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. $\int_2^3 \frac{x}{2} dx =$ (CO1) 1

(a) 1/4

(b) 3/4

(c) 5/4

(d) 2

1-b. **The integral $\int xe^x dx$ can be found using: (CO1)** 1

(a) Substitution

(b) Partial fractions

(c) Integration by parts

(d) Trigonometric substitution

1-c. If the characteristic equation of a second-order linear differential equation has complex roots, the general solution involves: (CO2) 1

(a) Trigonometric functions

(b) Exponential functions

(c) Logarithmic functions

(d) None of these

1-d. The complete solution of the differential equation 1

$\frac{dy}{dx} + P\,y = Q$ is given by (CO2)

(a) $y = \int Q\,(I.F.)\,dx + C$

(b) $y = (I.F.) \int Q\,dx + C$

(c) $y\,(I.F.) = \int Q\,(I.F.)\,dx + C$

(d) None of these.

1-e. Let $(L, \leq)$ be a lattice. For each $a \in L$ then $a \wedge a$ is equal to (CO3) 1

(a) a<b

(b) b>a

(c) a

(d) None of these

1-f. Another name for GLB is (CO3) 1

(a) Infimum

(b) Supremum

(c) Minimal

(d) None of these

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

(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. In how many ways can the letters of the word "APPLE" be arranged? (CO5) 1

(a) 61

(b) 62

(c) 63

(d) 60

1-j. A car travels 10 km towards the north, then it turns left and travels for 6 km. How far is it from the starting point? (CO5) 1

(a) 12.13 km

(b) 12.41 km

(c) 11.66 km

(d) 13.12 km

2. Attempt all parts:-

2.a. Solve $\int_0^7 (e^3+1)\,dx.$ (CO1) 2

2.b. Find I.F. of $\frac{dy}{dx} + x^2y = \cos x$ (CO2) 2

2.c. Define LUB and GLB in a poset. (CO3) 2

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

2.e. In a group of 8 friends, how many different ways can 3 of them be selected to form a committee? (CO5) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Solve the integral $\int \frac{1}{(x+3)(x+2)}\,dx.$ (CO1) 6

3-b. Evaluate $\int 3x\,e^{x^2}dx.$ (CO1) 6

3-c. Using method of variable separable, Solve: $\frac{dy}{dx} = \frac{5y}{x}$ (CO2) 6

3-d. Solve: $(D^2-9)y = e^{3x}$ (CO2) 6

3.e. Write condition of poset to be called as lattice? Define distributive and complemented lattice? (CO3) 6

3.f. If $u = \log\left(\frac{x^3+y^3}{x+y}\right)$ then by using Eulers theorem show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2.$ (CO4) 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) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Solve the integral $\int (6x+3)e^{3x^2+3x}\,dx.$ (CO1) 10

4-b. Determine: (i) $\int \frac{x^4}{x^5+1}\,dx.$

(ii) $\int (x-1)\sin x\,dx$ (CO1) 10

5. Answer any one of the following:-

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

5-b. Solve by method of integrating factors: $\frac{dy}{dx} + \frac{10}{x}y = \frac{1}{x^9}$ (CO2) 10

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

6-a. Draw the Hasee diagram of S=({D_{48}}, /) and find out if it is a complemented lattice? (CO3) 10

6-b. Define a lattice and provide an example. Explain the properties that make it a lattice.(CO3) 10

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

7-a. Discuss the maxima and minimum of $u(x,y) = xy(1-x-y)$ (CO4) 10

7-b. If $z = f(x+ay) + \phi(x-ay)$., prove that $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$. (CO4) 10

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

8-a. (i) Alice walks 2 kilometers north, then turns and walks 3 kilometers east. How far is she from her starting point, and in which direction?
(ii) A car travels 40 kilometers north, then turns and travels 30 kilometers west. What is the straight-line distance between its starting point and final position? (CO5) 10

8-b. A 30-liter container is filled with a mixture of milk and water. If the ratio of milk to water is 3:2, how much of the mixture should be replaced with water so that the ratio becomes 2:3? (CO5) 10