INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

TUTORIAL QUESTION BANK

Course Title	**DISCRETE MATHEMATICAL STRUCTURES**				
Course Code	ACSB04				
Programme	B.Tech				
Semester	III	CSE | IT			
Course Type	Core				
Regulation	IARE - R18				
Course Structure		**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Ms. K Mayuri, Assistant Professor				
Course Faculty	Mr. N V Krishna Rao, Assistant Professor				
	Ms. B Pravallika, Assistant Professor				
	Ms. N M Deepika, Assistant Professor				
	Ms. G Nishwitha, Assistant Professor				
	Ms. B Dhanalaxmi, Assistant Professor				

COURSE OBJECTIVES:
The course should enable the students to:

I	Describe the logical and mathematical foundations, and study abstract models of computation.
II	Illustrate the limitations of predicate logic.
III	Define modern algebra for constructing and writing mathematical proofs.
IV	Solve the practical examples of sets, functions, relations and recurrence relations.
V	Recognize the patterns that arise in graph problems and use this knowledge for constructing the trees and spanning trees.

COURSE OUTCOMES:

C0 1	To understand the concepts associated with Mathematical Logic and Predicate calculus
CO 2	Ability to learn the basic concepts about relations, functions and to draw different diagrams like Lattice, Hasse diagrams.
CO 3	To understand the concepts of Algebraic Structures and combinatorics.
CO 4	To describe various types of recurrence relations and the methods to find out their solutions.
CO 5	To understand the basic concepts associated with Graphs and Trees.and spanning trees.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

SI. No.	Description
ACSB04.01	Understand logical connectives and compound prepositions for building compound statements.
ACSB04.02	Learn the formal symbols and use the preposition logic and predicate logic to solve problems on logical equivalences and implications.
ACSB04.03	Memorize different scientific notations to simplify the logical statements.
ACSB04.04	Prepare valid arguments from the given propositional statements by using rules of inference.
ACSB04.05	Identify ordered pairs to form a binary relation from the given sets.
ACSB04.06	Construct directed graph and a matrix representation using a binary relation on finite order pairs.
ACSB04.07	Identify the properties of relations to check for equivalence relation and partial order relation and compute relations using operations on relations.
ACSB04.08	Construct a hasse diagram to recognize the relevant partial ordered sets from the given binary relation.
ACSB04.09	Describe the types of functions (one to one, on-to, bijective, Identity and constant function).
ACSB04.10	Implement the concept of the inverse and recursive functions to get an optimized solution for an appropriate problem.
ACSB04.11	Use the concept of lattices (Greatest Lower Bound (GLB) and Least Upper Bound (LUB) to represent a defined finite set in multi-dimension applications.
ACSB04.12	Explain about the properties and types of lattices (bounded and distributive lattice).
ACSB04.13	Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.
ACSB04.14	Understand binomial and multinomial theorems to compute the coefficients for the given expansions.
ACSB04.15	Understand the concept of homomorphism and isomorphism of semi-groups.
ACSB04.16	Analyze the given sets by using inclusion and exclusion principle.
ACSB04.17	Identify the different counting techniques (permutations) related to mathematics and computer science.
ACSB04.18	Solve discrete probability and set problems by using permutations and combinatorics.
ACSB04.19	Identify the series of expansion to represent the sequence by using generating functions
ACSB04.20	Identify the general solution for first-order and second-order linear homogeneous recurrence relations.
ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.
ACSB04.22	Understand the use of graphs and trees as representation tools in a variety of context.
ACSB04.23	Identify Euler"s and Hamilton rule for a simple connected graph in NP-complete problems.
ACSB04.24	Construct a spanning tree by using search techniques (Depth First Search and Breadth First Search).
ACSB04.25	Construct a minimal spanning tree by using Kruskal"s and Prim"s algorithm in order to obtain a solution for a real time problem.
ACSB04.26	Possess the knowledge and skills for employability and to succeed in national and international level competitive exams.

