MCS-013

MCA (Revised) / BCA (Revised)

Term-End Examination

June, 2022

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

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

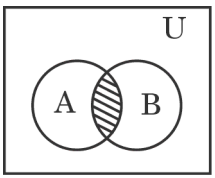
1. (a) Use pigeonhole principle to find the minimum number of cars that will have same colour, if 20 cars are painted using 6 colours. *2*

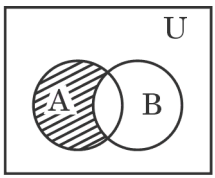
(b) Show that $\sqrt{3}$ is irrational. *4*

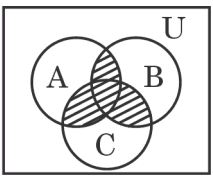
(c) Draw the logic circuit for the following Boolean expression : *4*

$$(X_1 \wedge X_2 \vee X'_3) \vee (X'_1 \vee X'_2 \wedge X_3)$$

(d) Write the set expression (shaded part) for the following Venn diagrams : *3*







(e) Write suitable mathematical statement that can be represented by $(\forall x)(\forall y)(\exists z)P$. 2

(f) Disprove that
$(\forall a \in R)(\forall b \in R)[(a^2 = b^2) \Rightarrow (a = b)]$,
using a counter-example. 2

(g) There are 5 women and 6 men. A committee has to be formed of 3 people. In how many ways can this be done if at least one woman should be there in the committee ? 3

2. (a) Prove using mathematical induction that

$$(1 + x)^n > 1 + nx \text{ for all } x > 0 \text{ and } n > 1.$$ 5

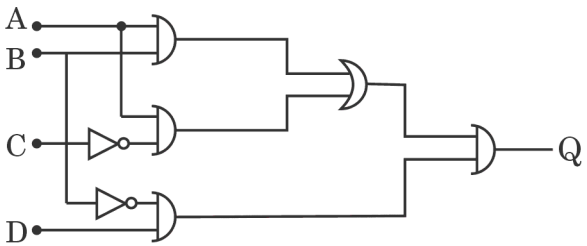
(b) What is proper subset ? Explain with the help of an example. 2

(c) Show $p \wedge (p \vee q) \leftrightarrow p$ is a tautology. 3

3. (a) Every function is a relation. Is every relation a function ? Why ? 3

(b) Explain circular permutation with the help of an example. 3

(c) Find the Boolean expression of Q in the logic circuit given below : 4



4. (a) If A and B are two mutually exclusive events such that P(A) = 0·4 and P(B) = 0·2, what is the probability that either A or B does not occur ? *2*

(b) Give the geometric representation of {3} × R. *2*

(c) Present a direct proof of the statement "Square of an odd integer is odd." *3*

(d) Find the inverse of the function

$$f(x) = \frac{x - 4}{x - 3}.$$ *3*

5. (a) Show that

$$C(n, m)\, C(m, k) = C(n, k)\, C(n - k, m - k)$$

for $1 \le k \le m \le n$. *3*

(b) How many 3-letter words can be formed from the letters of the word "HAPPY" ? *2*

(c) What is contradiction ? Show whether $p \wedge q \wedge \sim p$ is a contradiction or not. *3*

(d) Draw the Venn diagram for the expression $A \cap B \cap C$. *2*