2011

CIVIL ENGINEERING

Paper 1

Time : 3 Hours]   [Maximum Marks : 300

INSTRUCTIONS

Candidates should attempt **all** the questions in Parts A, B & C. However, they have to choose only **three** questions in Part D.

Answers must be written in the medium opted (i.e. English or Kannada).

This paper has four parts :

A	20 marks
B	100 marks
C	90 marks
D	90 marks

Marks allotted to each question are indicated in each part.

PART A

Answer all questions. Each question carries 5 marks.

1. (a) State Castigliano's II theorem. Briefly explain how to analyze a statically indeterminate structural frame by the strain energy method.

   (b) Explain the limit state of collapse and limit state of serviceability − for design of RCC structures.

   (c) A capillary tube having an inside diameter of 2 mm is dipped in water at 80°F. Determine the height of water which rises in the tube if surface tension force T = 0·0735 N/m and if angle of contact (with the horizontal) is 30° (See Figure 1).
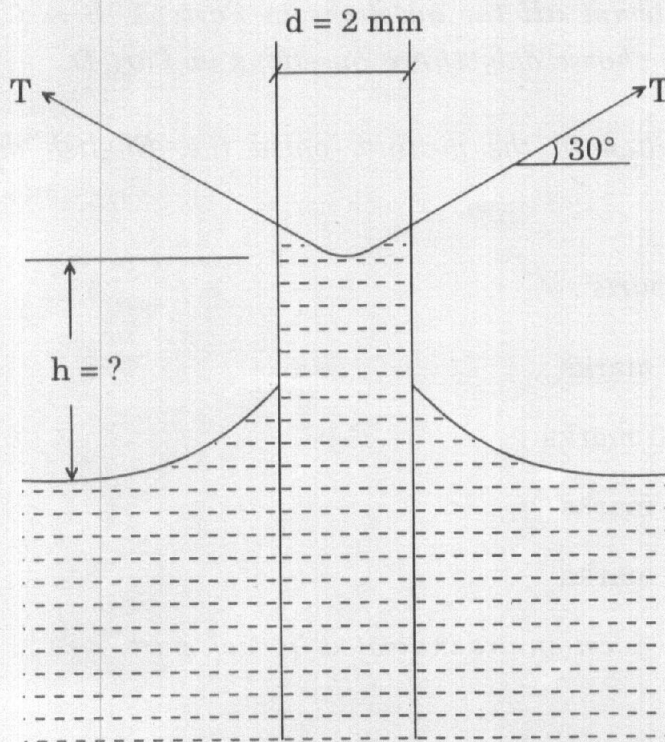

Figure 1

   (d) Clearly differentiate between effective stress, total stress and neutral stress in a soil mass, and state the relationship between these stresses.

PART B

10×10=100

Answer all questions. Each question carries 10 marks.

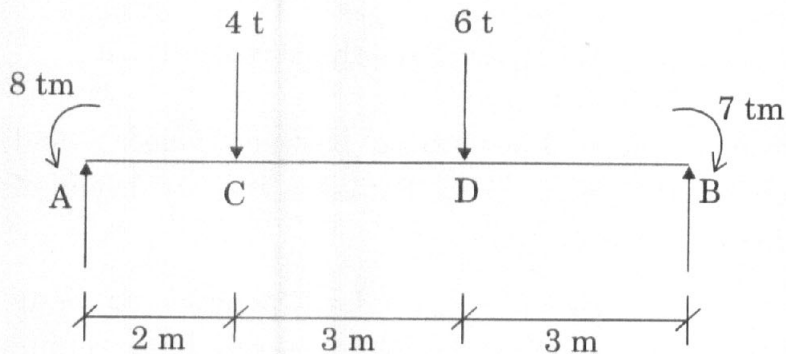2. Analyze and sketch the S.F. and B.M. diagrams for the beam shown in Figure 2.

Figure 2

3. Draw the influence line for support reaction at A and for shear force at a point E in a simply supported beam as shown in Figure 3.
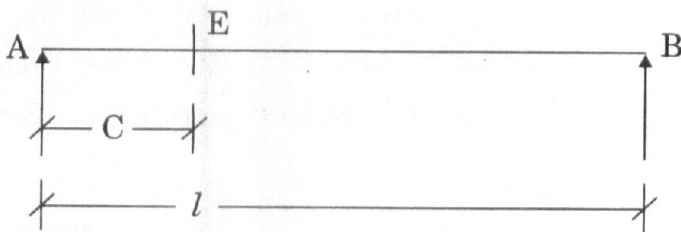

Figure 3

4. Briefly explain the salient points in the design of an isolated RCC footing by the limit state method.

5. A singly reinforced beam 200 mm wide has an effective depth of 400 mm. Determine the limit moment of resistance of the beam section and also the limiting area of reinforcement. Use M20 grade concrete and Fe-415 grade steel. Take $(x_{u\ max}/d) = 0.48$.