	MODULE - I			
	Mathematical Logic and Predicates			
	PART - A (Short Answer Questions)			
S. No	**Question**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcome**
1	Define statement and atomic statement?	Understand	CO1	ACSB04.01
2	Describe logical equivalence with an example?	Understand	CO1	ACSB04.02
3	Define Tautology?	Understand	CO1	ACSB04.01
4	Identify the converse, inverse and contra positive for the following propositions: P → (Q →R)	Remember	CO1	ACSB04.03
5	Illustrate NAND and NOR with examples?	Understand	CO1	ACSB04.01
6	Differentiate conditional and biconditional statements?	Understand	CO1	ACSB04.01
7	Define contradiction?	Understand	CO1	ACSB04.01
8	State the definition for contradiction and provide a proof by contradiction of the following statement: For every integer „n‟, if n^2 is odd then „n‟ is odd.	Understand	CO1	ACSB04.03
9	Write short notes on converse, contra-positive and inverse of implication?	Understand	CO1	ACSB04.03
10	Translate the following statements in to symbolic form: a) all men are good b) no men are good	Understand	CO1	ACSB04.02
11	Identify the disjunctive normal form of the formula: P↔Q?	Understand	CO1	ACSB04.02
12	Paraphrase the value of: P↔Q in terms of {~, V} only?	Understand	CO1	ACSB04.03
13	Define free and bound variables?	Remember	CO1	ACSB04.01
14	Discuss about the statement "if „m‟ is an even integer then m+7 is an odd integer" by indirect proof?	Understand	CO1	ACSB04.03
15	State the truth table for conjunction and conditional statements?	Remember	CO1	ACSB04.02
16	Describe the truth table for p→(q→r)?	Understand	CO1	ACSB04.02
17	Identify whether p∨[~(p∧q)] is a tautology or not?	Understand	CO1	ACSB04.02
18	R: Mark is rich. H:Mark is happy Translate the statements into symbolic form a) mark is poor but happy b)mark is poor but not happy	Understand	CO1	ACSB04.02
19	Translate the following statement into symbolic form: "the crop will be destroyed if there is a flood".	Understand	CO1	ACSB04.02
20	Identify whether (p∨q)∨~p is a tautology or not?	Understand	CO1	ACSB04.02
	PART-B (Long Answer Questions)			
1	Write conditional proposition and logical equivalence with suitable examples.	Remember	CO1	ACSB04.01
2	Explain the term tautology? Show that [(p→q)→r]→[(p→q)→(p→r)] is tautology ?	Remember	CO1	ACSB04.01
3	Solve that S V R is a tautologically implied by (p ∨ q)∧ (p→ r) ∧ (q→ s)	Remember	CO1	ACSB04.04
4	Show that RVS is valid conclusion from the premises: C∨D,(C∨D)→~H),~H→(A∧~B),(A∧~B)→R∨S	Remember	CO1	ACSB04.04
5	a)Prove that i) ~ (P↑Q)↔ ~P↓~ Q ii) ~ (P↓Q)↔ ~P↑~ Q Without using truth table?	Remember	CO1	ACSB04.04
6	(a) Describe the proposition (p ∧ q) ∧~ (p ∨ q) is a contradiction. (b) Symbolize the following statements: i. all men are good ii. no men are good iii. some men are good	Remember	CO1	ACSB04.04

