JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

M.Tech-I Semester (~~CSE/IT/BT/EC~~E/CE) - SE

COURSE CODE (CREDITS): 25M11CE114 (3) MAX. MARKS: 15

COURSE NAME: FINITE ELEMENT METHODS

COURSE INSTRUCTOR: Dr. KAUSHAL KUMAR MAX. TIME: 1 Hour

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) ***Use of Scientific calculator is allowed***

Q1. Solve the differential equation [***15 Marks***]

$$\varphi'' - \varphi = x^2, \quad 0 \le x \le 1$$

subject to the boundary conditions

$$\varphi(0) = 0 \text{ and } \varphi(1) = 0.$$

Obtain the **approximate solution** using any of the **3** methods from the following methods:

i. Point Collocation Method {Choose, x = 0.25 and x = 0.5 as collocation points}

ii. Least-Squares Method

iii. Galerkin Method

iv. Rayleigh–Ritz Method

The exact solution of the differential equation $\varphi'' - \varphi = x^2$ can be expressed as:

$$\varphi = -0.073349 \sinh(x) + 2\cosh(x) - x^2 - 2$$

Compare the approximate solutions obtained by these methods with the **exact solution** and comment on their accuracy.

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