

**Code: 19A37BT**

IV B.Tech. I Semester Supplementary Examinations March/April 2023

**Finite Element Methods**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks )

\*\*\*\*\*

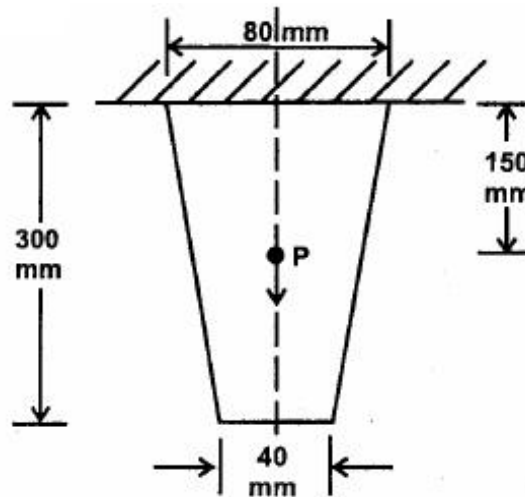
Marks CO BL

**UNIT-I**

1. a) Explain in detail the fundamental steps involved in FEM for solving a problem. Also mention the applications of FEM. 7M 1 1
- b) Differentiate between Plane stress and Plane strain conditions with examples. Write the stress-strain relationship for the both plane stress and plane strain problems. 7M 1 2

**OR**

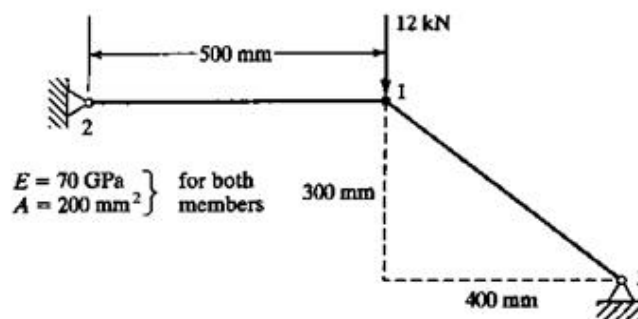
2. A tapered bar of uniform thickness  $t = 10$  mm as shown in figure. Find the displacements at the nodes by forming into two element model. The bar has a mass density  $\rho = 7800$  kg/m<sup>3</sup>, the young's modulus  $E = 2 \times 10^5$  MN/m<sup>2</sup>. In addition to self-weight, the bar is subjected to a point load  $P = 1$  kN at its centre. Also determine the element stresses and reaction force at the support.



14M 1 3

**UNIT-II**

3. Determine the nodal displacements and elemental stresses for the truss shown in figure.



14M 2 3

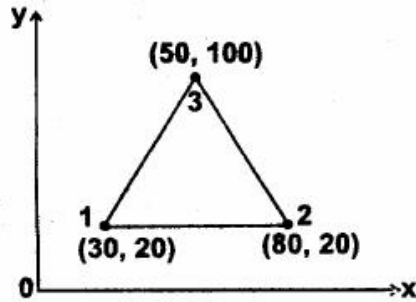
**OR**

4. a) Briefly explain Hermite shape functions for a beam element. 7M 2 2
- b) Derive element stiffness matrix for the beam element. 7M 2 2

**UNIT-III**

5. a) Derive strain displacement matrix of CST element. 8M 2 3

- b) Evaluate the stiffness matrix for the plane stress element shown in figure. Assume  $E = 210 \times 10^3 \text{ N/mm}^2$ , Poisson's ratio  $\nu = 0.25$  and element thickness  $t = 10 \text{ mm}$ . The coordinates are given in millimeters.