	iv. some men are not good			
7	Demonstrate the disjunctive normal form of the formula: $P\rightarrow((P\rightarrow Q)\wedge\sim(\sim Q\vee\sim P))$?	Remember	CO1	ACSB04.03
8	Explain free and bound variables with an example?	Remember	CO1	ACSB04.01
9	Show that if „m" is an even integer then m+7 is an odd integer by using indirect proof?	Remember	CO1	ACSB04.02
10	Explain proof by contradiction with example?	Understand	CO1	ACSB04.03
11	Explain the direct proof of the statement "The square of an odd integer is an odd integer"	Understand	CO1	ACSB04.03
12	State the converse for the statement "If a quadrilateral is a parallelogram, then its diagonals bisect each other".	Remember	CO1	ACSB04.03
13	State the inverse for the statement "If a triangle is not isosceles, then it is not equilateral".	Remember	CO1	ACSB04.03
14	Define the converse, inverse and contra positive of the following propositions: i. P → (Q → R) ii. (P ∧ (P → Q)) → Q.	Remember	CO1	ACSB04.03
15	Express p→(∼ p→q) i)in terms of „↑" only ii)in terms of „↓"only ?	Remember	CO1	ACSB04.04
16	Write each of the following in symbolic form i)all monkeys have tails ii)no monkey have tail iii)some monkey have tails iv)some monkey have no tails	Remember	CO1	ACSB04.02
17	Explain the indirect proof of the statement "If n^2 is odd, then n is odd"	Understand	CO1	ACSB04.03
18	Define quantifier and types of quantifier with an example	Understand	CO1	ACSB04.03
19	Demonstrate the conjunctive normal form of the formula: $P\rightarrow((P\rightarrow Q)\wedge\sim(\sim Q\vee\sim P))$?	Remember	CO1	ACSB04.03
20	Prove that by using truth tables 1. $\sim(P\uparrow Q)\leftrightarrow\sim P\downarrow\sim Q$ 2. $\sim(P\downarrow Q)\leftrightarrow\sim P\uparrow\sim Q$	Understand	CO1	ACSB04.03
	PART-C (Problem Solving and Critical Thinking Questions)			
1	Write the negations of the following statements, a) Jan will take a job in industry or go to graduate school b) James will bicycle or run tomorrow c) If the processor is fast then the printer is slow	Remember	CO1	ACSB04.02
2	Write the pdnf of (p∧q)∨(∼p∨r)∨(q∨r) using truth table.	Understand	CO1	ACSB04.03
3	Show that: R∧(P∨Q) is a valid conclusion from premises P∨Q, Q→R , P→M and ∼M.	Remember	CO1	ACSB04.04
4	Show that the following premises are inconsistent. (a) If jack misses many classes through illness, then he fails high school (b) If jack fails high school, then he is uneducated. (c) If jack reads lot of books, then he is not uneducated.. (d) Jack misses many classes through illness and lot of books	Remember	CO1	ACSB04.02
5	Select p,q and r be the propositions p: you have the flee q: you miss the final examination r: you pass the course. Write the following propositions into statement form. (i) p→q (ii) ∼p→r (iii) q→∼r (iv) p∨q∨r	Understand	CO1	ACSB04.02

	(v) (p→~r)∨(q→~r)			
	(vi) (p∧q)∨(~q∧r).			
6	Write the following proposition in symbolic form, and find its negation: "If all triangles are right angled, then no triangle is equiangular"	Understand	CO1	ACSB04.03
7	Show that:R→S can be derived from the premises, P→(Q→S), ~R∨P and Q	Understand	CO1	ACSB04.03
8	Show that ~P from the premisis ~Q,P->Q	Remember	CO1	ACSB04.02
9	Show that SVR tautologically implied by (PVQ)∧(P->R)∧(Q->S)	Understand	CO1	ACSB04.03
10	Obtain PDNF of P->Q	Remember	CO1	ACSB04.04

MODULE – II				
Relations, Functions and Lattices				
PART - A (Short Answer Questions)				
1	Define a relation?	Remember	CO2	ACSB04.05
2	List the operations on relations?	Remember	CO2	ACSB04.05
3	Explain Reflexive relation?	Remember	CO2	ACSB04.05
4	Define Symmetric relation?	Remember	CO2	ACSB04.05
5	Define Irreflexive relation?	Remember	CO2	ACSB04.05
6	Define Compatibilty relation?	Remember	CO2	ACSB04.05
7	Describe Tranisitive relation?	Remember	CO2	ACSB04.05
8	Write short notes on a partial order relation?	Remember	CO2	ACSB04.05
9	Interpret equivalance relation?	Remember	CO2	ACSB04.05
10	Define Indegree and Outdegree for diagraph?	Remember	CO2	ACSB04.06
11	Identify A X B and B X A where A = {1,2,3}, B={4,5}?	Understand	CO2	ACSB04.07
12	Defineonto function and one to one function	Remember	CO2	ACSB04.09
13	Explain bijective function?	Remember	CO2	ACSB04.09
14	Write short notes on constant function?	Remember	CO2	ACSB04.09
15	Define Identity function?	Remember	CO2	ACSB04.09
16	Determine Inverse function?	Remember	CO2	ACSB04.09
17	Identify inverse of f(x) and g(x) where f(x)=x^3,g(x)=2x+3?	Remember	CO2	ACSB04.10
18	Define lattice? If A is finite set and P(A) is power set then prove that (P(A), ⊆) is a lattice for A={a }	Remember	CO2	ACSB04.11
19	List the properties of lattice?	Understand	CO2	ACSB04.12
20	Describe distributive lattice?	Remember	CO2	ACSB04.12

