Course Code	:	MCS-013
Course Title	:	Discrete Mathematics
Assignment Number	:	BCA (II)/013/Assignment/2024-25
Maximum Marks	:	100
Weightage	:	25%
Last Date of Submission	:	31st October, 2024 (for July Session)
		30th April, 2025 (for January Session)

There are eight questions in this assignment, which carries 80 marks. Rest 20 marks are for viva-voce. Answer all the questions. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1. (a) What is Power Set? Find P(A) for A = { a,b,c,d,e,f} **(2 Marks)**

(b) Make truth table for followings. **(4 Marks)**

i) $p \rightarrow (\sim r \wedge \sim q) \wedge (p \vee r)$

ii) $p \rightarrow (r \vee \sim q) \vee (\sim p \wedge \sim r)$

c) What is proposition ?

i) Write any two statements which are not proposition. **(2 Marks)**

ii) Write any two statements which are proposition.

d) Define the terms Domain, Co-domain and Range in the context of a function. Also find the domain, co-domain and range for a function A to B, where A={1,2,3,4,5} and ={1,4,9,16,25}. **(2 Marks)**

Q2. (a) Draw Venn diagram to represent followings: **(3 Marks)**

i) $A \subseteq B$

ii) $C \cup B \cup C$

iii) $(A \subset B$

(b) Write down suitable mathematical statement that can be represented by the following symbolic properties. **(4 Marks)**

i) $(\forall x) (\forall y) (\exists z)P$

ii) $(\exists y) (\forall z)Q$

iii) $(\exists y) (\forall x) (\forall z)P$

iv) $(\exists x) (\forall y)Q$

(c) Show whether $\sqrt{11}$ is rational or irrational. **(3 Marks)**

Q3. **(a)** Explain applications of inclusion-exclusion principle with example. **(2 Marks)**

(b) Draw logic circuit for the following Boolean expressions: **(4 Marks)**

i) (x'yz) + (xyz)' + (xz'y)

ii) (xyz') +xyz)+ (x'y'z)

iii) $(x+y+z')(x+y+z)(x'+y'+z)$

(c) What is a relation? Is every relation a function? Explain critically. Also, explain equivalence relation with the help of example. **(4 Marks)**

Q4. **(a)** How many words can be formed using letter of "DETERMINATION" using each letter at most once? **(2 Marks)**

      i) If each letter must be used,
      ii) If some or all the letters may be omitted.

  (b) Prove that $1^3 + 2^3 + 3^3 + ... + n^3 = \frac{1}{4}n^2(n+1)^2$; $\forall\ n \in N$ **(4 Marks)**

  (c) What is a tautology? If P and Q are statements, show whether the statement $(P \wedge Q) \rightarrow (P \vee Q)$ is a tautology or not. **(4 Marks)**

Q5. **(a)** A committee consisting of 5 male and 2 female workers is to be constituted from 8 male and 9 female workers. In how many distinct ways can this be done? **(2 Marks)**

  (b) A and B are mutually exclusive events such that $P(A) = 1/4$ and $P(B) = 1/2$ and $P(A \cup B) = 1/6$. What is the probability of $P(A \cap B)$? **(2 Marks)**

  (c) Find how many 3 digit numbers are even? **(2 Marks)**

  (d) Explain whether the function $f(x) = x^2 + 2$ is one-one or not. **(2 Marks)**

  (e) Let f and g be the two functions such that $f(x) = x^2 + 5$ and $g(x) = 2x+2$ Define fof, fog, gof and gog. **(2 Marks)**

Q6. **(a)** How many ways are there to distribute 29 district items into 5 distinct boxes with: **(3 Marks)**

      i) At least two empty box.
      ii) No empty box.

  (b) Explain principle of multiplication with an example. **(3 Marks)**

  (c) Three Sets A, B and C are: A = {1, 3,5, 7,9,12,13, 15,17}, B = { 1,2, 3 ,7,8,9, 10,17 } and C {1,2,7, 8, 10, 11, 12,13,17}. Find $A \cup B \cap C$; $A \cap \sim B \cup C$; $A \cap B \cup C$ and $(A \cap \sim C)$. **(4 Marks)**

Q7. **(a)** Explain addition theorem in probability with an example. **(2 Marks)**

  (b) Prove $^{n+1}C_r = {}^nC_r + {}^nC_r n$ **(3 Marks)**

  (c) What is a function? Explain how to find inverse of a function with the help of an example. **(3 Marks)**
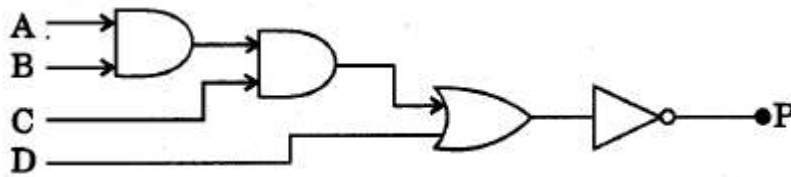
  (d) Write the following statements in symbolic form: **(2 Marks)**
    (i) Mahesh is hardworking student therefore he is a good performer.
    (ii) Either exercise regularly or be ready for poor health.

Q8. (a) Find dual of Boolean Expression for the output (P) of the following logic circuit.

(3 Marks)

(b) Show, using the pigeonhole principle, that in any group of 30 people, 5 people can always be found who were born on the same day of the week. **(2 Marks)**

(c) "If today is a holiday then I will not go to school". Write inverse and contrapositive for this sentence. **(2 Marks)**

(d) Explain circular permutation and its application in problem solving with en example. **(3 Marks)**