H.T No: | | | | | | | | | | | R22 Course Code: B420301

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech I Semester Supplementary Examinations September-2023

Course Name: ADVANCED STRUCTURAL MECHANICS

(Structural Engineering)

Date: 05.09.2023 FN **Time: 3 hours** **Max.Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries ONE mark. **10x1=10M**

1. Differentiate between symmetric and nonsymmetrical bending in beam. 1 M
2. Define shear center in bending. 1 M
3. In case of semi-circular fixed beam with radius of curvature "R" subjected to central concentrated load "W". What will be the maximum bending moment at mid span? 1 M
4. Mention the factors affecting the deflection of a curved beam. 1 M
5. What is buckling of columns Euler theory for elastic buckling? 1 M
6. What is the difference between elastic and inelastic buckling? 1 M
7. Explain briefly the term degree of static indeterminacy. 1 M
8. Define degree of freedom. 1 M
9. What are the advantages of direct stiffness method? 1 M
10. Define banded matrix. 1 M

PART-B

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

11.A). Determine the centroidal moment of inertia of the section shown in figure. 10M

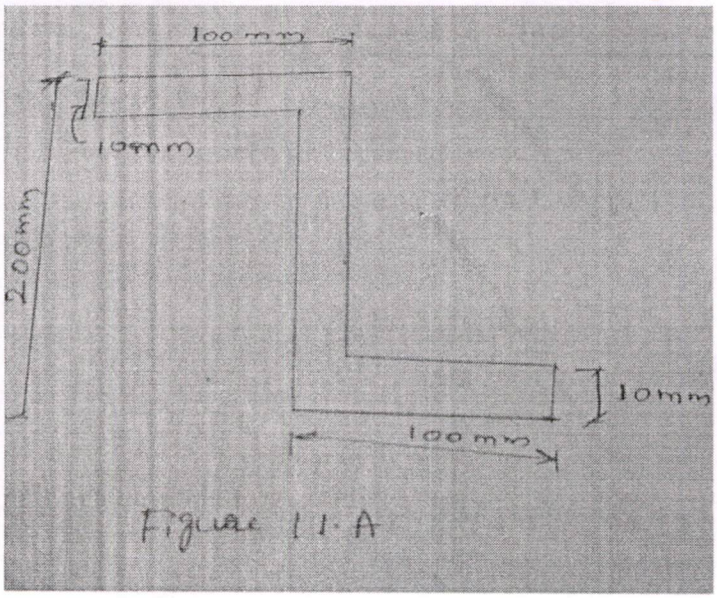


Figure 11.A

(P.T.O..)

