SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

S.R.M. Nagar, Kattankulathur - 603203

DEPARTMENT OF MATHEMATICS

QUESTION BANK

III SEMESTER

Computer Science, Information Technology, Cyber Security & Artificial Intelligence & Data Science

1918302-DISCRETE MATHEMATICS

Regulation – 2019

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SUBJECT : 1918302-DISCRETE MATHEMATICS

SEM / YEAR: III/ II Year Common to Computer Science, Information Technology, Cyber Security &Artificial Intelligence & Data Science

UNIT I --LOGIC AND PROOFS

Propositional logic – Propositional equivalences – Normal forms - Predicates and quantifiers – Nested quantifiers – Rules of inference

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Construct the truth table for the compound proposition $(p \to q) \leftrightarrow (\neg p \to \neg q)$.	BTL -1	Remembering
2.	Construct the truth table for the compound proposition $(p \to q) \to (q \to p)$.	BTL -1	Remembering
3.	Construct the truth table for the compound proposition $(p \vee q) \to (q \wedge p)$	BTL -1	Remembering
4.	Construct the truth table for the compound proposition $(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow q)$	BTL -2	Understanding
5.	Construct the truth table for the compound proposition $(p \to q) \vee (\neg p \to q)$.	BTL -3	Applying
6	What are the contrapositive, the converse and the inverse of the conditional statement "If you work hard then you will be rewarded".	BTL -3	Applying
7.	What are the contrapositive, the converse and the inverse of the conditional statement "If it is raining then I get wet".	BTL -2	Understanding
8	Write the symbolic representation and give its contra positive statement of "If it rains today, then I buy an umbrella".	BTL -2	Understanding
9.	Write down the negation of the statement: Some people have no two wheeler.	BTL -3	Applying
10	Negate the statements" Every student in this class is intelligent"	BTL -2	Understanding
11.	When do you say that two compound propositions are equivalent?	BTL -4	Analyzing
12.	Show that $(p \to r) \wedge (q \to r) and\ (p \vee q) \to r$ are logically equivalent.	BTL -3	Applying
13.	Show that the propositions $p \to q\ and\ \neg p \vee q$ are logically equivalent.	BTL -4	Analyzing
14.	Without using truth table show that $p \to (q \to p) \Leftrightarrow \neg p \to (p \to q)$.	BTL -2	Understanding
15.	Show that $(p \to (q \to r)) \to ((p \to q) \to (p \to r))$ is a tautology.	BTL -4	Analyzing
16.	Is $\neg p \wedge (p \vee q)) \to q$ a tautology?	BTL -1	Remembering
17.	Using the truth table, show that the proposition $p \vee \neg(p \wedge q)$ is	BTL -4	Analyzing

	a tautology.		
18.	Given $P = \{2,3,4,5,6\}$, state the truth value of the statement $(\exists x \in P)(x+3=10)$.	BTL -2	Understanding
19.	Let $E = \{-1,0,1,2\}$ denote the universe of discourse. If $P(x,y) = x+y+1$, find the truth value of $(\forall x)(\exists y)P(x,y)$.	BTL -4	Analyzing
20.	Find a counter example, if possible, to these universally quantified statements, where the universe of discourse for all variables consists of all integers (a)$\forall x \forall y\ (x^2 = y^2 \Longrightarrow x = y)$(b) $\forall x \forall y\ (xy \geq x)$.	BTL -3	Applying
21.	If the universe of discourse consists of all real numbers and if p(x) and q(x) are given by $p(x): x \geq 0, and\ q(x): x^2 \geq 0$, then determine the truth value of $(\forall x)\big(p(x) \rightarrow q(x)\big)$	BTL -2	Understanding
22.	Write the negation of the statement$(\exists x)(\forall y)P(x,y)$.	BTL -4	Analyzing
23.	Write the following sentence in symbolic form (i) All Lions are fierce (ii) Some Lions do not drink coffee	BTL -3	Applying
24.	Prove that $p, p \rightarrow q, q \rightarrow r \Longrightarrow r$	BTL -2	Understanding
25.	Let A={1,2,3,4,5,6}, determine the truth value of each of following (i) $(\exists x \in A)(x^2 > 25)$ (ii) $(\forall x \in A)(x^2 - x < 30)$	BTL -4	Analyzing
	PART – B		
1.(a)	Prove that $((p \vee q) \wedge \neg(\neg p \wedge (\neg q \vee \neg r))) \vee (\neg p \wedge \neg q) \vee (\neg p \wedge \neg r)$ is a tautology	BTL -3	Applying
1.(b)	Show that $(\exists x)(P(x) \wedge Q(x)) \Longrightarrow (\exists x)P(x) \wedge (\exists x)Q(x)$. Is the converse true?	BTL -1	Remembering
2.(a)	Without using truth table Show that $q \vee (p \wedge \neg q) \vee (\neg p \wedge \neg q)$is a tautology.	BTL -2	Understanding
2.(b)	Without constructing the truth tables, obtain the principle disjunctive normal form of $(\neg p \rightarrow r) \wedge (q \leftrightarrow r)$	BTL -1	Remembering
3.	Show that $(p \rightarrow q), (r \rightarrow s), (q \rightarrow t), (s \rightarrow u), \neg(t \wedge u), (p \rightarrow r) \Longrightarrow \neg p$	BTL -2	Understanding
4.(a)	Show that $\forall x\big(P(x) \rightarrow Q(x)\big), \forall x\big(R(x) \rightarrow \neg Q(x)\big) \Longrightarrow \forall x(R(x) \rightarrow \neg P(x))$	BTL -2	Understanding
4.(b)	Show that $r \rightarrow s$ can be derived from the premises $p \rightarrow (q \rightarrow s), \neg r \vee p\ and\ q$	BTL -3	Applying
5.	Without using truth table find PCNF and PDNF of $[P \longrightarrow (Q \wedge R)] \wedge [\neg P \rightarrow (\neg Q \wedge \neg R)]$.	BTL -2	Understanding
6.(a)	Show that $\big(\neg P \wedge (\neg Q \wedge R)\big) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ without using truth table.	BTL -1	Remembering
6.(b)	Establish these logical equivalences, where A is a proposition not involving any quantifiers. Show that $\big(\forall x P(x)\big) \wedge A \equiv \forall x(P(x) \wedge A) and\ \big(\exists x P(x)\big) \wedge A \equiv \exists x(P(x) \wedge A)$	BTL -3	Applying
7.	Show that $\forall x(P(x) \vee Q(x)) \Longrightarrow \forall x P(x) \vee \exists x Q(x)$ by indirect method.	BTL -1	Remembering
8.(a)	Obtain the PDNF and PCNF of $(P \wedge Q) \vee (\neg P \wedge R)$	BTL -6	Creating
8.(b)	Using indirect method, show that $R \rightarrow \neg Q, R \vee S, S \rightarrow \neg Q, P \rightarrow Q \Longrightarrow \neg P$	BTL -3	Applying
9.	Using indirect method of proof, derive $P \longrightarrow \neg S$ from the	BTL -4	Analyzing

