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 (2023 - 2024)

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. $\int (x^2 + \frac{2}{x^3} - 7)\, dx$: (CO1) 1

(a) $\frac{x^3}{3} + \frac{2}{x^2} - 7x + c$

(b) $\frac{x^3}{3} + \frac{2}{x^2} - 7 + c$

(c) $\frac{x^3}{3} - \frac{1}{x^2} - 7x + c$

(d) $\frac{x^3}{3} - \frac{2}{x^2} - 7x + c$

1-b. $\int e^{2x+1}\, dx$ is: (CO1) 1

(a) $\frac{e^{2x+1}}{2} + c$

(b) $e^{2x+1} + c$

(c) $x + c$

(d) $e^x + c$

1-g. The function $f(x,y) = x^2 + 2xy + y^2 + 4x - 2y + 3$ has a critical point at (-1,1). What can be said about this critical point (CO4) 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-c. The complementary function of differential equation y'' - 6y' + 9y = 0 is (CO2) 1

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

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

(c) $(C_1 + C_2x)\ e^{3x}$

(d) $C_1e^{-6x} + C_2e^{-9x}$

1-h. A saddle point of a function of two variables is ....(CO4) 1

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

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

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

(d) Further investigation is needed

1-d. 1

The value of y in equation $\frac{dy}{dx} = 5$ is (CO2)

(a) 5

(b) x+5

(c) 5x

(d) 5x+C

1-i. In how many ways can 3 books be selected from a shelf containing 10 books? (CO5) 1

(a) 130

(b) 140

(c) 150

(d) 120

1-e. A complemented lattice is a lattice in which: (CO3) 1

(a) Every element has a unique complement

(b) Every element has at least one complement

(c) There exists a top element and a bottom element

(d) The lattice is distributive

1-j. If the ratio of apples to oranges in a basket is 3:5, and there are 25 oranges in the basket, how many apples are in the basket? (CO5) 1

(a) 13

(b) 15

(c) 14

(d) 12

1-f. If a poset has a unique maximum element, then the join of any two elements in the poset: (CO3) 1

(a) Always exists

(b) Does not exist

(c) Exists if the elements are comparable

(d) None of these

2. Attempt all parts:-

2.a. Solve $\int_0^1 (x^2 - x)dx.$ (CO1) 2

2.b. Separate the variables (CO2) 2

$$\frac{dy}{dx} = x^2y + xy$$

2.c. Draw Hasse diagram of A=({1, 3, 5, 15}, /) (CO3) 2

2.d. Find the second order partial derivative of $f(x,y) = x^3 + 2xy^2$ with respect to x. (CO4) 2

2.e. Emily is the daughter of Kate. Kate is the sister of Mark. What is the relationship between Mark and Emily? (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

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

3-b. Evaluate $\int \frac{Sec^2x}{tanx + 2}\,dx.$ (CO1) 6

3-c. Using method of integrating factors, Solve: $\frac{dy}{dx} + y = e^{-x}$ (CO2) 6

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

3.e. Define a partially ordered set (poset) and provide an example. Explain the properties that must hold in a poset. (CO3) 6

3.f. Discuss the maxima and minima of $u(x,y) = x^2 + y^2 + 6x + 12.$ (CO4) 6

3.g. John 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 6

interest will he have to pay in total? (CO5)

SECTION C **50**

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

4-a. Evaluate : $\int (x^2+2x-17)(x+2)\,dx.$ (CO1) 10

4-b. Evaluate by Subtitution: $\int (21x^2+9)\log(7x^3+9x)\,dx.$ (CO1) 10

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

5-a. Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = \cos x$ (CO2) 10

5-b. Solve the differential equation $(D^2 + 12D + 32)y = e^{3x}$ (CO2) 10

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

6-a. Consider the lattice D_{30}, divisor of 30 ordered by divisibility. (CO3) 10
(i) Draw the Hasse diagram
(ii) Find the complement of 2 and 10 if any.

6-b. Given a poset, write the steps to construct its corresponding Hasse diagram. Determine the Hasse diagram of relation R, where A={1,2,3,4} &R={(1,1),(1,2),(2,2),(2,4),(1,3),(3,3),(3,4),(1,4),(4,4)} (CO3) 10

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

7-a. If $z = xy$, Then check whether this statement satisfy $\frac{\delta^3 z}{\delta x^2 \delta y} = \frac{\delta^3 z}{\delta x \delta y \delta x}$ or not.(CO4) 10

7-b. If $z = \log(e^x + e^y)$ then find $rt - s^2$. (CO4) 10

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

8-a. (i) The ratio of the ages of John and Mary is 4:7. If the sum of their ages is 66, what is Mary's age? 10
(ii) The ratio of the ages of Sarah and John is 4:9. The sum of their ages is 65. Find their ages. (CO5)

8-b. Three partners, X, Y, and Z, start a business together. They invest in the ratio of 2:3:5 respectively. If the total profit after one year is $60,000, how much profit does each partner receive? (CO5) 10