OR

11. B). Locate the shear Centre of the section shown in figure given below. Thickness is 6mm throughout. 10M

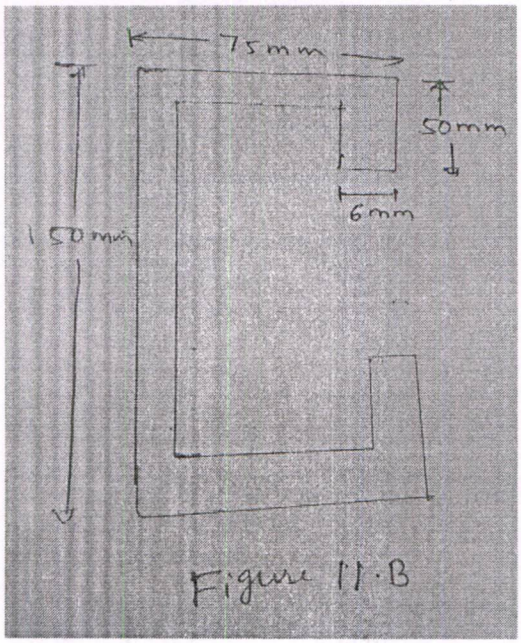


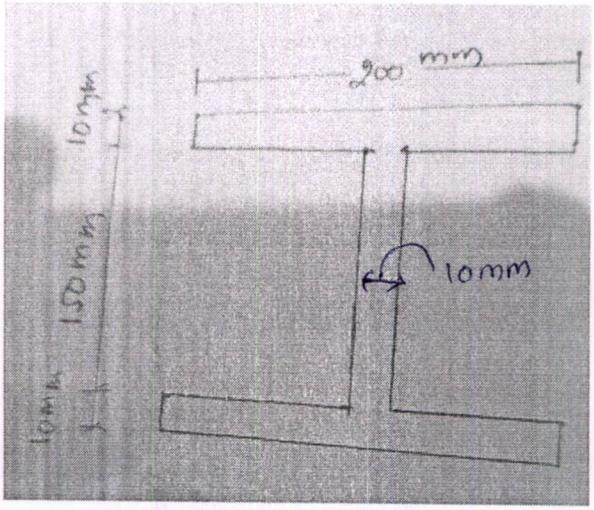
Figure 11.B

12. A). A semicircular girder is fixed at both the ends and is subjected to a uniformly distributed load over its entire span. Determine the expression for bending moment at any point of the beam. 10M

OR

12. B). Determine the rotation at the free end of a cantilever curved beam of quarter circle of radius R subjected to a concentrated load P at its free end. 10M

13. A). A steel column has a length of 9m and is pinned at both ends. If the cross sectional area has the dimensions shown in figure. Determine the critical load. E = 200 GPa, fy= 250 MPa 10M



OR

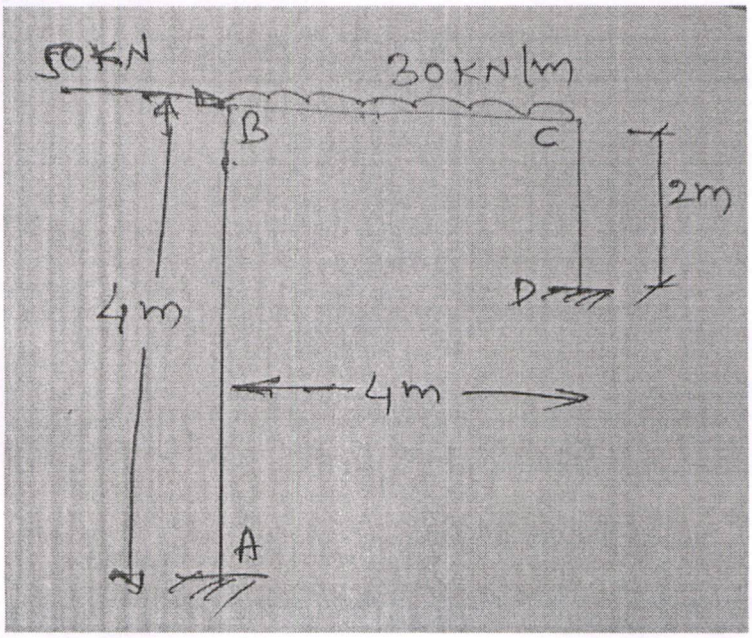
13. B). Write a note on column inelastic buckling. 10M

(P.T.O..)

14. A). Differentiate the relationship between flexibility and stiffness matrices. 10M

OR

14. B). Analyze the portal frame ABCD shown in figure by flexibility matrix method. EI is constant throughout. 10M



15. A). Write the step by step procedure to obtain the structural matrix for a plane truss member. 10M

OR

15. B). Explain the term semi-bandwidth with suitable example. 10M

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H.T No: | | | | | | | | | | | R22 | Course Code: B420302

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech I Semester Supplementary Examinations September-2023

Course Name: THEORY OF ELASTICITY & PLASTICITY

(Structural Engineering)

Date: 07.09.2023 FN **Time: 3 hours** **Max.Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries ONE mark. **10x1=10M**

1. Discuss Lami's constants. 1 M
2. Write the expression for octahedral stress. 1 M
3. List the assumptions of linear elasticity. 1 M
4. Define generalised Hooke"s law. 1 M
5. Write the equilibrium equation in 2-D element in polar coordinates. 1 M
6. Prioritize uniform and non-uniform state of stress. 1 M
7. Illustrate St.Venant"s Theory of torsion. 1 M
8. Write the concept of membrane analogy. 1 M
9. Mention the various assumptions made in plastic theory. 1 M
10. What is meant by strain hardening? 1 M

PART-B

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

11.A). Investigate the equation for Stress transformation law in 3-D Cartesian co-ordinates. 10M

