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R22

Course Code: B420301



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech I Semester Regular Examinations March-2023

Course Name: **ADVANCED STRUCTURAL MECHANICS**
(Structural Engineering)

Date: 20.03.2023 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

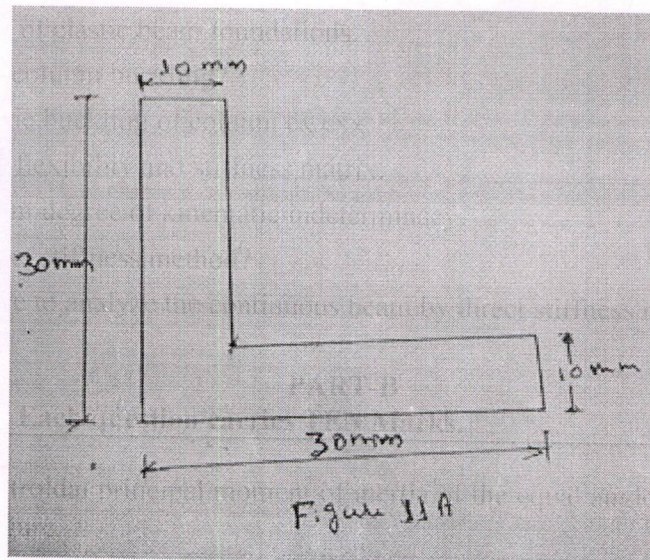
1. What are the assumptions made in the analysis of unsymmetrical bending? 1 M
2. Define Centre of flexure. 1 M
3. Mention the forces developed in a section of curved beam. 1 M
4. Write the applications of elastic beam foundations. 1 M
5. What are the types of column buckling? 1 M
6. Explain briefly inelastic buckling of column $cx\ cxx$. 1 M
7. Differentiate between flexibility and stiffness matrix. 1 M
8. Explain briefly the term degree of kinematic indeterminacy. 1 M
9. What is meant by direct stiffness method? 1 M
10. Write a brief procedure to analyze the continuous beam by direct stiffness method. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Determine the centroidal principal moment of inertia of the equal angle section 30x30x10 mm as shown in figure. 10M

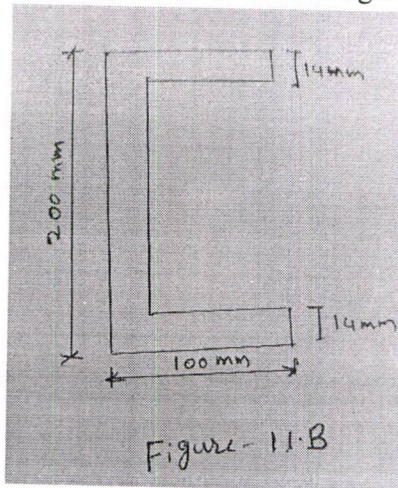


(P.T.O..)

