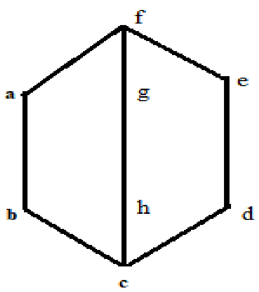
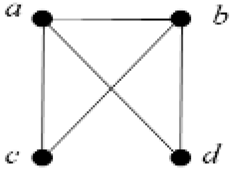
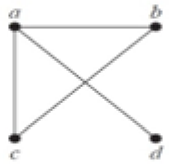
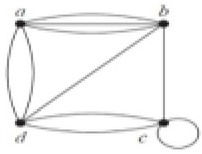
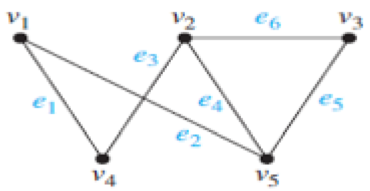
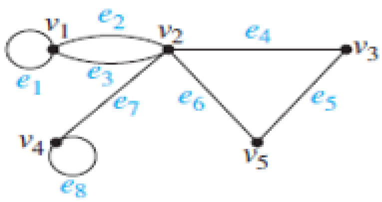
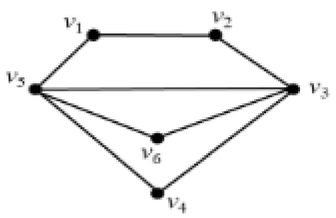
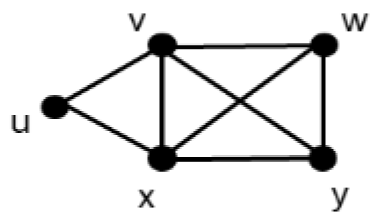
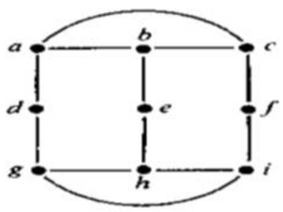
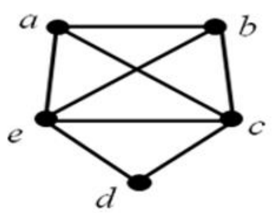
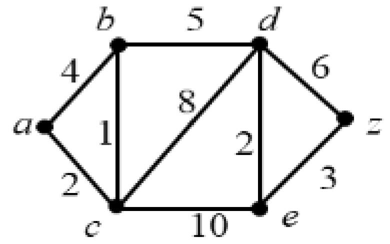
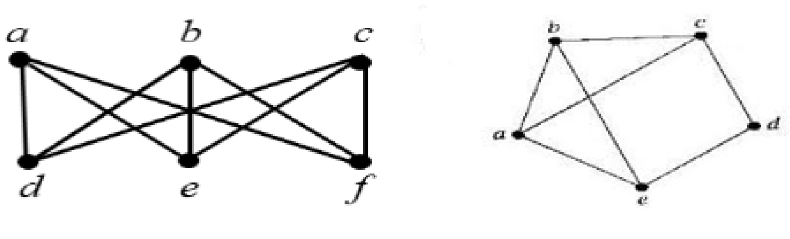
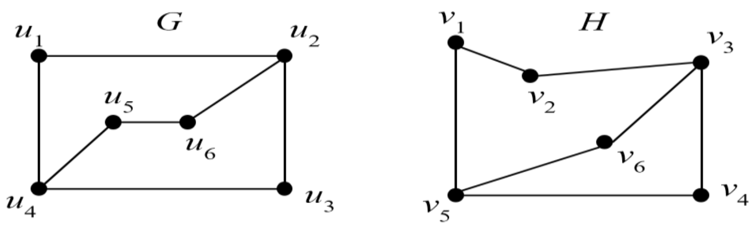
Qno	Question	Marks	Section
1	**a)** If $A=\{a,b,c,d\}$ and $B=\{x,y,z\}$. Let R be the following relation from A to B: $R=\{(a,x),(a,z),(d,y),(c,x),(b,z),(d,x)\}$ (i) Determine the matrix of the relation. (ii) Draw the arrow diagram of R. (iii) Find the inverse relation R^{-1} of R. **b)** Prove that for any positive integer m, the relation congruence modulo m is an equivalence relation on the integers.	8	Section-I
2	**a)** Let R is a relation on set of real numbers and it is defined as $(a, b) \epsilon R$ iff x-y is an integer. Then show that R is an equivalence relation. **b)** Suppose $(a, b) \epsilon R$ iff the price of book a is greater than or equal to the price of book b. Show that R is partially ordered relation.	8	Section-I
3	Define one-one, onto and composite functions. Prove that $f^{-1} \circ g^{-1} = (g \circ f)^{-1}$ for $f, g: Q \to Q$ such that $f(x) = 4x$ and $g(x) = x + 5$.	8	Section-I
4	Define POSET. Let R is a relation on set of integers ($\mathbb{Z}$) and defined as $R = \{(x, y) / x$ divides $y\}$ then prove that $\mathbb{Z}$ is POSET and also verify $\mathbb{Z}$ is TOSET or not?	8	Section-I
5	**a)** Show that the inclusion relation $\subseteq$ is a partially ordered relation on the power set of R. **b)** Let $S = \{1,2,3\}$, draw the Hasse diagram for the POSET $(P(S), \subseteq)$.	8	Section-I
6	**a)** Verify $R = \{(x,y) / x \leq y\}$ is a partially ordering relation on the set of integers or not? **b)** Draw the Hasse diagram for $\{\{1,3,5,9,15,45\}, /\}$.	8	Section-I
7	Verify the following Hasse diagram is lattice or not?  	8	Section-I
8	If A = {1,2,3,5,30} and R is the divisibility relation, draw its Hasse diagram and prove that (A, R) is lattice but not distributed lattice?	8	Section-I

