H.T No: | | | | | | | | | | | R22

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

**Examination** : **M.Tech I Semester Supplementary Examinations August-2025**
**Course Name** : **Advanced Structural Mechanics**
**Course Code** : **B420301**
**Branch** : **Structural Engineering**
**Date & Session** : **26-08-2025 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. | State the two reasons for unsymmetrical bending. | 1 M |
| 2. | Define shear centre. | 1 M |
| 3. | How is the deflection of curved beams calculated? | 1 M |
| 4. | How does an elastic foundation affect the deflection of a beam? | 1 M |
| 5. | State the Limitations of Euler's formula. | 1 M |
| 6. | Mention the stresses which are responsible for column failure. | 1 M |
| 7. | Compare flexibility method and stiffness method. | 1 M |
| 8. | What is the displacement transformation matrix? | 1 M |
| 9. | What is a local stiffness matrix | 1 M |
| 10. | Why is the global stiffness matrix always symmetric? | 1 M |

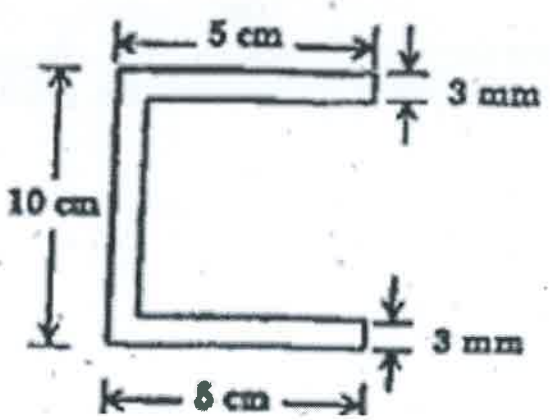
**PART-B**

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

11.A). A 80 x 80 x 10 mm angle is used as a simply supported beam over a span of 2.4 m. It carries a load of 400 kN along the vertical axis passing through the centroid of the section. Determine the resulting bending stress on the outer corners of the section along the middle section of the beam. 10M

**OR**

11. B). (i) Determine the shear center for the section shown in Figure. Section is subjected to a vertical shear load of 5 kN. 5M




5M

(ii) State the condition for the two axes to be principal axes for the given two perpendicular axes.

*(P.T.O.)*

12. A). Derive the equation for stress variation across the curved beam. 10M

**OR**

12. B). (i) Derive the governing differential equation for a beam on an elastic foundation. 5M

(ii) Discuss the boundary conditions for beams on elastic foundations. 5M

13. A). (i) Explain buckling of bars with varying in cross section with a suitable example. 5M

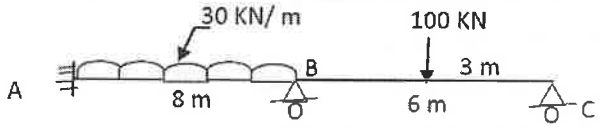
(ii) Difference between lateral & longitudinal buckling. 5M

**OR**

13. B). (i) A hollow alloy tube 4 m long with external and internal diameters of 40 mm and 25 mm respectively was found to extend 4.8 mm under a tensile load of 60 kN. Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube, taking a factor of safety as 5. 5M

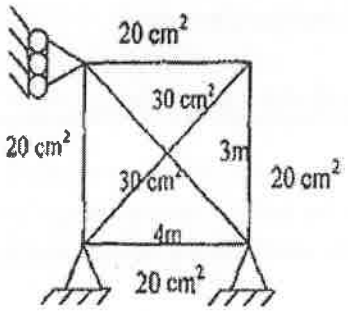
(ii) An I section joist 400 mm × 200 mm × 20 mm and 6 m long is used as a strut with both ends fixed. What is Euler's crippling load for the column? Take Young's modulus for the joist as 200 GPa. 5M

14. A). Analyse the continuous beam shown in figure using stiffness method and draw BMD. 10M




**OR**

14. B). Analyse the truss shown in Fig below using displacement method. 10M

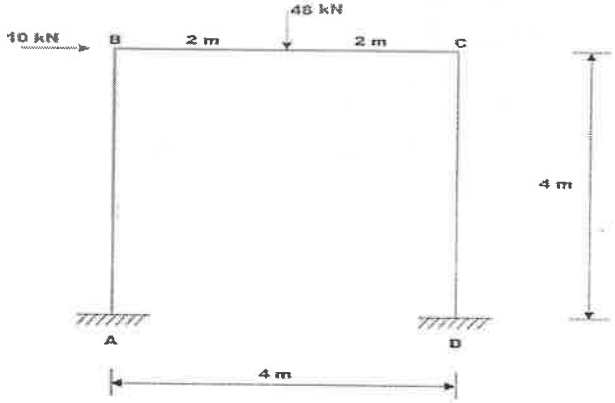



15. A). (i) Write the discussion on band width and semi band width how does it effects. 5M

(ii) Explain about Beams on elastic foundation. 5M

**OR**

15. B). Analyse the rigid frame shown in figure by direct stiffness matrix method. Assume E=200 GPa, I=1.33x10$^{-5}$ m$^4$ and A=0.01 m$^2$. The flexural rigidity EI and axial rigidity EA are the same for all beams. 10M

