Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI • EXAMINATION – WINTER • 2014

Subject Code: 163401 Date: 26-11-2014

Subject Name: FEA in manufacturing engineering

Time:02:30 pm - 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)**	Explain the elimination approach of imposing boundary conditions.	**07**
	(b)	Explain the penalty approach of imposing boundary conditions.	**07**
Q.2	**(a)**	Explain Rayleigh-Ritz method with example.	**07**
	(b)	Explain any two Gaussian elimination methods.	**07**
		OR	
	(b)	Explain the Galerkin approach with all force terms.	**07**
Q.3	**(a)**	Explain the temperature effect in one dimensional problem with example.	**07**
	(b)	Consider the thin (steel) plate in fig.-(1) the plate has a uniform thickness t = 1 in., young's modulus E = 30 x 10^6 psi, and weight density ρ = 0.2836 lb/in^3 . In addition to its self-weight, the plate is subjected to a pint load P = 100 lb at its mid point. 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.	**07**
		OR	
Q.3	**(a)**	Explain the potential energy approach with all force terms.	**07**
	(b)	Discuss shape function and quadratic shape functions with respect to one dimensional problem.	**07**
Q.4	**(a)**	An axial load P = 300 x 10^3 N is applied at 20°C to the rod as shown in fig.-(2). The temperature is then raised to 60°C. 1) Assemble the K and F matrices. 2) Determine the nodal displacements and element stresses.	**07**
	(b)	Explain the properties of stiffness matrix K.	**07**
		OR	
Q.4	**(a)**	For the configuration shown in Fig.-(3), determine the deflection at the point of load application using a one-element model. If a mesh of several triangular elements is used, comment on the stress values in the elements close to the tip.	**07**
	(b)	Consider the four bar truss shown in fig.-(4). It is given that E= 29.5 x 10^6 psi and A_e = 1 $in.^2$ for all elements. Determine the element stiffness matrix for each element and assemble the structural stiffness matrix K for the entire truss.	**07**
Q.5	**(a)**	Explain the axisymmetric FEA of a pressure vessel.	**07**
	(b)	Explain the FEA simulation of metal cutting process.	**07**
		OR	
Q.5	**(a)**	Explain the application of FEM in various metals forming process.	**07**

(b) Explain the FEA simulation of solidification of castings. **07**

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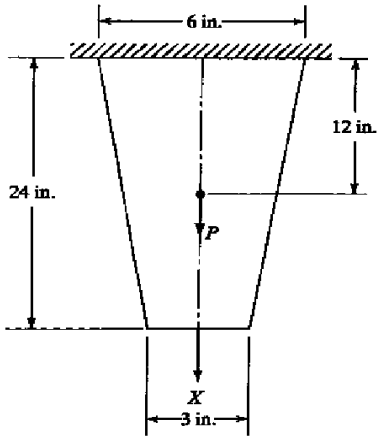
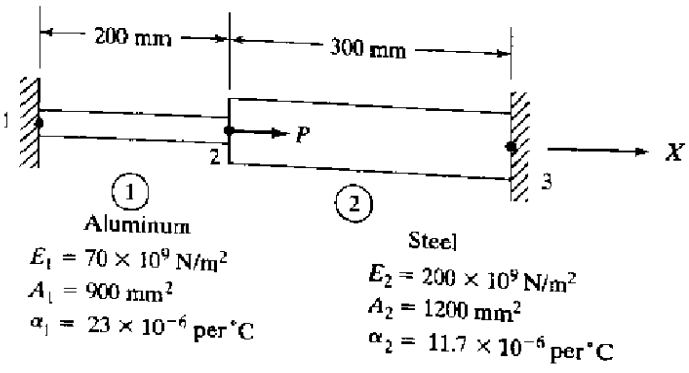
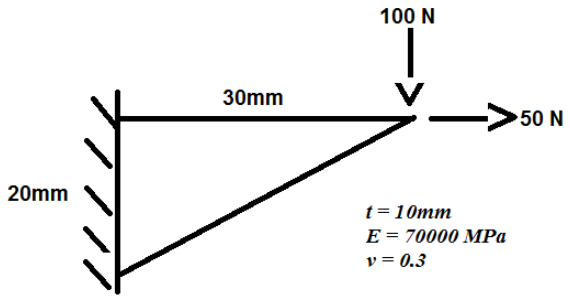


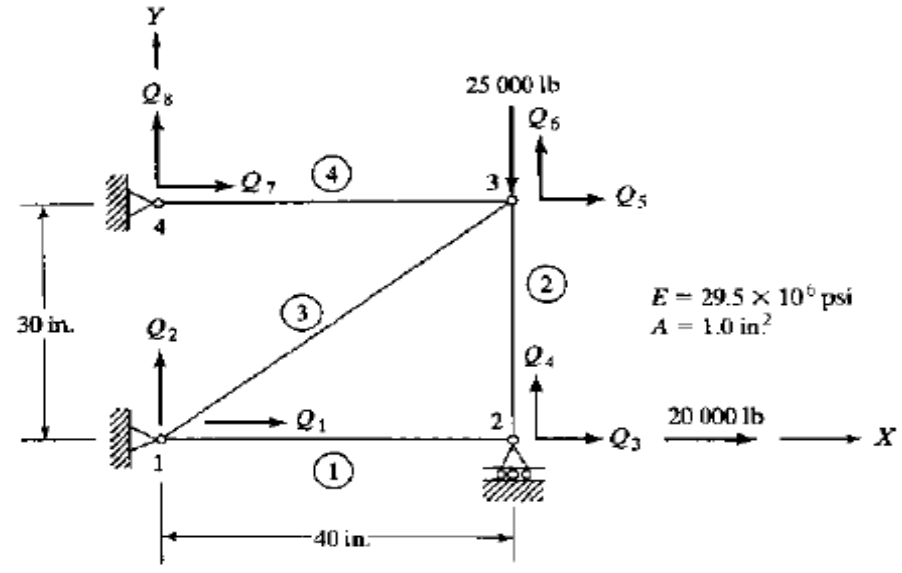
Q.3 (b) Fig.-(1)



Q.4 (a) Fig.-(2)



Q.4 (b) Fig.-(3)



Q.4 (b) Fig.-(4)