OR

11. B). Locate the shear center of the channel section shown in figure.

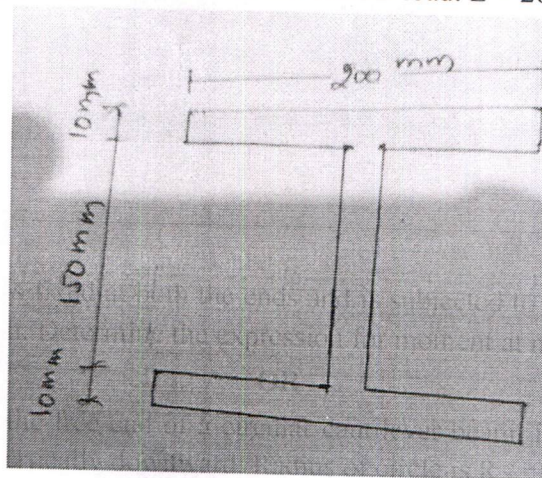
10M



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 moment at mid-span. 10M

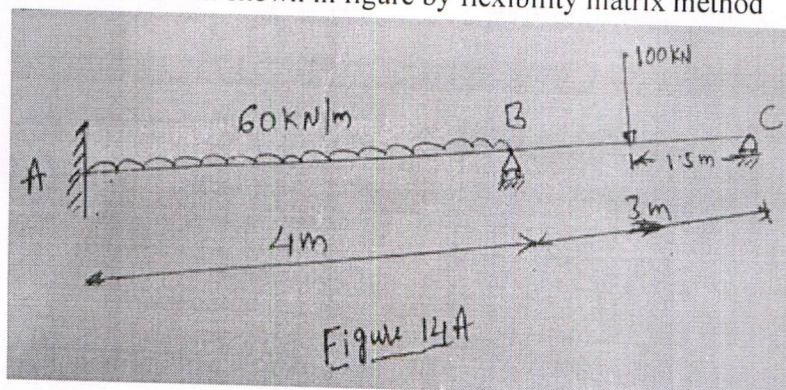
OR

12. B). Find the deflection at the free end of a circular cantilever beam, if it is loaded by "P" at mid span, "P" acting vertically downward. Radius of circle is R. 10M
13. A). A steel column has a length of 9m and is fixed at both ends. If the cross sectional area has the dimensions shown in figure. Determine the critical load. $E = 200 \text{ GPa}$, $f_y = 250 \text{ MPa}$ 10M



OR

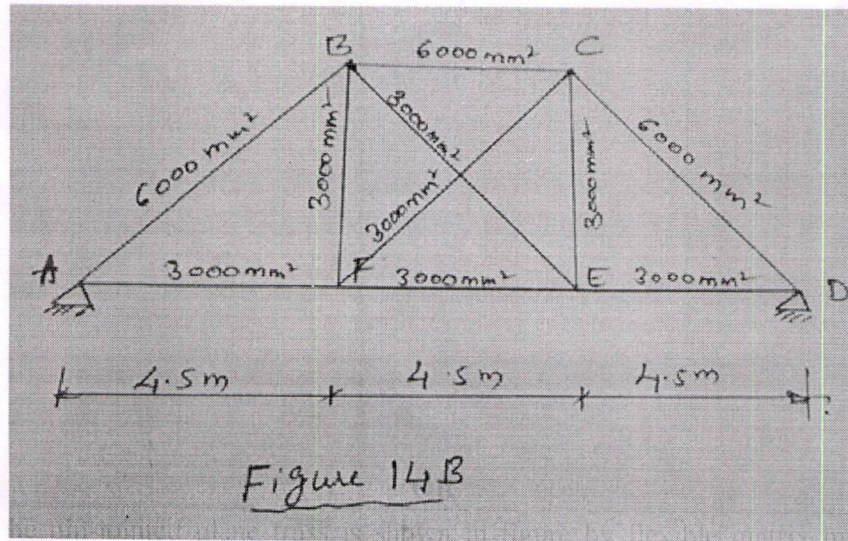
13. B). Write a note on local buckling of column. 10M
14. A). Analyze the continuous beam shown in figure by flexibility matrix method 10M



(P.T.O..)

OR

14. B). Analyze the pin-jointed plane truss is shown in figure by flexible matrix method. The 10M
cross section of the members in given in figure in mm^2 .



15. A). Derive the member stiffness matrix for plane truss member. 10M

OR

15. B). Explain the term banded matrix with suitable example. 10M

H.T No:

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R22

Course Code: B420302

**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**

(UGC AUTONOMOUS)

M.Tech I Semester Regular Examinations March-2023

Course Name: THEORY OF ELASTICITY & PLASTICITY

(Structural Engineering)

Date: 23.03.2023 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 generalized Hooke's law. 1 M
2. Write the expression for octahedral stress. 1 M
3. Discuss Lami's constants. 1 M
4. Compare surface force and body force. 1 M
5. Relate Cartesian and polar co-ordinates. 1 M
6. Write the equilibrium equation in 2-D element in polar coordinates 1 M
7. Illustrate St.Venant's Theory of torsion. 1 M
8. Outline prandtl stress function. 1 M
9. Discuss the Tresca's yield criteria. 1 M
10. Invent the stress-strain curve for a plastic and elastic material. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Illustrate the differential equation of equilibrium in 3-D rectangular co-ordinates. 10M

OR

11. B). When the stress tensor at a point with reference to axes (x, y, z) is given by the array. 10M

$$\sigma = \begin{bmatrix} 4 & 1 & 2 \\ 1 & 6 & 0 \\ 2 & 0 & 8 \end{bmatrix}$$

Find the stress invariants remain unchanged by transformation of the axes by 45° about the z-axis. Also find normal, shear and resultant stress.

