No. of Printed Pages : 4 **MCS-013**

M. C. A. (REVISED)/B. C. A. (REVISED) (MCA/BCA)

Term-End Examination

December, 2022

MCS-013 : DISCRETE MATHEMATICS

Time : 2 Hours *Maximum Marks : 50*

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

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1. (a) Write De Morgan's laws for predicate logic and propositional logic. 4

(b) Show that $[(p \to q) \wedge \sim q] \to \sim p$ is a tautology, without using truth table. 4

(c) Show that $2^n > n^3$ for $n \geq 10$. 4

(d) Construct the logic circuit represented by the Boolean expression $(X_1' \wedge X_2) \vee (X_1 \vee X_3)$, where X_1, X_2, X_3 are assumed inputs to the circuit. 4

(e) What is the difference between permutation and combination ? If n couples are at a dance party, in how many ways can the men and women be pained for a single dance ? 4

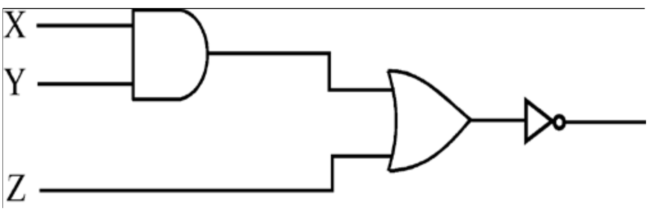
2. (a) If m and n are positive integers, show that : 3

$$(m+n)! \geq m! + n!$$

(b) Find inverse of the function $f(x)$, where $f(x) = x^3 - 3$. 3

(c) Show whether $\sqrt{15}$ is a rational or irrational. 4

3. (a) Find the Boolean expression corresponding to the following circuit. Also obtain the CNF of the expression : 4



(b) What is Cartesian product ? Give the geometric representation of the Cartesian product of A and B, where A = {2, 3, 4} and B = {1, 4}. 4

(c) Let A = $\{a, b, c, d\}$ and B = {1, 2, 3} and R = $\{(a, 2), (b, 1), (c, 2), (d, 1)\}$. Is R a function ? Why ? 2

4. (a) What is Piegonhole principle ? Explain with a suitable example. 3

(b) Determine all the integer solution to $x_1 + x_2 + x_3 + x_4 = 9$, where $x_i \geq 1$, $i = 1, 2, 3, 4$. 3

(c) Prove by induction that $n^3 - n$ is divisible by 3 for all positive integers. 4

5. (a) If there are 5 men and 4 women, how many circular arrangements are possible in which women don't sit adjacent to each other ? 4

(b) Write the principle of duality. Find the dual of : 6

(i) $\sim (X \wedge Y) \vee Z$

(ii) $(X \vee Y) \wedge (X \wedge Z)$