H.T No: | | | | | | | | | | | R22 | Course Code: B420304

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech II Semester Regular Examinations September-2023

Course Name: FINITE ELEMENT ANALYSIS

(Structural Engineering)

Date: 04.09.2023 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. How to develop the equilibrium equation for a finite element? 1 M
2. Differentiate between initial value problem and boundary value problem. 1 M
3. Define shape function. 1 M
4. Express the element stiffness matrix of a truss element. 1 M
5. Define natural coordinate system. 1 M
6. Explain QST (Quadratic strain Triangle) element. 1 M
7. Differentiate between geometric and material non-linearity. 1 M
8. Define Isoparametric element with suitable examples. 1 M
9. Write the Lagrange shape functions for a 1D, 2noded elements. 1 M
10. Explain geometric Isotropy. 1 M

PART-B

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

11.A). The (x, y) coordinate of nodes i, j, and k of triangular elements are given by (0, 0), (3,0) and (1.5, 4) mm respectively. Evaluate the shape functions N1, N2 and N3 at an interior point P (2, 2.5) mm for the element. For the same triangular element, obtain the strain-displacement relation matrix B. 10M

OR

11. B). Develop the Shape function, Stiffness matrix and force vector for one dimensional linear element. 10M

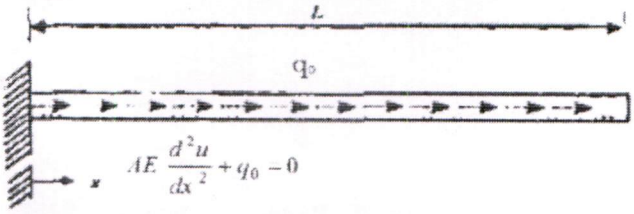
12. A). i) Write down the differential equation of Finite Element formulation for 1-D problems. 6M

ii) Explain about FE formulation of beam using Euler Bernoulli. 4M

(P.T.O..)

OR

12. B). A uniform rod subjected to a uniform axial load is illustrated in figure, the deformation of the bar is governed by the differential equation given below. Determine the displacement by applying Weighted Residual Method 10M



$$AE\frac{d^2u}{dx^2}+q_0-0$$

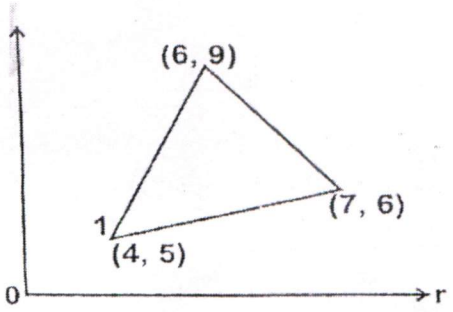
with the boundary conditions $u(0)-0, \frac{du}{dx}_{x=L}-0$

13. A). A simple supported beam subjected to uniformly distributed load over entire span and it is subjected to a point load at the centre of the span. Calculate the deflection uing Rayleigh-Ritz method and compare with exact solutions. 10M

OR

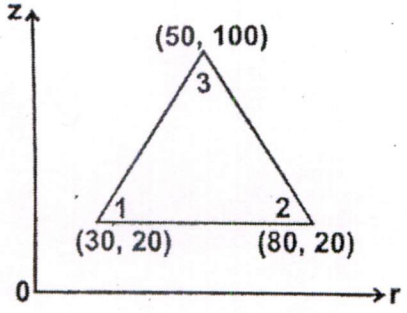
13. B). Evaluate the partial derivatives of the shape function at $\zeta = 1/2$, $\eta = ½$ of a quadrilateral element, assuming that the temperature is approximated by bilinear. 10M

14. A). Calculate the element strains for an axisymmetric triangular element shown in fig the nodal displacement are. u1= 0.001, u2 = 0.002, u3 = -0.003, w1 = 0.002, w2 = 0.001 and w3 = 0.004 all dimensions are in mm 10M



OR

14. B). For an axisymmetric triangular element as shown in fig. Evaluate the stiffness matrix. Take modulus of elasticity E = 210 GPa. Poisson's ratio = 0.25. the coordinates are given in millimeters. 10M



(P.T.O..)

