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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

MCA

SEM: I - THEORY EXAMINATION (2024 -2025)

Subject: Basic Mathematics

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,K3) 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. The order of the matrix $A = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$ is..... (CO1,K1) 1

- (a) 3X3
- (b) 2X3
- (c) 3X1
- (d) 3X2

- 1-c. The Range of the function $f(x) = \sin x$ is (CO2,K1) 1

- (a) $[0,1]$
- (b) \mathbb{R}
- (c) $[-1,1]$
- (d) $\mathbb{R} - \{-1\}$

1-d. If $U = \{1,2,3,4,5,6,7,8,9,10\}$ and $A = \{4,8,10\}$, Then $(A')'$ is..... (CO2,K1)

1

- (a) $\{4,8,10\}$
- (b) $\{1,2,3,5,6,7,9,10\}$
- (c) $\{2,4,8,10\}$
- (d) $\{2,5,7,8\}$

1-e. The derivative of $\tan x$ is (CO3,K1)

1

- (a) $\sec x$
- (b) $\tan x \sec x$
- (c) $\sec^2 x$
- (d) none of these

1-f. The value of $\lim_{x \rightarrow \infty} x \sin\left(\frac{1}{x}\right)$ is: (CO3,K2)

1

- (a) 0
- (b) 1
- (c) infinite
- (d) Does not exist

1-g. $\int_2^3 \frac{x}{2} dx =$ (CO4,K3)

1

- (a) 45748
- (b) $\frac{3}{4}$
- (c) $\frac{5}{4}$
- (d) 2

1-h. $\int \left(x + \frac{1}{2}\right) dx =$ (CO4,K3)

1

- (a) $\frac{x^2}{2} + c$
- (b) $\frac{x^2}{2} + \frac{1}{2} + c$
- (c) $\frac{x^2}{3} + \frac{x}{2} + c$
- (d) $\frac{x^2}{2} + \frac{x}{2} + c$

1-i. The value of 28% of 450 + 45% of 280 is (CO5,K3)

1

- (a) 126

- (b) 252
- (c) 226
- (d) 262

1-j. Instead of selling the bicycle for Rs.2000, a shopkeeper sold it for Rs.1500, then the loss incurred in transaction is (CO5,K3) 1

- (a) 20%
- (b) 33.33%
- (c) 25%
- (d) Data inadequate

2. Attempt all parts:-

2.a. Distinguish between Scalar matrix and unit matrix with example. (CO1,K1) 2

2.b. If $A=\{a,b,c,d,e,f\}$, $B=\{c,e,g,f\}$ and $C=\{a,e,m,n\}$ then find $C \cap A$. (CO2,K3) 2

2.c. Given the function $h(x) = \frac{x^2 + 2}{2}$, find $h'(x)$. (CO3,K3) 2

2.d. Evaluate $\int_{-2}^2 (\sin^2 x + \cos^2 x) dx$. (CO4,K2) 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, Determine the average age of the group ? (CO5,K3) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Determine the adjoint of the matrix $A = \begin{bmatrix} 2 & 1 & -1 \\ 0 & 1 & 0 \\ 1 & 3 & -1 \end{bmatrix}$ (CO1,K3) 6

3-b. Evaluate the determinant of the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & 2 \\ 1 & 1 & 2 \end{bmatrix}$ and also calculate $A + A^T$. (CO1,K3) 6

3-c. If $U=\{1,2,3,4,5,6,7,8\}$, $A=\{1,3,5,7\}$, $B=\{1,2,4,5,7,8\}$ verify that $A' \cap B' = (A \cup B)'$. (CO2,K3) 6

3-d. If $f(x) = x^3 - \frac{1}{x^3}$ then prove that $f(x) + f(\frac{1}{x}) = 0$. (CO2,K3) 6

3.e. (i) Evaluate: $\lim_{x \rightarrow -2} \frac{x^3 + 8}{x + 2}$ (CO3,K3) 6

(ii) Evaluate: $\lim_{x \rightarrow 0} \frac{\sin(\frac{x}{2})}{5x}$

3.f. Evaluate $\int_0^4 (e^x - x) dx$. (CO4,K3) 6

- 3.g. An orange vendor makes a profit of 10% by selling oranges at a certain price. If he charges Rs. 1.4 higher per orange he would gain 30%. Find the original price at which he sold an orange. (CO5,K3) 6

SECTION-C

50

4. Answer any one of the following:-

- 4-a. Solve the following equations: (CO1,K3) 10
 $2x + 3y - 3z = 0$, $5x - 2y + 2z = 19$, $x + 7y - 5z = 5$.

- 4-b. Using properties of determinants show that 10

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3. \quad (\text{CO1,K3})$$

5. Answer any one of the following:-

- 5-a. Out of 880 students, 224 play cricket, 240 play hockey and 336 play basketball, 64 play both basket ball and hockey, 80 play cricket and Basket ball, 40 play hockey and cricket, 24 play all three games. How many do not play any game.(CO2,K3) 10
- 5-b. Define the following with example: (CO2,K1) 10

- i. Reflexive Relation
- ii. Symmetric Relation
- iii. Transitive

6. Answer any one of the following:-

- 6-a. Determine the value of a, if the function f(x) defined by (CO3,K3) 10

$$f(x) = \begin{cases} 2x - 1, & x < 2 \\ a, & x = 2 \\ x + 1, & x > 2 \end{cases}$$

is continuous at $x = 2$.

- 6-b. Investigate the maxima and minima of the function $t(x) = 2x^3 - 21x^2 + 36x - 20$. (CO3,K3) 10

7. Answer any one of the following:-

- 7-a. Evaluate by Substitution: $\int (21x^2 + 9)\log(7x^3 + 9x) dx$. (CO4,K3) 10

- 7-b. Evaluate: (i) $\int_1^2 \sqrt{9x-5} dx$ 10
 (ii) $\int_0^{\pi/2} x \sin x dx$ (CO4,K3)

8. Answer any one of the following:-

- 8-a. In a certain code language, 'po se de' means 'she is good', 'tep re po' means 'good are clever' and 'se tep flu' means 'boy is clever'. Find means 'are' in that language? (CO5,K3) 10

- 8-b. (i) A can do a work in 4 days, B in 5 days and C in 10 days. Calculate 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,K3)

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