	premises $P \longrightarrow (Q \vee R),\ Q \rightarrow \neg P, S \rightarrow \neg R$ and P.		
10.(a)	Show that the conclusion $\forall x(P(x) \rightarrow \neg Q(x))$ follows from the premises $\exists x(P(x) \wedge Q(x)) \rightarrow \forall y(R(y) \rightarrow S(y))$ and $\exists y(R(y) \wedge \neg S(y))$	BTL -2	Understanding
10.(b)	Prove that $(P \longrightarrow Q) \wedge (R \longrightarrow Q) \Leftrightarrow (P \vee R) \longrightarrow Q)$	BTL -2	Understanding
11.	Obtain the PDNF and PCNF of $(\neg P \longrightarrow R) \wedge (Q \leftrightarrow P)$	BTL -4	Analyzing
12.(a)	Show that the premises "One student in this class knows how to write programme in JAVA", and "Everyone who knows how to write the programme in JAVA can get a high paying job imply a conclusion "someone in this class can get a high paying job" .	BTL -1	Remembering
12.(b)	Show that $(\neg P \longrightarrow R) \wedge (Q \leftrightarrow P) \Longleftrightarrow (P \vee Q \vee R) \wedge (P \vee \neg Q \vee R) \wedge (P \vee \neg Q \vee \neg R) \wedge (\neg P \vee Q \vee R) \wedge (\neg P \vee Q \vee \neg R)$.	BTL -2	Understanding
13.	Show that the premises "All Hummingbirds are richly colored", "No large birds live on honey", "Birds that do not live on honey are dull in color" imply the conclusion "Hummingbirds are small".	BTL -1	Remembering
14.(a)	Prove that the premises $P \longrightarrow Q,\ Q \longrightarrow R,\ R \longrightarrow S, S \longrightarrow \neg R$ and $P \wedge S$ are inconsistent.	BTL -1	Remembering
14.(b)	Establish the validity of the argument "All integers are rational numbers. Some integers are powers of 3. Therefore, some rational numbers are powers of 3".	BTL -3	Applying
15.	Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \rightarrow R, P \rightarrow M, \neg M$	BTL -4	Analyzing
16.(a)	Show that the following premises are inconsistent. 1. If Jack misses many classes through illness, then he fails high school. 2. If Jack fails high school, he is uneducated 3. If Jack reads a lot of books, then he is not uneducated. 4. Jack misses many classes through illness, and reads a lot of books.	BTL -4	Analyzing
16.(b)	Show that R ∨ S is a valid conclusion from the premises $C \vee D, C \vee D \rightarrow \neg H, \neg H \rightarrow (A \wedge \neg B)$ and $(A \wedge \neg B) \rightarrow (R \vee S)$	BTL -3	Applying
17.	Show that the following set of premises is inconsistent: If Rama gets his degree, he will go for a job. If he goes for a job, he will get married soon. If he goes for higher study, he will not get married. Rama gets his degree and goes for higher study.	BTL -4	Analyzing
18.(a)	Prove or disprove the validity of following argument: Every living thing is a plant or an animal. David's dog is alive and it is not a plant. All animals have hearts. Hence, David's dog has a heart.	BTL -3	Applying
18.(b)	Show that the premises $R \longrightarrow \neg Q, R \vee S,\ S \longrightarrow \neg Q,\ P \longrightarrow Q, P$ are inconsistent.	BTL -3	Applying
	PART – C		
1.	Show that the hypothesis, "It is not sunny this afternoon and it is colder than yesterday". "We will go swimming only if it is sunny", " If do not go swimming then we will take a canoe trip" and " If we take a canoe trip, then we will be home by	BTL -6	Creating

	sunset". Lead to the conclusion "we will be home by sunset".		
2.	Construct an argument "To show that the following premises imply that conclusion "It rained". "If does not rain or if there is no traffic dislocation, then the sports day will be held and cultural program will go on", "If the sports day is held , the trophy will be awarded" and "The trophy was not awarded".	BTL -1	Remembering
3.	Show that the following argument is valid "Every microcomputer has a serial interface port." "Some microcomputer have a parallel port". Therefore some microcomputer has both serial and parallel port.	BTL -2	Understanding
4.	Test the validity of the following argument, If an integer is divisible by 10 then it is divisible by 2.If an integer is divisible by 2, then it is divisible by 3.Therefore the integer divisible by 10 is also divisible by 3.	BTL -4	Analyzing
5.	Show the following by constructing derivations. $(\exists x)P(x) \rightarrow (x)((P(x) \vee Q(x)) \rightarrow R(x))$, $(\exists x)P(x), (\exists x)Q(x) \Rightarrow (\exists x)(\exists y)((R(x) \wedge R(y))$	BTL -3	Applying

UNIT II - COMBINATORICS

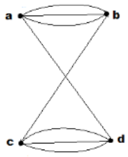
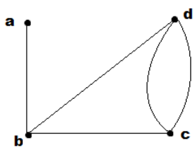
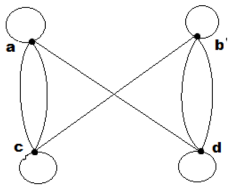
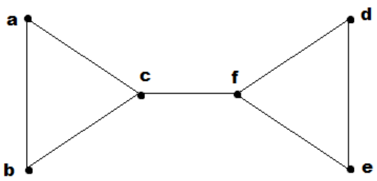
Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

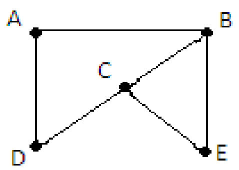
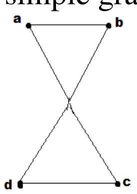
Q.No.	Question	BT Level	Competence
	PART – A		
1.	State the Principle of Mathematical Induction.	BTL -1	Remembering
2.	Prove that $1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$ using Mathematical Induction.	BTL -1	Remembering
3.	Prove that $1 + 2 + 2^2 + \cdots + 2^n = 2^{n+1} - 1,\ for\ n \geq 1$.	BTL -1	Remembering
4.	How many different bit strings are there of length seven?	BTL -2	Understanding
5.	How many permutations are there in the word MISSISSIPPI?	BTL -3	Applying
6	In how many ways can all the letters in MATHEMATICAL be arranged?	BTL -3	Applying
7.	How many permutations of {*a,b,c,d,e,f,g*} starting with *a*?	BTL -2	Understanding
8	In how many ways can first, second and third prize in Pie-baking contest be given to 15 participants?	BTL -2	Understanding
9.	How many permutations are there in the word MALAYALAM?	BTL -3	Applying
10	How many 7 digit numbers can be formed using the digits 1, 2, 0,2,4,2 and 4?	BTL -2	Understanding
11.	State the Pigeonhole principle.	BTL -4	Analyzing
12.	State Generalized Pigeonhole Principle.	BTL -3	Applying
13.	How many cards must be selected from a deck of 52 cards to guarantee that atleast 3 cards of the same suit are chosen?	BTL -4	Analyzing
14.	How many 16-bit strings are there containing exactly 5 zeros?	BTL -2	Understanding
15.	From 10 programmers, in how many ways can five be selected when a particular programmer is included every time?	BTL -4	Analyzing
16.	How many solutions does the equation $x_1 + x_2 + x_3 = 11,\ x_1, x_2, x_3 \geq 0$ have and are integers?	BTL -1	Remembering