12. A). Outline the analysis of a rotating disc in polar co-ordinates. 10M

OR

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

13. A). Show that the following Airy's stress functions and examine the stress distribution represented by them: i) $\phi = Ax^2 + By^2$, ii) $\phi = Ax^3$ and iii) $\phi = A(x^4 - 3x^2y^2)$ 10M

OR

13. B). Outline the analysis of a rotating disc in polar co-ordinates. 10M

(P.T.O..)

14. A). Predict the torsion equation of thin-walled closed rectangular section. 10M

OR

14. B). A hollow circular torsion member has an outside diameter of 22mm and inside diameter of 18mm, with mean diameter, $D = 20$ mm and $t/D = 0.10$. Compute the torque and angle of twist per unit length if shearing stress at mean diameter is 70MPa. Invent these values if a cut is made through the wall thickness along the entire length $G = 77.5$ GPa. 10M

15. A). Discuss in detail the various theories of failure normally adopted to find the yield criteria. 10M

OR

15. B). Explain the experimental verification of St.Venant's theory of plastic flow in detail. 10M

H.T No:

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R22

Course Code: B420402

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

M.Tech I Semester Regular Examinations March-2023

Course Name: COMPUTER ORIENTED NUMERICAL METHODS
(Structural Engineering)

Date: 25.03.2023 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 Iterative method. 1 M
2. Explain Householder's method for Symmetric matrices. 1 M
3. Define spectral norm. 1 M
4. Write the truncation error for Taylor's series interpolation. 1 M
5. Expand $\ln(1+x)$ in a Taylor expansion about $x_0 = 1$ through terms of degree 4. 1 M
6. What is the error obtained in Simpson's $3/8^{\text{th}}$ method? 1 M
7. Explain Radau Integration method. 1 M
8. Prove that $Ef(x) = e^{hD}f(x)$. 1 M
9. Define implicit Runge Kutta method of fourth 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). Solve the system of $x + y + z = 1$, $4x + 3y - z = 6$ and $3x + 5y + 3z = 4$, using LU Decomposition method. 10M

OR

11. B). For the following system of equations $2x + y = 7$, $-x + 2y - z = 1$, $-y + 2z = 1$ perform three iterations of the Successive Over Relaxation method in its error format with initial approximations $x^{(0)} = 0$, $y^{(0)} = 0$, $z^{(0)} = 0$ 10M

12. A). Find the eigenvalues of the matrix $A = \begin{bmatrix} -15 & 4 & 3 \\ 10 & -12 & 6 \\ 20 & -4 & 2 \end{bmatrix}$ using Rutishauser method. 10M

OR

12. B). For the following data 10M

X	0	1	2	3	4
Y(x)	1	1.5	2.2	3.1	4.6

Calculate the differences and obtain the forward and backward difference polynomials. And hence interpolate $x = 0.8$ and $x = 3.2$

(P.T.O..)

13. A). Using Richardson's extrapolation method find $f'(1)$ from the following tabular values 10M
With $h = 0.2$

X	0.6	0.8	0.9	1.0	1.1	1.2	1.4
F(X)	0.707 178	0.858 92	0.925 863	0.984 007	1.033 74	1.074 575	1.127 986

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 Trapezoidal method evaluate $\int_1^2 \int_1^2 \frac{dx dy}{x^2+y^2}$ by taking $h = k = 0.25$. 10M

15. A). Solve the initial value problem $u' = -2tu^2, u(0) = 1$, with $h = 0.2$ on the interval $[0, 0.4]$ use second order implicit Runge Kutta method 10M

OR

15. B). Find the solution of the boundary value problem $x^2 y'' - 2y + x = 0, x \in [2, 3] y(2) = y(3) = 0$ with the shooting method. Use the fourth order Taylor series method with $h = 0.25$ 10M

H.T No:

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R22

Course Code: B420404



CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech I Semester Regular Examinations March-2023

