BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO2024)

CLASS: BTECH | **SEMESTER : V**
BRANCH: MECHANICAL | **SESSION : MO/24**

SUBJECT: ME351 FINITE ELEMENT METHODS

TIME: 02 hrs | **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

	Question	Marks	CO	BL
Q.1	Obtain an approximate displacement equation by using least squares method for the simply supported beam shown in Figure 1 using the trial solution y(x)=Asin(πx/H). The governing differential equation is	[5]	1	4

$$EI\frac{d^2y}{dx^2} - \frac{M_o x}{H} = 0$$

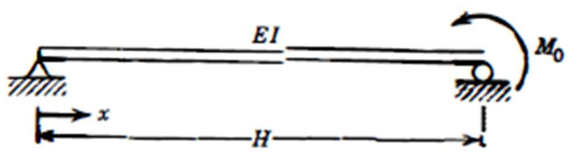


Figure 1

	Question	Marks	CO	BL
Q.2	Explain all method for solving boundary value problem.	[3]	1	2
Q.3	The coordinate ξ shown in Figure 2 is a natural coordinate whose origin is at the center of the element. The value of ξ at nodes i and j is 1 and -1, respectively. Develop the shape functions N_i(ξ) and N_j(ξ) starting with $\Phi(\xi) = a_1 + a_2\xi$ and solving for a_1 and a_2. Also check the shape function is following all the properties	[5]	2	3

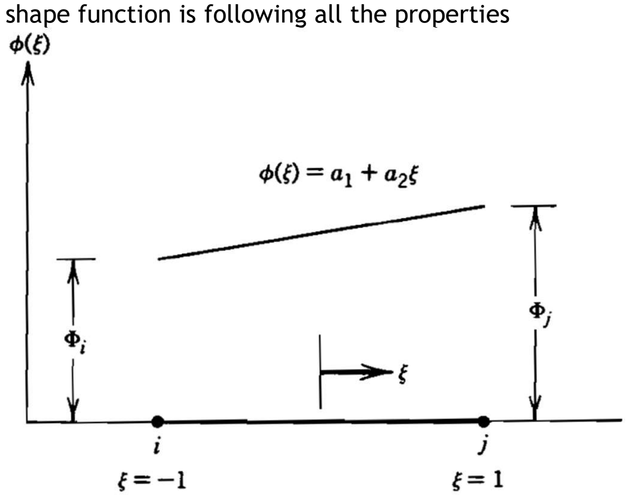


Figure 2

	Question	Marks	CO	BL
Q.4	Derive the Galerkin's formulation of nodal residue integrals for the given one dimensional differential equation	[5]	2	3

$$D\frac{d^2\varphi}{dx^2} + Q = 0$$

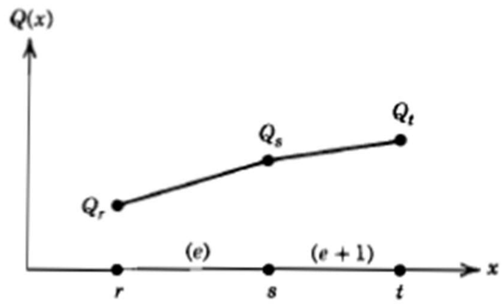
Boundary conditions φ(0)= φ_0 and φ(H)= φ_H
Also Evaluate using linear Elements

PTO

Q.5 Evaluate the contribution of [5] 3 4

$$\int_0^H WQdx$$

to the Galerkin residual equation R_s when Q varies linearly over an element



The equation Q in each element is

$$Q^{(e)} = N_r^{(e)} Q_r + N_s^{(e)} Q_s$$

$$Q^{(e+1)} = N_s^{(e+1)} Q_s + N_t^{(e+1)} Q_t$$

::::::23/09/2024::::::M