PART-B (Long Answer Questions)				
1	Define a relation? Explain the properties of relations and the operations on relations?	Remember	CO2	ACSB04.07
2	Let A={1,2,3,4,6}and R be a relation on A defined by aRb if and only if a is multiple of b represent the relation R as a matrix and draw its diagraph.	Remember	CO2	ACSB04.07
3	Let A={1,2} and B={p,q,r,s}and let R be a relation from A to B defined by R={(1,q), (1,r), (2,p), (2,q), (2,s)} Write the matrix and digraph of R	Remember	CO2	ACSB04.07
4	Consider the set A={ball,bed,dog,let,egg} and define the relation R on A by R={(x,y)|x,y € A and x R y if x and y contain some letter}. Verify R is a compatibility relation which is not transitive.	Remember	CO2	ACSB04.07
5	Describe the sets A & B given that A – B = { 1,2,4 } B – A ={ 7,8 } and A U B = { 1,2,4,5,7,8,9}.	Understand	CO2	ACSB04.07
6	Construct the hasse diagram for the divisibility relation i)A={3,6,12,36,72} ii)A={1,2,3,5,6,10,15,30}	Remember	CO2	ACSB04.08
7	Let A be a given finite set and p(θ) its power set. Let <= be the inclusion relation on the elements p(θ) Construct the hasse diagram of (P(A), ⊆) i)A={a} ii)B={a,b}	Remember	CO2	ACSB04.08
8	Construct the hasse diagram represented with positive divisors of 36?	Remember	CO2	ACSB04.08
9	Describe a)onto function b)one to one function c) bijective function d)constant function	Understand	CO2	ACSB04.09
10	Describe the function and find the inverse of the function	Understand	CO2	ACSB04.10