6M 3 3

OR

6. Discuss the problem formulation through FEM and stress-strain equations for axis-symmetric solids.

14M 3 2

UNIT-IV

7. a) Write short note on the following:

- (i) Purpose of Iso-parametric elements
- (ii) Shape functions of four noded quadrilateral element

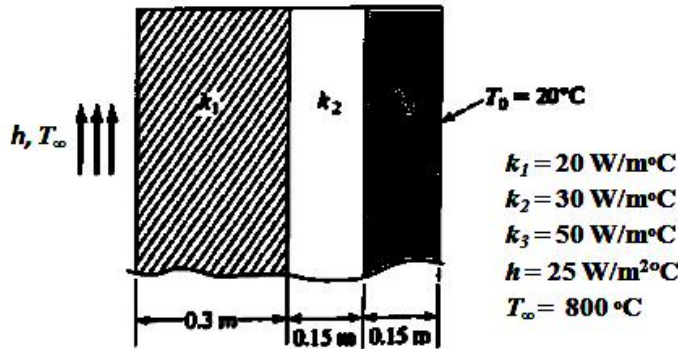
7M 4 2

- b) Evaluate the integral  $I = \int_{-1}^{+1} \left[ 3e^x + x^2 + \frac{1}{(x+2)} \right] dx$  using one-point and two-point Gaussian quadrature. Compare with exact solution.

7M 4 3

OR

8. A composite wall consists of three materials as shown in figure. The outer temperature is  $T_o = 20^\circ\text{C}$ . Convection heat transfer takes place on the inner surface of the wall with  $T = 800^\circ\text{C}$  and  $h = 25 \text{ W/m}^2 \text{ }^\circ\text{C}$ . Determine the temperature distribution in the wall.



14M 4 3

UNIT-V

9. a) What do you mean by consistent and lumped mass matrices? Derive the same for linear bar element.

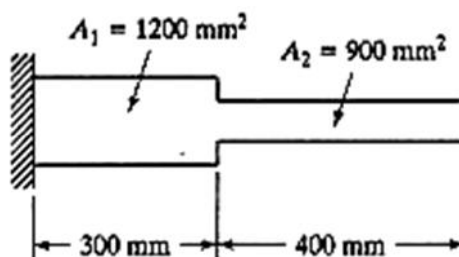
7M 5 2

- b) Write the procedure to determine the natural frequency of a simply supported beam using lumped mass matrix approach.

7M 5 1

OR

10. Determine the Eigen values and Eigen vectors for the stepped bar shown in figure. Take  $\rho = 7830 \text{ kg/m}^3$  and  $E = 2.1 \times 10^{11} \text{ N/m}^2$ .



14M 5 3

\*\*\*END\*\*\*

**Code: 19A37ET / 19A37LT**

IV B.Tech. I Semester Supplementary Examinations March/April 2023

**Non-Conventional Sources of Energy**

(Common to ME &amp; ECE)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks)

\*\*\*\*\*

|  | Marks | CO  | BL |
|--|-------|-----|----|
| <b>UNIT-I</b>  |       |     |    |
| 1. a) Define Solar Constant and explain the terms Beam and Diffuse Solar radiation.  | 6M    | CO1 | L1 |
| b) Calculate the angle made by beam radiation with the normal to a flat collector on July 4, at 10.00 AM Solar time for a location at 29°38' N. The collector is tilted at an angle of latitude plus 15°, with the horizontal and is pointing due south. | 8M    | CO1 | L3 |
| <b>OR</b>  |       |     |    |
| 2. a) Explain about Terrestrial and Extra Terrestrial radiation.   | 6M    | CO1 | L2 |
| b) Define the following:<br>i. Zenith Angle    ii. Incident angle    iii. Latitude angle    iv. Longitude angle.   | 8M    | CO1 | L1 |
| <b>UNIT-II</b>   |       |     |    |
| 3. a) Explain different methods of storing solar energy.   | 7M    | CO2 | L2 |
| b) What are the important performance indices of a solar collector? Explain them briefly.  | 7M    | CO2 | L2 |
| <b>OR</b>  |       |     |    |
| 4. a) Explain photovoltaic energy conversion with its merits and demerits.   | 7M    | CO2 | L2 |
| b) Explain solar water heating system with natural circulation and forced circulation.   | 7M    | CO2 | L2 |
| <b>UNIT-III</b>  |       |     |    |
| 5. a) Explain the constructional features of drum and dome type biogas plants.   | 7M    | CO3 | L2 |
| b) Explain Wet fermentation and Dry fermentation in detail.  | 7M    | CO3 | L2 |
| <b>OR</b>  |       |     |    |
| 6. a) How are WEC systems classified? Discuss in brief.  | 8M    | CO3 | L1 |
| b) Describe with a neat sketch the working of a wind energy system with its main components.   | 6M    | CO3 | L2 |
| <b>UNIT-IV</b>   |       |     |    |
| 7. a) Explain the various methods to extract geothermal energy.  | 7M    | CO4 | L2 |
| b) Explain the power generation from double cycle system for tidal energy utilization.   | 7M    | CO4 | L2 |
| <b>OR</b>  |       |     |    |
| 8. a) Explain any two types Wave energy conversion systems.  | 8M    | CO4 | L2 |
| b) Explain in detail about mini-hydel power plant.   | 6M    | CO4 | L2 |
| <b>UNIT-V</b>  |       |     |    |
| 9. a) Explain Seebeck and Thompson effects.  | 4M    | CO5 | L2 |
| b) Explain the principle of thermoelectric power generation with the help of a neat sketch.  | 10M   | CO5 | L2 |
| <b>OR</b>  |       |     |    |
| 10. Briefly describe the working principle and operation of H <sub>2</sub> -O <sub>2</sub> fuel cell with a neat diagram?  | 14M   | CO5 | L2 |

