(19)

Program: B. Sc. in ME,6th Semester | **Date: 16 February, 2023**
Semester: Summer | **Time: 10:00 a.m.– 11:30 a.m.**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination | **Summer Semester: 2021 - 2022**
Course Number: ME 4637 | **Full Marks:75**
Course Title: Computational Mechanics | **Time: 1.5 Hours**

There are **3** (**Three**) questions. Answer **all** of them.
The symbols have their usual meanings. Marks of each question and corresponding CO and PO are written in the brackets. Assume reasonable value for any missing data.

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1. a. List the three main approaches to engineering analysis and describe their differences. **(6) (CO1) (PO1,K3,P1)**

`b. Write down the general conservation equation and briefly explain the physical meanings behind each of the terms. **(7) (CO1) (PO1,K3,P1)**

c. Describe the steps involved in the discretization process. **(6) (CO1) (PO1, K3,P1)**

d. Explain the concepts of approximation and error in computational techniques. **(6) (CO1) (PO1, K3,P1)**

2. Following is the One Dimensional Diffusion Equation .

$$\frac{d^2\varphi}{dx^2} = 6x,$$

Boundary Conditions:

$$\varphi(0) = 1, \frac{d\varphi}{dx} = 0, at\ x = 1$$

We discretize the domain $0 \leq x \leq 1$ using grid points x_i,i = 1,..., 5, as shown in the **Figure** 1 below

Figure 1

a. Solve for a finite difference solution on the domain. **(18) (CO2) (PO5/ PO4,K3/K5,P3/P5)**

b. Implement a finite difference solution in MATLAB code. **(12) (CO2) (PO5/PO4, K3/K5,P3/P5)**

3. a. Explain Neumann and Drichlet Boundary Condition. **(5) (CO1) (PO1)**

b. Poisson equation is as follows: **(15) (CO2) (PO5/ PO4, K3/K5,P3/P5)**

$$\frac{\partial^2 \varphi}{\partial x^2} + \frac{\partial^2 \varphi}{\partial y^2} = Q(x, y)$$

Describe the steps involved in finite difference solution of this equation, consider the rectangle (**Figure 2**) with uniform grid spacing as computational domain.

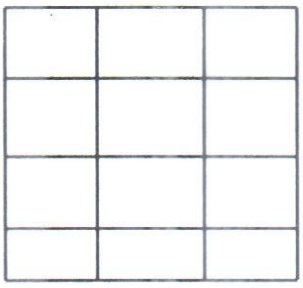

Figure 2