Code No: OR320357 **OR**

III B.Tech II Semester Supplementary Examinations, April/May 2005
FINITE ELEMENTS METHODS
(Common to Mechanical Engineering, Mechatronics and Production Engineering)

Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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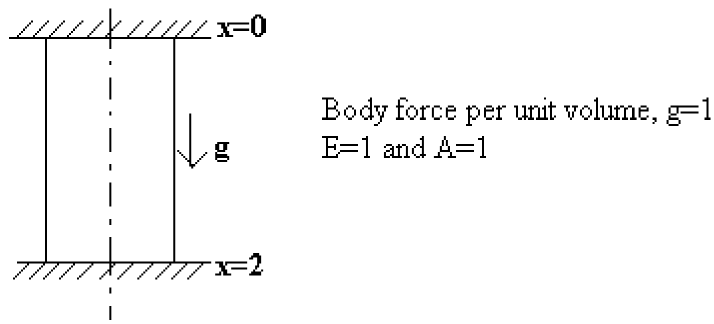
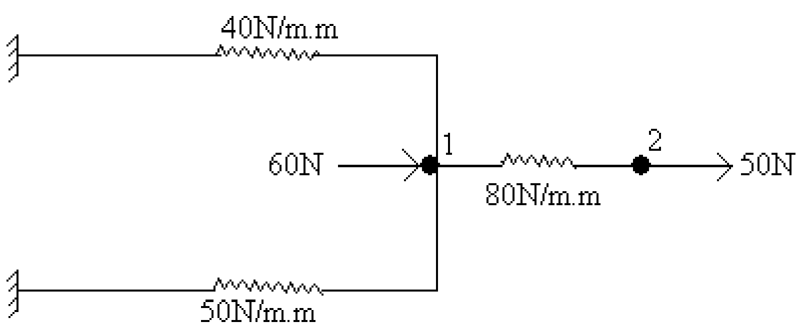
1. (a) State and explain the principle of minimum potential energy.
   (b) Using Rayleigh-Ritz method, find the displacement of the mid point of the rod as shown in figure.

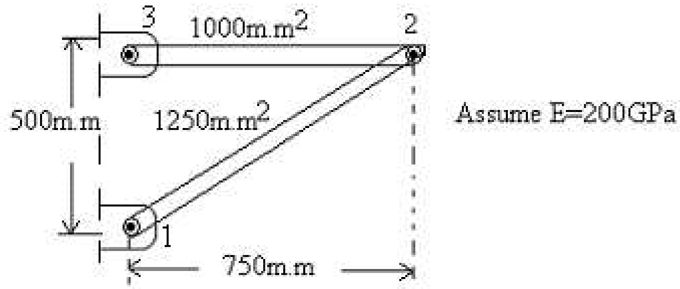


2. (a) What are the important variational principles considered in finite element analysis? Explain the method of obtaining equilibrium equations.
   (b) Derive the displacements of nodes of the spring system shown in figure.



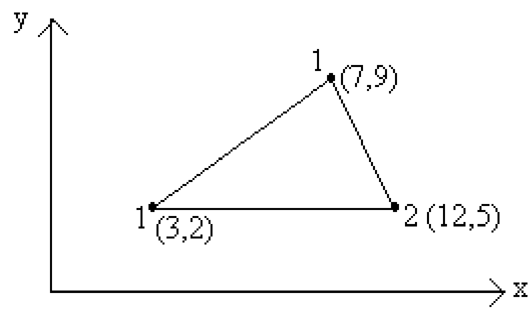
3. (a) What are quadratic stape functions and derive the expressions.
   (b) For the pin-jointed configuration as shown in Figure, displacements determine the stiffness values k_{11},k_{12},k_{22} of the global stiffuess, matrix and determine the nodel displaces, for a horizontal load of 30N is applied in the x direction at node '2'.

4. (a) Distinguish the bar, beam, frame element and give the applications of these elements with suitable examples.



(b) Write a note on boundary consideration in beams and frames. Derive the element stiffuese matrix for a flexural beam element.

5. (a) Determine the Jacobian for the (x,y) – (z,u) transformation for the triangular element as shown in figure, also find the area of the triangle.

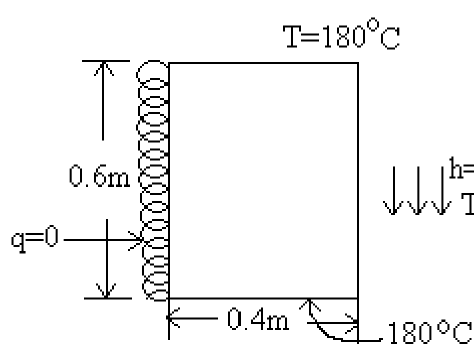


(b) Derive the stiffeness matrix for the quadrilateral element from the strain energy in the body, given by $U = \int_V \frac{1}{2}\sigma^T \varepsilon dv$.

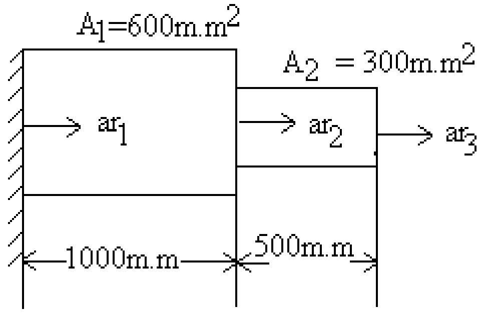
6. (a) Explain Gaussian Quadrature method.

(b) Derive [B] matrix (strain-displacement matrix) for an axisymmetric problem.

7. A long bar of rectangular cross-section, having thermal conductivity of 1.5W/m^{o}C is subjected to the boundary conditions as shown in figure. Determine the temperature distribution in the har.



8. Determine the eigen values for a stepped bar in axial vibrations shown in figure. Assume E= 200GPq, e=7800 kg/m^3.


A1=600m.m2
A2 = 300m.m2
ar1
ar2
ar3
1000m.m
500m.m

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