\*\*\*END\*\*\*

Hall Ticket Number :

R-19

Code: 19A372T

IV B.Tech. I Semester Supplementary Examinations March / April 2023

**Operations Research**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks )

\*\*\*\*\*

Marks CO BL

**UNIT-I**

1. Analyze the following LPP by Big M method.  
Maximize  $Z=2X_1+ 3X_2$   
Subject to the conditions  $X_1 + X_2 \leq 2$  ;  $X_1 + 2X_2 \leq 8$  ;  $X_1, X_2 \geq 0$  14M 1 4
- OR**
2. a) Explain the characteristics and phases of Operations research 4M 1 2  
b) Solve the following Linear Programming Problem by graphical method. Maximize  $Z=3 X_1+ 5 X_2$   
Subject to the conditions  $X_1 \leq 4$  ;  $2X_2 \leq 12$  ;  $3X_1 + 2X_2 \leq 18$  and  $X_1, X_2 \geq 0$  10M 1 3

**UNIT-II**

3. Solve the assignment problem (allocate Jobs to the Persons) for minimum total cost.

| Persons<br>Jobs | J <sub>1</sub> | J <sub>2</sub> | J <sub>3</sub> | J <sub>4</sub> |
|-----------------|----------------|----------------|----------------|----------------|
| A               | 20             | 25             | 22             | 28             |
| B               | 15             | 18             | 23             | 17             |
| C               | 19             | 17             | 21             | 24             |
| D               | 25             | 23             | 24             | 24             |

14M 2 3

**OR**

4. Find the optimum transportation cost.

|                | D1 | D2 | D3 | D4 | Supply |
|----------------|----|----|----|----|--------|
| S <sub>1</sub> | 5  | 2  | 7  | 3  | 22     |
| S <sub>2</sub> | 4  | 8  | 1  | 6  | 15     |
| S <sub>3</sub> | 4  | 6  | 7  | 5  | 8      |
| Demand         | 7  | 12 | 17 | 9  |        |

14M 2 3

|                 |
|-----------------|
| <b>UNIT-III</b> |
|-----------------|

5. The cost of a product is Rs. 6100, and its scrap value is Rs. 100. The maintenance cost found from experience is as follows:

| Year                  | 1   | 2   | 3   | 4   | 5   | 6    | 7    | 8    |
|-----------------------|-----|-----|-----|-----|-----|------|------|------|
| Maintenance Cost (Rs) | 100 | 250 | 400 | 600 | 900 | 1200 | 1600 | 2000 |

When should the product be replaced?

14M 3 1

**OR**

6. A and B play a game in which each has three notes, a 5 rupee note, a 10 rupee note, and a 20 rupee note. Each selects a note without the knowledge of the others choice. If the sum of the notes is an odd amount, A wins B'S note; if the sum is even, B wins A's note. Find the best strategies for each player and the value of the game.

14M 3 3

|                |
|----------------|
| <b>UNIT-IV</b> |
|----------------|

7. In a railway marshalling yard, goods trains arrive at a rate of 30 per day. Assuming that the service time is 36 min. calculate (i) Average number of trains in system, (ii) probability that the queue size exceeds 10, (iii) Expected waiting time in queue. (iv) Average time a customer spends in the system

14M 4 3

**OR**

8. Define Simulation? How do you apply the simulation technique to solve queuing problems?

14M 4 3

|               |
|---------------|
| <b>UNIT-V</b> |
|---------------|

9. A manufacturing company purchase 9000 parts of a machine for its annual requirements, ordering one month's usage at a time. Each part costs Rs. 20. The ordering cost per order is Rs. 15 and the carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year?