	i) f(x)=10/5√7-3x ii) 4.e$^{(6x+2)}$			
11	Define lattice? If A is finite set and P(A) us Power set then prove that (P(A), ⊆) is a lattice for i) A={a } ii)A={a,b}	Remember	CO2	ACSB04.11
12	Describe bounded lattice and distributive lattice? What is a partial order relation?	Understand	CO2	ACSB04.12
13	Construct the hasse diagram for the divisibility relation on set A in each of the following case .A={2,3,6,12,24,36}	Remember	CO2	ACSB04.08
14	**Let** f:R->R and g:R->R and h:R->R is defined as f(x)=2x+1 for all x belongs to R and g(x)=3x+2 for all x belongs to R h(x)=2x-2 for all x belongs to R then find fog,gof,fo(gof),go(foh).	Remember	CO2	ACSB04.08
15	**Consider the poset A=**{1,2,3,4,5,6,7,8} under the partial order whose diagram is as shown below consider the subsets B={1,2} and C={3,4,5} Find all the lower and upper bounds of B and C	Understand	CO2	ACSB04.12
16	Let A be a given finite set and p(θ) its power set. Let <= be the inclusion relation on the elements p(θ) Construct the hasse diagram i)A={a,b,c} ii)B={a,b,c,d}	Remember	CO2	ACSB04.08
17	LET a={1,2,3,6,8,12} on a define the partial ordering relation r by aRb if and only if a/b i.draw the hasse diagram ii.write the relation matrix for R	Understand	CO2	ACSB04.12
18	Construct the hasse diagram for the divisibility relation on set A in each of the following case .A={1,2,3,4,6,8,9,12,18,24}	Remember	CO2	ACSB04.08
19	Define bounded lattice and explain with an example?	Understand	CO2	ACSB04.12
20	Explain complemented lattice with a suitable example?	Remember	CO2	ACSB04.08
	PART-C (Problem Solving and Critical Thinking Questions)			
1	How many relations are there on a set with `n' elements? If a set A has `m' elements and a set B has `n' elements, how many relations are there from A to B? If a set A = {1, 2}, **Recognize** all relations from A to A.	Understand	CO2	ACSB04.05
2	Consider sets A={a,b,c} B={1,2,3},R={(a,1),(b,1),(c,2),(c,3) } and s={(a,1),(a,2),(b,1),(b,2) } from A to B. **Define** (i) $\overline{R}$ (ii) $\overline{S}$ (iii) RUS (iv) R∩S (v) R^c (vi) S^c	Remember	CO2	ACSB04.07
3	Let A={1,2,3,4,6,12) on set A define the relation A to B, iff A divides B.. **Show** that R is partial order relation and draw the Hasse diagram form this relation.	Remember	CO2	ACSB04.08
4	**Describe** Complemented lattice with example.	Remember	CO2	ACSB04.08
5	**Describe** a bijective function. Explain with reasons whether the following functions are bijective or not. Find also the inverse of each of the functions. (i) f(x) = 4x+2, A = set of real numbers (ii) f(x) = 3+1/x, A= set of non- zero real numbers	Understand	CO2	ACSB04.09
6	Let f(x): x^2 -3x+2. Find f(x^2) and f(x+3) and f(2 x^2 +3x+2)?	Understand	CO2	ACSB04.09
7	**Explain** in brief about Inversive and Recursive functions with examples?	Understand	CO2	ACSB04.10
8	Let A={1,2,3,4}, B={a,b,c}, C={w,x,y,z} with f:A→B and g:B→C given by f={(1,a),(2,a),(3,b),(4,c)} and g={(a,x),(b,y),(c,z)} **Find** gof and fog.	Understand	CO2	ACSB04.10

9	Find the value of f(2,5) by using f(x,y) =x+y and the initial value f(2,0)=2	Understand	CO2	ACSB04.10
10	Let: f:R->R is defined as f(x) =$3x^3$+3 then find inverse function	Understand	CO2	ACSB04.10

MODULE – III				
ALGEBRAIC STRUCTURES AND COMBINATORICS				
PART - A (Short Answer Questions)				
1	**Define** group and semi group?	Remember	CO 3	ACSB04.13
2	**Write** short notes on monoid and sub group?	Remember	CO 3	ACSB04.13
3	**Explain** homomorphism?	Remember	CO 3	ACSB04.15
4	**Define** isomorphism?	Remember	CO 3	ACSB04.15
5	**Discuss** if a, b are elements of M and a*b=b*a, then (a*b)*(a*b)=(a*a)*(b*b) where (M,*)is an algebraic system.	Understand	CO 3	ACSB04.13
6	**Explain** whether the given table with respect to operation * on the set 	*	a	b
---	---	---
a	a	b
b	b	b | A={a,b} is a semi group or monoid	Understand	CO 3	ACSB04.13
7	Let(G.*) be a group and let a,b € G, then **Identify** $(a^{-1})^{-1}$=a	Understand	CO 3	ACSB04.13
8	**Show** that the function from < Z,+> to < E,+ > defined by f(x)=x^2 for all x€Z is not a homomorphism.	Remember	CO 3	ACSB04.15
9	Consider the semi groups < Z,+> and < E,+ >. **Define** the function f:Z→E by f(x)=2x for all x€Z is a isomorphism.	Understand	CO 3	ACSB04.14
10	**Define** Subgroup.	Remember	CO 3	ACSB04.13
11	**Define** Submonoid.	Remember	CO 3	ACSB04.13
1	**Identify** the number of ways we can select the counting rules from the class Which having 6 boys and 5 girls	Understand	CO 3	ACSB04.17
2	If a person having 4 trousers and 3 shirts then **Identify** the number of ways of selecting a pair?	Understand	CO 3	ACSB04.18
3	**Recognize** the number of ways of forming three digit number from 5 elements?	Understand	CO 3	ACSB04.18
4	**Discover** the number of ways of selecting 9 committees with 7 persons?	Understand	CO 3	ACSB04.18
5	**Enumerate** the number of ways forming a 4 letter word from the word MIXTURE in which at least one letter is repeated?	Understand	CO 3	ACSB04.18
6	**Report** that if there are 8 cars and 26 passengers at least one car has 4 or more passengers?	Understand	CO 3	ACSB04.18
7	A library contains 30 books whose total number of pages is 2560. **Report** that one of the books must have at least 86 pages?	Understand	CO 3	ACSB04.17
8	**Explain** how many words of three distinct letters can be formed from the letters of the word MAST?	Understand	CO 3	ACSB04.18
9	**Describe,** that in how many different outcomes are possible by tossing 10 similar coins?	Understand	CO 3	ACSB04.17
10	**Identify** in how many different 8 digit numbers can be formed by arranged digits 1, 1,1,1,2,3,3,3.	Understand	CO 3	ACSB04.18
11	**Describe,** that in how many numbers can be formed using the digits 1, 3, 4,5,6,8 and 9 if no repetitions are allowed?	Understand	CO 3	ACSB04.17
12	**Express** how many ways are there to seat 10 boys and 10 girls around a circular table, if boys and girls seat alternatively?	Understand	CO 3	ACSB04.17
13	**Report** in how many ways can the digits 0,1,2,3,4,5,6,7,8,and 9 be arranged so that 0 and 1 are adjacent and in the order of 01?	Understand	CO 3	ACSB04.17

