H.T No: | | | | | | | | | | | **R18** **Course Code: B30411**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations September-2023

Course Name: FINITE ELEMENTS METHODS IN STRUCTURAL ENGINEERING

(Structural Engineering)

Date: 04.09.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all FIVE questions (Compulsory)

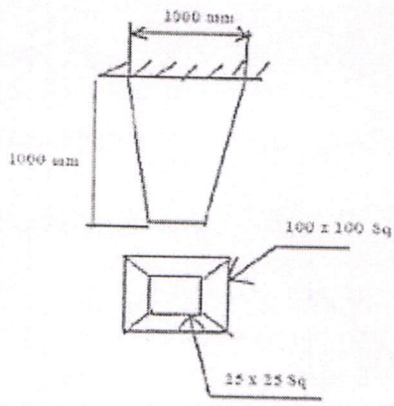
Each question carries FOUR marks. **5x4=20M**

1. List out the merits and demerits of FEM. 4M
2. List out different types of two dimensional elements. 4M
3. Differentiate Lagrangian elements and–serendipity elements. 4M
4. What are the limitations in Mindlin's approximations? 4M
5. Explain the different types of Non-linearities encountered in the structural analysis. 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). For the tapered steel bar shown in figure, subjected to its own self, determine the deflection at the free end using Ritz Technique. Assume E = 200 GPa, $\gamma = 77\ kN/m^2$. 10M

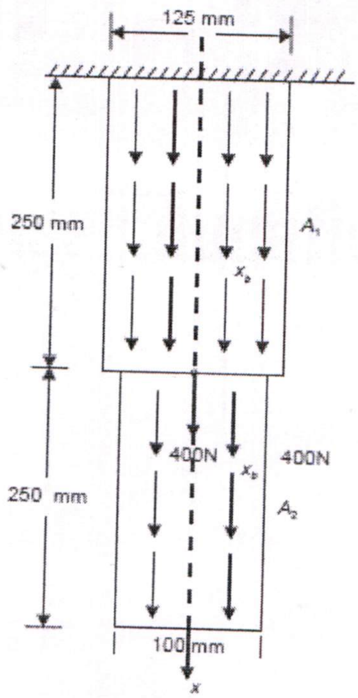


OR

6. B). Explain the steps involved in finite element formulation. 10M

7. A). The thin plate of uniform thickness 20mm is as shown in figure. In addition to the self weight, the plate is subjected to a point load of 400 N at mid depth. The Young's modulus $E = 2 \times 10^5 N/mm^2$ and unit weight $\rho = 0.8 \times 10^{-4} N/mm^2$. Analyse the plate after modeling it with two elements and find the stresses in each element. Determine the support reaction also. 10M

(P.T.O..)



OR

7. B). Determine the shape function for a three noded bar element: 10M
i) Using polynomial form in local coordinates
ii) Using Lagrangian functions.
Plot their shapes.

8. A). Write down the step by step procedure for an isoparamatic fomulation of a bar element. 10M

OR

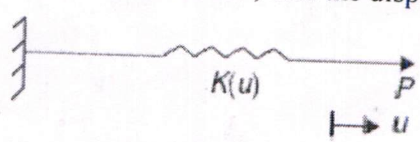
8. B). Derive the isoparametric formulation of the stiffness matrix for linear hexahedral element. 10M

9. A). Explain the term Mindlin's C^o continuity plate element and briefly explain stiffness matrix formulation for such elements. 10M

OR

9. B). Enumerate the various three dimensional elements used in the analysis of shells neat sketch. 10M

10. A). Consider the geometrically non-linear spring with single -DOF system shown in the figure. If K(u)=200+20u^2 N/mm and P 1140N , find the displacement u. 10M



OR

10. B). Briefly describe the finite element formulation for non linear analysis. 10M

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H.T No: | | | | | | | | | | **R18** **Course Code: B30414**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations September-2023

Course Name: DESIGN OF PRE STRESSED CONCRETE STRUCTURES

(Structural Engineering)

Date: 08.09.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all FIVE questions (Compulsory)

Each question carries FOUR marks. **5x4=20M**

1. What are the various stages of the pre-tensioning and post-tensioning operation? 4M

2. Distinguish between web-shear, flexural and flexure-shear cracks in concrete beams with sketches. 4M

3. Discuss the various methods of predicting long-term deflections of uncracked prestressed concrete members. 4M

4. What is transmission length? List the various factors influencing transmission length. 4M

5. Explain with sketches the various methods of achieving continuity in prestressed concrete members. 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). A rectangular prestressed beam 150 mm wide and 300 mm deep is used over an effective span of 10 m. The cable with zero eccentricity at the supports and linearly varying to 50 mm at the centre, carries an effective prestressing force of 500 kN. Find the magnitude of the concentrated load Q located at the centre of the span for the following: 10M
conditions at the centre-of-span section:
(i) If the load counteracts the bending effect of the prestressing force
(neglecting self-weight of beam), and
(ii) If the pressure line passes through the upper kern of the section under the action of the external load, self-weight and prestress.

OR

6. B). A post-tensioned concrete beam, 100 mm wide and 300 mm deep, spanning over 10 m is stressed by successive tensioning and anchoring of three Cables 1, 2 and 3, respectively. The cross-sectional area of each cable is 200 mm^2 and the initial stress in the cable is 1200N/mm^2, $\alpha_e = 6$. The first cable is parabolic with an eccentricity of 50 mm below the centroidal axis at the centre of span and 50 mm above the centroidal axis at the support sections. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50 mm at the centre of the span. The third cable is straight with a uniform eccentricity of 50 mm below the centroidal axis. Estimate the percentage loss of stress in each of the cables, if they are successively tensioned and anchored. 10M

(P.T.O..)