14M 5 1

**OR**

10. Solve the following Linear Programming Problem by **DPP method**. Maximize  $Z=6X_1+ 4X_2$   
Subject to the conditions  $2X_1 + 3X_2 \leq 100$  ;  $4X_1 + 2X_2 \leq 120$  and  $X_1, X_2 \geq 0$

14M 5 2

\*\*\*END\*\*\*

**Code: 19A37CT**

IV B.Tech. I Semester Supplementary Examinations March/April 2023

**Unconventional Machining Process**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks )

\*\*\*\*\*

|                 |  | Marks | CO | BL |
|-----------------|--|-------|----|----|
| <b>UNIT-I</b>   |  |       |    |    |
| 1.              | a) Compare the process capabilities and limitations of electrical energy based, thermal energy based and mechanical energy based unconventional machining processes. | 7M    | 1  | 3  |
|                 | b) Is unconventional machining process an alternate or complement to conventional machining process? Justify   | 7M    | 1  | 3  |
| <b>OR</b>       |  |       |    |    |
| 2.              | a) Make a comparison between traditional and unconventional machining processes in terms of cost, application, scope, Machining time, advantages and limitations.    | 7M    | 1  | 3  |
|                 | b) What do you understand by the word "unconventional" in unconventional machining processes?  | 7M    | 1  | 3  |
| <b>UNIT-II</b>  |  |       |    |    |
| 3.              | a) Select any four process variables that control the material removal rate in AJM process.  | 7M    | 2  | 3  |
|                 | b) Discriminate Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining.   | 7M    | 2  | 3  |
| <b>OR</b>       |  |       |    |    |
| 4.              | a) Describe the apparatus, metal removal rate, process principles and application of Water Jet Machining.  | 7M    | 2  | 2  |
|                 | b) Quote the limitations in ultrasonic machining.  | 7M    | 2  | 3  |
| <b>UNIT-III</b> |  |       |    |    |
| 5.              | a) Compare the Chemical Machining (CHM) with Electro-Chemical Machining (ECM) with respect to their process parameters.  | 7M    | 3  | 3  |
|                 | b) Explain the process parameters MRR and surface finish in CHM.   | 7M    | 3  | 2  |
| <b>OR</b>       |  |       |    |    |
| 6.              | a) Discuss the effect of high temperature and pressure of electrolyte of ECM process.  | 7M    | 3  | 3  |
|                 | b) Explain in detail about the types of maskants used in chemical machining  | 7M    | 3  | 2  |
| <b>UNIT-IV</b>  |  |       |    |    |
| 7.              | a) Explain the process of Electrical discharge grinding (EDG) and list any two of its advantages, limitations and applications                                       | 7M    | 4  | 2  |
|                 | b) List the advantages and disadvantages of wire – cut EDM   | 7M    | 4  | 3  |
| <b>OR</b>       |  |       |    |    |
| 8.              | a) What are the desirable properties of a dielectric fluid? Give some examples for dielectric fluids. Explain the functions of dielectric fluid.                     | 7M    | 4  | 2  |
|                 | b) Sketch and discuss the effects of the following parameters on MRR during EDM  |       |    |    |
|                 | i) Pulse duration on material removal rate,  |       |    |    |
|                 | ii) Surface finish and relative electrode wear rate  | 7M    | 4  | 3  |
| <b>UNIT-V</b>   |  |       |    |    |
| 9.              | a) Discuss the applications and limitations of Plasma Machining Process  | 7M    | 5  | 3  |
|                 | b) Explain the production of laser beam and working principle of LBM?  | 7M    | 5  | 2  |
| <b>OR</b>       |  |       |    |    |
| 10.             | a) Explain the thermal features of Laser beam machining. Discuss the performance of various types of Lasers.   | 7M    | 5  | 2  |
|                 | b) Why is EBM carried out in vacuum? Explain the process with a neat sketch.   | 7M    | 5  | 2  |

\*\*\*END\*\*\*

**Code: 19A371T**

IV B.Tech. I Semester Supplementary Examinations March/April 2023

**CAD/CAM**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer any five full questions by choosing one question from each unit (5x14 = 70 Marks )

\*\*\*\*\*

Marks CO BL

**UNIT-I**

1. With the help of neat sketches, describe construction, working, advantages, limitations and applications of any two input devices.

