) provide appropriate curtailment at 5m and 10m of span. The plate girder is laterally supported throughout without intermediate stiffeners. 16
- Q.5 a) Design a bolted bracket connection with an eccentricity of 180 mm from the web of the column. The column is of ISHB 350 @ 661.2 N/m and carries an end reaction of 360 kN due to factored load. The thickness of the bracket plate is 12 mm, and the diameter of the bolts is 24 mm. (Fig. 5.a) 08



- b) Determine the design bending strength (M_d) of a beam ISLB 300 @ 369.7 N/m which is used as a laterally unsupported beam using IS 800:2007 table No. 13(a) & 14; the effective length of the beam is 4.8 m, also determine the amount of UDL that can be applied over the span safely. 08

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[Total Marks: 80]

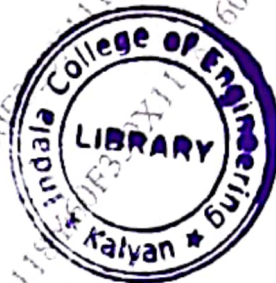
N.B: 1. Question No:1 is compulsory

2. Attempt any three questions from the remaining five questions.
3. Figures to the right indicates full marks

- Q1 (20)
- a Classify the following equipments as Standard & Special Equipment :
Conventional Concrete Mixer, Tunnel boring Machine, Platform Vibrator, Air Compressor, Tower crane, Concrete placing boom, Scraper, Wheel trencher.
- b Discuss the advantages offered by Equipments over labourers.
- c Draw a neat sketch/flowchart showing the components of an Atomic power plant.
- d List the equipments required for Concrete dam construction.
- Q2 (20)
- a With the help of a sketch, explain the working of Vertical shaft sinking machine 10
- b Enlist the various dewatering technique for trenches and explain the working of well point system. 10
- Q3 (20)
- a Draw neat-labelled sketch for : i) Jaw Crusher ii) Tower Crane 10
- b How does LIDAR technique work ? State its applications in Civil Engg. 10
- Q4 (20)
- a Describe the working of Tunnel lining trolley. 10
- b Enlist the advantages offered by Slip formwork. 05
- c What care should be taken during transportation and storing of blasting materials ? 05
- Q5
- a Explain balanced cantilever method of bridge construction. 08
- b Discuss any two methods of controlled demolition of buildings. 07
- c Describe the various types of construction involved in setting up a fuel station. 05
- Q6 (20)
- a Discuss the role of drones and GPS for monitoring the construction progress of infrastructure projects. 10
- b Describe the EM system of Maglev. 05
- c State the advantages of prefabricated housing system. 05



4. a) What is activated sludge process? Explain the following terms 10
1) Hydraulic retention time 2) Sludge Age 3) MLSS 4) SVI
- b) Design high rate trickling filter for the following data. 10
Sewage flow- 6 MLD
Recirculation ratio-1:5
BOD₅ of raw sewage- 300 mg/lit.
BOD removal in PST- 25%.
Final effluent BOD₅ desired - 30mg/lit.
5. a) Design septic tank for the small colony of 150 persons. 10
Given data
Sewage/capita/day=130lit
Desludging period=2 years
Length: width=3:1.
Explain any one method used for disposal of septic tank effluent.
- b) What are the factors affecting for self-purification of polluted streams? Draw DO 10
sag curve. What measures would you recommend to control stream pollution in
India?
6. a) 1) Differentiate one pipe and two pipe system of plumbing. 10
2) Water softening Zeolite process
- b) 1) Effects of Air Pollution on human health and the environment 10
2) Break point Chlorination



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