9	**a)** Let $I = \{0,1,2\}$, the functions f & g are defined from $I \to I$ as $\forall\, x \in I$, $f(x)=(x^2+x+1) \bmod 3$, $g(x)=(x+2)^2 \bmod 3$, check whether f=g or not? **b)** If $f(x) = 2x+3$ and $g(x) = 2x$ and defined f, g: R→R, then find fog and gof.	8	Section-I
10	Show that the functions $f: R \to (1, \infty)$ and $g: (1, \infty) \to R$ defined by $f(x) = 3^{2x}+1$, $g(x)=\frac{1}{2}\log_3(x-1)$ are inverses.	8	Section-I
11	Prove that for any propositions p,q and r, $[p \to (q \wedge r)] \to (p \to r)$ is a tautology by using a truth table.	8	Section-II
12	Obtain PDNF and PCNF of $(p \longrightarrow q) \longrightarrow r$.	8	Section-II
13	**a)** "If the figure is square then it is quadrilateral" Write its converse, inverse, and contrapositive. **b)** Prove $(p \vee q) \wedge \sim(\sim p \vee q) \Leftrightarrow p \wedge \sim q$ using laws of logic.	8	Section-II
14	Construct the truth tables of the following compound propositions a) $(p \wedge q) \to r$ b) $(p \to q) \leftrightarrow [\sim p \vee q)] = \sim (q \vee p) \leftrightarrow (p \vee q)$	8	Section-II
15	Obtain DNF and CNF of $p \wedge (p \longrightarrow q)$.	8	Section-II
16	**a)** Verify the validity of following argument "All integers are rational numbers" "Some integers are powers of 2" Therefore, "some rational numbers are powers of 2" **b)** Show that the premises "It is not sunny this afternoon and it is colder than yesterday" "We will go swimming only if it is sunny" "If we do not go swimming then we will take a Hyderabad trip" "If we take the Hyderabad trip then we will be home by sunset" lead to the conclusion "We will be home by sunset."	8	Section-II
17	**a)** Define quantifiers and symbolize the following argument and check for its validity: "If you send me an email, then I will finish writing the program" "If you do not send me an email, then I will go to sleep early" "If I go to sleep early then I will wake up feeling refreshed" Therefore, "If I do not finish writing the program, then I will wake up feeling refreshed." **b)** Explain universal and existential quantifiers. Symbolize the following argument and check for its validity: "Tigers are dangerous animals." "There are Tigers." Therefore, "there are dangerous animals."	8	Section-II

18	**a)** Verify the validity of the following argument "It is not sunny this afternoon and it is colder than yesterday," "We will go swimming only if it is sunny," "If we do not go swimming then we will take a Hyderabad trip" "If we take the Hyderabad trip then we will be home by sunset" Therefore, "We will be home by sunset." **b)** Check whether the following arguments are valid or not? "If a baby is hungry, then the baby cries." "If the baby is not mad, then he does not cry." "If the baby is mad, then he has a red face." Therefore, "If a baby is hungry, then he has a red face."	8	Section-II
19	**a)** Construct an argument using rules of inference to show that the hypothesis: "Ravi works hard" "If Ravi works hard, then he is a dull boy", and "If Ravi is a dull boy, then he will not get the job" imply the conclusion "Ravi will not get the job." **b)** Check whether the following arguments are valid or not? "All men are fallible" "All kings are men" Therefore, "All kings are fallible."	8	Section-II
20	Check whether the following arguments are valid or not? **a)** "If Sachin hits a century, then he gets a free car," "Sachin doesn't get a car" Therefore, "Sachin has not hit a century." **b)** "All engineering students are good in studies" "Sachin is good in studies" Therefore, "Sachin is an engineering student."	8	Section-II
21	**a)** Slove the recurrence relation $a_n = a_{n-1} + \frac{1}{n(n+1)}$, $a_0 = 1$. **b)** Find the solution of the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ and $a_0 = 2;\ a_1 = 7$.	8	Section-III
22	**a)** Slove the recurrence relation $a_n = 2a_{n-1} + 1\ for\ n \geq 2$ and $a_1 = 2$. **b)** Find the solution of the recurrence relation $a_n + 4a_{n-1} + 4a_{n-2} = 0$ and $a_0 = 2; a_1 = 1$.	8	Section-III
23	Solve the recurrence relation $a_n - 3a_{n-1} + 2a_{n-2} = 5n + 3$ for $n \geq 2$.	8	Section-III
24	Solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 7.3^n + 4^n$ for $n \geq 2$.	8	Section-III

