GALGOTIAS UNIVERSITY

ADMISSION NUMBER												

School of Basic Sciences

Master of Science in Mathematics
Mid Term Examination - Mar 2024

Duration : 90 Minutes
Max Marks : 50

Sem IV - MSCM425 - Finite Element Method

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Distinguish between essential boundary condition and natural boundary condition. K2 (2)

2) Give the comparison between finite element methods and finite difference methods. K1 (3)

3) Solve the following equations using Galerkin's method (Use at least a two-parameter solution) K2 (4)

$\frac{dy}{dx}$=5(1+cosx)-0.05y, 0≤x≤2π, y(0)=20

4) Using the Rayleigh Ritz method, find the solution of K2 (6)

$\frac{d}{dx}$ [$\frac{du}{dx}$]-u+x^2 =0 for 0<x<1

subject to the boundary conditions

u(0)=1, $\frac{du}{dx}$=0 at x=1 .

5) Consider the differential equation $\frac{d^2y}{dx^2} = -\cos \pi x, \quad 0 \le x \le 1$ K3 (6)

Subject to the following two sets of boundary conditions:

$u(0) = 0, \quad \frac{du}{dx}\Big|_{x=1} = 0.$

$\frac{du}{dx}\Big|_{x=0} = 0, \quad \frac{du}{dx}\Big|_{x=1} = 0.$

Determine a solution, with trigonometric functions, using the Ritz method

6) Consider the differential equation $\frac{d^2y}{dx^2} = -\cos \pi x, \quad 0 \le x \le 1$ K3 (9)

Subject to the following two sets of boundary conditions:

$u(0) = 0, \quad \frac{du}{dx}\Big|_{x=1} = 0.$

$\frac{du}{dx}\Big|_{x=0} = 0, \quad \frac{du}{dx}\Big|_{x=1} = 0.$

Determine a three- parameter solution, with trigonometric functions, using the colocation at $x = \frac{1}{4}, \frac{1}{2}$ and $\frac{3}{4}$.

7) Discuss the assembly for linear, quadratic and cubic element in 1D. K4 (8)

8) Construct the matrix taking two quadratic element for the boundary value problem K4 (12)

$\frac{d^2y}{dt^2} + y = t^2 \text{for } 0 < t < 1$ satisfying y(0)=1,y(1)=0.

OR

1. Discuss basic steps of finite element analysis. K4 (12)
2. Discuss connectivity of elements with examples.
3. Develop the weak form and find the solution

$$\frac{d^2v}{dx^2} - q = 0$$

Subject to boundary condition

$v(0) = 0, \frac{dv}{dx}(1) = 0.$