

H.T No:

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

R22



**CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)**

Examination : B.Tech V Semester Regular & Supplementary Examinations Nov/Dec-2025
Course Name : Geotechnical Engineering
Course Code : A401311
Branch : Civil Engineering
Date & Session : 27-11-2025 AN **Duration: 3 hours** **Max. Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. List the main types of soils according to Indian Classification system of soils. 1 M
2. Define Dry Density and Moisture Content. 1 M
3. List out the factors that affecting permeability. 1 M
4. What is Darcy's Law? 1 M
5. What are the assumptions made in the Boussinesq's equations? 1 M
6. Write down the formula of vertical stress due to point loads according to Westergard's theory. 1 M
7. What are the three stages of consolidation? 1 M
8. Differentiate Soil Compaction and Soil Consolidation. 1 M
9. What are the factors that influence shear strength? 1 M
10. Give the expression to find the shear strength by vane shear test. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). The wet density of a glacial deposit is 19.2 KN/m^3 . The specific gravity of the soil is 2.67 and the moisture content of the soil is 12% by dry weight. Calculate: (i) Dry density (ii) Porosity (iii) Voids ratio (iv) Air content (v) Percentage air voids. Assume the necessary data. 10M

OR

11. B). Explain about three phase block diagram of soil along with a neat sketch. 10M
12. A). A soil profile consists of a top layer of sand 3 m thick having unit weight 19 kN/m^3 and an intermediate clayey silt layer 2 m thick and saturated unit weight of 21 kN/m^3 and a bottom layer of gravel 4 m thick and having 20 kN/m^3 . The water table is at the top clayey silt layer. Determine the effective stress at various levels. 10M

OR

12. B). A falling head permeability test was performed on a sample of silty sand. The time required for head to fall in the stand pipe from 60cm to 30cm mark was 70min. The sectional area of the stand pipe was 1.25 Sq.cm . If the height and diameter of the sample were respectively 10 and 9cm, determine the value of k. 10M

(P.T.O.)

13. A). Explain the Construction procedure of a Newmark's influence chart and explain the uses of Newmark's chart to find vertical pressure at a point. 10M

OR

13. B). A foundation is of 3 m external diameter and 2.00 m internal diameter. It transmits a uniform pressure of 90 kN/m². Calculate the vertical stress at a depth of 1.5 m directly beneath the centre of the loaded area. 10M

14. A). A normally consolidated clay layer 2 m thick is sandwiched between two sand layers. The average overburden stress at the middle of clay layer can be taken as 160 kN/m². Due to construction of a structure there is an increase in effective vertical stress of 40 kN/m² at the middle of clay layer. The liquid limit of clay layer is 60% and the initial void ratio is 0.9. Estimate the Primary settlement. 10M

OR

14. B). Explain Terzaghi's theory of consolidation. 10M

15. A). Explain Mohr-Coulomb's theory for shear strength of a soil. Discuss the factors that affect the shear strength parameters of soil. 10M

OR

15. B). The following are the results of box shear test on soil 10M

Normal stress (Kpa)	25	75	150	250
Shear stress at failure (Kpa)	55	75	100	140

Determine cohesion and angle of internal friction of the soil. Also determine the deviator stress required for the failure of the same soil specimen under triaxial test with a cell pressure of 100Kpa.

H.T No:

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

R22



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

Examination : B.Tech V Semester Regular & Supplementary Examinations Nov/Dec-2025
Course Name : Hydrology and Water Resources Engineering
Course Code : A401313
Branch : Civil Engineering
Date & Session : 29-11-2025 AN **Duration:** 3 hours **Max. Marks:** 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. State the components of hydrological cycle. 1 M
2. What is probable maximum precipitation? 1 M
3. State Dalton's law of evaporation. 1 M
4. Define runoff. 1 M
5. What are the limitations of unit hydrograph? 1 M
6. Define hydrograph. 1 M
7. Define aquifer. 1 M
8. What is specific yield? 1 M
9. Define canal lining. 1 M
10. Define water logging. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain the different methods of determining the average rainfall over a catchment due to a storm. Discuss the relative merits and demerits of the various methods. 10M

OR

11. B). i) Define rain gauge network. 3M
ii) Determine the optimum number of rain gauges for a basin with the following data: 7M
Number of existing rain gauges = 6
Allowable percentage error = 8%
The average rainfall at the existing gauges = 90, 100, 85, 65, 55 and 46cm.