25	**a)** Using generating function, solve the recurrence relation $a_n - 9a_{n-1} + 20a_{n-2} = 0$ for $n \geq 2$ with $a_0 = -3,\ a_1 = -10$. **b)** Solve the recurrence relation $a_k = 3a_{k-1}$ for k = 1, 2, 3, … and initial condition $a_0 = 2$ using generating functions.	8	Section-IV
26	**a)** Find an explicit formula for the Fibonacci numbers using recurrence relation. **b)** Solve the Divide and Conquer recurrence relation $a_n = ca_{\frac{n}{d}} + e$ for $a_1 = e, c \neq 0$ & $n = d^k$ where c, d & e are constants.	8	Section-III
27	Find the number of integral solutions of the equation $x_1 + x_2 + x_3 = 20$ such that $2 \leq x_1 \leq 5,\ 4 \leq x_2 \leq 7,\ -2 \leq x_3 \leq 9$.	8	Section-III
28	Find number of (i) non-negative (ii) positive integral solutions of the equation $x_1 + x_2 + x_3 + x_4 = 25$.	8	Section-III
29	**a)** Solve $a_n + a_{n-1} - 5a_{n-2} + 3a_{n-3} = 0,\ n \geq 3$ with $a_0 = 0,\ a_1 = 1$ and $a_2 = 0$. **b)** Determine the number of positive integers $'n'$ such that $1 \leq n \leq 250$ and $'n'$ is not divisible by 2 or 3 or 5.	8	Section-III
30	In a survey of 120 people, it was found that: 65 read Newsweek magazine, 20 read both Newsweek and Time, 45 read Time, 25 read both Newsweek and Fortune, 42 read Fortune, 15 read both Time and Fortune, 8 read all three magazines. **(a)** Find the number of people who read at least one of the three magazines. **(b)** Draw its Venn diagram. **(c)** Find the number of people who read exactly one magazine. **(d)** Find the number of people who read Time and Fortune but not Newsweek.	8	Section-III
31	**a)** Draw a graph with the adjacency matrix $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ with respect to the ordering of vertices a, b, c, d. **b)** Find the adjacency list for the following graph 	8	Section-IV

32	Use an adjacency matrix to represent the (a) graph and (b) the pseudo-graph shown below:   (a) (b)	8	Section-IV
33	Obtain the incidence matrix of the following graphs.   **(a)** **(b)**	8	Section-IV
34	Find the Euler path, Euler circuit for the following graphs.   (a) (b)	8	Section-IV
35	**a)** In a graph, that has 21 edges, 4 vertices of degree 3 and all other vertices of degree 2. Find the total number of vertices in this graph. **b)** Show that the complete bipartite graph $K_{2,3}$ is a planar graph and complete graph of 5 vertices is non planar.	8	Section-IV
36	Find a Hamiltonian path for the following graphs:   (a) (b)	8	Section-IV

37	State and prove Euler's formula.	8	Section-IV
38	Use Dijkstra's algorithm to find the length of a shortest path between a and z in the weighted graph. 	8	Section-IV
39	Find the chromatic number for following graphs  (a) (b)	8	Section-IV
40	Show that the following graphs are Isomorphic. 	8	Section-IV
41	Define group. Show that $S = \{1, \omega, \omega^2\}$ is a group under multiplication.	8	Section-V
42	Define binary operation. Show that $a * b = a + b - ab$ is an abelian group on $R - \{1\}$.	8	Section-V
43	Define subgroup. Prove that $H = \{0, 2, 4\}$ forms a subgroup of $<Z_6, +>$.	8	Section-V
44	Define order of a group and order of an element. Find order of $U = \{1,2,4,7,8,11,13,14\}$ under X_{15} also find order of an elements 2 and 7.	8	Section-V
45	Define normal subgroup. Show that $H = \{1, -1\}$ is a normal subgroup of the group $G = \{1, -1, i, -i\}$ under multiplication.	8	Section-V
46	Define kernel of a group homomorphism. Find the kernel of $f(x) = x^4$, where $f: (R, .) \to (R, .), x \in R$.	8	Section-V
47	Define Ring. Show that the set Z of integers with respect to usual addition and multiplication is a commutative ring with unit element.	8	Section-V

48	Define subring. Show that the set of matrices $\begin{bmatrix} a & b \\ 0 & c \end{bmatrix}$ is a subring of 2x2 matrices whose elements are integers.	8	Section-V
49	Prove the set of even integers is a ring with respect to usual addition and multiplication of integers.	8	Section-V
50	The intersection of two subrings of ring R is a subring of R.	8	Section-V