6. State the momentum equation. How will you apply the momentum equation for detemining the force exerted by a flowing liquid on a pipe bend ?

[Turn over

7. State Buckingham's π-theorem. What do you mean by repeating variables ? How are the repeating variables selected in dimensional analysis ?

8. (a) What is specific energy diagram ?

 (b) Explain how to draw a specific energy diagram for a rectangular channel. Therein explain how the critical depth is represented. 4+6

9. With respect to flow through soils, differentiate between velocity and discharge velocity and obtain the relationship between the coefficient of percolation and the coefficient of permeability.

10. Explain the procedure and significance of Standard penetration tests (SPT) in geotechnical investigations. Why do the observed blow counts (observed N values) during the test have to be corrected ?

11. A member consisting of two ISA 90 $\times$ 90 $\times$ 10 (Cross-sectional Area = 1703 mm^2) back-to-back is riveted with 24 mm rivets to a 20 mm thick gusset plate on one side. Determine the tension capacity of the member and also the number of rivets required to develop 85% tension capacity. Take allowable stress in the material as 150 N/mm^2 and shear capacity of rivet as 0·08 kN/mm^2.

PART C

Answer all questions. Each question carries 15 marks.

12. (a)   Describe the character set of FORTRAN language.

    (b)   What is a data type ? How are data types supported by FORTRAN ?

                                                                          7+8

13. A rafter member of a truss is subjected to an axial compression of 73 kN. The spacing of the purlins is at 1·524 m and all the purlins are on the truss joints. Design the member with welded connections. Take f_y = 250 MPa with a corresponding allowable stress of 70 MPa for ISA 65 × 65 × 8 and 83 MPa for ISA 75 × 75 × 8.

    ISA 65 × 65 × 8, Area = 976 mm^2, γ_{min} = 12·5 mm

    ISA 75 × 75 × 8, Area = 1138 mm^2, γ_{min} = 14·5 mm

14. A horizontal pipe of diameter 400 mm is suddenly contracted to a diameter of 200 mm. The pressure intensities in the larger and smaller pipes are 0·15 MPa and 0·13 MPa respectively. If coefficient of contraction C_c = 0·64, find the loss of head due to contraction. Also detemine the rate of flow of water.

15. Laminar flow of oil with specific gravity 0·92 and dynamic viscosity of 2·45 N.sec/m^2 takes place between two parallel plates 0·1 m apart. The maximum velocity of flow is 1·5 m/sec. Determine (i) flow rate/m width (ii) shear stress at walls. Take Average velocity U as (u_{max} / 1·5).

16. An open channel has side slopes of 2 H : 1 V laid on a slope of 1 in 1500 to carry a discharge of 30 cu.m. per sec. Determine the dimensions of an ecomomical, trapezoidal section of an open channel, assuming Chezy's coefficient as equal to 50.

17. What do you understand by turbulent flow through pipes ? Write short notes on water hammer and surge tank.

PART D

3×30=90

Answer any **three** *of the following five questions. Each question carries 30 marks.*

18. Analyze and draw the SF diagram and BM diagram (by the moment distribution method) for the continuous beam shown in Figure 4.
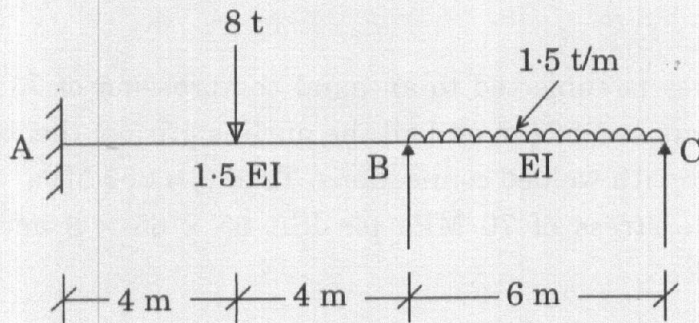

Figure 4

19. (a) Explain the principles of prestressing and the advantages of prestressed concrete structures. What are the limitations of PSC ?   8+8+6

    (b) Discuss the various types of losses of PSC.   8

20. Design a simply supported slab supported on masonry walls at the two ends given that the clear span is 3·05 m, live load is 3·5 kN/sq.m. Use M20 grade concrete and Fe-415 grade steel for reinforcement. Use appropriate formula for estimating percentage of steel.

21. (a) With respect to unconsolidated undrained triaxial shear test, draw the effective and total stress (Mohr) circles. Show the effective and total stress envelops in the Mohr stress space. Explain how these total and effective strength parameters are used in geotechnical analyses. Draw the effective stress path (ESP) and the total stress path for the UU tests in p-q stress space.   5+5+5+5

    (b) Write a short note on constants and variables in FORTRAN.   5+5

22. (a) What are the different types of possible pile load tests that can be conducted at site ? Explain briefly the procedure of conducting the compression loading test on a pile and how to determine the allowable load on piles in compression ?

