2206BTC01012

A+B

BEM-C202

SEMES TER EXAMINATION- MAY 2024
B.TECH SEMESTER: I
ENGINEERING MATHEMATICS II

Time: 3 hours **Max. Marks: 70**

Note: Question Paper is divided into two sections: **A** and **B**. Attempt both the sections as per given instructions.

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SECTION-A (SHORT ANSWER TYPE QUESTIONS)

Instructions: Answer any ***five*** questions in about 150 words each. Each question carries six marks. (5 × 6 = 30 Marks)

1. By understanding the concept of exactness solve the following differential equation **CO1 L1**

$$\left(xy^2 - e^{\frac{1}{x^3}}\right)dx - x^2y\,dy = 0$$

2. Find the solution of following differential equation **CO1 L1**

$$y'' + 4y' - 12y = (x-1)e^{2x}$$

3. By understanding the concept of linear partial differential equation solve **CO2 L2**

$$2\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} - 3\frac{\partial^2 z}{\partial y^2} = 5e^{x+y}$$

4. Classify the nature of following partial differential equation **CO2 L2**

$$(1-x^2)\frac{\partial^2 z}{\partial x^2} - 2xy\frac{\partial^2 z}{\partial x \partial y} + (1-y^2)\frac{\partial^2 z}{\partial y^2} + x\frac{\partial z}{\partial x} + 3x^2y\frac{\partial z}{\partial y} - 2z = 0$$

5. Express $4x^3 + 6x^2 + 7x + 2$ in terms of Legendre polynomials. **CO3 L2**
6. Deduce that when *n* is a positive integer $J_{-n}(x) = (-1)^n J_n(x)$. **CO3 L3**
7. Obtain the Fourier series expansion of $f(x) = \frac{\pi - x}{2}$ in the interval $(0,2\pi)$. **CO4 L4**
8. Obtain the half range sine series for the function $f(x) = x^2 in\ 0 < x < 3$. **CO4 L4**
9. A manufacturer knows that the condensers he makes contain on an average 1% of defectives. He packs them in a box of 100. What is the probability that a box picked at random will contain **CO5 L5**
   - (i) Exactly 2 faulty condensers
   - (ii) 4 or more faulty condensers
10. A manufacturer of envelopes knows that the weight of the envelopes is normally distributed with mean 1.9 gm and variance 0.01 gm. Examine how many envelopes weighing **CO5 L3**
    - (i) 2 gm or more
    - (ii) 2.1 gm or more

    Can be expected in a given packet of 1000envelopes.

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SECTION-B (LONG ANSWER TYPE QUESTIONS)

Instructions: Answer any ***four*** questions in detail. Each question carries 10 marks.

(4 × 10 = 40 Marks)

1. Evaluate the following differential equation by changing the independent variable **CO1 L5**

$$x\frac{d^2y}{dx^2} + (4x^2 - 1)\frac{dy}{dx} + 4x^3y = 2x^3$$

2. Use variation of parameter method to solve **CO1 L1**

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{-x}logx$$

3. Use method of separation of variables to evaluate **CO2 L5**

$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x, 0) = 6e^{-3x}$.

4. Find the power series solution of the following differential equation about $x=0$ **CO3 L3**

$$(1 - x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0.$$

5. Express that $\int_{-1}^{1} P_m(x)P_n(x)dx = 0\ if\ m \neq n$ **CO3 L2**

6. Express $f(x) = x + x^2\ for - \pi < x < \pi$ in terms of Fourier series hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$ **CO4 L4**

7. The following marks have been obtained by a class of students in mathematics **CO5 L4**

Paper I	80	45	55	56	58	60	65	68	70	75	85
Paper II	81	56	50	48	60	62	64	65	70	74	90

Calculate the coefficient of correlation for the above data. Find the lines of regression *y* on *x* and *x* on *y*.

8. Apply method of least square to obtain a parabola that approximates the data **CO5 L3**

x	1	1.2	1.4	1.6	1.8	2
y	2.345	2.419	2.592	2.863	3.233	3.702

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