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Subject Code:- AMICA0105

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

MCA (Integrated)

SEM: I - THEORY EXAMINATION (2022 - 2023)

Subject: Basic Mathematics-I

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. If  $A = [a_{ij}]$  is a square matrix of order 2 such that  $a_{ij} = 1$ , when  $i \neq j$  and  $a_{ij} = 0$ , when  $i = j$ , then  $A^2$  is (CO1) 1

(a)  $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$

(b)  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(c)  $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

(d)  $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

1-b. Find the order of the matrix  $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$  (CO1) 1

(a)  $1 \times 2$

(b)  $3 \times 2$

(c)  $3 \times 1$

(d)  $2 \times 2$

- 1-c. Let  $f(x) = \frac{x-1}{x+1}$  then  $f(f(x))$  is (CO2) 1
- (a)  $-\frac{1}{x}$
- (b)  $\frac{1}{x}$
- (c)  $\frac{1}{x+1}$
- (d)  $-\frac{1}{x+1}$
- 1-d. If  $A=\{1,2,3,4,5\}$  and  $B=\{7,8,9,10,11\}$  then find  $A \cup B$  (CO2) 1
- (a)  $\{4,5,7\}$
- (b)  $\{3,4,5,10,11\}$
- (c)  $\{1,2,3,4,7,8,9\}$
- (d)  $\{1,2,3,4,5,7,8,9,10,11\}$
- 1-e. The value of  $\lim_{x \rightarrow 2} \frac{2(x^2-2)}{x+2}$  is (CO3) 1
- (a) 0
- (b)  $1/2$
- (c) 1
- (d) None of these
- 1-f.  $\lim_{x \rightarrow \infty} \frac{5x^3+27}{20x^3+10x+9}$  is (CO3) 1
- (a)  $\infty$
- (b)  $1/4$
- (c) 2
- (d) 8
- 1-g. The derivative of the function  $f(x) = e^x$  is (CO4) 1
- (a)  $2e^x$
- (b)  $3e^x$
- (c)  $e^x$
- (d) None of these
- 1-h. If  $f(x) = x \sin x$ , then  $f'(\pi/2)$  is equal to (CO4) 1
- (a) 1

- (b) 0
- (c) -1
- (d) None of these

- 1-i. Instead of selling the bicycle for Rs.2000, a shopkeeper sold it for Rs.1500. Find the loss incurred in transaction. (CO5) 1
- (a) 20%
  - (b) 33.33%
  - (c) 25%
  - (d) Data inadequate
- 1-j. A can finish a work in 18 days and B can do the same work in half the time taken by A. Then, working together, what part of the same work they can finish in a day? (CO5) 1
- (a)  $1/6$
  - (b)  $1/9$
  - (c)  $2/5$
  - (d)  $2/7$

## 2. Attempt all parts:-

- 2.a. Define unit matrix. (CO1) 2
- 2.b. Define equivalence relation. (CO2) 2
- 2.c. Find  $\lim_{x \rightarrow 0} \frac{\sin 3x}{\sin 2x}$  (CO3) 2
- 2.d. Find the derivative of  $y = 7/\sqrt{x} + 5/x^3$ . (CO4) 2
- 2.e. Find the missing term of the series 1,4,9,16,...,36. (CO5) 2

## SECTION B

30

## 3. Answer any five of the following:-

- 3-a. Find the cofactor of each element of the following Matrix  $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 4 & 1 \\ 5 & 3 & 7 \end{bmatrix}$  (CO1) 6
- 3-b. Using properties of determinants prove that  $\begin{vmatrix} x+9 & x & x \\ x & x+9 & x \\ x & x & x+9 \end{vmatrix} = 243(x+3)$  (CO1) 6
- 3-c. Define finite and infinite sets. Distinguish these concept with the help of suitable examples. (CO2) 6

- 3-d. Define one-one function. Show that mapping  $f: \mathbb{R} \rightarrow \mathbb{R}$  where  $f(x) = -\sin x, x \in \mathbb{R}$  is neither one-one nor onto. (CO2) 6
- 3.e. Evaluate  $\lim_{x \rightarrow 1} \frac{(1+x)^6 - 1}{(1+x)^2 - 1}$  (CO3) 6
- 3.f. Find the derivative of  $y = \frac{e^x}{\sin x}$  (CO4). 6
- 3.g. The mean weight of a group of seven boys is 56 kg. The individual weights (in kg) of six of them are 52, 57, 55, 60, 59 and 55. Find the weight of the seventh boy. (CO5) 6

### SECTION C

50

#### 4. Answer any one of the following:-

- 4-a. Solve the following system of equations: (CO1) 10  
 $3x + y - z = 1$   
 $5x + 2y + 3z = 2$   
 $8x + 3y + z = 3.$
- 4-b. Find the inverse of the matrix  $A = \begin{bmatrix} 9 & 5 & 6 \\ 7 & -1 & 8 \\ 2 & 4 & 2 \end{bmatrix}$  (CO1) 10

#### 5. Answer any one of the following:-

- 5-a. If  $A = \{2, 4, 6, 8, 10\}$ ,  $B = \{1, 2, 3, 4, 5, 6, 7\}$ ,  $C = \{2, 6, 7, 9, 10\}$  10  
 Verify that  $A \cup (B \cap C) = (A \cup B) \cap C$ . (CO2)
- 5-b. Let  $R$  be a binary relation defined as  $R = \{(a, b) \in \mathbb{R}^2 : (a - b) \leq 3\}$  determine 10  
 whether  $R$  is reflexive, symmetric and transitive. (CO2)

#### 6. Answer any one of the following:-

- 6-a. (i) Find the value of  $\lim_{x \rightarrow 0} \left[ \frac{x}{\sin 2x} \right]^{1/2}$  10  
 (ii) Test the continuity of the following function at  $x = 0$ : (CO3)  

$$f(x) = \begin{cases} 2x - 1, & x < 0 \\ 2x + 1, & x \geq 0 \end{cases}$$
- 6-b. (i) Find the  $\lim_{n \rightarrow \infty} \frac{1^2 + 2^2 + 3^2 + \dots + n^2}{n^3}$  10

(ii) Find the value of  $\lim_{n \rightarrow \infty} \left\{ \frac{1 + 2 + 3 + \dots + n}{n + 2} - \frac{n}{2} \right\}$  (CO3)

**7. Answer any one of the following:-**

- 7-a. Differentiate  $y = (2x^3 + 3x^2 - 5x + 7) / (x^4 + x^3 - 2x^2 + x - 3)$  with respect to  $x$ . 10  
(CO4)
- 7-b. Investigate the maxima and minima of the function  $t(x) = 2x^3 - 21x^2 + 36x - 20$ . 10  
(CO4)

**8. Answer any one of the following:-**

- 8-a. In certain code language 'si po re' means 'book is thick', 'ti na re' means 'bag is heavy', 'ka si' means 'interesting book' and 'de ti' means 'that bag'. What should stand for 'that is interesting' in that code language? (CO5) 10
- 8-b. (i) A can do a work in 4 days, B in 5 days and C in 10 days. Find the time taken by A, B and C to do the work together? 10  
(ii) If Roger can do a piece of work in 8 days and Antony can complete the same work in 5 days, in how many days will both of them together complete it? (CO5)