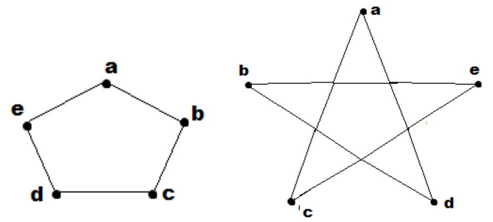
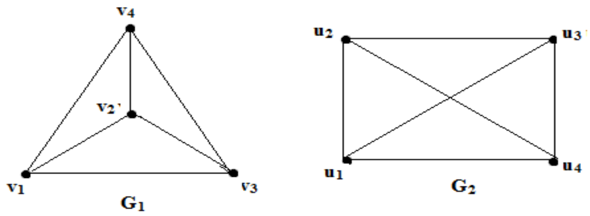
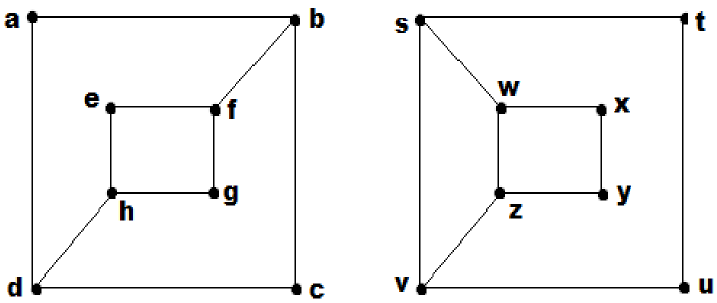
17.	Form the recurrence relation from $S(k) = 5 \cdot 2^k, k > 0$.	BTL -4	Analyzing
18.	Find the recurrence relation for the Fibonacci sequence.	BTL -2	Understanding
19.	Find the recurrence relation satisfying the equation $y_n = A(3)^n + B(-4)^n$	BTL -4	Analyzing
20.	Find the recurrence relation from $f(k) = 2k + 9$.	BTL -3	Applying
21.	Find the recurrence relation of the sequence $s(n) = a^n, n \geq 1$	BTL -2	Understanding
22.	Solve $a_n - 5a_{n-1} + 6a_{n-2} = 0$	BTL -4	Analyzing
23.	What is the solution of the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$. ?	BTL -3	Applying
24.	Solve the recurrence relation $y(k) - 8y(k-1) + 16y(k-2) = 0, \; k \geq 2$	BTL -2	Understanding
25.	Define Generating Function.	BTL -4	Analyzing
	PART – B		
1.(a)	From a club consisting of six men and seven women, in how many ways we select a committee of (1) 3 men and 4 women? (2) 4 persons which has at least one woman? (3) 4 persons that has at most one man? (4) 4 persons that has both sexes?	BTL -3	Applying
1.(b)	Using induction principles prove that $n^3 + 2n$ is divisible by 3.	BTL -1	Remembering
2.(a)	Prove by Mathematical induction, that $\frac{1}{1X2} + \frac{1}{2X3} + \frac{1}{3X4} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}$.	BTL -5	Evaluating
2.(b)	If we select ten points in the interior of an equilateral triangle of side 1,show that there must be at least two points whose distance apart less than $1/3$.	BTL -5	Evaluating
3.(a)	How many permutations can be made out of the letters of the word "BASIC"? How many of those (1) Begin with B? (2) End with C? (3) B and C occupy the end places?	BTL -3	Applying
3.(b)	Find the number of integers between 1 to 100 that are not divisible by any of the integers 2,3, 5 or 7.		
4.(a)	Use mathematical induction to show that $n^2 - 1$ is divisible by 8 whenever n is an odd positive integer.	BTL -3	Applying
4.(b)	There are three piles of identical red, blue and green balls, where each piles contains at least 10 balls. In how many ways can 10 balls be selected (1) If there is no restriction? (2) If at least 1 red ball must be selected? (3) If at least 1 red, at least 2 blue and at least 3green balls must be selected? (4) If at most 1 red ball is selected?	BTL -3	Applying
5. (a)	Use mathematical induction to show that $\frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \cdots + \frac{1}{\sqrt{n}} > \sqrt{n}, \quad n \geq 2$	BTL -3	Applying
5.(b)	A Committee of 5 is to be selected from 6 boys and 5 girls. Determine the number of ways of selecting the committee if it	BTL -5	Evaluating