15. A). Brief notes on i) Garkin's method of weight residuals, ii) Strain displacement relationship for 3-D element. 10M

OR

15. B). Analysis and post processing of the results using commercially available FEA software and available codes. 10M

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H.T No: | | | | | | | | | | | R22 Course Code: B420305

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech II Semester Regular Examinations September-2023

Course Name: STRUCTURAL DYNAMICS

(Structural Engineering)

Date: 06.09.2023 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 "Degree of Freedom". 1 M
2. State Hamilton's principle. 1 M
3. What is SDOF system ? 1 M
4. Define Logarithmic decrement. 1 M
5. What are forced vibrations ? 1 M
6. What are damped vibrations ? 1 M
7. What is the assumption made in Stodola method ? 1 M
8. Define fundamental time period. 1 M
9. Draw an example of a continuous system. 1 M
10. Define natural frequency. 1 M

PART-B

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

11.A). What are the fundamental objectives of dynamic analysis ? Distinguish between Lumped mass idealization and Continuous mass system. 10M

OR

11. B). Formulate the equations of motion using D'Alembert's principle. 10M

12. A). Derive an expression for the displacement of a SDOF system for the undamped harmonic excitation. Sketch the response. 10M

OR

12. B). A machine of weight 1000 kg is mounted centrally on a simply supported steel beam of span 2 m. A piston that moves up and down in the machine produces a harmonic force of magnitude 2000 kg and frequency 50 rad/sec. Neglecting the weight of the beam and assuming 10 % of the critical damping, determine 10M
(i) the amplitude of the motion of the machine
(ii) the corresponding phase angle. Take E $= 2 \times 10^5$ Mpa, I = 5000 cm^4.

13. A). Evaluate the structural property matrices and formulate the equations of motion for MDOF system. 10M

(P.T.O..)

OR

13. B). Determine the fundamental frequency of vibration and the corresponding mode shapes for the three storied building as shown in Fig. 1. The stiffness of the columns are as given below. 10M

$k_1 = 500$ kN/cm, $k_2 = 1000$ kN/cm, $k_3 = 1500$ kN/cm.

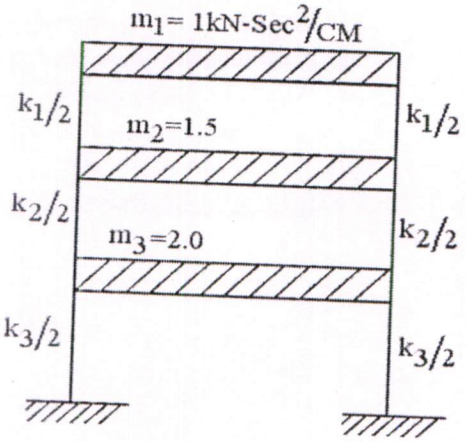

Fig. 1

14. A). Determine the fundamental mode shape and the corresponding frequency for the 3 storied idealized shear building using Stodola method. The stiffness and mass of the columns from top to bottom stories are as given below. 10M

$k_1 = 300$ kN/cm $k_2 = 600$ kN/cm $k_3 = 900$ kN/cm

$m_1 = 2$ kN-sec^2/cm $m_2 = 3$ kN-sec^2/cm $m_3 = 4$ kN-sec^2/cm

OR

14. B). How do you carry out practical vibration analysis of second and higher modes? Illustrate with an example. 10M

15. A). Derivation of governing differential equation of motion for the undamped free vibrations of beams with continuous systems in flexure. Both the ends of the beam are fixed. 10M

OR

15. B). How do you find the natural frequencies and mode shapes of a simply supported beam with continuous system ? 10M

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H.T No: | | | | | | | | | | | R22 | Course Code: B420407

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(UGC AUTONOMOUS)

M.Tech II Semester Regular Examinations September-2023

Course Name: ADVANCED STRUCTURAL STEEL DESIGN

(Structural Engineering)

Date: 08.09.2023 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. Write a short note on Strength of a joint. 1 M
2. Discuss in short about the load transfer mechanism of simple connections. 1 M
3. Define the term Plastic hinge. 1 M
4. Write a brief note on collapse load. 1 M
5. Write a short note on bolted framed connections. 1 M
6. Discuss in short about welded bracket connections. 1 M
7. Write briefly about different types of loadings that act on a structure. 1 M
8. Define the term bracings. 1 M
9. List out the different types of truss bridges. 1 M
10. Write a short note on Compression member. 1 M

PART-B

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

11.A). Design a lap joint between two plates of size 100×16mm thick and 100×10mm thick so as to transmit a factored load of 120kN using a single row of 16mm bolts of grade 4.6 and grade 410 plates. Sketch the details of the joint. 10M

