Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (NEW) EXAMINATION – WINTER 2017

Subject Code: 2181911 Date: 10/11/2017

Subject Name: Finite Elements Method(Department Elective II)

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define: Nodes, Primary Nodes, Secondary Nodes and Internal Nodes.	**03**
	(b)	How will you discretise the FEA model in 1D, 2D and 3D.	**04**
	(c)	List and describe the general steps of the Finite Element Method.	**07**
Q.2	**(a)**	Explain: Local Coordinates, Global Coordinates, Natural Coordinates and Area Coordinates.	**03**
	(b)	Explain the penalty approach of imposing boundary conditions.	**04**
	(c)	Explain Gaussian Elimination method with example.	**07**
		OR	
	(c)	Consider the bar shown in fig. an axial load P = 200x 10^3N is applied as shown in **Fig. 1.** Using the penalty approach for handling boundary conditions do the following: a) Determine the nodal displacements. b) Determine the stress in each material c) Determine the reaction forces.	**07**
Q.3	**(a)**	Write the expression for potential energy π.	**03**
	(b)	Explain the axisymmetric FEA of a pressure vessel.	**04**
	(c)	Obtain a shape function and stiffness matrix for four nodded quadrilateral 07 element.	**07**
		OR	
Q.3	**(a)**	List out Euler-Langrange Equation.	**03**
	(b)	Explain the properties of stiffness matrix K.	**04**
	(c)	Explain Rayleigh-Ritz method with example.	**07**
Q.4	**(a)**	Explain the FEA simulation of solidification of castings.	**03**
	(b)	What are the Field problems in FEA? What is advantage and disadvantage of FEA?	**04**
	(c)	Explain the temperature effect in one dimensional problem.	**07**
		OR	

Q.4 **(a)** Explain applications of FEM in metal cutting process. **03**

(b) Explain Consistent and Lumped mass matrices. **04**

(c) Consider the thin (steel) plate as shown in **Fig. 2.** The plate has a uniform thickness t = 1 in., young's modulus E = 30 x 106 psi, and weight density ρ = 0.2836 lb/in3. In addition to its self-weight, the plate is subjected to a pint load P = 100 lb at its mid point. **07**

1) Model the plate with two finite elements.

2) Write down expressions for the element stiffness matrices and element body force vectors.

3) Assemble the structural stiffness matrix K and global load vector F.

4) Using the elimination approach, solve for the global displacement vector- Q.

5) Evaluate the stresses in each element.

6) Determine the reaction force at the support.

Q.5 **(a)** Discuss the term CST & LST. **03**

(b) Explain the potential energy approach with all force terms. **04**

(c) Explain the Galerkin approach in detail. **07**

OR

Q.5 **(a)** Explain stress- strain relations in linear elastic material for FEA? **03**

(b) Discuss shape function and quadratic shape functions with respect to one dimensional problem. **04**

(c) List out the software used to solve FEM problems and discuss the applications of FEM. **07**

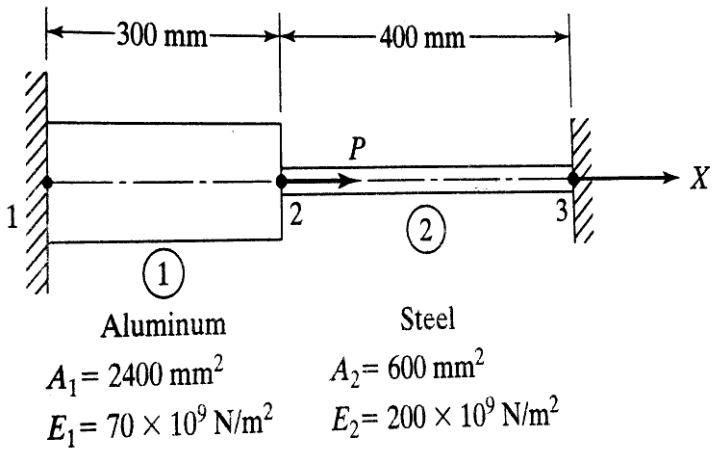

Fig. 1.

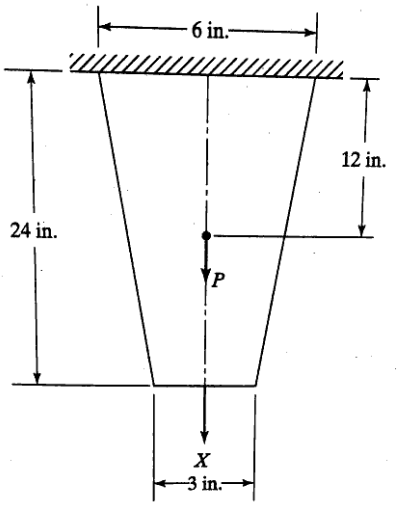

Fig. 2.

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