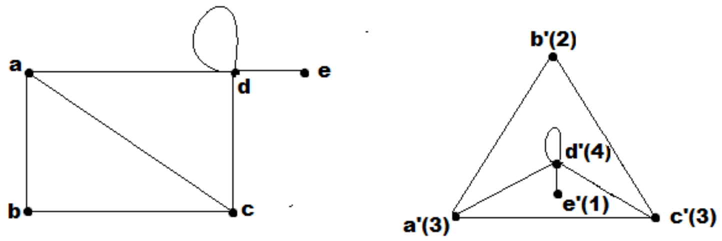
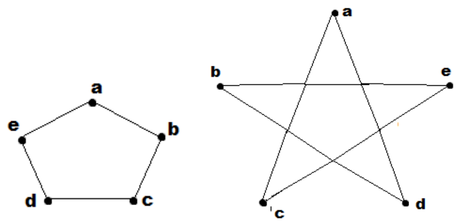
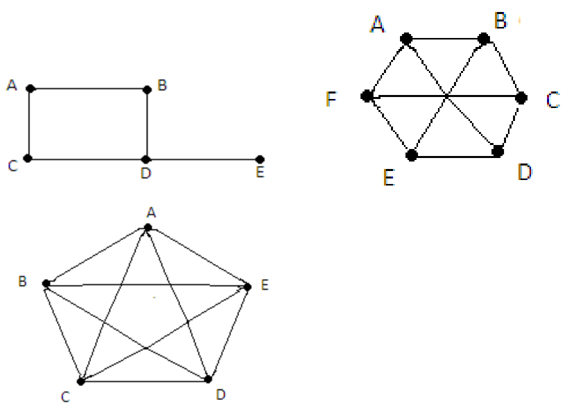
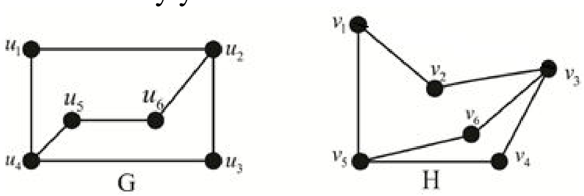
	is to consist of at least 1 boy and 1 girl.		
6.(a)	Prove by mathematical induction that $8^n - 3^n$ is divisible by 5, for each positive integer n.	BTL -3	Applying
6.(b)	Prove that in a group of six people at least three must be mutual friends or at least three must be mutual strangers.	BTL -3	Applying
7.	Use the method of generating function to solve the recurrence relation $a_n + a_{n-1} 4a_{n-2} + 4^n,\ n \geq 2$.	BTL -1	Remembering
8.(a)	Prove by induction $13^n - 6^n$ is divisible by 7.	BTL -4	Analyzing
8.(b)	Triangle ACE is equilateral with AC=1. If five points are selected from the interior of the triangle, there are at least two whose distance apart is less than ½.	BTL -3	Applying
9.	Find the solution to the recurrence relation $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with initial conditions $a_0 = 2, a_1 = 5\ and\ a_2 = 15$	BTL -5	Evaluating
10.(a)	Prove by mathematical induction $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$	BTL -6	Creating
10.(b)	Prove that in a group of six people at least three must be mutual friends or at least three must be mutual strangers.	BTL -3	Applying
11.	Solve $G(k) - 7\,G(k-1) + 10G(k-2) = 8k + 6$, for $k \geq 2\,, G(0) = 1, G(1) = 2$.	BTL -4	Analyzing
12.(a)	40 computer programmers interviewed for a job. 25 knew JAVA, 28 knew ORACLE and 7 knew neither language. How many knew both languages?	BTL -3	Applying
12.(b)	Solve the difference equation $a_r + a_{r-1} + a_{r-2} = 0$.	BTL -3	Applying
13.	Solve the recurrence relation $a_n = 3a_{n-1} + 2,\ n \geq 1$, $with\ a_0 = 1$ by the method of generating function.	BTL -4	Analyzing
14.(a)	Solve the recurrence relation $s(r+2) - 5s(r+1) + 6s(r) = 5^r$.	BTL -3	Applying
14.(b)	Determine the number of positive integer n, $1 \leq n \leq 2000$ that are not divisible by 2, 3 or 5 but are divisible by 7.	BTL -3	Applying
15.	Solve the difference equation $a_r + 6a_{r-1} + 9a_{r-2} = 3$ with the initial condition $a_0 = 1, a_1 = 1$.	BTL -4	Analyzing
16.(a)	How many bits of string of length 10 contain (i)Exactly four 1's (ii)At most four 1's (iii)At least four 1's (iv)An equal number of 0's and 1's	BTL -4	Analyzing
16.(b)	Find the minimum number of m integers to be selected from $S = \{1,2,3 \ldots 9\}$ so that the sum of two of m integers is even.	BTL -3	Applying
17.	A survey of 550 television watchers produced the following information: 285 watch football game, 195 watch hockey game, 115 watch baseball game, 45 watch football and baseball games, 70 watch football and hockey games, 50 watch hockey and baseball games, 100 do not watch any of the three games. Then (a) How many people in the survey watch all three games? (b) How many people watch exactly one of the three games?	BTL -4	Analyzing
18.(a)	Find the number of integers between 1 to 250 that are not divisible by any of the integers 2,3,5 and 7	BTL -3	Applying

18.(b)	Solve the recurrence relation $a_r - 3a_{r-1} + 2a_{r-2} = 0$ with the initial condition $a_0 = 1, a_1 = 4$.	BTL -3	Applying
	PART – C		
1.	In a survey of 120 passengers, an Airline found that 52 enjoyed wine with their meals, 75 enjoyed mixed drinks and 62 enjoyed iced tea. 35 enjoyed any given pair these beverages and 20 passengers enjoyed all of them. Find the no. of passengers who enjoyed (i) Only tea (ii) Only one of the three (iii) Exactly two of the three beverages None of the drinks	BTL -4	Analyzing
2.	During a four-week vacation, a school student will attend at least one computer class each day, but he won't attend more than 40 classes in all during the vacation. Prove that no matter how he distributes his classes during the four weeks, there is a consecutive span of days which he will attend exactly 15 classes?	BTL -4	Analyzing
3.	A total of 1232 students have taken a course in Spanish, 879 have taken a course in French and 114 have taken a course in Russian. Further 103 have taken courses in both Spanish and French, 23 have taken courses in both Spanish and Russian and 14 have taken courses in both French and Russian. If 2092 students have taken at least one Spanish, French and Russian, how students have taken a course in all three languages?	BTL -2	Understanding
4.	Use the method of generating function to solve the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2} + 4^n;\ n \geq 2\ given\ that$ $a_0 = 2\ and\ a_1 = 8$.	BTL -2	Understanding
5.	If (n+1) integers are selected from the set of 2n integers {1,2, 3,…,2n}, then show that there must be an integer that divides another selected integer.	BTL -3	Applying
UNIT III -Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.			
Q.No.	**Question**	**BT Level**	**Competence**
	PART – A		
1.	Define complete graph and draw K_5.	BTL -1	Remembering
2.	Define a regular graph. Can a complete graph be a regular graph?	BTL -1	Remembering
3.	Define pseudo graphs	BTL -1	Remembering
4.	Define strongly connected graph.	BTL -2	Understanding
5.	State the handshaking theorem.	BTL -1	Remembering
6	What is the degree sequence of K_n , where n is a positive integer? Explain your answer.	BTL -3	Applying
7.	When is a simple graph G bipartite? Give an example.	BTL -2	Understanding
8	How many edges are there in a graph with 10 vertices each of degree 3?	BTL -3	Applying
9.	How many edges does a graph have if it has vertices of degree 5, 2, 2, 2, 2, 1? Draw such a graph.	BTL -3	Applying

