

No. of Printed Pages : 7

**MCS-013**

**MASTER OF COMPUTER  
APPLICATIONS  
(REVISED)/BACHELOR OF  
COMPUTER APPLICATIONS  
(REVISED) (MCA/BCA)  
Term-End Examination  
June, 2025**

**MCS-013 : DISCRETE MATHEMATICS**

*Time : 2 Hours*

*Maximum Marks : 50*

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*Note : Question No. 1 is compulsory. Attempt  
any **three** questions from the rest.*

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**B-1082/MCS-013**

**P. T. O.**

1. (a) What is dual of a Boolean expression ?

Explain the principle of duality with the help of an example. 2

- (b) Let there be a function  $f: X \rightarrow Y$ , where  $X$  and  $Y$  are sets as given below :

$$X = \{a, b, c, d\}, Y = \{p, q, r, s\}$$

$$f = \{(a, p), (b, q), (c, r), (d, s)\}$$

Explain whether  $f$  is : 3

(i) one-to-one

(ii) onto

(iii) bijective.

- (c) Show that : 4

$$\sim(p \vee q) = \sim p \wedge \sim q$$

and  $\sim(p \wedge q) = \sim p \vee \sim q$

- (d) Determine the domain for which the functions :

$$f(x) = 3x^2 - 1$$

and  $g(x) = 1 - 5x$

are equal. Also, find a domain for which the functions are not equal. 3

- (e) Prove that : 2

$$(A - B) \cup B = A \cup B$$

- (f) Determine  $n$ , if  $2P(n, 2) + 50 = P(2n, 2)$  .2

- (g) Draw Venn diagram to represent  $(A \Delta B)$  and  $(A \cap B \cup C)$  for sets A, B and C. 2

- (h) If there are 12 persons in a party, and if each two of them shake hands with each other, how many handshakes will happen in the party ? 2

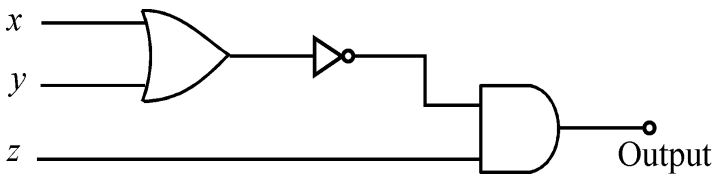
2. (a) Show that for integers greater than zero :

$$2^n \geq (n+1)$$

- (b) If  $f : \mathbb{R} \rightarrow \mathbb{R}$  is a function such that  $f(x) = 3x + 5$ , prove that if  $f$  is one-one onto.

- (c) Verify that  $p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$  is a tautology.

- (d) Find the Boolean expression for the output of the circuit given below :



3. (a) Verify whether  $\sqrt{5}$  is rational or irrational.

- (b) Explain pigeonhole principle with example. 2
- (c) Given  $X = \{1, 3, 5, 7\}$  and  $Y = \{2, 3, 5, 8\}$  : 3
- (i) List the elements of  $(A \times B) \times (B - A)$ .
- (ii) Is  $(A \times B) \times (B - A)$  a subset of  $A \times B$  ?
- (d) If  $P(X) = \frac{1}{4}$  and  $P(Y) = \frac{2}{5}$ , find : 2
- (i)  $P(A \cap B)$
- (ii)  $P(A \cap B')$
4. (a) How many solutions are there of : 3
- $$x + y + z = 17$$
- subject to the constraints :
- $$x \geq 1; y \geq 2; z \geq 3$$

- (b) Let  $A = \{a, b, c, d\}$ ,  $B = \{1, 2, 3\}$  and  $R = \{(a, 2), (b, 1), (c, 2), (d, 1)\}$ . Tell whether  $R$  is a function or relation? Justify your answer. 2
- (c) Determine in how many ways can 25 identical books be placed in 5 identical boxes. 3
- (d) Find how many 4-digit numbers are odd. 2
5. (a) Show that : 3

$$(1 \times 2) + (2 \times 3) + \dots + n(n+1)$$

$$= \frac{n(n+1)(n+2)}{3}$$

- (b) Write negation of the following statement, using propositional logic : 2

“If it is raining, then the game is cancelled.”

- (c) From the digits 1, 2, 3, 4, 5, 6; how many three-digit odd numbers can be formed ? 3
- (i) When the repetition of digits is allowed ?
- (ii) When the repetition of digits is not allowed ?
- (d) Show that in any group of 30 people, we can always find 5 people who were born on the same day of the week. 2

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