



School: School of Engineering and Technology
Program/s: B. Tech(CME)
Year: 1st **Semester:** 2nd
Examination: End Sem Examination
Examination year: May 2023

Course Code: MA102 **Course Name:** Mathematics-II
Date: 19/05/2023
Time: 2 pm to 4 pm

Total Marks: 40
Total Pages: 2

Instructions:

- Write each answer on a new page.
- Use of a calculator is permitted/not permitted.
- *COs=Course Outcome mapping. # BTL=Bloom's Taxonomy Level mapping

| Q. No. | Details | Marks | COs* | BTL# |
|--------|--|-------|---------------------|---------------------|
| Q1 (a) | Answer in short: (i) $y' + xy = \sin(x)$ is linear differential equation. (True / False) (ii) A differential equation with initial condition is called _____. (iii) $y(x) = e^{3x}$ is a solution of differential equation $y' - 3y = 0$. (True / False) (iv) The order of the differential equation $y'' - y = 0$ is 1. (True/False) (v) What is the difference between homogeneous and non-homogeneous differential equations? | 5 | CO1 | BT1. BT2 |
| Q1 (b) | Attempt Any THREE: (i) Solve separable differential equation with given initial condition: $xy' + y = 0, y(4) = 6$. (ii) Solve the differential equation $\sin x \cos y dx + \cos x \sin y dy = 0$ by checking the equation is exact or not. If not, find integrating factor and solve. (iii) Solve initial value problem: $y'' + y' - 6y = 0, y(0) = 10, y'(0) = 0$. (iv) Solve the given non-homogeneous differential equation: $y'' + 9y = \sec(3x)$ using variation of parameters method. | 15 | CO1. CO2 | BT1. BT2. BT3 |
| Q2 (a) | Answer in short: (i) What is periodic function? (ii) The PDE $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ represents one dimensional ____ equation. (heat / wave) (iii) The function $f(x) = \sin(2x)$ is periodic with period _____. ($2\pi / \pi$) (iv) Fourier series can be found only for periodic function. (True / False) (v) The function $h(x) = 5$ on domain $[-2, 2]$ is an even function. (True / False) (vi) The order of the partial differential equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ is _____. | 6 | CO1. CO2. CO3 | BT1. BT2 |

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|--------|---|----|---------------------|---------------------|
| Q2 (b) | <p>Attempt Any TWO:</p> <p>(i) The one-dimensional heat equation is given by $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions: $u(0,t) = 0$ and $u(1, t) = 0$ and initial condition: $u(x, 0) = 100 \sin(\pi x)$. Find the solution of the equation using separation of variable method.</p> <p>(ii) Find the Fourier series of the given function $f(x) = x$ in $-\pi < x < \pi$, which is assumed to have the period 2π. Show the details of your calculations.</p> <p>(iii) Find the deflection $u(x, t)$ for the string of length l and fasten it at the ends $x = 0$ and $x = l$ with $c^2 = 1$ when the initial velocity is zero and initial deflection is $0.01 \sin(3\pi x)$.</p> | 14 | CO1, CO2, CO3 | BT1, BT2, BT3 |
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*****End of Question Paper*****