10	Define connected graph and a disconnected graph with example.	BTL -1	Remembering
11.	Let G be the graph with 10 vertices. If four vertices has degree four and six vertices has degree five , then find the number of edges of G.	BTL -3	Applying
12.	Use an incidence matrix to represent the graph. 	BTL -3	Applying
13.	Draw the graph with the following adjacency matrix $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$	BTL -4	Analyzing
14.	Give an Example of a bipartite graph which is Hamiltonian but not Eulerian.	BTL -3	Applying
15.	What should be the degree of each vertex of a graph G if it has Hamilton circuit?	BTL -4	Analyzing
16.	Define complete bipartite graph.	BTL -1	Remembering
17.	State the necessary and sufficient conditions for the existence of an Eulerian path in a connected graph.	BTL -1	Remembering
18.	Define Hamiltonian path.	BTL -2	Understanding
19.	Show that there does not exist a graph with 5 vertices with degrees 1, 3, 4, 2, 3 respectively.	BTL -4	Analyzing
20.	Give an example of a graph which is Eulerian but not Hamiltonian	BTL -3	Applying
21.	For which value of *m* and *n* does the complete bipartite graph $K_{m\,n}$, have an (i) Euler circuit (ii) Hamilton circuit .	BTL -3	Applying
22.	Represent the given graph using an adjacency matrix.  	BTL -5	Evaluating
23.	An undirected graph G has 16 edges and all the vertices are of degree 2. Find the number of vertices.	BTL -3	Applying
24.	For which values of n do the graphs K_n and C_n have an Euler path but no Euler circuit?	BTL -4	Analyzing
25.	Does the graph have a Hamilton path? If so find such a path. 	BTL -6	Creating
	PART – B		
1.	Prove that the maximum number of edges in a simple disconnected graph G with n vertices and k components is $(n-k)(n-k-1)/2$	BTL -2	Understanding

2.(a)	Prove that a connected graph G is Euler graph if and only if every vertex of $G$is of even degree.	BTL -2	Understanding
2.(b)	Let $\delta(G) and \ \triangle(G)$ denotes minimum and maximum degrees of all the vertices of G respectively. Then show that for a non-directed graph G, $\delta(G) \leq \frac{2\|E\|}{\|V\|} \leq \triangle(G)$	BTL -3	Applying
3.(a)	The sum of all vertex degree is equal to twice the number of edges (or) the sum of the degrees of the vertices of G is even.	BTL -2	Understanding
3.(b)	Prove that the complement of a disconnected graph is connected.	BTL -2	Understanding
4.(a)	For any simple graph G, the number of edges of G is less than or equal to $\frac{n(n-1)}{2}$, where n is the number of vertices in G.	BTL -1	Remembering
4.(b)	Derive a connected graph has an Euler trail if and only if it has at most two vertices of odd degree.	BTL -3	Applying
5.(a)	If a graph G has exactly two vertices of odd degree there is a path joining these two vertices.	BTL -3	Applying
5.(b)	Show that a graph G is self-complementary, if it has n or 4n+1 vertices (n is non negative integer)	BTL -1	Remembering
6.(a)	Define (i) Complete graph. (ii) Complete bipartite graph with example.	BTL -1	Remembering
6.(b)	Show that the complete graph K_n contain $\frac{n(n-1)}{2}$ different Hamilton cycle.	BTL -3	Applying
7.	Prove that the following statements are equivalent for a connected graph G. 1. G is Eulerian 2. Every vertex has even degree 3. The set of edges of G can be partitioned into cycles	BTL -3	Applying
8.(a)	Show that a graph G is connected if and only if for any partition of V into subsets V_1 and V_2 there is an edge joining a vertex of V_1 to a vertex of V_2.	BTL -4	Analyzing
8.(b)	Find the number of paths of length 4 from the vertex D to E in the undirected graph given below.  	BTL -3	Applying
9.(a)	How many paths of length four are there from a to d in the simple graph G given below.  	BTL -5	Evaluating
9.(b)	If G is a graph with n vertices and $(G) \geq \frac{n-1}{2}$, then G is connected.	BTL -2	Understanding
10.(a)	Using adjacency matrix examine whether the following pairs of	BTL -5	Evaluating

	graphs G *and* G^1 given below are isomorphism or not. 		
10.(b)	Write the adjacency matrix of the digraph $G = \left\{ \begin{matrix} (v_1, v_3), (v_1, v_2), (v_2, v_4), \\ (v_3, v_1), (v_2, v_3), (v_3, v_4), \\ (v_4, v_1), (v_4, v_2), (v_4, v_3) \end{matrix} \right\}$. Also draw the graph.	BTL -3	Applying
11.	Define isomorphism. Establish an isomorphism for the following the graphs. 	BTL -4	Analyzing
12.(a)	Show that the following graphs G and H are not isomorphic. 	BTL -3	Applying
12.(b)	Prove that a simple graph with n vertices must be connected if it has more than $\frac{(n-1)(n-2)}{2}$ edges.	BTL -2	Understanding
13	Define Isomorphism between the two graphs. Are the simple graphs with the following adjacency matrices isomorphic? $\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$ and $\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$	BTL -3	Applying
14.(a)	The adjacency matrices of two pairs of graph as given below. Examine the isomorphism of G and H by finding a permutation matrix. $A_G = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ $A_H = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$	BTL -4	Analyzing

14.(b)	Represent each of the following graphs with an adjacency matrix$(i)\ K_4\ (ii)\ K_{1,4}\ (iii) C_4\ \ (iv)\ W_4$	BTL -4	Analyzing
15.(a)	Show that the following graphs are isomorphic.  	BTL -4	Analyzing
15.(b)	Show that a graph G is disconnected if and only if its vertex set V can be partitioned into two nonempty subsets V_1 and V_2 such that there exists no edge is G whose one end vertex is in V_1 and the other is in V_2.	BTL -2	Understanding
16.(a)	Using adjacency matrix examine whether the following pairs of graphs $G\ and\ G^1$ given below are isomorphism or not.  	BTL -4	Analyzing
16.(b)	Find an Euler path or an Euler Circuit if it exists, in each of the three graphs given below.  	BTL -3	Applying
17.	Examine whether the following pair of graphs are isomorphic or not. Justify your answer.  	BTL -4	Analyzing
18.(a)	Give an example of a graph which is (i) Eulerian but not Hamiltonian (ii) Hamiltonian but not Eulerian	BTL -4	Analyzing