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

**Examination** : **M.Tech I Semester Supplementary Examinations Aug/Sept-2025**
**Course Name** : **Computer Oriented Numerical Methods**
**Course Code** : **B420402**
**Branch** : **Structural Engineering**
**Date & Session** : **01-09-2025 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 equation of a matrix. 1 M
2. When do you say that the system of equations are illconditioned ? 1 M
3. If 1, -2 are eigen values of a 2 x 2 square matrix, then what are the eigen values of $A^3$? 1 M
4. State Gregory-Newton forward interpolation formula. 1 M
5. Define Lagrange's interpolation polynomial. 1 M
6. What is the relation between the operators E and D ? 1 M
7. Define extrapolation. 1 M
8. Write is Radau Integration method. 1 M
9. What is the implicit equation for $u_{j+1}$ in backward Euler method? 1 M
10. What is the formula using in Euler-Cauchy method? 1 M

**PART-B**

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

11.A). (i) Using Cramer's rule solve the system of equations 5M
$4x+y+z=4$, $x+4y-2z=4$, and $3x+2y-4z=6$

(ii) Using LU Decomposition method solve the system of equations 5M
$x+y-z=2$, $2x3y+5z=-3$, $3x+2y-3z=6$

**OR**

11. B). Apply Gauss-Jordan method solve the system of equations 10M
$x+y+z=1$, $4x+3y-z=6$, $3x+5y+3z=4$

12. A). Find all eigen values and eigen vectors of the matrix $\begin{pmatrix} 2 & 3 & 1 \\ 3 & 2 & 2 \\ 1 & 2 & 1 \end{pmatrix}$. 10M

**OR**

12. B). Using Hermite interpolation estimate the values of f(-0.5) and f(0.5) using the values of f(x) and f'(x) 10M

| x | -1 | 0 | 1 |
|---|---|---|---|
| f(x) | 1 | 1 | 3 |
| f'(x) | -5 | 1 | 7 |

*(P.T.O..)*

13. A). Using the values of f(x) = log x find the approximate value of f'(2.0) and f''(2.0) using the methods based on linear and quadratic interpolation. 10M

| i | 0 | 1 | 2 |
|---|---|---|---|
| $x_i$ | 2.0 | 2.2 | 2.6 |
| $f_i$ | 0.69315 | 0.78846 | 0.95551 |

**OR**

13. B). Using the following data find f'(6.0) , error =0(h) and f''(6.3), error =$0(h^2)$ 10M

| x | 6.0 | 6.1 | 6.2 | 6.3 | 6.4 |
|---|---|---|---|---|---|
| f(x) | 0.1750 | -0.1998 | -0.2223 | -0.2422 | -0.2596 |

14. A). Find the Jacobian matrix for the system of equations 10M
$f_1(x,y)=x^2+y^2-x=0$ and $f_2(x,y)= x^2-y^2-y=0$

**OR**

14. B). Evaluate the integral I = $\int_0^1 \frac{dx}{1+x}$ using (i) composite trapezoidal rule, (ii) Composite Simpson's rule, with 2, 4 and 8 equal subintervals. 10M

15. A). Solve the initial value problem $u' =-2tu^2$ , u(0)=1 using the following methods: 10M
Euler method (ii) Backward Euler method (iii) Midpoint method.

**OR**

15. B). Use the classical Runge-Kutta formula of foruth order to find the numerical solution at x = 0.8 for $dy/dx = (x+y)^{1/2}$, y(0.4)=0.41 by assuming the step length 0.2 10M

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

**Examination** : **M.Tech I Semester Supplementary Examinations Aug/Sept-2025**
**Course Name** : **Advanced Reinforced Concrete Design**
**Course Code** : **B420404**
**Branch** : **Structural Engineering**
**Date & Session** : **03-09-2025 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 plastic hinge. 1 M
2. Define characteristic load. 1 M
3. How does IS456 address shear and moment behaviour in deep beams? 1 M
4. What is yield line criterion in the context of slab analysis? 1 M
5. Define virtual work. 1 M
6. In what situations drops are used in flat slabs? 1 M
7. What is an anchorage length? 1 M
8. What are the different forms of shear reinforcement used in beams? 1 M
9. Define short column. 1 M
10. What is additional moment method in the design of slender column? 1 M

