Code No. 2146

FACULTY OF ENGINEERING

B.E. 4/4 (M/P) I-Semester (Main) Examination, November / December 2012

Subject : Finite Element Analysis

Time : 3 Hours **Max. Marks: 75**

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Define equilibrium and compatibility conditions. (2)
2. Derive quadratic shape functions for I-D element in global coordinates. (3)
3. What is plane stress? Write 'D' matrix. (2)
4. Define (a) Virtual displacement (b) potential energy (2)
5. Write the stiffness matrix of a frame element. (3)
6. Write the equivalent load vector of a beam subjected to triangular load. (3)
7. The shape functions in triangular element are 0.3 and 0.2. The nodal displacements are $\{0.0, 0.01, 0.02, 0.03, 0.01, 0.0\}^T$, mm, find the displacement at any point in the triangle. (3)
8. If the torque on node 1 is 1000 N-M of a circular shaft of 10mm dia and length of 2m, find the nodal twists of $G=0.8 \times 10^{10} N/m^2$. (3)
9. What is convergency ? Explain. (2)
10. Derive capacitance matrix for rod. (2)

PART – B (5x10=50 Marks)

11. Determine the nodal (figure1) displacements the element strains and stresses and the reaction forces if

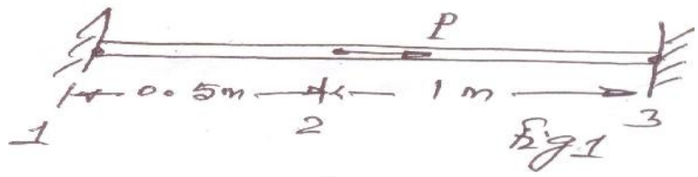

Fig.1

$A=0.0001m^2$, $E=200$ GPa, $P=10^5 N$, $\alpha=6\times10^{-6}/^oC$ and subject to a uniform temperature load of $\Delta T=100^oC$.

12. For the plane truss shown in figure 2. Determine the nodal displacement element stresses and reaction forces if $A=1\times10^{-4}m^2$, $E=200$GPa.

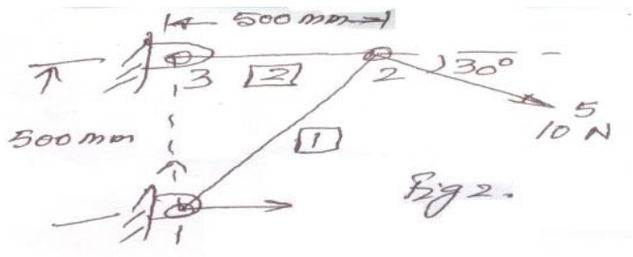

Fig. 2

13. For the beam shown in figure 3. Determine the max displacement and the reaction forces and moments if E = 200 GPa.

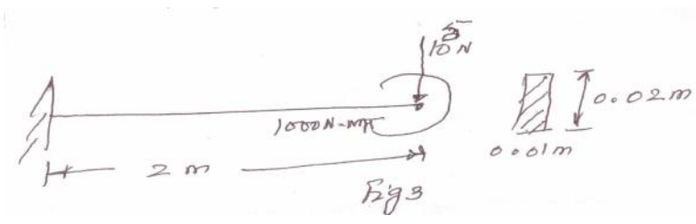

Fig. 3

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14. Derive strain-displacement Matrix for
    (i) Axi symmetric Triangular element
    (ii) Constant strain Triangle

15.(a) For the 4-noded qudrilateral element find the displacement at point P(ξ^2=-0.5, n=-0.4) if the noded displacements are q={0.001, 0.0, 0.0, -0.002, 0.0, -0.01, -0.001, + 0.003}^{T} mm.

(b) Find $I_\xi = \int_{-1}^{1} (\xi^2 + 3\xi - 10.0)d\xi$ using

Gaussian quadrature (for n=1, ξ=0.0, w=2.0, for n=2, ξ=$\pm$0.577, w_1=w_2=1.0) and compare the solution with numerical integration.

16. For the rod shown in figure 4 subjected to convection and heat flux, determine the temperature distribution if thermal conductivity is 50w/cm^{o}c.

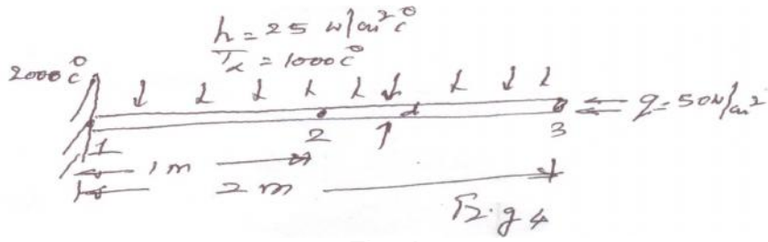

Fig. 4

17. Determine the natural frequencies of a cantilever beam as shown in figure 5 E=200 GPa, s = 7800 kg/m^3.

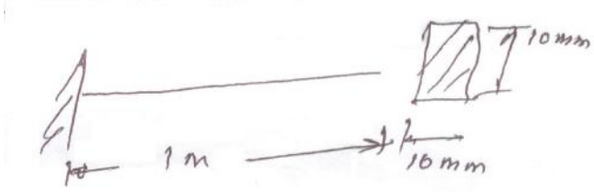

Fig. 5

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