12. A). A reservoir with average surface spread of 4.8 km^2 in the first week of November has the water surface temperature of 30°C and relative humidity of 40%. Wind velocity measured at 3m above the ground is 18 km/h. The mean barometer reading is 760mm of Hg. Calculate the average evaporation loss from the reservoir in mm/day and the total depth and volume of evaporation loss in the first week of November. Use both Meyer's equation as well as Rohwer's equation. Take saturation vapour pressure at 30°C as 31.81mm of Hg. 10M

(P.T.O.)

OR

12. B). Infiltration capacity data obtained in a flooding-type infiltration test is given below: 10M

Time (min)	Infiltration (cm)
5	1.75
10	3.00
15	3.95
25	5.50
45	7.25
60	8.30
75	9.30
90	10.20
110	11.28
130	12.36

(i) For this data, plot the curves of: (a) Infiltration capacity vs. time (b) Infiltration capacity vs. cumulative infiltration (c) Cumulative infiltration vs. time.

(ii) Obtain the best-fit values of the parameters in Horton's infiltration capacity equation to represent this data set.

13. A). What is a Unit Hydrograph (UH)? List the assumptions involved in the Unit Hydrograph theory. 10M

OR

13. B). Derive the S-curve for the 4-hour Unit Hydrograph (UH) given below: 10M

Time (h)	Ordinates of 4-h UH (m ³ /s)
0	0
4	10
8	30
12	25
16	18
20	10
24	5
28	0

Using the above 4-hour Unit Hydrograph, construct the S-curve (cumulative hydrograph) for the catchment.

14. A). Explain types of aquifers with neat sketches. 10M

OR

14. B). An unconfined aquifer ($K = 6$ m/day) situated on the top of a horizontal impervious layer connects two parallel water bodies P and Q which are 1500 m apart. The water surface elevations of P and Q, measured above the horizontal impervious bed, are 12.00 m and 9.00 m. If a uniform recharge at the rate of 0.003 m³/day per m² of horizontal area occurs on the ground surface, estimate (i) the water table profile, (ii) the location and elevation of the water table divide, (iii) the seepage discharges into the lakes, and (iv) the recharge rate at which the water table divide coincides with the upstream edge of the aquifer and the total seepage flow per unit width of the aquifer at this recharge rate. 10M

15. A). i) Distinguish between non-modular, semi-modular and modular canal outlets. 7M
ii) Explain the criteria for selecting a canal outlet type and discuss its role in efficient irrigation water management. 3M

OR

15. B). Explain the necessity of canal lining. Discuss different types of canal lining used in practice, highlighting their advantages and disadvantages with respect to cost, durability, and effectiveness against seepage. 10M

H.T No:

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

R22



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

Examination : B.Tech V Semester Regular & Supplementary Examinations Nov/Dec-2025
Course Name : Structural Engineering-I
Course Code : A401310
Branch : Civil Engineering
Date & Session : 02-12-2025 AN Duration: 3 hours Max. Marks: 60

(Note: Assume suitable data if necessary, use IS 456:2000 and related SP-16 charts is allowed)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. In which method of design, factor of safety is considered? 1 M
2. Classify structures. 1 M
3. Give the expression to find the development length of bars. 1 M
4. Shear reinforcement is provided to prevent the propagation of what type of cracks? 1 M
5. What should be the minimum cover for slabs? 1 M
6. Classify slabs. 1 M
7. Tell the failure pattern of short columns. 1 M
8. Define long columns. 1 M
9. Mention the need of a combined footing. 1 M
10. Give the functions of a foundation. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Compare and contrast limit state method and working stress method of design of structures. 10M

OR

11. B). A concrete beam has 300 mm breadth and 500 mm effective depth. Design the beam if it is subjected to a super-imposed bending moment of 200 kNm. Use M20 grade of concrete and Fe 415 steel. 10M

12. A). A reinforced concrete beam 250 mm wide and 400 mm effective depth is subjected to ultimate design shear force of 150 kN at the critical section near supports. The tensile reinforcement at the section near the supports is 0.5%. Design the shear stirrups near the supports. Also design the minimum shear reinforcement at the mid span. Assume M20 grade concrete and Fe 415 grade steel. 10M

OR

12. B). Determine the longitudinal and transverse reinforcement required for a rectangular beam section with the following data. 10M

Width of section = 300 mm

Depth of section = 500 mm

Factored bending moment = 65 kNm

Factored torsional moment = 40 kNm

Factored shear force = 70kN

Use M20 grade concrete and Fe 415 grade steel.

