

Satyug Darshan Institute of Engineering & Technology, Faridabad

Department of Computer Science and Engineering

Academic year 2025-26

Programme: BTech CSE/ CE	Year & Semester: 2 nd Year, Sem IV
Course Name: Discrete Mathematics	Course Code: CEU-202-V
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Unit I

Short answer questions

Q.N.	Question	KL
1	If $A = \{3,6,9,12,18,21\}$ and $B = \{4,8,12,16,20\}$. Find $(A \cap B)$ and $(B - A)$.	KL2
2	Write the given set in Roster form $B = \{x: 4x-3 < 6, x \in \mathbb{N}\}$.	KL2
3	For any set A and B, show that $(A \cap B) \cup (A - B) = A$	KL3
4	What do you mean by Countable and Uncountable set?	KL1
5	Let $A = \{2,3,4\}$ and $B = \{3,6,8\}$. Find R where R is the relation 'x divides y' from set A to set B. Also, find R^{-1} .	KL3
6	Write the difference between Antisymmetric Relation and Asymmetric Relation.	KL2
7	Differentiate between Partial Order Relation and Equivalence Relation.	KL2
8	If $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = 3x^2 - 8x + 1$, find $f(f(x))$.	KL3
9	State Well Ordering Principle.	KL1
10	Show that $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$.	KL3
11	What do you mean by injective and surjective function?	KL1
12	What do you mean by one-to-one correspondence?	KL1
13	What do you mean by Ternary Relation?	KL1

Long answer questions

Q.N.	Question	KL
1	State and Prove Demorgan's law and Distributive law.	KL3
2	Determine whether the relation R in the set $A = \{4,5,6,7\}$ and defined as $R = \{(4,5), (5,4), (7,6), (6,7), (5,5), (6,6)\}$ is reflexive, symmetric, transitive, antisymmetric or asymmetric.	KL3
3	If R is a binary relation on the set of integers such that $(a, b) \in R$ if and only if $(a - b) \geq 1$ then determine whether the relation R is (i) Reflexive (ii) Symmetric (iii) Antisymmetric (iv) Transitive (v) Equivalence Relation (vi) Partial Order Relation	KL3
4	If $A = \{1,2,3,4,5\}$, $B = \{4,5,6,7\}$, $C = \{5,6,7,8,9\}$, $D = \{1,3,5,7,9\}$, $E = \{2,4,6,8\}$, $F = \{1,5,9\}$. Find out: (i) $A \cup B$ and $A \cap B$ (ii) $C \cup D$ and $C' \cap B$ (iii) $A \cap (B \cup E)$ (iv) $(B \cap F) \cup (C \cap E)$ (v) $A \setminus (B \cup C)$	KL3

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5	Let f be a function from the set of integers such that $f(x)=x^3-2$. Is f invertible and if it then what is its inverse.	KL3
6	If a $f(x)$ be a function from the set $\{1,2,3,4\}$ to the set $\{a, b, c, d\}$ with $f(1) = a$, $f(2) = b$, $f(3) = c$ and $f(4) = d$, then determine $f^{-1}(a)$, $f^{-1}(b)$, $f^{-1}(c)$ and $f^{-1}(d)$.	KL2
7	(a) If $f(x)$ and $g(x)$ be the function from the set of integers defined as $f(x) = 2x^2 + 2$ and $g(x) = 3x^2+3$ then determine the following: (i) fogof (ii) gof	KL3
8	State and prove the Schroeder Bernstein theorem.	KL3
9	Discuss Euclid's algorithm for GCD. Find the GCD (441,662) using this algorithm.	KL3
10	Prove that some of the infinite sets are not countable.	KL3
11	State and Prove Power Set Theorem.	KL3

Unit II

Short answer questions

Q.N.	Question	KL
1	In a group of 50 students, how many minimum number of people have their birthday in the same month?	KL3
2	In how many ways can a committee consisting of three men and two women be chosen from seven men and five women?	KL3
3	How many 11 letter words can be formed using letters from the word "INSTITUTION"?	KL3
4	Define circular permutation.	KL1
5	Three red balls are to be placed in ten distinguishable boxes but one box can contain exactly one ball. Find the number of distinct ways in which the balls can be placed?	KL3
6	Every student of a class participates in either one or two or all the three games being played in the school. Make Venn diagram for this.	KL2

