Hall Ticket Number :

R-14

Code: 4G573

IV B.Tech. I Semester Supplementary Examinations November 2019

Finite Element Methods

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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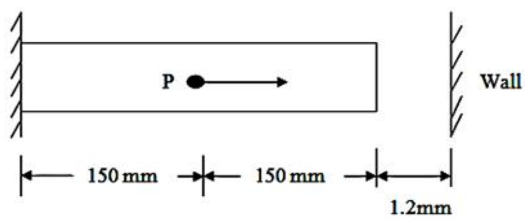
UNIT–I

1. a) Derive Stress-equilibrium conditions for structural element. 9M

   b) What is potential energy? State and explain the principle of minimum potential energy. 5M

OR

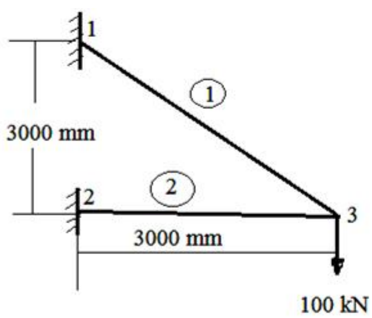
2 A rod subjected to an axial load P=600kN is applied as shown in figure. Divide the domain into two elements. Determine displacement at each node, stresses in each element and reactions at each node. Take A= 250 mm^2, E = $2X10^5$ N/mm^2.



14M

UNIT–II

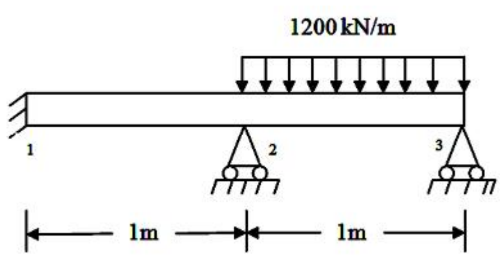
3. For the two-bar truss shown in figure, determine the displacements and stresses. A_1=500mm^2, A_2=1200mm^2, E=$2x10^5$ N/mm^2.



14M

OR

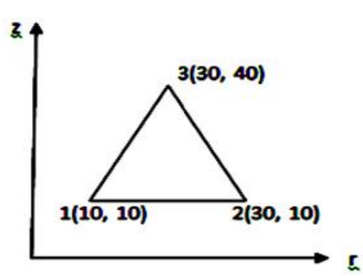
4. For the beam and loading shown in figure, determine the slopes at nodes 2, 3 and vertical deflection at the midpoint of the distributed load. E=200 GPa and I=$4X10^6$ mm^4.



14M

UNIT–III

5. Calculate the stiffness matrix for the triangular element shown in figure. Co-ordinates are given in mm. Assume plane stress conditions. Take E=$2.1X10^5$ N/mm^2, υ=0.25, t=10mm.

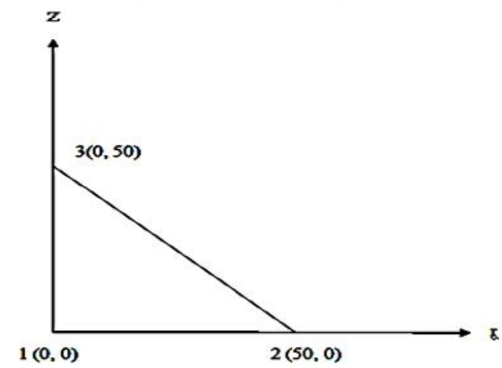


14M

OR

6. For the axisymmetric element shown in figure, determine the element stresses. Let E=210 GPa and ^{3} = 0.25. The coordinates are shown in millimeters. The nodal displacements are:

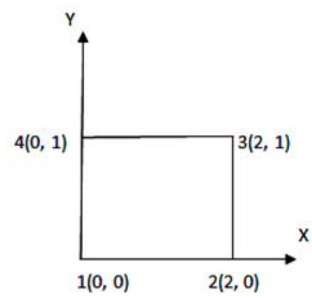
$u_1 = 0.05mm, w_1 = 0.03mm\ u_2 = 0.02mm,\ w_2 = 0.02mm, u_3 = 0mm, w_3 = 0mm$



14M

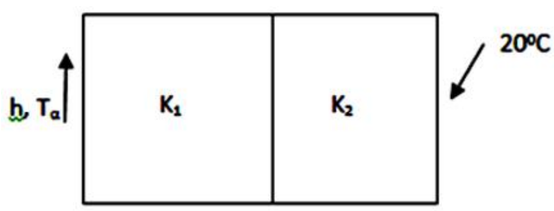
UNIT–IV

7 4 noded rectangular element is shown in figure. Determine (i) Jacobian Matrix (ii)Strain – Displacement Matrix (iii) Element Stresses. Take E=2x10^5N/mm^2, υ=0.25, U= [0, 0, 0.003, 0.004, 0.006, 0.004, 0, 0]^T mm. Assume Plane Stress conditions. (x, y) co-ordinates are in mm. Assume natural coordinates ¶ = 0, ¦ = 0.



