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

Examination : M.Tech I Semester Regular & Supplementary Examinations March-2025
Course Name : B420301
Course Code : Advanced Structural Mechanics
Branch : Structural Engineering
Date & Session : 17-03-2025 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

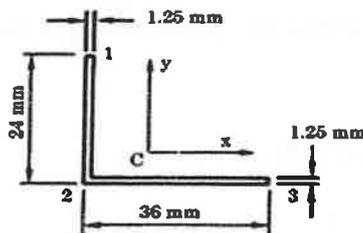
1. Define Unsymmetrical Bending. 1 M
2. Define principal moment of inertia. 1 M
3. Differentiate between straight beam and a curved beam. 1 M
4. Name two practical applications of beams on elastic foundations. 1 M
5. Define Slenderness ratio. 1 M
6. State the assumptions made in the Euler's column theory. 1 M
7. What is degree of kinematic indeterminacy and give an example. 1 M
8. Write a note on global stiffness matrix. 1 M
9. What is the difference between the stiffness matrix and the flexibility matrix? 1 M
10. What is a banded matrix? 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A. (i) Explain the stresses induced due to unsymmetrical bending. 5M
(ii) Determine the section properties of the angle section given in Figure. What are principal axes of inertia and how are they determined? 5M



OR

- 11.B. A cantilever of length 1 m carries a point load of 2000 N at the free-end. The cross-section of the cantilever is an unequal angle of dimensions 100 mm by 60 mm and 10 mm thick. The small leg of the angle (i.e., 60 mm) is horizontal. The load passes through the centroid of the cross-section. Determine: 10M
(i) position of neutral axis and
(ii) the magnitude of maximum stress set up, at the fixed section of the cantilever.

(P.T.O.)

12. A). Derive the expression for circumferential stresses in curved beams. 10M

OR

12. B). (i) Explain Procedure for incorporating Support Displacements. 5M
(ii) Explain Analysis of Beams on Elastic Foundations. 5M

13. A). (i) Determine the critical load of a column with one end fixed and other end free. 5M
(ii) Differentiate between elastic buckling & inelastic buckling. 5M

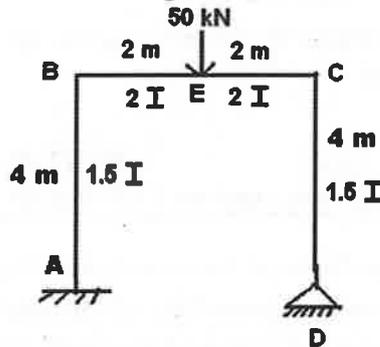
OR

13. B). (i) Calculate the safe compressive load on a hollow steel column of external and internal diameter 250 mm and 150 mm respectively. The column is 7.5m long with one end fixed and other end hinged. Take FOS=4 and $E = 2 \times 10^5 \text{ N/mm}^2$. 5M
(ii) Compare the ratio of the strength of a solid steel column to that of a hollow of the same cross-sectional area. The internal diameter of the hollow column is 3/4 of the external diameter. Both the columns have the same length and are pinned at both ends. 5M

14. A). A two span continuous beam ABC is fixed at A and C and rests on simple support at B. All the three supports are at same level. The span AB=4.5m and span BC=6.3m. The span AB carries a uniformly distributed load of 48kN/m and span BC carries a central point load of 75kN. EI is constant for the whole beam. Find the moments and reactions at all the support Using stiffness method. 10M

OR

14. B). Analyze the portal frame ABCD shown in Fig below by stiffness method. 10M



15. A). Explain the Direct Stiffness Method (DSM) and derive the global stiffness matrix for a simple portal frame. 10M

OR

15. B). Differentiate the relationship between flexibility and stiffness matrices. 5M
5M

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : M.Tech I Semester Regular & Supplementary Examinations March-2025
 Course Name : Theory of Elasticity and Plasticity
 Course Code : B420302
 Branch : Structural Engineering
 Date & Session : 19-03-2025 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. Differentiate between kinetics and kinematics. | 1 M |
| 2. What is a deviatoric stress? | 1 M |
| 3. What do you mean by strain rosette? | 1 M |
| 4. What is principal strain? | 1 M |
| 5. State the characteristics of Mohr's circle. | 1 M |
| 6. What is called isotropic? | 1 M |
| 7. List the properties of torsion. | 1 M |
| 8. What causes a beam to bend? | 1 M |
| 9. What is a yield criterion, and why is it important in plasticity? | 1 M |
| 10. What are the different types of hardening rules? | 1 M |

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Is the following state of stress a possible one? 10M
 $\sigma_x = \sigma_y = ky^2/x^2$, $\tau_{xy} = ay/x^2$, Assume k is a constant and zero body forces.