Long answer questions

Q.N.	Question	KL
1	In a pollution study of 200 cities has revealed the following report, 70 were polluted by Sulphur compounds, 60 were polluted by lead and 80 were polluted by fly ash, 40 were polluted by Sulphur and fly ash, 30 were polluted by Sulphur and lead, 35 were polluted by lead and fly ash and 10 cities were polluted by all three compounds. Then find: (i) How many were polluted by one of the three impurities? (ii) How many cities are only Sulphur, lead and fly ash? (iii) How many of the cities are not polluted at all?	KL3
2	Seven women and nine men are on faculty in the mathematics department in a university. In how many ways a committee of five members of the department can be constructed if at least one woman and at least one man must be in the committee?	KL3
3	Among 100 students, 32 study Mathematics, 20 study Physics, 45 study Biology, 7 study Mathematics & Physics, 10 study Physics and Biology and 30 do not study any of the three subjects. (i) Find the number of students studying all the three subjects? (ii) Find the number of students studying exactly one of the three subjects?	KL3

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4	State the Pigeon hole principle. Find the minimum number of students in a class to be sure that three of them are born in the same month.	KL3
5	In class of 10 students, 5 students play football and 3 students play cricket. Find the probability that none of the students play both the games.	KL3

Unit III

Short answer questions

Q.N.	Question	KL
1	What do you mean by Contradiction and Tautology?	KL1
2	Define proposition and its connectives.	KL1
3	Describe proof by contradiction?	KL2
4	What are quantifiers?	KL1
5	Prove that $p \wedge (\sim p)$ is contradiction.	KL3

Long answer questions

Q.N.	Question	KL
1	Show that $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent.	KL3
2	Consider three propositions – (i) The temperature exceeds 70-degree Celsius. (ii) the alarm will be sounded. (iii) If the temperature exceeds 70-degree Celsius then the alarm will be sounded. In what situation proposition 3 will be true?	KL3
3	Consider two propositions: (i) I don't love "X". (ii) I love "X" iff I love "Y". Any one of the above propositions is true at a time. Determine using truth table whether I love "Y" or not.	KL3
4	Find whether the following implication is tautology, contradiction or contingency. (i) $[(p \Rightarrow q) \vee r] \Rightarrow [(p \vee r) \Rightarrow (q \vee r)]$ (ii) $[p \wedge (q \Rightarrow r)] \vee (p \Rightarrow r) \vee (q \Rightarrow r)$	KL3
5	Find the validity of the argument: If I study then I will not fail in Mathematics, If I do not play football then I will study. But I failed in Mathematics. Therefore, I must have played football.	KL3
6	Write short note on Rules of inference.	KL2

Unit IV

Short answer questions

Q.N.	Question	KL
1	What do you mean by monoid and group in relevance to algebraic system?	KL1
2	Define semigroup in relevance to Algebraic structure.	KL1
3	Define Normal Subgroup.	KL1
4	What do you mean by cyclic group?	KL1
5	What do you mean by Permutation Group?	KL1

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Long answer questions

Q.N.	Question	KL
1	Explain Ring, Integral Domain and Field in reference to algebraic structure with two binary operations?	KL2
2	Obtain both CNF and DNF for the given Boolean function – $(y + x')z$.	KL3
3	Write the properties of group in algebraic structure. Prove that the set I of all integers is a group with respect to the operation of addition of integers.	KL3
4	Explain conjunctive normal form and disjunctive normal form. Obtain the Conjunctive Normal form (CNF) and Disjunctive Normal form (DNF) of the given Boolean function, $f(x, y, z) = (x + z)(x + y')$.	KL3
5	Consider an algebraic structure $(G, *)$, where G is the set of all non-zero real numbers and * is a binary operation defined by $a*b = a + b - ab$ Show that $(G, *)$ is a group.	KL3
6	Write short note on: (a) Quasi Group, Semi Group, Abelian Group (b) Subgroups in algebraic structure (c) Give example of algebraic system with two Binary operations.	KL2