OR

11. B). The state of stress at a point is given by $\sigma x = 100$, $\sigma y = 200$, $\sigma z = -100$, $\tau xy = 200$, $\tau yz = 100$, $\tau xz = 300$ kpa. Compose a) The stress in variants b) The principal stresses c). The direction cosines of the principal planes. 10M

12. A). Describe the deflection equation for bending a simply supported beam uniformly loaded over the entire span in terms of Cartesian coordinates. 10M

OR

12. B). What is a strain rosette? Explain the different types. Also Derive principal stress and stain equations. 10M

13. A). Illustrate the airy's stress function by direct method. 10M

OR

13. B). Show that the following Airy's stress functions and examine the stress distribution represented by them: 10M

a) $\phi = Ax^2 + By^2$, b) $\phi = Ax^3$, c) $\phi = A(x^4 - 3x^2y^2)$

14. A). A 300mm steel beam with flanges and web 12.5mm thick, flange widh 300mm is subjected to a torque of 4 kN m. Find the maximum shear stress induced in the section and angle of twist per unit length. Assume G=100 GPa. 10M

OR

14. B). Describe the torsion equation of thin-walled hollow rectangular section. 10M

(P.T.O..)

15. A). A rectangular beam having linear stress-strain behavior is 6cm wide and 8cm deep. It is 3m long, simply supported at the ends and carries a uniformly distributed load over the whole span. The load is increased so that the outer 2cm depth of the beam yields plastically. If the yield stress for the beam material is 240MPa, illustrate the residual stress distribution in the beam. 10M

OR

15. B). Discuss in detail about the various failure theories of plasticity with its limitations. 10M

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H.T No: | | | | | | | | | | | **R22** **Course Code: B420402**

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech I Semester Supplementary Examinations September-2023

Course Name: COMPUTER ORIENTED NUMERICAL METHODS

(Structural Engineering)

Date: 09.09.2023 FN **Time: 3 hours** **Max.Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)

Each question carries ONE mark. **10x1=10M**

1. Define the rate of convergence of SOR method. 1 M
2. Write the condition for triangularization method to be called Doolittle's method. 1 M
3. Explain Householder's method for Symmetric matrices. 1 M
4. What is the error in Hermite interpolation? 1 M
5. Obtain the second-degree polynomial approximation by using Taylor's series expansion of $f(x) = (1+x)^{1/2}$ $about$ $x = 0$. 1 M
6. Expand ln(1 + x) in a Taylor expansion about x0 = 1 through terms of degree 4. 1 M
7. Prove that $Ef(x) = e^{hD}f(x)$. 1 M
8. What is the error obtained in Simpson's $3/8^{th}$ method. 1 M
9. Define implicit Runge Kutta method of second order. 1 M
10. Consider the differential equation $y' = x(y+x) - 2, y(0) = 2$, use Euler's method with step size $h = 0.3$ to find $y(0.6)$. 1 M

PART-B

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

11.A). Find the inverse of the coefficient matrix of the system $x + y + z = 1$, $4x + 3y - z = 6$ and $3x + 5y + 3z = 4$, by Gauss-Jordan with partial pivoting and hence solve the equations. 10M

OR

11. B). Solve the system of equations $2x + y = 7, -x + 2y - z = 1, -y + 2z = 1$ using Gauss-Seidal method. 10M

12. A). Find the eigen values and eigen vectors for the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & 2 \\ -1 & 2 & 1 \end{bmatrix}$ 10M

OR

12. B). Find the unique polynomial of degree 3 or less such that $y(-1) = -2, y(1) = 0$, $y(4) = 63$ and $y(7) = 342$ using Lagrange interpolation and hence interpolate at $x = 5$. 10M

(P.T.O..)

13. A). Using Richardson's extrapolation method find $f''(0.6)$ from the following tabular values 10M

X	0.2	0.4	0.5	0.6	0.7	0.8	1.0
F(X)	1.420 072	1.881 243	2.128 147	2.386 761	2.657 971	2.942 897	3.559 753

With h = 0.2

OR

13. B). Calculate y′(0.398) as accurately as possible using the table below and with the aid of the approximation S(h). Give the error estimate (the values in the table are correctly rounded). 10M

X	0.398	0.399	0.400	0.401	0.402
F(x)	0.408591	0.409671	0.410752	0.411834	0.412915