	(iii) Both Eulerian and Hamiltonian (iv) Not Eulerian and not Hamiltonian		
18.(b)	Explain cut edges and cut vertices with suitable example.	BTL -3	Applying
	PART – C		
1.	Model the following situations as (possibly weighted, possibly directed) graphs. Draw each graph, and give the corresponding adjacency matrices. (a) Ada and Bertrand are friends. Ada is also friends with Cecilia and David. Bertrand, Cecilia and Évariste are all friends of each other. (b) Wikipedia has five particularly interesting articles: Animal, Burrow, Chile, Desert, and Elephant. Some of them even link to each other! (c) It is well-known that in the Netherlands, there is a 2-lane highway from Amsterdam to Breda, another 2-lane highway from Amsterdam to Cappeleaan den IJssel, a 3-lane highway from Breda to Dordrecht, a 1-lane road from Breda to Ede and another one from Dordrecht to Ede, and a 5-lane superhighway from Cappeleaan den IJsseltto Ede	BTL -4	Analyzing
2.	In the town of Königsberg in Prussia, there was a river containing two islands. The islands were connected to the banks of the river by seven bridges (as seen below). The bridges were very beautiful, and on their days off, townspeople would spend time walking over the bridges. As time passed, a question arose: was it possible to plan a walk so that you cross each bridge once and only once?	BTL -4	Analyzing
3.	Suppose 10 new radio stations are to be set up in a currently unpopulated (by radio stations) region. The radio stations that are close enough to each other to cause interference are recorded in the table below. What is the fewest number of frequencies the stations could use?	BTL -2	Understanding

	A	B	C	D	E	F	G	H	I
A			x			x	x		
B			x	x					
C	x					x	x		
D		x			x	x		x	
E				x					x
F	x		x	x			x		
G	x		x			x			
H				x					x
I					x			x	
J	x		x			x	x		x

4.	There are 25 telephones in Geeks land. Is it possible to connect them with wires so that each telephone is connected with exactly 7 others	BTL -2	Understanding
5.	Describe a discrete structure based on a graph that can be used to model airline routes and their flight times.	BTL -3	Applying

UNIT IV -ALGEBRAIC STRUCTURES

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphisms – Normal subgroup and

cosets – Lagrange‘s theorem – Definitions and examples of Rings and Fields.			
Q.No.	**Question**	**BT Level**	**Competence**
	PART – A		
1.	Define semi group and monoid. Give an example of a semi group which is not a monoid.	BTL -1	Remembering
2.	Show that semi-group homomorphism preserves the property of idempotency.	BTL -1	Remembering
3.	Find the idempotent elements of $G = \{1, -1, i, -i\}$ under the binary operation multiplication	BTL -1	Remembering
4.	Prove that monoid homomorphism preserves invertibility.	BTL -2	Understanding
5.	Define group and State any two properties of a group.	BTL -3	Applying
6	Define a cyclic group and give an example	BTL -3	Applying
7.	Prove that identity element in a group is unique.	BTL -2	Understanding
8	Prove that the inverse of each element of the group $(G,*)$is unique	BTL -2	Understanding
9.	Show that the cancellation laws are true in a group $(G,*)$	BTL -3	Applying
10	If $(G,*)$ is a group infer that the only idempotent element of a is the identity element	BTL -4	Analyzing
11.	Prove if a has inverse b and b has inverse c, then a = c .	BTL -4	Analyzing
12.	Let R be the set of non-zero real numbers and * is the binary operation defined as $a * b = \frac{ab}{2}, for\ a, b \in R$. Find the inverse of any element	BTL -3	Applying
13.	In a group $(G,*), prove\ that\ (a * b)^{-1} = b^{-1} * a^{-1}$for all $a, b \in G$	BTL -4	Analyzing
14.	Let Z be a group of integers with binary operation * defined by $a * b = a + b - 2$ for all $a, b \in Z$. Find the identity element of the group$\langle Z,*\rangle$.	BTL -2	Understanding
15.	Prove that the order of an element a of a group G is the same as that of its inverse (a^{-1})	BTL -4	Analyzing
16.	Prove that if G is abelian group, then for all $a, b \in G, (a * b)^2 = a^2 * b^2$	BTL -1	Remembering
17.	Prove that every cyclic group is abelian	BTL -4	Analyzing
18.	Show that $(Z_5, +_5)$ is a cyclic group.	BTL -2	Understanding
19.	Is $(Z_5^*, \times_6)$ a cyclic group.Justify	BTL -4	Analyzing
20.	If$a$is a generator of a cyclic group$G$, then show that a^{-1} is also a generator of$G$.	BTL -3	Applying
21.	State Lagrange’s theorem.	BTL -2	Understanding
22.	Find the left cosets of $\{[0], [3]\}$ in the addition modulo group $(Z_6, +_6)$.	BTL -4	Analyzing
23.	Discuss a ring and give an example	BTL -3	Applying
24.	Define a commutative ring.	BTL -2	Understanding
25.	Define a field with example	BTL -4	Analyzing
	PART – B		
1.	If $S = NXN$, the set of ordered pairs of positive integers with the operation $*$ defined by $(a, b) * (c, d) = (ad + bc,\ bd)$ and if	BTL -3	Applying