OR

11. B). The displacement components in a strained body are as follows: $u = 0.01 xy + 0.02y^2$, $v = 0.02x^2 + 0.01z^2y$, $w = 0.01xy^2 + 0.05z^2$. determine the strain matrix at the point P (3,2,-5). 10M

12. A). The displacement field in a body is specified as $u = x^3 + 3y^2$, $v = 3y^2 + 4x$, $w = 0$ 10M
 Determine the stress and strain component at a point whose coordinates are (2, 3) take $E = 2 \times 10^5 \text{ N/mm}^2$, Poisson's ratio = 0.3.

OR

12. B). Resolve the given state of stress into spherical and deviator state of stress determine the normal and shearing stresses on a octahedral plane. 10M

$$\sigma_x = \sigma_y = \sigma_z = 2, \tau_{xy} = \tau_{yz} = \tau_{zx} = 1$$

13. A). Explain plane stress and plane strain state of stress. 10M

OR

13. B). Make use of equilibrium equations, stress-strain relation in three dimensions, show that the volume expansion 'e' satisfies the following differential equation. 10M

$$\frac{\partial^2 x}{\partial x^2} + \frac{\partial^2 x}{\partial y^2} + \frac{\partial^2 x}{\partial z^2} = 0$$

(P.T.O..)

14. A). A hollow thin walled brass tube has an equilateral triangular section the mean length of the side of the triangle is 125mm and thickness of the wall is 3mm the tube is subjected to a twisting moment of $2 \times 10^4 \text{ Nmm}$. Find the maximum shearing stress and the angle of twist per unit length. 10M

OR

14. B). Explain the analogy of torsion. 10M
15. A). Discuss the yield criteria and the flow rules for perfectly plastic and strain hardening materials. 10M

OR

15. B). i) Compare and contrast Tresca's and Von Mises' yield criteria. 3M
ii) Explain the Saint-Venants theory of plastic flow in detail. 7M

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : M.Tech I Semester Regular & Supplementary Examinations March-2025
Course Name : Computer Oriented Numerical Methods
Course Code : B420402
Branch : Structural Engineering
Date & Session : 21-03-2025 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. Define pivoting. 1 M
2. Define relaxation parameter. 1 M
3. When λ is an eigen value of a square matrix A, what is the eigen value of A^m ? 1 M
4. State Lagrange's interpolation formula. 1 M
5. Define error of approximation. 1 M
6. Write the Taylor's series expansion of $f(x)$ about the point x_0 . 1 M
7. Define first order partial derivatives of f with respect to x and with respect to y . 1 M
8. How many minimum number of intervals are required to apply Trapezoidal rule and Simpson's rule to numerical integration? 1 M
9. Define order of a difference equation. 1 M
10. What is second order implicit Runge-Kutta method. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). (i) Apply Cramer's rule to find solution of the system of equations: $x+2y-z=2$, $3x+6y+z=1$ and $3+3y+2z=3$ 5M
(ii) Using Gauss Seidel method solve the system of equations correct to 3 decimal places: $2x-y=7$, $-x+2y-z=1$, and $-y+2z=1$ 5M

OR

11. B). Using Gauss-Jordan method solve the system of equations: $4x+2z=4$, $5y+2z=-3$ and $5x+4y+10z=2$ 10M
12. A). By using lagranges interpolation find $f(x)$ at $x=3.0$ 10M

x	-1	2	4	5
F(x)	-5	13	255	625

OR

12. B). Find all eigen values and eigen vectors of the matrix $\begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$ 10M
13. A). For the following data, calculate the differences and obtain the forward and backward difference polynomials. Interpolate at $x = 0.25$ and $x = 0.35$ 10M

x	0.1	0.2	0.3	0.4	0.5
F(x)	1.40	1.56	1.76	2.00	2.28

(P.T.O..)

OR

13. B). A differentiation rule of the form $f'(x_0) = \alpha_0 f_0 + \alpha_1 f_1 + \alpha_2 f_2$, ($x_k = x_0 + kh$) is given. Find the values of α_0 , α_1 and α_2 so that the rule is exact for $f \in P_3$. Find the error term. 10M

14. A). The following table of values is given: 10M

x	-1	1	2	3	4	5	7
f(x)	1	1	16	81	256	625	2401

Using the formula $f'(x_1) = (f(x_2) - f(x_0)) / 2h$ and the Richardson extra polation, find $f'(3)$

OR

14. B). Find the approximate value of the integral $I = \int_0^1 \frac{dx}{1+x}$ using composite trapezoidal rule with 2, 3 5 9 nodes and Romberg integration. 10M

15. A). Solve the initial value problem $u' = -2tu^2$, $u(0) = 1$ using the following methods: 10M
i) Euler method (ii) Mid point method with $h = 0.2$ over the interval $[0, 1]$. Also determine the percentage relative error at $t = 1$.

