Indian Institute of Technology Mandi

Sub: **Applied FEM (**ME 505)

Quiz no. 1

Duration: 1 hour Marks: 40

Set B

1. Answer in terms of true or false: **(Marks: 10× 1 = 10** for all correct answers**; 10× (-0.5) = -5** for all incorrect answers**)**
    - o Do not write anything on the question paper except your name.
    - o Mention your set number in the answer sheet. If not mentioned, **set A** will be assumed by default.

    i. A FEM mesh has 10 elements and 20 nodes. Minimum degree of freedom of the system would be 30.

    ii. Meshing on surface is done to reduce the infinite degree of freedom into finite dof.

    iii. Use of FEM reduces the number of prototypes of the product.

    iv. During product development phase, cost of design changes are less during initial phase of development.

    v. The number of nodes in the mesh of a solid geometry is 700. For heat conduction problem, the number of degree of free at each node would be 700.

    vi. While modelling a car using FEM, the engine can be modelled by mass element and while frames and sheet metal parts can be modelled by shell elements.

    vii. During finite element analysis, if geometry is in mm and force is in Newton, then stress unit should be in MPa.

    viii. If the order of a differential equation is 6, then the order of trial function solution would be 4 using Rayleigh-Ritz Method.

    ix. The trial function solution should be continuous and differentiable in the entire solution domain.

    x. If the trial function is of the form $y = c_0+c_1x+c_2x^2+c_3x^3$, then one of the weight function for Rayleigh-Ritz and Petrov-Galerkin can be x^3 and x^5 respectively.

2. Solve the following differential equation, **(Marks: 4×7.5=30)**

$$\frac{dy}{dx} + y = 0; \quad y(0) = 1, \ 0 \le x \le 1$$

using

a) Point collocation method (at x = 1/3 and x = 2/3)

b) Least square method,

c) Rayleigh-Ritz method,

d) Compare the solutions from above methods with exact solution at x = 0.5.