Printed Page:-04 **Subject Code:- AMICA0205**

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.*

SECTION-A 20

1. Attempt all parts:-

1-a. $\int k\,dx$ is: (CO1, K3) 1

(a) kx

(b) $kx + c$

(c) $k + c$

(d) Undefined

1-b. $\int (x + \frac{1}{2})\,dx =$ ... (CO1,K3) 1

(a) $\frac{x^2}{2} + \frac{x}{2}$

(b) $\frac{x^2}{2} + \frac{1}{2}$

(c) $\frac{x^2}{2} + \frac{x}{2} + c$

(d) $\frac{x^2}{3} + \frac{x}{2} + c$

1-c. If the number of constants in general solution of a differential equation is 2 , then the order of differential equation is (CO2,K2) 1

(a) 0

(b) 2

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(c) 4

(d) 5

1-d. The value of y in equation $\frac{dy}{dx} = 5$ is (CO2,K3) 1

(a) 5

(b) x+5

(c) 5x

(d) 5x+C

1-e. R= {(1,1),(5,5),(8,1),(1,5),(5,1),(1,8)} is (CO3,K2) 1

(a) Reflexive

(b) Transitive

(c) Symmetric

(d) All of these

1-f. If $b \vee c = c \vee b$ for any element b, c of lattice L, this is part of following Law: (CO3,K2) 1

(a) Idempotent

(b) Commutative

(c) Associative

(d) Distributive

1-g. The saddle point of a function of two variables is ....(CO4,K2) 1

(a) A point where the function has neither a minimum nor a maximum value

(b) A point where the function has a minimum value

(c) The critical point is a maximum of the function

(d) Further investigation is needed

1-h. The function $f(x,y) = 3x^2 + 2xy + 4y^2 - 4x + 5$ has a critical point at (1,1). This critical point is.....(CO4,K3) 1

(a) The critical point is a maximum of the function

(b) The critical point is a saddle point of the function

(c) It is a local minimum of f(x,y)

(d) Further investigation is needed

1-i. If the ratio of apples to oranges in a basket is 3:5, and there are 25 oranges in the basket, the no. of apples in the basket are....(CO5,K3) 1

(a) 13

(b) 12

(c) 14

(d) 15

1-j. The age of a father is three times the age of his son. After 10 years, the age of the father will be twice the age of his son. The present age of son and father is ..... (CO5,K3) 1

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(a) 10 and 30 years
(b) 15 and 45 years
(c) 20 and 30 years
(d) 30 and 90 years

2. Attempt all parts:-

2.a. Calculate $\int_0^2 (2x-1)dx$. (CO1,K3) 2

2.b. Determine the c.f. of $(D^2 + 2)y = \sin x$ (CO2, K3) 2

2.c. Given a Poset with elements {1, 2, 3, 4, 5} and the order relation defined as the usual "less than or equal to" relation, what is the LUB of 3 and 4? (CO3,K3) 2

2.d. Check whether the point (0, 0) is maxima, minima, saddle point of the function $f(x,y) = x^3 - 3x^2y + 2y^3$.(CO4,K3) 2

2.e. Amit said - "This girl is the wife of the grandson of my mother". How is Amit related to the girl?(CO5,K2) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Evaluate $\int (3x + 2x^2)\, dx$.(CO1,K3) 6

3-b. Prove that $\int_{-5}^{5} (x^5 - x)\, dx = 0$ (CO1,K3) 6

3-c. Evaluate: $\frac{dy}{dx} + y = e^x$ (CO2,K3) 6

3-d. Solve: $\frac{dy}{dx} + 2xy = x$ (CO2,K3) 6

3.e. i) Draw the Hasse diagram of $(A, \leq)$ where $A = \{3,4,12,24,48,72\}$ and relation $\leq$ be such that $a \leq b$, if a divides b. (CO3,K2) 6
ii) Draw the Hasse diagram of the relation S defined as 'divides' on set B where B ={2,3,4,6,12,36,48}. (CO3,K2)

3.f. Calculate the minimum and maximum value for the following function $x^2+y^2+6x+12$. (CO4,K3) 6

3.g. A sum of $10,000 is invested at an annual interest rate of 5%, compounded annually. What will be the value of the investment after 3 years? (CO5,K3) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Evaluate $\int \frac{e^x}{(e^x+1)} dx$. (CO1,K3) 10

4-b. State the fundamantal theorem of Calculus. Hence find $\int_0^2 (x^2 - 2x + 1)e^x\, dx$. (CO1,K3) 10

5. Answer any one of the following:-

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5-a. Evaluate y: $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = \cos 2x$ (CO2,K3) 10

5-b. Solve: $\frac{d^2y}{dx^2} + \frac{dy}{dx} = \sin x$ (CO2,K3) 10

6. Answer any <u>one</u> of the following:-

6-a. Define a distributive lattice and explain the distributive property it satisfies. Give an example of a distributive lattice. (CO3,K2) 10

6-b. Explain the Lattice. Is A =(D36,/) a lattice? (CO3,K2) 10

7. Answer any <u>one</u> of the following:-

7-a. Discuss the maxima and minima for the function $f(x,y) = x^2 + y^2 + 36$.(CO4,K3) 10

7-b. If $u=\log(x^2+y^2+z^2)$, Then determine (CO4,K3) 10

$$x\frac{\partial^2 u}{\partial y \partial z} + y\frac{\partial^2 u}{\partial z \partial x} + z\frac{\partial^2 u}{\partial x \partial y}.$$

8. Answer any <u>one</u> of the following:-

8-a. Tom borrows $20,000 from a bank at an interest rate of 8% per annum, compounded annually. If he agrees to repay the loan after 5 years, how much interest will he have to pay in total? (CO5,K3) 10

8-b. A chemist has two solutions: one is 50% acid and the other is 25% acid. How much of each solution should be mixed to obtain 10 liters of a 40% acid solution? (CO5,K3) 10