BIRLA INSTITUTE OF TECHONOLOGY AND SCIENCE, PILANI
First Semester (2017-2018), Mid-Semester Examination
Course: Finite Element Analysis (CE G619)

Date: 13th Oct. 2017 (Room:2201) Max. Marks: 50 Duration: 11:00AM-12:30PM

Q.1. Derive the governing differential equation of the system shown in **Fig.1** (Tapered bar subjected to a body force *f(x)* and a concentrated end load). Find the weak form of the derived differential equation using Modified Galerkin approach. Taking this weak form equation formulate the Finite Element equation considering the whole bar as one linear element. Solve this derived FE equation by taking, *f(x)*=30kN/m^3,A=0.002 m^2,L=2m and E=200GPa. Find the displacement, strain and stress at the centre of the bar. [25]

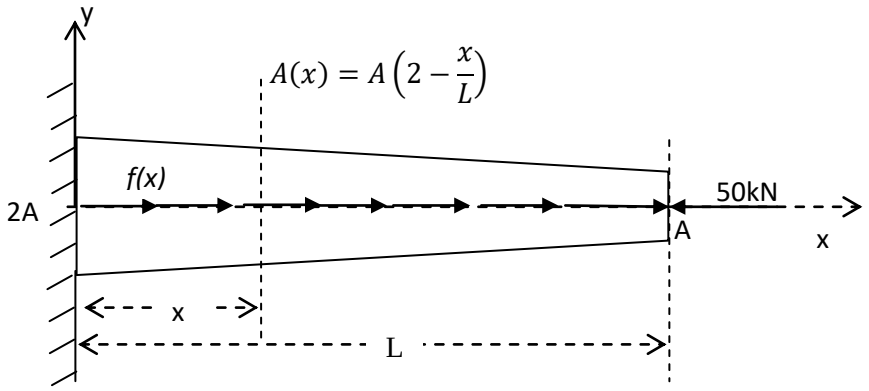

Fig.1 Tapered bar subjected to body force and concentrated force

Q.2. Find the approximate solution of the differential equation given below by (i) Collocation method (ii) Galerkin method, (iii) Ritz method(Minimization quadratic functional and weak form). [20]

$$\frac{d^2u}{dx^2} + x\,\frac{du}{dx} - u = 0 \ , 0 \le x \le 1, \quad u(0) = 0 \text{ and } u(1) = 2.5$$

Find the values of u at $x = 0.25$ and $x = 0.5$ in all methods.

Q.3. Write the different steps in finite element analysis. What do you understand by variational formulation. [5]