Course Name: ADVANCED REINFORCED CONCRETE DESIGN
(Structural Engineering)

Date: 27.03.2023 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 concrete in reinforced concrete design? 1 M
3. What is the minimum span to depth ratio for a continuous 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 flat slab? 1 M
7. What is the minimum development length required for a 28 mm diameter HYSD rebar in tension? 1 M
8. Name any one way to improve bond in reinforced concrete. 1 M
9. What are long columns? 1 M
10. What is additional moment method? 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain the following:
- i) Characteristic strength and characteristic loads 4M
 - ii) Partial safety factors and design values 3M
 - iii) Assumption for limit state of collapse in flexure 3M
- OR**
11. B). Write a note on:
- i) Reliability based method of design 5M
 - ii) Moment redistribution in RCC members. 5M
12. A). Design a simply supported deep beam to the following requirements. Clear span = 4.2 m, bearing at each end = 450 mm, overall depth = 3500 mm, width of beam = 250 mm, super imposed load = 225 kN/ m. Use M 30 concrete and Fe 415 grade steel. 10M
- OR**
12. B). Explain the IS code provisions of loading pattern and it application in continuous beams. 10M

(P.T.O.)

13. A). A right angled triangular slab is simply supported at the adjacent edges AB and BC. The side AB = 4 m and BC = 3 m and CA = 5 m. The Slab is isotopically reinforced with 10 mm diameter bars at 100 mm centre to centre both ways at an average effective depth of 120 mm. the overall depth of the slab is 150 mm. If $f_{ck} = 20 \text{ N/mm}^2$ and $f_y = 415 \text{ N/mm}^2$, estimate the safe permissible service live load on the slab. 10M

OR

13. B). A RC grid floor of size 9 m × 12 m is required for an assembly hall. The ribs of grid beams are spaced at 2 m intervals in both the directions. Live load on roof is assumed as 5 kN/m². Design the grid floor. Adopt M 25 grade of concrete and Fe415 steel. 10M

14. A). A reinforced concrete simply supported beam is of rectangular section 150 × 350 mm, with 3 nos of 16 mm as tension steel continued to the ends. Assume M 25 concrete and Fe 415 grade steel. Determine (i) the maximum shear force for which no shear steel need to be provided. (ii) the size and spacing of nominal stirrups to be provided and (iii) the size and spacing of stirrups if the maximum shear expected at the end section of the beam is 40 kN is under a uniformly distributed load over 6 m span. 10M

OR

14. B). An RCC cantilever beam has a span of 3m and free breadth of 450 mm with the depth varying from 200 mm at the end to 500 mm at the fixed end. It carries a UDL of 15 kN/m. Calculate the maximum size of bars that can be used as reinforcement for the member, if one-half of the steel is to be cut off at mid span of the member. The bond requirements should be fully satisfied. Assume M 20 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 M25 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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R22

Course Code: B420303



CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech I Semester Regular Examinations March-2023

Course Name: RESEARCH METHODOLOGY & IPR

(Common for all Branches)

Date: 29.03.2023 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 meaning of research. 1 M
2. List the sources of data collection. 1 M
3. What are the various literature studies approaches? 1 M
4. What do you mean by Research Ethics? 1 M
5. Who are involved in research committee? 1 M
6. Differentiate between a report and paper for research proposal. 1 M
7. What is Patenting under PCT? 1 M
8. Define trademark. 1 M
9. How is the patent information stored? 1 M
10. List the various patent databases. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain the meaning and sources of Research problem. 10M
- OR**
11. B). Discuss in detail about the types of errors in selecting a research problem. 10M
12. A). Explain the effective literature studies approaches in research. 10M
- OR**
12. B). What is Plagiarism? Explain how it is affecting the research process. 10M
13. A). Explain the mechanics of writing a research report. 10M
- OR**
13. B). Discuss in detail about effective technical writing and paper in developing research proposal. 10M
14. A). Explain the processing of patenting and development. 10M
- OR**
14. B). What are the salient features of designs and copyrights? 10M
15. A). Explain the scope of patent rights and geographical indications. 10M
- OR**
15. B). Describe the salient features of Administration of patent system. 10M