(b) Explain the concept of Reinforced Earth (RE) and Mechanically Stabilized Earth (MSE). Discuss the materials used in RE and MSE structures; and briefly discuss their applications in civil engineering constructions.

(c) What are the principles to be followed in the design of machine foundations, as compared to normal foundations subjected to only static loads ? Discuss.

10+10+10

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Paper 2

Time : 3 Hours]   *[Maximum Marks : 300*

INSTRUCTIONS

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This paper has four parts :

A	20 marks
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C	90 marks
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Marks allotted to each question are indicated in each part.

PART A

Answer all questions. Each question carries 5 marks.

1. (a) What is the difference between the time estimates of a PERT activity and a CPM activity ?

   (b) What are the characteristics of first class bricks ?

   (c) Differentiate between (i) active and dormant cracks (i) non-structural and structural cracks.

   (d) With reference to permanent way, what is a double slip and what are the requirements of a complete set of double slip ?

PART B

10×10=100

Answer all questions. Each question carries 10 marks.

2. Differentiate between BOD and COD tests.

3. What is mastic asphalt ? Discuss its properties, application and advantages.

4. A recuperative test is conducted in a well, 3 m in diameter, with normal water level at 4 m below the ground level. The pumping lowers the water level in the well to 12 m below the ground level. 3 hours after pumping is stopped, the water level rises to 6 m below ground level. Determine : (i) the specific yield of the well in cu.m./hour (ii) yield in cu.m./hour under a head of 3 m.

5. With a neat sketch, describe a canal intake.

6. (a) What is superelevation (in a railway track) ?

   (b) On a broad gauge (BG), in a curve whose radius is 100 m, the design speed is 70 Km/Hr, calculate the superelevation in cm. What would be the corresponding superelevation in MG and NG for same radius and design speed ?   4+6

7. What is ferrocement ? Discuss its advantages, uses and applications.

8. (a) Explain the terms 'duty' and 'delta'.

   (b) A certain crop has a kor period of 20 days and requires a depth of water of 10 cms. Calculate the duty of water in hectares/cumec.   5+5

9. Discuss the merits and demerits of the activated sludge system.

10. (a) Enumerate the different methods of slope stability analysis. Give a one-sentence salient feature of each of the methods.

    (b) What do you understand by the term 'Mobilized cohesion' ? Define factor of safety of a homogenous earthen dam, made of clayey soil, with respect to cohesion.   5+5

11. Write a detailed note on joints in concrete pavements.

PART C

6×15=90

Answer all questions. Each question carries 15 marks.

12. What are the requirements of an ideal permanent way ?

13. Enumerate the various types of river training and control works. Explain any one of them in detail.

14. What are the qualities of good timber used for building construction ? How can the fire resistance of timber be improved ?

15. Briefly discuss the various technologies available for sewage treatment and disposal.

16. (a) Write a note on function of septic tank.

    (b) A septic tank is to be designed (only the dimensions of the septic tank) for 100 users given the following data :

    rated water supply = 50 litres/head/day

    detention period = 24 hours

    cleaning period = 3 years

    settling = same as rated water supply

    digestion = 0·0425 cu.m./capita

    3 years storage = 0·085 cu.m./capita   7+8

17. Differentiate between rigid and flexible pavements. What factors affect the design thickness of flexible pavements ? Describe briefly the CBR method of designing pavements.

PART D $3 \times 30 = 90$

*Answer any **three** of the following five questions. Each question carries 30 marks.*

18. (a) Briefly explain the types of precipitation. What are the various forms of precipitation ?   10

    (b) What is a unit hydrograph ? How is it derived ? Explain its use in construction of flood hydrograph resulting from two or more periods of rainfall.   5+8+7

19. (a) Write a note on reservoir sedimentation. How do you estimate the probable life of a reservoir ?   10+10

    (b) Briefly explain the vibroflotation technique of ground improvement technique for densifying in-situ foundation soils to control seepage through foundations of embankment dams.   10

20. (a) Write down the specifications for

    (i)   damp proof course

    (ii) painting old woodwork   10+10

    (b) Explain how the ventilation of a room can be improved.   10

21. (a) What are the functions of ballast placed below sleepers in a railway track ?

    (b) What are the factors governing the width of a carriageway ? State the IRC specifications for width of carriageway for various classes of roads.

    (c) What is a WBM road ? Discuss its advantages and disadvantages.
                                                                      10+10+10

22. (a) Enumerate the general standards followed for drinking water.

    (b) Define total hardness. Explain the different processes for softening hard water.   15+15