H.T.No. | | | | | | | | | | |

Code No: ME1911 **GEC-R14**

M. Tech II Semester Regular/Suppl. Examinations, July 2017

FINITE ELEMENT METHODS

(Machine Design)

Time: 3 Hours **Max. Marks: 60**

Note: Answer any **FIVE** questions. All Questions carry equal Marks.

5 × 12 = 60M

1. a) Write the Weighted Residual statement and construct the weak form for the following differential equation. (6M)

$$AE\frac{d^2u}{dx^2}+ax=0$$

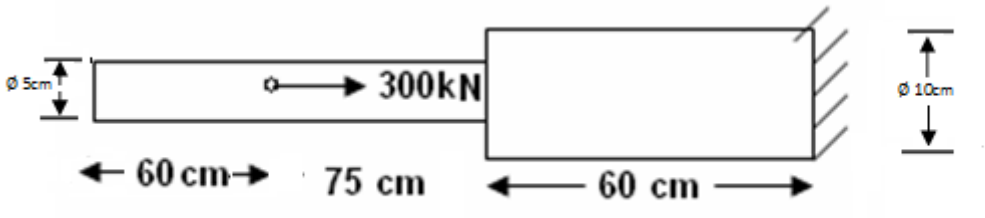
$$u(0)=0$$

subjected to

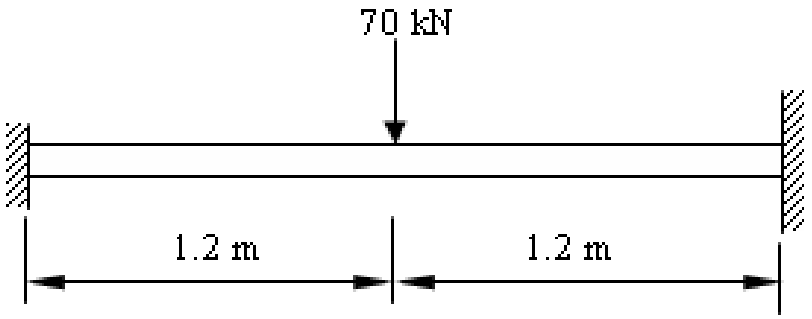
$$AE\frac{d^2u}{dx^2}(L)=0$$

b) Explain the General procedure of F.E.M. (6M)

2. A stepped bar is subjected to an axial load of 300 kN as shown in figure. Find the nodal displacements, element stresses and strains and reactions. Take E = 2 x 10^5 N/mm^2. (12M)

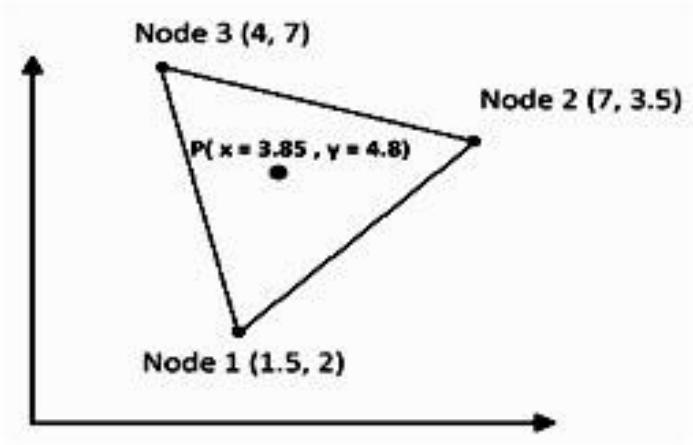


3. Determine the deflection and slope under the point load for the beam shown in figure. E = 180GPa; I = 2x10^{-6} m^4. (12M)



4. a) What is a constant strain triangular element? State its properties and applications. (6M)

   b) An Isoparametric constant strain triangular element is shown in Figure. Determine the Jacobian of transformation J for the element. (6M)



5. a) Derive the load vector for the axi-symmetric triangular element with the constant surface load on the surface. (6M)

   b) What is the importance of natural coordinate system in solving the Axi sysmmteric element and derive the shape functions of the element. (6M)

6. a) List out various advantages by using the concept of numerical integration and its utility in generating Isoperimetric finite element matrices. (4M)

   b) Evaluate the integral $I=\int\int(3x^2+2xy+7y^2)\,dx\,dy$ in the limits of -1 to 1 using gauss quadrature numerical integration and verify with exact solution. (8M)

7. a) Discuss the importance of Iso-parametric concept used in FEM. Name the Iso-parametric elements. How is 'assembly' done in Iso-parametric formulation? (6M)

   b) Explain in detail how the element stiffness matrix and the load vector are evaluated in Iso-parametric formulations. (6M)

8. a) Distinguish between consistent mass matrix and lumped mass matrices (4M)

   b) Derive an approximate solution for the first two natural frequencies of a cantilever beam using one element model. EI is flexural rigidity. (8M)

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