14	**Predict** that in how many ways two slices of pizza can be chosen from a plate containing one slice each of pepperoni, sausage, mushroom, and cheese pizza?	Understand	CO 3	ACSB04.18
15	**Identify** that in how many five letter passwords can be generated using first three letters as any of the English alphabets and last two being any digit from 0 to 9 ?(repetition is allowed)	Understand	CO 3	ACSB04.18
16	**Define** sum rule and product rule?	Understand	CO 3	ACSB04.17
17	If a person is having 3 shirts and 5 ties then **Enumerate** the number of ways of selecting a pair?	Understand	CO 3	ACSB04.18
	PART-B (Long Answer Questions)			
1	**Write** short notes on Ring. Explain Commutative ring and ring with unity.	Understand	CO 3	ACSB04.15
2	Let G be the set of all non-zero real numbers and let a*b= ½ ab. **Show** that <G,*> is an abelian Group.	Understand	CO 3	ACSB04.13
3	Let G be the set of real numbers not equal to -1 and * be defined by a*b = a+b+ab. **Show** that <G,*> is an abelian Group.	Understand	CO 3	ACSB04.13
4	**Show** that in a group (G,*) for every a,b € G$(a*b)^2 = a^2*b^2$ if (G,*) is an abelian.	Understand	CO 3	ACSB04.13
5	**Show** that If A ={1,-1,I,-I} are the fourth roots of unity. Show that (A,*) forms a group.	Remember	CO 3	ACSB04.13
1	**Solve** that the number of ways we can select the counting rules from the class which having 6 boys and 5 girls?	Understand	CO 3	ACSB04.17
2	If a person is having 4 trousers and 3 shirts then **Find** the number of ways of selecting a pair?	Understand	CO 3	ACSB04.18
3	**Solve,** If a person has four transport modems for travelling from(Hyd to Chennai) and three transport modems travelling from(Chennai to Bangalore) then find the no of ways of the person travelling from (Hyd-Bangalore) via Chennai	Understand	CO 3	ACSB04.18
4	a) **Identify** the number of ways of forming three digit numbers from 5elements? b) **Discover the** number of ways of selecting 9 members committee with 7 persons?	Understand	CO 3	ACSB04.18
5	**Solve** that the number **of** ways of arranging 5 boys and 4 girls in a line and the line can start with boy and end with boy also?	Understand	CO 3	ACSB04.17
6	**Recognize** the number **of** ways of forming committee of 5 persons from a group of 5 Indians 4 Russians such that three are at least 3 Indians committee?	Understand	CO 3	ACSB04.17
7	**Solve** that the number **of** ways forming a 4 letter word from the word MIXTURE in which at least one letter is repeated?	Understand	CO 3	ACSB04.17
8	**Report** the number **of** ways we can distribute 12 identical pencils to 4 children such that every children get at least one pencil?	Understand	CO 3	ACSB04.18
9	i) **Describe** that if 8 cars 26 passengers at least one car has 4 or more passengers? ii)A library contain 30 books whose total number of pages are 2560 show that one of the book must have at least 86 pages?	Understand	CO 3	ACSB04.18
	PART-C (Problem Solving and Critical Thinking Questions)			