Unit V

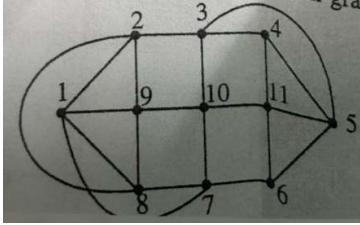
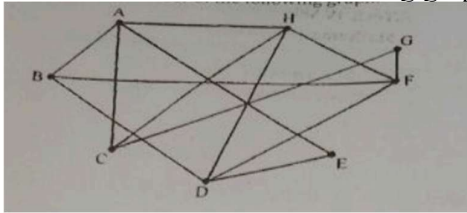
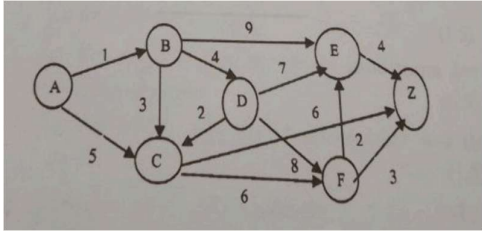
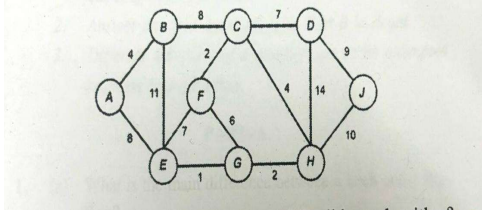
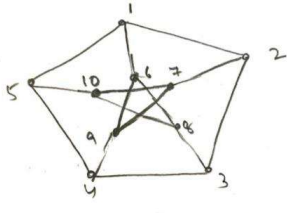
Short answer questions

Q.N.	Question	KL
1	Define weighted and un-weighted Graph?	KL1
2	What do you mean by Planar Graph and Non-Planar Graph?	KL1
3	What do you mean by Bi-connected components in a graph?	KL1
4	What do you mean by Connected Directed Graph?	KL1
5	Differentiate between path and circuit.	KL2
6	Differentiate between Graph and Tree.	KL2
7	Prove that the sum of degree of all vertices in a graph is equal to twice the number of edges in graph.	KL2
8	Describe articulation points by giving suitable example.	KL2
9	What is isomorphism of graph?	KL1
10	Explain Euler Formula with example.	KL2
11	List the applications of trees.	KL2
12	What do you mean by rooted and non-rooted tree?	KL1
13	What is a bipartite graph?	KL1
14	Explain Perfect Graph with example.	KL2

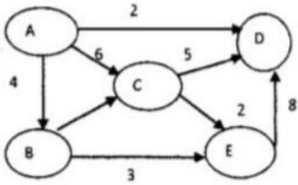
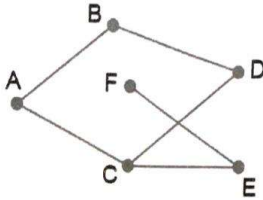
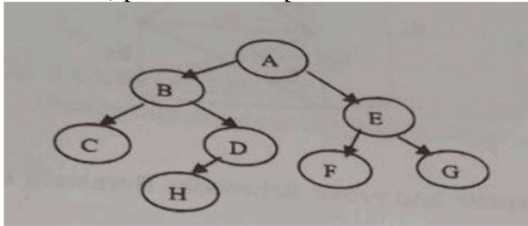
Long answer questions

Q.N.	Question	KL
1	Find the Eulerian Path in the given graph.	KL3

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2	What do you mean by the graph colouring and chromatic number of the graph? Determine the chromatic number of the following graph. 	KL3
3	Find the shortest distance between A to Z: 	KL3
4	Discuss the key characteristics of trees. Find the minimum weight spanning. 	KL3
5	Write short note on the following: (a) Hamiltonian Graph (b) Prefix Codes (c) Regular Graph (d) Self-complementary Graphs (e) Handshaking Lemma (f) Eulerian Graph (g) Complementary Graph (h) Complete Graph	KL2
6	Consider the following simple graph and find whether it is a Hamiltonian graph or Euler graph or both. 	KL3

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7	Draw the Minimum Spanning tree for following graph: 	KL3
8	Write down the adjacent and incidence matrices for the given graph. 	KL2
9	Determine the In-order, preorder and post-order Traversal of the following tree: 	KL3