OR

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

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : M.Tech I Semester Regular & Supplementary Examinations March-2025
Course Name : Advanced Reinforced Concrete Design
Course Code : B420404
Branch : Structural Engineering
Date & Session : 24-03-2025 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. Define Characteristic Strength. 1 M
2. What is the maximum redistribution of moment allowed in indeterminate beams? 1 M
3. Why do continuous beams have reduced bending moments compared to simply supported beams? 1 M
4. Draw the stress distribution across the cross section in deep beams. 1 M
5. What is a yield line in slabs? 1 M
6. What is the critical section of two way shear in flat slabs? 1 M
7. What is the effect of compressive force on bond strength? 1 M
8. What is primary torsion? 1 M
9. Define slenderness ratio. 1 M
10. How the long column behaviour is different from short column? 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Discuss in detail about Moment rotation characteristics of RC member, with neat sketch. 10M

OR

11. B). i) What do you understand by the term "Redistribution of moments"? Explain with an example. 5M
ii) Discuss 'assumptions in limit state method'. 5M

12. A). A reinforced concrete deep girder is continuous over spans of 8 m apart, from center to center. It is 5 m deep, 300 mm thick and the supports are columns of 800 mm in width. If the girder supports a udl of 175 kN/m including its self weight, design the necessary reinforcement. Use M25 concrete and Fe 415 grade steel. Sketch the reinforcement details. 10M

OR

12. B). i) Outline the bending moment envelope after 30% redistribution, for a fixed ended beam of span 5m carrying 20 kN/m load at collapse. 5M
ii) Describe different types of loading patterns considered in the flexural design of beams. 5M

(P.T.O.)

13. A). Using yield line theory, design the floor slab of a class room of a multi-storeyed structure for the following data. Dimensions of the class room are 4 m x 4 m. The panel is continuous on all edges. Assume M30 concrete and Fe415 grade steel. Derive the formulae involved. Sketch the reinforcement details. Assume moderate exposure condition. 10M

OR

13. B). Discuss in detail the analysis and design procedure for ribbed slab. 10M

14. A). i) What is the development length? Discuss different bond failures in RC members with neat sketches. 5M

ii) What is primary torsion and discuss the code provisions for the transverse reinforcement in a beam subjected to torsion. 5M

OR

14. B). A reinforced concrete beam of rectangular section 300 mm wide is reinforced with 4 bars of 25mm diameter at an effective depth of 550 mm. The beam has to resist a factored shear force of 350 kN at support section. Adopt M25 grade concrete and Fe 500 steel. Design vertical stirrups for the section. Sketch the reinforcement details. 10M

15. A). An RCC circular short column of 450 mm diameter subjected to a factored load of 3000kN. The unsupported length of column is 3m. Design the column by considering longitudinal reinforcement and helical reinforcement. Use M25 grade concrete Fe500 grade steel. 10M

OR

15. B). Discuss in detail the design procedure for slender column. 10M

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : M.Tech I Semester Regular & Supplementary Examinations March-2025
Course Name : Research Methodology and IPR
Course Code : B420303
Branch : SE/PE/ES/CSE
Date & Session : 26.03.2025 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. Define Research Problem. 1 M
2. What is primary data? 1 M
3. What is literature review? 1 M
4. Write the meaning of plagiarism. 1 M
5. What is a research report? 1 M
6. What is research proposal? 1 M
7. Define patent. 1 M
8. What is copyright? 1 M
9. What is licensing? 1 M
10. Write the full form of IPR. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Examine the essential criteria and characteristics of a well-defined research problem. 10M
Illustrate your answer with relevant examples to demonstrate how these criteria contribute to the formulation of a robust research problem.

OR

11. B). Write a short note on following :
i) Errors in selecting research problem. 5M
ii) Sources of research problem. 5M

12. A). Critically analyze and compare the different approaches used in literature studies, highlighting their significance and application in academic research. 10M

OR

12. B). Explain about research report and its components. 10M

13. A). Describe the essential components of a research proposal. Explain the purpose of each section and how it contributes to the overall proposal. 10M

OR

13. B). Discuss the key principles of effective technical writing. For each principle, provide an example of how it can be applied to enhance clarity and usability in a technical document. 10M

(P.T.O..)

14. A). Why do geographical indications need protection? How are geographical indications protected? 10M

OR

14. B). Discuss the steps of the process of patenting and development with example. 10M

15. A). Discuss recent developments and trends in intellectual property rights (IPR). Analyse how these changes impact the protection of intellectual property, innovation, and global business practices. 10M

OR

15. B). Write a short note on :

(i) Patent information and databases

5M

(ii) scope of patent rights.

5M