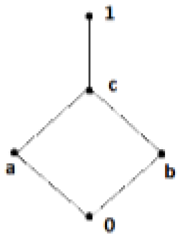
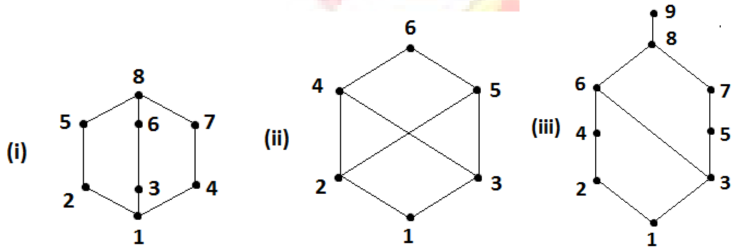
	$f:(S,*) \to (Q,+)$ is defined by $f(a,b) = a/b$, show that f is a semi group homomorphism.		
2.(a)	Prove that in a group G the equations $a * x = b$ and $y * a = b$ have unique solutions for the unknowns x and y as $x = a^{-1} * b, y = b * a^{-1}$ when $a, b \in G$.	BTL -5	Evaluating
2.(b)	Evaluate that the set of all matrices $\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ forms an abelian group with respect to matrix multiplication.	BTL -5	Evaluating
3.	Prove that $G = \left\{ \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}, \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \right\}$ forms an abelian group under matrix multiplication.	BTL -3	Applying
4.(a)	If $(G,*)$ is an abelian group and if $\forall\ a, b \in G$. Show that $(a * b)^n = a^n * b^n, for\ every\ integer\ n$	BTL -3	Applying
4.(b)	Show that $(Q^+,*)$ is an abelian group where $*$ is defined as $a * b = ab/2, \forall a, b \in Q^+$	BTL -3	Applying
5.	Apply the definition of a group to Prove that $(G,*)$ is a non-abelian group where $G = R^* \times R$ and the binary operation * is defined as $(a,b) * (c,d) = (ac, bc + d)$	BTL -3	Applying
6.	Show that group homomorphism preserves identity, inverse, and subgroup	BTL -3	Applying
7.	Show that M_2, the set of all $2X2$ nonsingular matrices over R is a group under usual matrix multiplication. Is it abelian?	BTL -1	Remembering
8.(a)	Prove that the intersection of two subgroups of a group G is again a subgroup of G	BTL -4	Analyzing
8.(b)	Prove that the set $\{1, -1, i, -i\}$ is a finite abelian group with respect to the multiplication of complex numbers.	BTL -3	Applying
9.	Show that the union of two subgroups of a group G is again a subgroup of G if and only if one is contained in the other	BTL -5	Evaluating
10.(a)	Prove that the necessary and sufficient condition for a non-empty subset H of a group $(G,*)$ to be a subgroup is $a, b \in H \Rightarrow a * b^{-1} \in H$	BTL -6	Creating
10.(b)	Prove that every subgroup of a cyclic group is cyclic.	BTL -3	Applying
11.	Prove that $(S_3,*)$, where $S = (1,2,3)$ is a group under the operation of right composition. Is it abelian?	BTL -4	Analyzing
12.(a)	Prove that the kernel of a homomorphism f from a group $(G,*)$ to a group (T,Δ) is a subgroup $(G,*)$	BTL -3	Applying
12.(b)	Determine whether $H_1 = \{0, 5, 10\}$ and $H_2 = \{0, 4, 8, 12\}$ are subgroups of Z_{15}.	BTL -3	Applying
13.	If (G, *) is a finite cyclic group generated by ab element $a \epsilon G$ and is of order n then $a^n = e$ so that $G = \{a, a^2, \ldots\ a^n(= e)\}$. Also, n is the least positive integer for which $a^n = e$.	BTL -4	Analyzing
14.(a)	Let G be a group and $a \in G$. Let $f: G \to G$ be given by $f(x) = axa^{-1}, \forall\ x \in G$. Prove that f is an isomorphism of G onto G	BTL -3	Applying
14.(b)	Show that the group $(\{1, 2, 3, 4\}, X_5)$ is cyclic.	BTL -3	Applying
15.	If $(G,*)$ is a finite cyclic group of order n with a as a generator, then a^m is also a generator of $(G,*)$, if and only if the GCD of m and n is 1, where $m < n$	BTL -4	Analyzing
16.(a)	Prove that any group of prime order is cyclic.	BTL -4	Analyzing

16.(b)	Let $(H, \cdot)$be a subgroup of $(G, \cdot)$ Let $N = \{x \ / x \in G, xHx^{-1} = H\}$. Show that $(N, \cdot)$is a subgroup of G.	BTL -3	Applying
17.	Prove that every finite group of order n is isomorphic to permutation group of degree n	BTL -4	Analyzing
18.(a)	Prove that $(U_9, \times_9)$ is an abelian group	BTL -3	Applying
18.(b)	Let $H = \{[0],[4],[8]\}$ is a subgroup of $(Z_{12}, +_{12})$, find all the cosets of H	BTL -3	Applying
	PART – C		
1.	State and prove the fundamental theorem of group homomorphism	BTL -4	Analyzing
2.	If the permutations of the elements {1,2,3,4,5} are given by $f = \begin{pmatrix} 1 & 23 & 4 & 5 \\ 2 & 31 & 4 & 5 \end{pmatrix} g = \begin{pmatrix} 1 & 23 & 4 & 5 \\ 1 & 23 & 4 & 5 \end{pmatrix}$, $h = \begin{pmatrix} 1 & 23 & 4 & 5 \\ 5 & 43 & 1 & 2 \end{pmatrix}$ find fg, gf, f^2, h^{-1}, fgh	BTL -4	Analyzing
3.	Discuss and show that the order of a subgroup of a finite group divides the order of the group	BTL -2	Understanding
4.	Show that group of order 3 is cyclic and every group of order 4 is abelian	BTL -2	Understanding
5.	Show that $Z_4 = \{0,1,2,3\}$ is a commutative ring with respect to the binary operations $+_4$ *and* $\times_4$	BTL -3	Applying

UNIT V - LATTICES AND BOOLEAN ALGEBRA

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

Q.No.	Question	BT Level	Competence
	PART – A		
1.	Define partial order relation	BTL -1	Remembering
2.	Define POSET and give the example.	BTL -1	Remembering
3.	Draw the Hasse diagram for $[S, /]$ where $S = \{1,2,3,4,5,7,8,12\}$	BTL -3	Applying
4.	Draw the Hasse diagram for $[P(A), \subseteq]$ where $A = \{1,2,3\}$	BTL -3	Applying
5.	Draw the Hasse diagram for $[D_{30}, |]$ where $D_{30} = \{1,2,3,5,6,10,15,30\}$	BTL -3	Applying
6	Define Least upper bound and Greatest lower bound.	BTL -1	Remembering
7.	Define Lattice with example.	BTL -1	Remembering
8	Show that ({1,2,3,4,5}, /) is not a alattice.	BTL -2	Understanding
9.	Define Lattice Homomorphism	BTL -1	Remembering
10	Define Distributive lattice	BTL -1	Remembering
11.	Give an example of a lattice which is not distributive.	BTL -4	Analyzing
12.	Define Complemented Lattice.	BTL -1	Remembering
13.	Define Modular Lattice.	BTL -1	Remembering
14.	Prove that every distributive lattice is Modular.	BTL -2	Understanding
15.	State the reason to the statement "Every Chain is Modular".	BTL -4	Analyzing
16.	Show that the following lattice is not complemented.	BTL -1	Remembering

