Printed Page:-04 Subject Code:- BMICA0203 Roll. No: NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA (An Autonomous Institute Affiliated to AKTU, Lucknow) MCA (Integrated) SEM: II - THEORY EXAMINATION (2024-2025) Subject: Basic Mathematics-II **Time: 3 Hours** Max. Marks: 100 **General Instructions: IMP:** *Verify that you have received the question paper with the correct course, code, branch etc.* 1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice *Questions (MCQ's) & Subjective type questions.* 2. Maximum marks for each question are indicated on right -hand side of each question. 3. Illustrate your answers with neat sketches wherever necessary. 4. Assume suitable data if necessary. 5. Preferably, write the answers in sequential order. 6. No sheet should be left blank. Any written material after a blank sheet will not be

evaluated/checked.

DEC-2024 20 **SECTION-A** 1. Attempt all parts:-1-a. 1 $\int \cot x \, dx =$ (K1.CO1) (a) $\log \cos x + c$ (b) $-\log \csc x + c$ (c) $-\log \cos x + c$ (d) D. $-\log \sin x + c$ 1-b. 1 Sinx dx = K1.CO1 (a) 0 (b) 1 (c) 1/2Undefined (d)

The complementary function of differential equation y'' - 6y' + 9y = 0 is 1-c. (K3,CO2)

(a)
$$C_1e^{-3x} + C_2e^{3x}$$

(b)
$$(C_1 + C_2)x e^{3x}$$

(c)
$$(C_1 + C_2 x) e^{3x}$$

(d)
$$C_1 e^{-6x} + C_2 e^{-9x}$$

1-d. In a second-order linear homogeneous differential equation, if the characteristic 1

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1

equation has complex roots, the complementary function will involve:(K1,CO2)

- (a) Sine and cosine functions
- (b) Exponential functions
- (c) Polynomials
- (d) Logarithmic functions
- 1-e. Consider a poset with elements {1, 2, 3, 4, 5} and the order relation defined as 1 divisibility. Then LUB of 2 and 4 in this poset is.... (K2,CO3)
 - (a) 1
 - (b) 2
 - (c) 4
 - (d) 5
- 1-f. In a poset, if every pair of elements has a unique LUB and GLB, then the poset is 1 called a: (K1,CO3)
 - (a) Relation
 - (b) Chain
 - (c) Lattice
 - (d) None of these
- 1-g. The function $f(x,y) = x^2 + 4xy + y^2 2x 2y + 1$ has a critical point at (-1,1) then 1 (K3,CO4)

1

1

1

- (a) The critical point is a maximum of the function
- (b) The critical point is a minimum of the function
- (c) Further investigation is needed
- (d) The critical point is a saddle point of the function
- 1-h. A critical point of a function of two variables is(K1,CO4)
 - (a) A point where the function has a minimum value
 - (b) A point at which both the first partial derivatives are equal to zero.
 - (c) A point where the function has a maximum value
 - (d) None of these
- 1-i. "MANGO" words can be arranged so that the vowels are togetherin ways.(K3,CO5)
 - (a) 45
 - (b) 46
 - (c) 47
 - (d) 48

1-j. The difference between simple interest and compound interest is.... (K1,CO5)

- (a) Simple interest is always higher than compound interest.
- (b) Simple interest is calculated at a higher rate than compound interest.
- (c) Simple interest is calculated only on the principal amount, while compound interest

is calculated on both the principal and the accumulated interest

(d) None of these

.1. .

2. Attempt all parts:-

Solve
$$\int (x^2 + \frac{1}{x}) dx$$
. (K3,CO1)

2

2

30

6

6

6

6

6

6

50

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2.b.

2.a.

Find I.F. of
$$\frac{dy}{dx} + \frac{4}{x}y = e^x$$
 (K3,CO2)

А

- State the definition of a meet operation in a lattice.(K1,CO3) 2.c.
- Find the second order partial derivative of $f(x,y) = x^3 3x^2y + 2y^3$ with respect to 2.d. 2 x.(K3,CO4)
- 2.e. Mr Deepak Mohan walks 5 km towards the south and then turns to the right. After 2 walking 3 km he turns to the left and walks 5 km. Find the direction is he facing right now.(K3,CO5)

SECTION-B

3. Answer any five of the following:-

3-a. Evaluate
$$\int \frac{x^3-1}{x^2} dx$$
. (K3,CO1)

- 3-b. Evaluate $\int 3x e^{x^2} dx$. (K3,CO1)
- Solve: $(D^2 4)y = \sin x (K3,CO2)$ 3-c.

3-d. Solve:
$$(D^2 + 5D + 6)y = e^{5x} (K3,CO2)$$

- 3.e. Consider a poset {a, b, c, d} with the order relation defined as $a \le b \le c \le c$ d. Determine the result of the expression (a v b) v (c v d). Also find $(a \land b) \land (c \land d) (K3,CO3)$
- Examine for the minimum and maximum value of the function: x^3+y^3-3axy . 3.f. (K3,CO4)
- (i) A recipe calls for 2 cups of flour and 3 cups of sugar. If you want to make half 3.g. 6 the recipe, how much sugar should you use? (ii) The average age of a group of friends is 25 years. If the ages of three friends are 22, 24, and 28, Find the age of the fourth friend. (K3,CO5)

SECTION-C

4. Answer any one of the following:-

4-a. Find
$$\int (3x+1)\log(\frac{3x^2}{2}+x) dx$$
. (K3,CO1)

4-b. Solve
$$\int_{0}^{3} (x^2 - x + 1) e^{3x} dx$$
 (K3,CO1) 10

5. Answer any one of the following:-

5-a.

 $\frac{dy}{dx} + \frac{7}{x}y = \frac{1}{x^7}$ (K3.CO2) 10 Using method of integrating factors, Solve: Using method of variable separable, Solve: 5-b. 10 (i)

$$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{\mathrm{e}^{x}}{\mathrm{e}^{y}} (\mathrm{K3,CO2})$$

(ii)
$$\frac{dy}{dx} = \frac{x}{y}$$

6. Answer any one of the following:-

- 6-a. Consider the lattice D₃₀, divisor of 30 ordered by divisibility. (K3,CO3)
 (i) Draw the Hasse diagram
 - (ii) Find the complement of 2 and 10 if any.
- 6-b. Let $X=\{2,3,6,12,24,36\}$ and the relation R be such that xRy if x divides y. Draw 10 the Hasse diagram of (X, R). (K3,CO3)
- 7. Answer any one of the following:-
- 7-a.

If
$$u = \sin^{-1} \left(\frac{\sqrt{x} - \sqrt{y}}{\sqrt{x} + \sqrt{y}} \right)$$
, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0$ (K3,CO4) 10

7-b. Examine for the minimum and maximum value of the function: 10 $x^{3}+y^{3}-63(x+y)+12xy.(K3,CO4)$

8. Answer any one of the following:-

-OP.5

- 8-a. I. A jar contains a mixture of nuts and raisins. The ratio of nuts to raisins is 4:7. If 10 there are 60 raisins, Find the number of nuts. (K3,CO5)
 II. Sowmya Krishnan walked 20 m towards the north. Then she turned right and walks 30 m. Then she turns right and walks 35 m. Then she turns left and walks 15 m. Finally she turns left and walks 15 m. Find the distance from the starting position to last position.
- 8-b. (i) The ratio of the ages of John and Mary is 4:7. If the sum of their ages is 66, 10 Find Mary's age?

(ii) The ratio of the ages of Sarah and John is 4:9. The sum of their ages is 65. Find their ages. (K3,CO5)