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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

MCA (Integrated)

SEM: II - THEORY EXAMINATION (2022-2023 .)

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. Value of $\int e^{3x} dx$ will be: (CO1) 1
- (a) $3e^{3x} + c$
- (b) $e^{3x} + c$
- (c) $\frac{e^{3x}}{3} + c$
- (d) e^x
- 1-b. Find $\int 7 \cos mx dx$: (CO1) 1
- (a) $7 \frac{\sin mx}{x} + c$
- (b) $7 \frac{\sin mx}{m} + c$
- (c) $7 \frac{\cos mx}{m} + c$
- (d) $\frac{\sin mx}{m} + c$
- 1-c. P. I. of $D^2 y = \sin x$ is (CO2) 1
- (a) -1

- (b) $-\sin x$
- (c) $\cos x$
- (d) None of these

1-d. $f(x, y) = \cos\left(\frac{x^2 + y^2}{xy}\right)$ is (CO2) 1

- (a) Homogeneous with degree 1
- (b) Homogeneous with degree 0
- (c) Homogeneous with degree 2
- (d) None of these

1-e. Let (P, \leq) be a partially ordered set. where $P = \{1, 2, 3, 4, 5\}$ and \leq is the relation of the division which partially ordered the set P . Then the minimal elements of P is: (CO3) 1

- (a) 3
- (b) 3, 4, 5
- (c) 1
- (d) None of these

1-f. 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) $\sup\{a, a\}$

1-g. If $rt - s^2 > 0$ and $r > 0$ at (a, b) then (CO4) 1

- (a) $f(x, y)$ is maximum at $x = a, y = b$.
- (b) (a, b) is a saddle point
- (c) $f(x, y)$ is minimum at $x = a, y = b$.
- (d) Further investigation is needed

1-h. For the function $f(x, y) = x^2 - 4xy + 4y^2$ (CO4) 1

- (a) $(0, 0)$ is a maximum point
- (b) $(0, 0)$ is a minimum point
- (c) Further investigation is needed
- (d) All of the above

1-i. A company's profit is divided among its three owners in the ratio of 4:3:2. If the profit for the year is \$180,000, how much does the owner with the smallest share receive? (CO5) 1

- (a) 41,000 \$
- (b) 40,000 \$
- (c) 42,000 \$
- (d) None of these

- 1-j. The sum of the ages of a father and his son is 66. If the father is twice as old as his son, how old is the son? (CO5) 1
- (a) 22
 - (b) 23
 - (c) 24
 - (d) None of these

2. Attempt all parts:-

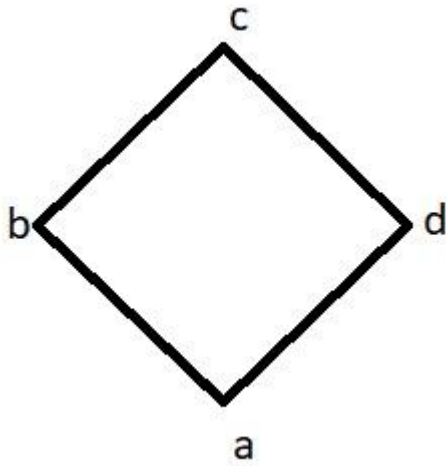
- 2.a. Integrate $\int \sqrt{(5x-2)^3} dx$ (CO1) 2
- 2.b. Find the general solution of the differential equation $\frac{dt}{dz} = e^{z+t}$ (CO2) 2
- 2.c. Draw Hasse diagram for the following relation on the set $A=\{1,2,3,4,12\}$ $R=\{(1,1), (2,2), (3,3), (4,4), (12,12), (1,2), (1,3), (4,12), (1,4), (1,12), (2,4), (2,12), (3,12)\}$ (CO3) 2
- 2.d. What is the chain rule of partial differentiation? (CO4) 2
- 2.e. Samantha is the grandmother of Lily. Lily's father is Daniel. What is the relationship between Samantha and Daniel? (CO5) 2

SECTION B

30

3. Answer any five of the following:-

- 3-a. Evaluate $\int \frac{x \cdot \sin^{-1} x}{\sqrt{1-x^2}} dx$ (CO1) 6
- 3-b. Evaluate $\int x \log x dx$. (CO1) 6
- 3-c. Solve: $(D^2 + 5D + 6)y = e^{5x} + 1$ (CO2) 6
- 3-d. Solve: $e^x dy + (ye^x + 2x)dx = 0$ (CO2) 6
- 3.e. Determine whether the following Hasse diagrams represent lattice or not. (CO3) 6



- 3.f. Examine for the minimum and maximum value of the function: $x^2+y^2+6x+12$. 6
(CO4)
- 3.g. A fruit juice contains a mixture of orange juice and apple juice. The ratio of the orange juice to apple juice is 3:2. How much apple juice should be added to 5 liters of orange juice to maintain the ratio at 2:3? (CO5) 6

SECTION C

50

4. Answer any one of the following:-

- 4-a. Find $\int_0^{\pi/2} \frac{\cos x}{(1 + \sin x)(2 + \sin x)} dx$ (CO1) 10
- 4-b. Evaluate (i) $\int_0^1 \frac{\sin^{-1} x}{\sqrt{1-x^2}} dx$ 10
(ii) $\int_0^{\pi/6} \sqrt{1 - \sin 2x} dx$ (CO1)

5. Answer any one of the following:-

- 5-a. Solve the following Differential equation (CO2) 10
$$xy \frac{dy}{dx} = 1 + x + y + xy$$
- 5-b. Solve: (i) $\frac{dy}{dx} = e^{x-y}$ (CO2) 10
(ii) $\frac{dy}{dx} = \frac{x}{y}$

6. Answer any one of the following:-

- 6-a. Explain the concepts of maximal and minimal elements in a poset. Provide 10 examples to illustrate these concepts. (CO3)
- 6-b. Consider the POSET: 10
 $A = (\{1,2,3,4,6,9,12,18,36\}, /)$

Draw the Hasse diagram. Find the greatest lower bound and least upper bound of the sets $\{6,18\}$ and $\{4,6,9\}$. (CO3)

7. Answer any one of the following:-

7-a. Verify $(\partial^2 z)/(\partial x \partial y) = (\partial^2 z)/(\partial y \partial x)$ for $z = \tan^{-1}(y/x)$. (CO4) 10

7-b. If $u = (x^2 + y^2)^5$, find the value of $x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy}$. (CO4) 10

8. Answer any one of the following:-

8-a. (i) The length, width, and height of a rectangular box are in the ratio 3:2:1. If the volume of the box is 48 cubic units, what are its dimensions? 10

(ii) The ages of three friends, Alice, Bob, and Charlie, are in the ratio 2:3:4. The sum of their ages is 54. Determine their ages. (CO5)

8-b. (i) Peter is three times as old as Sally. In 5 years, the sum of their ages will be 50. Determine their current ages. 10

(ii) How many arrangements can be made of the letters of the word "ASSASSINATION"? In how many of them are the vowels always together? (CO5)

2022-23 Jan - Jun