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Printed Page:-4 **Subject Code:- CMICA0104**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
MCA Integrated
SEM: I - THEORY EXAMINATION (2025 - 2026)
Subject: Matrices and Calculus

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. *A is 3 × 3 matrix, then* $|3A| = \ldots\ldots |A|$ *(CO1, K1)* 1

(a) 3
(b) 6
(c) 9
(d) 27

1-b. If value of a third order determinant is 11, then the value of the square of the determinant formed by the cofactors will be (CO1,K3) 1

(a) 11
(b) 121
(c) 1331
(d) 14641

1-c. If $f(x_1)=f(x_2) \Rightarrow x_{1=}\, x_2$ then the function A→ B is(CO2, K3) 1

(a) One-one
(b) Onto
(c) Many one
(d) None of these

1-d. If A={1,2,3,4,5} and B={4,5,6,7,8} then find A∪ B (CO2, K3) 1

(a) {4,5,7}
(b) {4,5}
(c) {1,2,3,4,5,6,7,8}
(d) {3,4,5}

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1-e. Examine the continuity of the function $f(x) = \frac{x^2-4}{x+2}$. (CO3, K3) 1

(a) Continuous everywhere
(b) Discontinuous at x=2
(c) Discontinuous at x=4
(d) Discontinuous at x = - 2

1-f. If $\lim_{x \to a^-} f(x) \neq \lim_{x \to a+} f(x)$ then (CO3, K3) 1

(a) Limit at that point does not exist
(b) f(x) is not continuous at x=a
(c) Both of above options are correct
(d) None of these

1-g. The derivative of the function f(x) = 1/x is (CO4, K3) 1

(a) $-3/x^2$
(b) $-2/x^2$
(c) $-1/x^2$
(d) $-4/x^2$

1-h. The derivative of the function $f(x) = 1/x^2$ is (CO4, K3) 1

(a) $2x^3$
(b) $-4/x^3$
(c) $-2/x^3$
(d) None of these

1-i. A student obtained 95 marks out of 250 in math. If passing % is 42 then by _____ many marks did he fail. (CO5, K3) 1

(a) 10
(b) 12
(c) 15
(d) 20

1-j. The average age of four boys, five years ago was 9 years. On including a new boy, the present average age of all the five is 15 years. The present age of the new boy is (CO5, K3) 1

(a) 14 years
(b) 6 years
(c) 15 years
(d) 19 years

2. Attempt all parts:-

2.a. Define with examples non singular Matrix. (CO1, K1) 2

2.b. Define inverse function with example. (CO2, K1) 2

2.c. Check whether there is a solution to the equation $3x^5 - 4x^3 - 3 = 0$ between the interval [0,2]. (CO3, K3) 2

2.d. Given the function $f(x) = x^3 - 3x^2 + 2$, find the maximum value of the function (CO4, K3) 2

2.e. If out of 10 selected students for an examination, 3 were of 20 years age, 4 of 21 and 3 of 22 years, find the average age of the group. (CO5, K3) 2

SECTION-B 30

3. Attempt all parts:-

3.a. Answer any one of the following:-

3.a.(i) Given $3\begin{bmatrix} x & y \\ w & z \end{bmatrix}=\begin{bmatrix} x & 6 \\ -1 & 2w \end{bmatrix}+\begin{bmatrix} 4 & x+y \\ z+w & 3 \end{bmatrix}$. Find x, y and z. (CO1, K3) 6

3.a.(ii) Solve the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix}=0$. (CO1, K3) 6

3.b. Answer any one of the following:-

3.b.(i) Let R={(1,2),(2,3)(3,1)} and A={1,2,3} find reflexive, and transitive closure of R using composite of relation. (CO2,K3) 6

3.b.(ii) If A={2,4,6,8,10,12} and B={3,4,5,6,7,8,10} Find (A-B)∪ (B-A). (CO2, K3) 6

3.c. Answer any one of the following:-

3.c.(i) Test the continuity of the following function at x = 0: (CO3, K3) 6

$$f(x)=\begin{cases} \frac{|x|}{x}, & x\neq 0 \\ 1, & x=0 \end{cases}$$

3.c.(ii) Test the continuity of the following function at x = 3: (CO3, K3) 6

$$f(x)=\begin{cases} \frac{x^2-x-9}{x-3}, & x\neq 3 \\ 5, & x=3 \end{cases}$$

3.d. Answer any one of the following:-

3.d.(i) Find the derivative of $y = \sin^3 x$. (CO4, K3) 6

3.d.(ii) Find the derivative of $y = (\sin^{-1} 5x)^2$. (CO4, K3) 6

3.e. Answer any one of the following:-

3.e.(i) A fruit seller had some apples. He sells 40% apples and still has 420 apples. Find the number of apples he had. (CO5, K3) 6

3.e.(ii) Find the approximate value of $(17.97)^2\times 4.99\div 44.78+299.99\div\sqrt{5634.96}\times 12.97$. (CO5, K2) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Find the inverse of the matrix $A=\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ and also find the determinant of the matrix. (CO1, K3) 10

4-b. Prove the following identities $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix}=xyz(x-y)(y-z)(z-x)$. (CO1, K3) 10

5. Answer any one of the following:-

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5-a. Let A={1,2,3,6}. If for x, y∈ A R={(x, y): x ≤ y} and S={(x, y): x divides y} write R and S as sets find R∩S. *(CO2, K3)* 10

5-b. Define: (CO2, K3) 10

i. Reflexive Relation
ii. Symmetric Relation
iii. Transitive, with example.

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

6-a. Given that $f(x) = \begin{cases} \frac{\sin 2x}{5x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at x=0. Find k. (CO3, K3) 10

6-b. Find the value of 'a' and 'b' if the following function is continuous in the interval [-1,2]: (CO3, K3) 10

$$f(x) = \begin{cases} x+1 & \text{for } -1 \le x \le 0 \\ ax+b & \text{for } 0 < x < 1 \\ -1 & \text{for } 1 \le x \le 2 \end{cases}$$

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

7-a. Find the derivative of $x^3y^3 + \frac{x}{y} = 3\cos(x^2y^2)$ with respect to x. (CO4, K3) 10

7-b. Find the derivative of $f(x) = \frac{2x^2+3x-1}{x^2+1}$ at x = -1. (CO4, K3) 10

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

8-a. A sum of Rs. 1360 has been divided among, A, B and C such that A gets 2/3 of what B gets 1/4 of what C gets. Find share of A, B and C. (CO5, K3) 10

8-b. A man sells a TV set for Rs. 4,800 and makes a profit of 20 %. He sells another TV at a loss of 16 %. If on the whole, he neither gains nor loses, find the selling price of the second TV set. (CO5, K3) 10