OR

11. B). A tie member 150 mm × 8 mm is to transmit a load of 180 kN. Design the fillet weld and calculate the overlap required with i) Welds on two sides, ii) Welds on three sides and iii) Welds on all four sides. 10M

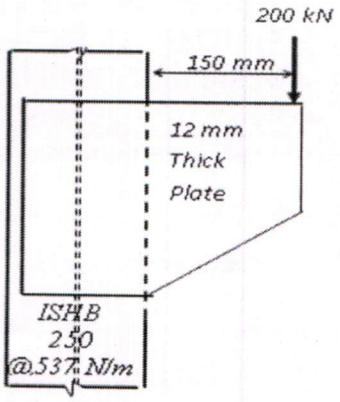
12. A). A simply supported beam of span 6m is subjected to UDL of 20 KN/m. Design a steel beam by plastic design using a combined load factor of 1.7 10M

OR

12. B). A portal frame ABCD with hinged foot has stanchions 4 m high and beam of 6 m span. There is horizontal point load of 40 kN at B. Whole the beam carries a point load of 120 kN at mid span. Using load factor of 1.5, establish collapse mechanism and calculate the collapse Moment. 10M

(P.T.O..)

13. A). Design a welded connection between column and the bracket to support an eccentric load as shown in figure. 10M



OR

13. B). An eccentric riveted steel bracket connection consists of 12 rivets of 20 mm diameter in six rows and two columns; c/c distance of rows and columns of rivets are 80 mm and 100 mm respectively. Find the safe load P which can be put at an eccentric distance of 250 mm from c.g. of rivet group. 10M

14. A). Illustrate elaborately about the items that are to be considered while planning and designing an industrial building. 10M

OR

14. B). Design a roof truss, rafter bracing, purlin for an industrial building located at Guwahati with a span of 20m and a length of 50m The roofing is galvanized iron sheeting Basic wind speed is 50m/s and the terrain in an open industrial area Building is class B with a clear height of 8m. 10M

15. A). Write a detailed note on bracing connections. 10M

OR

15. B). Design a laced column with two channels back to back of length 08 m to carry an axial factored load of 1200 kN. The column may be assumed to have restrained in position but not in direction at both ends. 10M

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H.T No: | | | | | | | | | | | R22 | Course Code: B420411

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

M.Tech II Semester Regular Examinations September-2023

Course Name: SPECIAL CONCRETES

(Structural Engineering)

Date: 11.09.2023 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. Mention the tests done for finding the workability of concrete. 1 M
2. Define Abram's law. 1 M
3. State inference for high strength concrete. 1 M
4. How to make use of high performance concrete. 1 M
5. List any three functions of fibres. 1 M
6. Classify the polymer concretes. 1 M
7. What is DOE method of mix design. 1 M
8. Define porous concrete. 1 M
9. What is performance evaluation of reinforced concrete structures? 1 M
10. list the various corrosion tests. 1 M

PART-B

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

11.A). What are the factors affecting the shrinkage and creep of concrete? Explain any one in details. 10M

OR

11. B). List the various tests done for hardened concrete and explain any two tests in detail with their merits and demerits. 10M

12. A). Describe the properties, uses and manufacture of high performance concrete. 10M

OR

12. B). Discuss the requirements and properties of high strength concretes in detail. 10M

13. A). Describe the properties and applications of self-compacting concrete. 10M

OR

13. B). Discuss in detail about light weight concrete with its merits compared to other types of concrete. 10M

(P.T.O..)

14. A). Design of M40 Concrete mix as per IS: 10262-2009, Concrete mix portioning-guidelines. 10M

Grade designation: M40
Type of cement: OPC 43 grade confirming to IS 8112
Maximum nominal size of aggregates: 20mm
Minimum cement content: 320 kg/m^3
Maximum water cement ratio: 0.45
Workability: 100mm (slump)
Exposure condition: severe (for reinforced concrete)
Degree of supervision: good
Types of aggregate: crushed angular aggregate
admixture: superplasticizer.

OR

14. B). Enumerate the step by step procedure for the design of concrete mixes using ACI method. 10M

15. A). Explain the causes of corrosion of concrete structures and various remedial measures undertaken. 10M

OR

15. B). Explain half-cell potential and rapid chloride penetration tests in detail with neat sketches. 10M

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