14M 1 1 &amp; 2

**OR**

2. a) A rectangle is defined by its corner points (2,2), (2,8), (10,8) and (10,2). Rotate the rectangle by an angle of 30 counterclockwise and then followed by a scaling with a factor of 2. Solve the above transformations and plot.
- b) Compare and contrast conventional design process with CAD process.

8M 1 1 &amp; 2

6M 1 1 &amp; 2

**UNIT-II**

3. a) Derive the parametric representation of a Hermite Cubic Spline curve.
- b) Write a note on surface patch.

10M 2 2

4M 2 2

**OR**

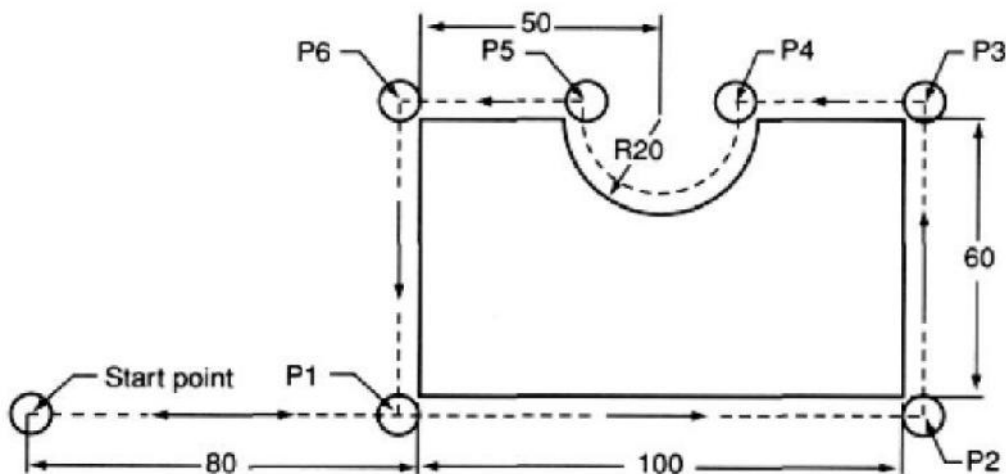
4. a) Differentiate B-rep and CSG representation schemes.
- b) List various wireframe and surface entities.

10M 2 2

4M 2 2

**UNIT-III**

5. Write a part program for the object shown below. All dimensions are in mm.



14M 3 3

**OR**

- |       |   |    |   |   |
|-------|---|----|---|---|
| 6. a) | With the help of a neat sketch, explain the structure of CNC machine tools.                         | 7M | 3 | 3 |
| b)    | Compare and contrast advantages of computer assisted part programming over manual part programming. | 7M | 3 | 3 |

**UNIT-IV**

- |       |  |     |   |   |
|-------|--|-----|---|---|
| 7. a) | Discuss on group technology. Justify its significance in the integration of CAD and CAM. | 10M | 4 | 3 |
| b)    | Write a brief note on production flow analysis.  | 4M  | 4 | 3 |

**OR**

- |    |   |     |   |   |
|----|---|-----|---|---|
| 8. | Discuss the principles of material handling. Name and describe any four types of material handling devices. | 14M | 4 | 3 |
|----|---|-----|---|---|

**UNIT-V**

- |       |  |    |   |   |
|-------|--|----|---|---|
| 9. a) | What are the fundamental concepts in MRP? Explain them.                    | 7M | 5 | 4 |
| b)    | Explain the method of part inspection using Co-ordinate measuring machine. | 7M | 5 | 4 |

**OR**

- |        |  |    |   |   |
|--------|--|----|---|---|
| 10. a) | Define computer aided quality control. Explain its implementation in detail. | 7M | 5 | 4 |
| b)     | Compare online and offline inspection.                                       | 7M | 5 | 4 |

\*\*\*END\*\*\*