

**GUJARAT UNIVERSITY**  
**Master of Computer Applications**  
**Semester - I**

Subject with code: MCA 112 Mathematical Foundations  
Sessional Examination - I

Time: 1 hour 30 min  
Date: November 09, 2023

Max. Marks: 40

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**Q1. Do as Directed.**

- (1) Define subset of a set with example.
- (2) Define one-one function with example.
- (3) (True/False):  $\{3\} \subset \{x \in \mathbb{N} | x \text{ is a prime number less than } 20\}$ . Justify your answer.
- (4) (True/False): The range of sine function is  $(-1, 1)$ . Justify your answer.
- (5) (MCQ): What is the total number of subsets of a set consisting of  $n$  elements?  
(a)  $2^n$       (b)  $2^{n-1}$       (c)  $2^{n-2}$       (d)  $2^n - 2$
- (6) (MCQ): If A and B are two sets containing 20 and 29 elements respectively, what can be the maximum number of elements in  $A \cup B$  ?  
(a) 29      (b) 20      (c) 49      (d) 19
- (7) (MCQ): The range of the real valued function  $f(x) = \begin{cases} \frac{x}{|x|}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$  is \_\_\_\_\_.  
(a)  $[-1, 1]$       (b)  $\{-1, 1\}$       (c)  $\{1, 0, -1\}$       (d)  $\{0\}$
- (8) (MCQ): If  $f(x) = \frac{1}{4x+3}$  then the domain of f is \_\_\_\_\_.  
(a)  $\mathbb{R}$       (b)  $\mathbb{R} - \left\{-\frac{3}{4}\right\}$       (c)  $\mathbb{R} - \left\{\frac{3}{4}\right\}$       (d) None of these

**Q2. Attempt the following Questions. (Any Four)**

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- (1) Evaluate the following limits:

(a)  $\lim_{x \rightarrow -1} \frac{x^5 + 1}{x + 1}$

(b)  $\lim_{x \rightarrow 0} \frac{(15)^x - 5^x - 3^x + 1}{x^2}$

- (2) Examine the continuity for the following function at mentioned point:

$$h(x) = \begin{cases} -2x^2, & \text{if } x \leq 0 \\ 5x + 2, & \text{if } 0 < x \leq 1 \\ 3x^2 + 4x, & \text{if } 1 < x \leq 2 \end{cases} \quad \text{at } x = 0, 1$$

(3) Evaluate the differentiation of following functions with respect to variable  $x$ .

(a)  $\frac{e^x - 1}{e^x + 1}$

(b)  $x^{\sin x} + (\sin x)^x$

(4) Let  $A = \{-3, -2, -1, 0, 1, 2, 3\}$ ,  $B = \{1, 2\}$  and  $C = \{-1, 0, 1\}$ . Verify the followings:

i.  $A \times (B \cap C) = (A \times B) \cap (A \times C)$

ii.  $A - (B \cap C) = (A - B) \cup (A - C)$

(5) There are 45 students in C++ class and 47 students in Python class. Find the number of students who are either in C++ or Python class under the following statements:

(a) When two classes meet at different hours and 12 students are enrolled for both C++ and Python class.

(b) When two classes meet at the same hour.

(6) If  $U = \{a, b, c, d, e, f\}$ ,  $A = \{a, b, c\}$  and  $B = \{c, d, e, f\}$ . Find the bit string representation for  $A$  and  $B$  with respect  $U$ . Also, find bit string for the following sets after performing given set operations:

(a)  $A \cup B$       (b)  $A \cap B$       (c)  $A' \cup B'$       (d)  $A' \cap B'$

### Q3. Attempt all of the following Questions.

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(1) In survey of 1000 readers of the newspapers, it was found that 280 reads Times of India (T), 300 reads Indian Express (I) and 420 reads The Hindu (H), 80 reads both T and I, 100 reads T and H, 50 reads I and H and 30 reads all the three newspapers. Answer the following:

1) How many read at least one of these newspapers?

2) How many read none of three newspapers?

3) How many read only Times of India?

4) How many read Times of India and The Hindu but not Indian Express?

(2) Derive the formula to count the number elements in union of two sets. Using this, derive the same for union of three sets.

(3) Define Logarithmic function. Write down any three properties for Logarithmic

function. Compute the value of  $\log\left(\frac{28}{51}\right) - \log\left(\frac{70}{69}\right) + \log\left(\frac{85}{46}\right)$ .

(4) Define ant-derivative. Evaluate the following integrals:

(a)  $\int e^{\tan x} \sec^2 x dx$       (b)  $\int_0^{\frac{11}{2}} \tan^2\left(\frac{x}{2}\right) dx$

\*\*\* \*\* ALL THE BEST \*\* \*\*\*\*\*

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