7. A). A pretensioned purlin with a rectangular section of 150 mm width and 350 mm over all depth, is stressed by high-tensile steel of area 200 mm^2 located at an effective depth of 300 mm. The section is also reinforced with two bars of 8 mm diameter, both in the tension and compression faces, at an effective cover of 50 mm. f_{pu} = 1600 N/mm^2, f_{pe} = 800 N/mm^2, f_y = 415 N/mm^2, f_{cu} = 40 N/mm^2, Es = 210 kN/mm^2. Estimate the moment capacity of the section using the strain compatibility method. 10M

OR

7. B). A concrete beam of rectangular section has a width of 250 mm and depth of 600 mm. The beam is prestressed by a parabolic cable carrying an effective force of 1000 kN. The cable is concentric at supports and has a maximum eccentricity of 100 mm at the centre of span. The beam spans over 10 m and supports a uniformly distributed live load of 20 kN/m. Assuming the density of concrete as 24 kN/m^3, estimate (a) the maximum principal stress developed in the section of the beam at a distance of 300 mm from the support, (b) the prestressing force required to nullify the shear force due to dead and live loads at the support section. 10M

8. A). A prestressed concrete beam having a cross-sectional area (A) of $5X10^4$ mm^2 is simply supported over a span of 10 m. It supports a uniformly distributed imposed load of 3 kN/m, half of which is non-permanent. The tendon follows a trapezoidal profile with an eccentricity of 100 mm within the middle-third of the span and varies linearly from the third-span points to zero at the supports. The area of tendons, Ap = 350 mm^2, have effective prestress of 1290 N/mm^2 immediately after transfer. Using the following data, calculate: 10M

(i) The short-term deflections.

(ii) The long-term deflections.

OR

8. B). A prestressed concrete beam of rectangular section 120 mm wide and 300 mm deep, spans over 6 m. The beam is prestressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. If it supports an imposed load of 4 kN/m and the modulus of elasticity of concrete is 38 kN/mm^2, compute the deflection at the following stages and check whether they comply with the IS code specifications: 10M

(i) Upward deflection under (prestress + self-weight).

(ii) Final downward deflection under (prestress + self-weight + imposed load) including the effects of creep and shrinkage. Assume the creep coefficient to be 1.80.

9. A). Distinguish between the terms (i) adhesion, (ii) friction and (iii) dilatancy, with respect to the transfer of prestress in pretensioned members and how do you calculate the flexural bond stress in uncracked and cracked pretensioned members? 10M

OR

9. B). The end block of a prestressed concrete girder is 200 mm wide and 300 mm deep. The beam is post-tensioned by two Freyssinet anchorages each of 100 mm diameter with their centres located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 2000 kN. Compute the bursting force and design suitable reinforcements according to the Indian Standard Code IS: 1343 provisions. 10M

(P.T.O..)

10. A). A prestressed concrete portal frame ABCD fixed at A and D has columns AB = CD = 5 m and transom BC = 10 m. The members have a cross-section 100 mm wide and 300 mm deep throughout. The columns are prestressed by a straight cable with an eccentricity of 50 mm towards the outside of frame at B and C. Transform BC is prestressed by a parabolic cable having an eccentricity of 50 mm above the centroid at B and C and 100 mm below the centroid at the centre of BC. The prestressing force in all the cables = 200 kN. Calculate the secondary moments developed at A and B. 10M

OR

10. B). What are concordant cables? Sketch a typical concordant cable profile in a two-span continuous prestressed concrete beam and briefly explain the various steps involved in the design of continuous prestressed concrete beams and portal frames. 10M

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H.T No: | | | | | | | | | | | **R18** **Course Code: B30417**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech II Semester Supplementary Examinations September-2023

Course Name: ADVANCED DESIGN OF FOUNDATIONS

(Structural Engineering)

Date: 11.09.2023 FN **Time: 3 hours** **Max.Marks: 70**

(Note: Assume suitable data if necessary)

PART-A

Answer all FIVE questions (Compulsory)

Each question carries FOUR marks. **5x4=20M**

1. State the codal provisions pertaining to permissible allowable settlement of structures under isolated, raft foundations for clay and sand. 4M
2. Explain the ultimate load carrying capacity for pile group. 4M
3. With the help of a neat sketch, show the components of an 'Open Caisson'. 4M
4. List the different types of sheet pile walls with sketches. 4M
5. Discuss the problems in expansive soils with suitable examples. 4M

PART-B

Answer the following. Each question carries TEN Marks. **5x10=50M**

6. A). Write briefly about elastic settlement of footings embedded in sands of infinite thickness. 10M

OR

6. B). Briefly describe the effect of size on the settlement of footings on homogeneous sand deposits. 10M

7. A). Explain the settlement analysis for pile groups on clay and sandy soils. 10M

OR

7. B). A concrete pile 20 m long having a cross section of 381 mm×381 mm is fully embedded in a saturated clay layer. For a clay, γ_{sat}=18.5 k/mm^3, ϕ=0, cu=70 kN/m^2. Assume that the water table lies below the tip of pile. Determine the allowable load that the pile can carry (FOS=3). Use the α method to estimate the skin friction. 10M

8. A). Identify the problems encountered in well sinking? How are they minimized. 10M

OR

8. B). Explain the components of open well foundation and its functions with a neat sketch. What are the different shapes of well foundations. 10M

9. A). Write about determination of depth of embedment in granular soils. 10M

OR

9. B). Write briefly about 'Timbering of Trenches' with Neat Sketches. 10M

10. A). Discuss about mechanism of swelling of expansive soils. 10M

OR

10. B). State the foundation techniques available for structures to be constructed in expansive soils. 10M

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