(P.T.O.)

13. A). Design a R.C. slab for a room measuring 5 m x 6 m size. The slab is simply supported on all the four edges, with corners held down and carries a super-imposed load of 3 kN/m² inclusive of floor finishes. Use M20 concrete and Fe 415 steel. 10M

OR

13. B). Design a R.C.C floor slab for a room having inside dimensions 3 m x 8 m and supported on all sides by a 30 cm thick brick wall. The super-imposed load may be taken as 2 kN/m². Use M20 concrete and Fe 415 steel. 10M

14. A). A concrete column is reinforced with 4 bars of 20 mm diameter. Determine the ultimate load carrying capacity of the column, using M20 concrete and Fe 415 steel, if the size of the column is 450 mm x 450 mm. What will be the allowable service load? 10M

OR

14. B). Find the reinforcement of a R.C.C. rectangular column of size 240 mm x 300 mm if it is subjected to $P_u = 500$ kN, $M_{ux} = 50$ kNm, and $M_{uy} = 30$ kNm. Take M20 concrete and Fe 415 steel. The reinforcement has an effective cover of 60 mm. 10M

15. A). Design an isolated footing of uniform thickness of a R.C. column bearing a vertical load of 600 kN and having a base of size 500 mm x 500 mm. The safe bearing capacity of soil may be taken as 120 kN/m². Use M20 concrete and Fe 415 steel. 10M

OR

15. B). Design a combined footing for two columns each 600 mm x 600 mm, 5 m apart and each carrying a load of 1800 kN. The available width is restricted to 2.4 m. The safe bearing capacity of soil may be taken as 200 kN/m². Use M20 concrete and Fe 415 steel. 10M

H.T No:

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

R22



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

Examination : B.Tech V Semester Regular & Supplementary Examinations Nov/Dec-2025
Course Name : Airports, Railways and Waterways
Course Code : A401401
Branch : Civil Engineering
Date & Session : 04-12-2025 AN **Duration:** 3 hours **Max. Marks:** 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. What is a Monorail? 1 M
2. Define the term coning of wheels. 1 M
3. Why the widening of gauges needed in the curves? 1 M
4. List the types of gradients used in railway track. 1 M
5. What is mean by marshalling yard? 1 M
6. What is the principle of measured shovel packing? 1 M
7. How orientation of runway is done? 1 M
8. Differentiate type I and type II wind rose diagram. 1 M
9. List the primary classification of harbours. 1 M
10. Distinguish between jetty and wharf. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). (i) What are the ideal requirements of a permanent way? 6M
(ii) Summarize the functions of a sleeper. 4M

OR

11. B). Write in detail about the different types of Fixtures and Fastenings in railway track. 10M
12. A). Discuss about grade compensation on curves and cant deficiency. 10M

OR

12. B). Derive an expression for the relationship between super elevation, gauge and curve in a railway track. 10M

13. A). Briefly explain the different types of level crossings with neat sketch. 10M

OR

13. B). Describe about the methods of maintenance of tracks. 10M

14. A). Discuss the necessity, functions and types of hangers in airport. 10M

OR

14. B). The length of runway under standard conditions is 1620m. The airport site has an elevation of 270m. Its reference temperature is 32.90°C. If the runway is to be constructed with an effective gradient of 0.20%. Determine the corrected runway length. 10M

15. A). What are the functions of wet Docks and explain their working principle and main features with neat sketch? 10M

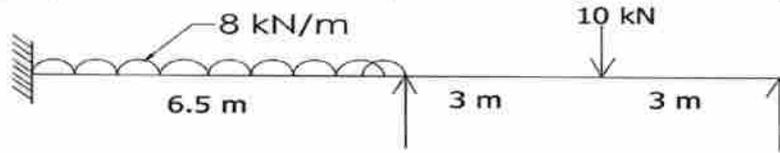
OR

15. B). Explain the different types of break waters with neat sketches. 10M

OR

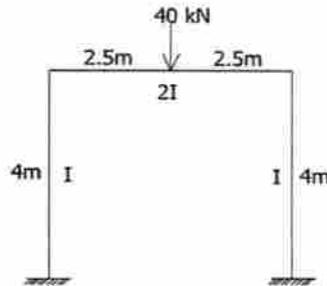
12. B). A cable of span 120 m and dip 10m carries a load of 6 kN/m of horizontal span. Find maximum tension in the cable and the inclination of the cable at the support. Find the forces transmitted to the supporting pier if the cable passes over smooth pulleys on top of the pier. The anchor cable is at 30° to the horizontal. Determine the maximum bending moment for the pier the Height of the pier is 15 m. 10M