14. A). Using the following data find f ′(6.0), error = O(h), and f ″(6.3), error = $O(h^2)$ 10M

X	6.0	6.1	6.2	6.3	6.4
F(x)	0.1750	-0.1998	- 0.2223	- 0.2422	- 0.2596

OR

14. B). Using Simpson's method evaluate $\int_1^2 \int_1^2 \frac{dxdy}{x^2+y^2}$ by taking $h = k = 0.25$. 10M

15. A). Use Runge-Kutta method to compute $y(0.4)$ for the differential equation $y' = \frac{y+x}{y-x}, y(0) = 1 \; and \; h = 0.2$. Round to 5 decimal places. 10M

OR

15. B). Find the solution of the boundary value problem y″ = y + x, x ∈ [0, 1], y(0)= 0, y(1) = 0 with the shooting method. Use the Runge-Kutta method of second order to solve the initial value problems with h = 0.2. 10M

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H.T No: | | | | | | | | | | | R22 Course Code: B420404

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech I Semester Supplementary Examinations September-2023

Course Name: ADVANCED REINFORCED CONCRETE DESIGN
(Structural Engineering)

Date: 12.09.2023 FN Time: 3 hours Max.Marks: 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions (Compulsory)
Each question carries ONE mark. 10x1=10M

1. Name any two methods of reinforced concrete design. 1 M
2. What is the partial safety factor for steel in reinforced concrete design? 1 M
3. What is the minimum span to depth ratio for a simply supported deep beam? 1 M
4. What is the minimum percentage of tension steel required in deep beam for crack control? 1 M
5. Define yield line. 1 M
6. Where do you recommend ribbed slab? 1 M
7. What is the minimum development length required for a 20 mm diameter HYSD rebar in tension? 1 M
8. Name any one way to improve bond in reinforced concrete. 1 M
9. Write the maximum slenderness ratio allowed for design of long columns. 1 M
10. What is the maximum strain allowed in concrete column under pure compression? 1 M

PART-B

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

11.A). Explain the basic concepts of working stress method and show how the limitations of the same are eliminated by limit state method? 10M

OR

11. B). Write a note on: (i) Stress strain curve of concrete and stress block parameters (ii) Reliability based method of design. 10M

12. A). Explain briefly how moment redistribution is achieved in a two span continuous beam loaded uniformly? 10M

OR

12. B). A deep beam has an overall depth of 7 m and effective span of 7 m. the width of the beam is 400 mm. the beam supports a uniformly distributed live load of 500 kN/m over the entire span. Design the beam and sketch the reinforcement details. Assume suitable grade of materials. 10M

13. A). A flat slab with drops is proposed or a warehouse 20 m by 30 m in size. Using a column grid of 5m by 5m, design an interior panel of the flat slab to support a live load of 7.5 kN/m^2. Adopt M_{20} grade concrete and Fe415 HYSD bar. 10M

OR

13. B). A RC grid floor of size 12 m × 15 m is required for an assembly hall. The ribs of grid beams are spaced at 1.5 m intervals in both the directions. Live load on roof is assumed as 5 kN/m^2. Design the grid floor. Adopt M_{25} grade of concrete and Fe415 steel. 10M

(P.T.O..)

14. A). A simply supported beam 350 mm × 550 mm is subjected to a dead load of 20 kN/m (including self-weight) and a live load of 20 kN/m. design and detail the shear reinforcement using vertical stirrups. Use M_{20} concrete and Fe415 steel. 10M

OR

14. B). Design the torsional reinforcement in a rectangular beam section 350 mm wide and 750 mm deep, subjected to an ultimate twisting moment of 140 kNm, combined with an ultimate bending moment of 200 kNm and an ultimate shear force of 110 kN. Assume M_{25} grade of concrete and Fe415 steel. 10M

15. A). Design the reinforcement in a spiral column of 400 mm diameter subjected to a factored load of 1500 kN. The column has an unsupported length of 3.4 m and is braced against side sway. Use M_{25} grade concrete and Fe415 grade steel. 10M

OR

15. B). Design the reinforcement in a column of size 250 mm × 400 mm, with an unsupported length of 6 m, subject to a factored axial load of 1100 kN. Assume the column to be braced and pinned at both ends in bot direction. Assume M_{25} grade of concrete and Fe415 steel and design by additional moment method. 10M

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