OR

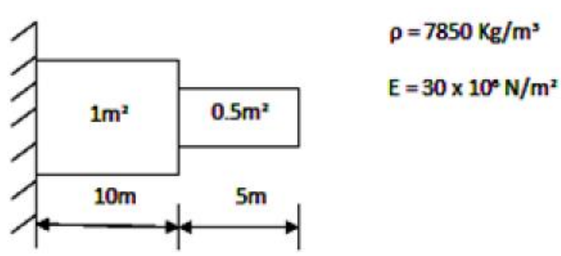
8. Determine the temperature distribution through the composite wall shown in figure when convective heat loss occurs on the left surface. Assume unit area. Thickness t_1 = 4 cm, t_2 = 2 cm, K_1 = 0.5W/cm K, K_2 = 0.05W/cm K, Tα=5^{0}C, h=0.1 W/cm^2 K. (use finite element method)



14M

UNIT–V

9. Determine the Eigen values and Eigen Vectors for the stepped bar as shown in figure?



14M

OR

10. Determine Eigen values and Eigen vectors of a stepped bar, for longitudinal vibrations using consistent mass matrix. Areas of 2 segments of bar are 50mm^2 and 100mm^2 and lengths are 500mm and 1000mm respectively. Assume E=200GPa and mass density is 8000 Kg/m^3. The bar is fixed at one end. 14M

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Hall Ticket Number :										

R-14

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IV B.Tech. I Semester Supplementary Examinations November 2019

Operations Research

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. A company has contracted to produce two products, A and B, over the months of June, July, and August. The total production capacity (expressed in hours) varies monthly. The following table provides the basic data of the situation:

	June	July	August
Demand for A (units)	500	5000	750
Demand for B (units)	1000	1200	1200
Capacity (hours)	3000	3500	3000

The production rates in units per hour are .75 and 1 for products A and B, respectively. All demand must be met. However, demand for a later month may be filled from the production in an earlier one. For any carryover from one month to the next, holding costs of $.90 and $.75 per unit per month are charged for products A and B, respectively. The unit production costs for the two products are $30 and $28 for A and B, respectively. Develop an LP model to determine the optimum production schedule for the two products. (don't solve the model)

OR

2. Given a linear programming problem

$$\begin{aligned} &Maximize \quad Z = 8x_1 + 6x_2 + x_3 \\ &subject\ to \quad 8x_1 + 6x_2 + 2x_3 \le 13 \\ &x_1 + x_2 + 2x_3 \le 4 \\ &x_1, x_2, x_3 \ge 0 \end{aligned}$$

Obtain the value of the objective function at the optimum by simplex method.

UNIT–II

3. Use Vogels' Approximation method for finding the initial basic feasible solution and then determine the optimal transportation cost.

					Supply
	6	5	8	8	30
	5	11	9	7	40
	8	9	7	13	50
Demand	35	28	32	25	

OR

4. Imagine yourself to be the Executive Director of a 5-Star Hotel which has four banquet halls that can be used for all functions including weddings. The halls are all about the same size and the facilities in each hall differed. During a marriage season, 4 parties approached you to reserve a hall for the marriage to be celebrated on the same day. These marriage parties were told that the first choice among these 4 halls would cost ‘10,000 for the day. They were also required to indicate the second, third and fourth preferences and the price that they would be willing to pay. Marriage parties A and B indicated that they won't be interested in Halls 3 and 4. Other particulars are given in the following table.

Revenue/hall

Marriage Party	**Hall**			
	1	2	3	4
A	10,000	9,000	X	X
B	8,000	10,000	8,000	5,000
C	7,000	10,000	6,000	8,000
D	10,000	8,000	X	X

where X indicates that the party does not want that hall. Decide on an allocation that will maximize the revenue to your hotel.

UNIT–III

5. A computer has a large number of electronic tubes. They are subject to mortality as given below:

Week	1	2	3	4	5
Probability of Failure	0.10	0.26	0.35	0.22	0.07

The cost of replacing individual tubes which fail in service cost Rs. 60 per tube. However, if all the tubes (say, 1000) are replaced simultaneously, it costs Rs. 15 per tube. Determine the replacement policy that minimises the average cost.

OR

6. Solve the following (2×3) game graphically:

		B I	B II	B III
A	I	1	3	11
	II	8	5	2

UNIT–IV

7. Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes. Then,

(a) What is the probability that a person arriving at the booth will have to wait?
(b) What is the average length of the queue that forms from time to time?
(c) The telephone department will install a second booth when convinced that an arrival would expect to have to wait at least three minutes for the phone. By how much must the flow of arrivals be increased in order to justify a second booth?
(d) Find the average number of units in the system.

OR

8. A manufacturer of personal computers purchases hard disk drives from a supplier. The factory operates 52 weeks per year, and requires assembling 100 disk drives into computers per week. The holding cost rate is 20 percent of the value (based on purchase cost) of the inventory. Regardless of the order size, the administrative cost of placing an order with the supplier has been estimated to be Rs.50. A quantity discount is offered by the supplier for large orders as shown below, where the price for each category applies to every disk drive purchased.

Discount Category	Quantity Purchased	Price (per disk drive)
1	1 to 99	Rs.100
2	100 to 499	Rs. 95
3	500 or more	Rs. 90

a) Determine the optimal order quantity according to the EOQ model with quantity discounts. What is the resulting total cost per year?

b) With this order quantity, how many orders need to be placed per year? What is the time interval between orders?

UNIT–V

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

OR

10. Solve the following LPP by dynamic programming:

Maximize $Z = 8x_1+7x_2$

Subject to

$2x_1+x_2 \leq 8,$

$5x_1+2x_2 \leq 5,$

$x_1, x_2 \geq 0.$

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