13. A). Analyse the continuous beam PQRS shown in figure by flexibility matrix method. 10M

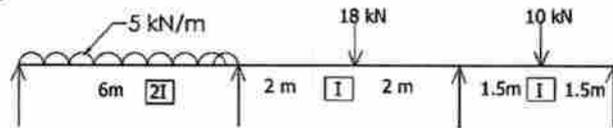


OR

13. B). Analyse the portal frame ABCD shown in figure by flexibility matrix method and sketch the bending moment diagram. 10M

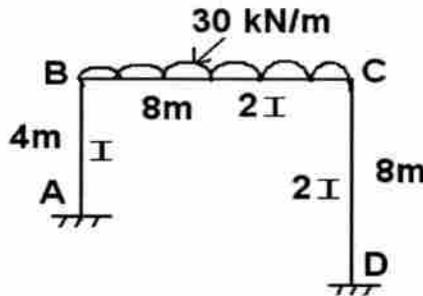


14. A). Analyse the continuous beam ABC shown in figure by stiffness matrix method and draw the shear force diagram. Take EI as constant. 10M



OR

14. B). Analyse the frame shown in figure by matrix stiffness method. 10M



15. A). i) Outline the effect of a moving load on a structure and how it is analyzed using influence line diagrams. 6M

- ii) Discuss about Müller-Breslau's principle. 4M

OR

15. B). Draw influence line for a moment at B MB for a two-span continuous beam ABC simply supported at A and C. Take EI is constant and AB=4m, BC =6m. 10M

H.T No:

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

R22



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

Examination : B.Tech V Semester Regular & Supplementary Examinations Nov/Dec-2025
Course Name : Transportation Engineering
Course Code : A401312
Branch : Civil Engineering
Date & Session : 08-12-2025 AN **Duration:** 3 hours **Max. Marks:** 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. Mention the factors influencing selection of highway alignment. 1 M
2. Define highway planning. 1 M
3. Why is super elevation provided on horizontal curves? 1 M
4. Mention different types of gradients used in geometric design. 1 M
5. What factors affect the capacity of a highway? 1 M
6. What is road safety audit (RSA)? 1 M
7. List any four aggregate tests used for evaluating their suitability in road construction. 1 M
8. What are modified bituminous binders? Mention two types? 1 M
9. Sketch a typical cross-section of a flexible pavement showing various layers. 1 M
10. Define critical load positions in rigid pavement slabs. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain the procedure for highway planning, including data collection, traffic studies, and forecasting future requirements. 10M

OR

11. B). Discuss the historical development of highways in India, highlighting major milestones and organizations involved in road planning and development. 10M

12. A). i) A road has a ruling gradient of 5% and a curve of radius 70 m. Find the gradient compensation to be provided and justify the same considering the IRC recommendations. 6M
ii) Define Overtaking Sight Distance (OSD) and explain the factors governing its design. 4M

OR

12. B). i) Describe briefly about PIEV theory. 6M
ii) Calculate the total extra widening required on a horizontal curve of radius 250 m for a two-lane highway. Vehicle length = 6 m, wheelbase = 6 m, design speed = 80 km/h. 4M

13. A). Define highway capacity and level of service (LOS). Describe the six levels of service as per Highway Capacity Manual (HCM) with sketches. 10M

(P.T.O.)

OR

13. B). i) Explain the objectives and procedure of accident studies. How are road safety audits conducted in practice? 5M
ii) A parking survey in a market area found 60 parking spaces. During a 3-hour study, 120 vehicles used the facility. The total parking time observed = 240 vehicle-hours. Compute the average occupancy, parking turnover, and parking load 5M
14. A). Explain the California Bearing Ratio (CBR) test procedure and how it is used to determine pavement thickness. 10M

OR

14. B). Explain the importance of advanced concrete in road applications and their typical properties. 10M
15. A). Explain how fatigue and rutting criteria are used in flexible pavement design (as per IRC:37). 10M

OR

15. B). A two-lane state highway is to be designed with the following data: Subgrade CBR = 8%, Vehicle damage factor (VDF) = 3.5, Design life = 20 years, Design reliability = 90%, Initial traffic = 450 CVPD (both directions), Annual growth rate = 7.5%. Compute the design traffic (N) in msa. 10M