**PART-B**

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

11.A). i) Sketch the idealized stress-strain curves for concrete and steel. What are the factors influencing the same. 5M

ii) Differentiate working stress method and Limit state method. 5M

**OR**

11. B). Explain the moment-rotation characteristics of reinforced concrete members. How does this behavior influence the design of indeterminate structures. 10M

12. A). Estimate flexural reinforcement and shear reinforcement for a three-span continuous beam of each span 6m having cross section dimensions 300 mm × 525 mm. The beam is subjected to a factored dead load of 15 kN/m and factored live load of 20 kN/m. Use M30 grade concrete and Fe 415 steel. Sketch the reinforcement details. 10M

**OR**

12. B). A simply supported deep beam has an overall depth of 5.5 m and an effective span 8 m. The width of the beam is 400 mm. The supports an udl of 35 kN/m over the entire span. Use M30 grade concrete and Fe500 grade steel. Design the beam and sketch the reinforcement details. 10M

13. A). Design a ribbed slab 6 x 6 m continuous over two adjacent sides simply supported on the other two sides if it is beams so that beams are spaced at 1.5 x 1.5m. Assume factored udl of 12 kN/m$^2$. Use M30 concrete and Fe415 steel. Sketch the reinforcement details. 10M

*(P.T.O..)*

**OR**

13. B). i) What are the limitations of direct design method and explain the moment distribution in column and middle strips? 5M

ii) Briefly explain the moment and shear transfer from flat slabs to column a structure. 5M

14. A). Design a rectangular beam of 300 mm x 500 mm overall dimensions subjected to a factored bending moment Mu=90 kN-m, factored shear force 70kN, and factored moment Tu=12 kN-m. Use M25 grade concrete and Fe500 steel. Sketch the reinforcement details. 10M

**OR**

14. B). i) Discuss various factors affects the shear resistance of concrete. 5M

ii) What is the development length? Discuss the factors affecting development length. 5M

15. A). i) What is minimum eccentricity in columns? Explain how it is considered in the design of columns? 5M

ii) Explain in detail the interaction diagram for design of columns. 5M

**OR**

15. B). Design a Long column of 6m length under biaxial bending with the following data: 10M

Size of column = 300 × 600 mm ;

Steel grade = Fe 500 ;Factored load Pu = 1800 kN ;

Factored moment Mux = 125 kNm; Muy = 90 kNm.

Assume M30 concrete and Fe500 grade steel.

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

**Examination** : **M.Tech I Semester Supplementary Examinations Aug/Sept-2025**
**Course Name** : **Theory of Elasticity and Plasticity**
**Course Code** : **B420302**
**Branch** : **Structural Engineering**
**Date & Session** : **09-09-2025 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. State various stress components in a 3 dimensional system. 1 M
2. Draw figures and show difference between cartesian coordinate and polar coordinate. 1 M
3. What is compatibility condition? 1 M
4. Discuss strain is a tensor or a vector. 1 M
5. What is the difference between isotropic and anisotropic materials? 1 M
6. What is orthotropic elasticity? 1 M
7. What is the effect of torsion in circular shafts? 1 M
8. What is membrane analogy? 1 M
9. Differentiate between pressure-dependent and pressure-independent yield criteria. 1 M
10. What are the different types of hardening in plasticity? 1 M

**PART-B**

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

11.A). Derive the equilibrium equation of 2D problems in polar coordinates. 10M

**OR**

11. B). The state of stress at a point is given by 10M

$\sigma_{xx} = 10$ , $\tau_{XY} = -20$

$\sigma_{YY} = -6$, $\tau_{YZ} = 8$

$\sigma_{ZZ} = 4$, $\tau_{ZX} = 0$

Determine the Principal stresses.

12. A). Derive the compatibility equations for a 3 Dimensional state of strain. 10M

**OR**

12. B). Explain the construction of Mohrs strain circle for strain Rosette. 10M

13. A). What is plane strain & plane stress problems? Explain with an example and derive appropriate equations for the above problems. 10M

**OR**

13. B). Derive an expression strain energy per unit volume for a two dimensional linearly elastic body for plane stress or plain strain in terms of Airy's stress function. 10M

***(P.T.O..)***

14. A). Determine the state of stress in a rectangular plate with sides parallel to the coordinate axes assuming a suitable stress function in terms of first order polynomial. 10M

**OR**

14. B). A shaft of elliptical cross section having semi major axis 50mm and semi minor axis 25mm. It is subjected to a torque of 1000 N-m. Determine the maximum stress developed in the shaft. 10M

15. A). State and explain different yield criteria for plastic analysis of a structure. 10M

**OR**

15. B). The state of stress at a point in a material is given by $\sigma_x$= 80MPa, $\sigma_y$= 100MPa and $\tau_{xy}$ = 60 MPa, If the yield strength of the material is 150 MPa, determine whether yielding of the material will occur or not according to the Tresca's and Mises yield criterias. 10M

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