			
17.	Show that every bounded chain of order ≥ 3 is not complemented.	BTL -4	Analyzing
18.	Define Boolean Algebra	BTL -1	Remembering
19.	What is the 0 element and unity element of $[D_{30}, /]$.	BTL -4	Analyzing
	State the dual of $a \wedge (b \vee c) = (a \wedge b) \vee (a \wedge c)$	BTL -3	Applying
21.	Define Sub-lattice.	BTL -1	Remembering
22.	When is a lattice said to be bounded?	BTL -4	Analyzing
23.	Give an example of a distributive lattice but not complemented.	BTL -3	Applying
24.	Define Sub Boolean Algebra.	BTL -1	Remembering
25.	In there a Boolean algebra with five elements? Justify.	BTL -4	Analyzing
PART – B			
1.(a)	Let N be set of all natural numbers. Prove that the relation R in N defined by $aRb \Leftrightarrow a\ divides\ b$ is a partial order relation.	BTL -3	Applying
1. (b)	Determine which of the following Hasse diagrams are lattices. 	BTL -3	Applying
2.	State and Prove Idempotent property, Commutative property and Associative property of lattice.	BTL -5	Evaluating
3.(a)	Let (L,≤) be a Lattice, then prove that for $a, b \in L,\ a \leq b \Leftrightarrow a \wedge b = a\ \Leftrightarrow a \vee b = b$.	BTL -5	Evaluating
3.(b)	Prove that in a Boolean Algebra$(a \cup b)' = a' \wedge b'$ and $(a \wedge b)' = a' \vee b'$	BTL -3	Applying
4.(a)	Let (L,≤) be a Lattice, for $a, b \in L$ then prove that $a \wedge (b \vee c) \geq (a \wedge b) \vee (a \wedge c)$ and $a \vee (b \wedge c) \leq (a \vee b) \wedge (a \vee c)$	BTL -3	Applying
4.(b)	In a complemented and distributive lattice, then prove that complement of each element is unique.	BTL -3	Applying
5.	Show that in a complemented distributive lattice, $a \leq b \Leftrightarrow a * b' = 0 \Leftrightarrow a' \oplus b = 1 \Leftrightarrow b' \leq a'$	BTL -3	Applying
6.(a)	Prove that the cancellation property: Let (L,≤) be a Lattice, for $a, b \in L$ then $a \vee b = a \vee c\ \&\ a \wedge b = a \wedge c \Rightarrow b = c$ $\forall a, b, c \in L$	BTL -3	Applying
6.(b)	If a and b are two elements of a Boolean Algebra, prove that $a + (a.b) = a;\ \ a.(a + b) = a$	BTL -3	Applying
7.	Draw the Hass diagram of $D_{42} = \{1,2,3,6,7,14,21,42\}$ and Prove that it is a complemented lattice by finding the	BTL -1	Remembering

	complements of all the elements.		
8.(a)	Show that a chain is a lattice. Let (L,≤) be a Lattice, for $a,b,c \in L$ then $a \le c \Rightarrow a \vee (b \wedge c) \le (a \vee b) \wedge c$ (or) $a \oplus (b * c) \le (a \oplus b) * c$	BTL -4	Analyzing
8.(b)	In a Boolean Algebra. Show that $(a+b')(b+c')(c+a') = (a+b')(b+c')(c+a') = (a'+b)(b'+c)(c'+a)$	BTL -3	Applying
9.	Prove that $\{S_{110},/\}$ is a Boolean Algebra and find all its sub algebras. Find also the number of sub lattices with 4 elements.	BTL -5	Evaluating
10.(a)	Prove that every chain is a distributive lattice.	BTL -6	Creating
10.(b)	In a Boolean Algebra, prove that $(a+b)' = a'.b'$ & $(a.b)' = a' + b'$	BTL -3	Applying
11.	In a Boolean Algebra, show that the following statements are equivalent. For any a, b (i) $a+b=b$ (ii) $a.b=a$ (iii) $a'+b=1$ (iv)$a.b'=0$ (v) $a \le b$	BTL -4	Analyzing
12.(a)	Show that in a Boolean Algebra, for any a and b, $a=b$ iff $(a \wedge b') \vee (a' \wedge b) = 0$ or $a=b$ iff $a.b' + a'.b = 0$.	BTL -3	Applying
12.(b)	Prove that $D_{42} \equiv \{S_{42}, D\}$ is a complemented Lattice by finding complements of all the elements.	BTL -3	Applying
13.	Let D_{30} = {1, 2, 3,5,6,10,15, 30} and let the relation R be divisor on D_{30}. Find 1. Draw the Hasse Diagram. 2. All lower bounds of 10 and 15. 3. the GLB of 10 and 15 4. all upper bounds of 10 and 15 5. LUB of 10 and 15. 6. All the sublattice which contains 4 elements.	BTL -4	Analyzing
14.(a)	In a Boolean Algebra, for any *a,b* Show that $(a \wedge b) \vee (a \wedge b') = a$ and $b \wedge \left(a \vee \left(a' \wedge (b \vee b')\right)\right) = b$	BTL -3	Applying
14.(b)	Find all the sub lattices of $[P(S), \subseteq]$ where $S = \{p,q,r\}$	BTL -3	Applying
15.	In a Boolean Algebra. Show that $(a+b')(b+c')(c+a') = (a'+b)(b'+c)(c'+a)$	BTL -4	Analyzing
16.(a)	Prove that in a Boolean Algebra, $a = 0$ iff $a.b' + a'.b = b$.	BTL -4	Analyzing
16.(b)	Show that in any Boolean Algebra, $(x+y)(x'+z) = xz + x'y$	BTL -3	Applying
17.	Let D_{24} = {1, 2, 3, 4, 6, 8, 12, 24} and let the relation R be divisor on D_{24}. Find 1. Draw the Hasse Diagram. 2. All lower bounds of 8 and 12. 3. the GLB of 8 and 12 4. all upper bounds of 8 and 12 5. LUB of 8 and 12. 6. All the sublattice which contains 5 elements.	BTL -4	Analyzing
18.(a)	In a Boolean Algebra, for any *a,b,c* Show that (i) $(a \wedge b \wedge c) \vee (b \wedge c) = b \wedge c$ (ii) $\left((a \vee c) \wedge (b' \wedge c)\right)' = (a' \vee b) \wedge c'$	BTL -3	Applying
18.(b)	Find all the sub lattices of the lattice (S_{12}, D)	BTL -3	Applying

PART – C

1.	Let $D_{100} \equiv \{1, 2, 4, 5, 10, 20, 25, 50, 100\}$ be the divisors of 100 and let the relation $\leq$ be the relation $a \leq b$ if $a \mid b$, then $(D_{100} \mid)$ is a poset. Determine (i) GLB {10, 20}, (ii) LUB {10, 20}, (iii) GLB {5, 10, 20, 25}, (iv) LUB {5, 10, 20, 25}	BTL -4	Analyzing
2.	Consider the lattice D_{105} with the partial ordered relation divides then 1. Draw the Hasse diagram of D_{105} 2. Find the complement of each element of D_{105} 3. Find the set of atoms of D_{105} 4. Find the number of sub algebras of D_{105}.	BTL -4	Analyzing
3.	If S_n is the set of all divisors of the positive integer n and D is the relation of 'division', prove that $\{S_{30}, D\}$ is a lattice. Find also all the sub lattices of $\{S_{30}, D\}$ that contain six or more elements.	BTL -2	Understanding
4.	If $a, b \in S,\ S = \{1, 2, 3, 6\}$ and $a + b = LCM\ (a, b)$, $a.b = GCD\ (a, b)$ and $a' = 6/a$, show that $\{S, +, \cdot, ', 1, 6\}$ is a Boolean Algebra.	BTL -2	Understanding
5.	Prove that algebraically (i) $ab' + bc' + ca' = a'b + b'c + c'a$ (ii)$(a + b).(b + c).(c + a) = a.c + b.c + a.b$ (iii) $ab + abc + a'b + ab'c = b + ac$	BTL -3	Applying