1	**Solve** whether the following algebraic systems satisfy the properties under binary operations * and +
	     (a) Odd integers
	     (b) All the positive integers.
		Remember	CO 3	ACSB04.13

2	**Solve** that (Z,*) is an abelian group where Z is a set of integers and the binary operations * is defined as a*b = a+b-3	Understand	CO 3	ACSB04.13
3	If o is an operation on Z defined by xoy=x+y+1, Prove that <Z,o> is an abelian group.	Remember	CO 3	ACSB04.13

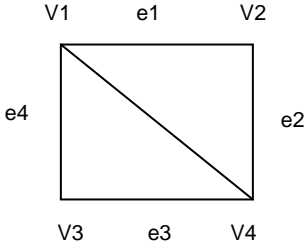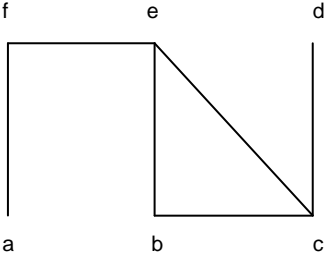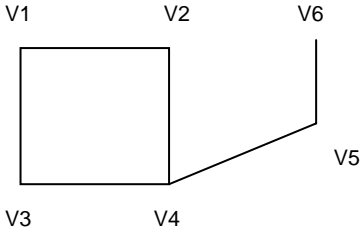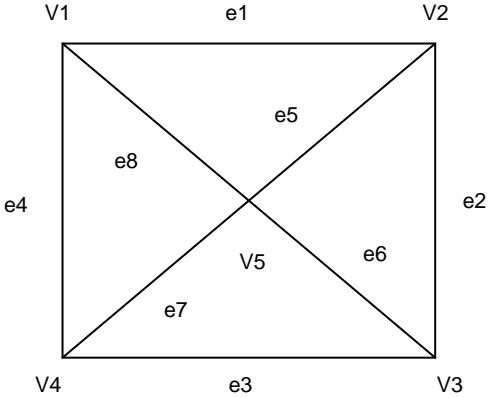| 4	On the set Q of all rational numbers, the operation * is defined by a * b= a+b-ab. Show that, under this operation Q forms a commutative monoid.	Remember	CO 3	ACSB04.13
5	**Show** that a group G is abelian iff $(ab)^{-1} = a^{-1}b^{-1}$ for all a,b€G.	Understand	CO 3	ACSB04.13
1	**Select** the number of rows of 6 Americans, 7 Mexicans and 10 Canadians in which an American invariably stands between a Mexican and a Canadian never stand side by side.	Understand	CO 3	ACSB04.17

2	**Solve** the words.
	   (a) TALLAHASSEE
	   (b) MISSISSIPPI
	How many arrangements can be made such that,
	   (a) No two letters A of TALLAHASSEE appear together
	   (b) Number of 4 letter words for both the given words.
		Understand	CO 3	ACSB04.18

3	**Find** in how many integers between 1 and 10^4 contain exactly one 8 and one 9.	Understand	CO 3	ACSB04.17

4	**Select** in how many integers between 10^5 and 10^6,
	   (i) Have no digit other than 2,5 or8
	   (ii) Have no digit other than 0,2,5 or 8.
		Understand	CO 3	ACSB04.17

5	**Estimate** in how many arrangements are there for the word `MISSISSIPPI` with no two pair of consecutive same letters?	Understand	CO 3	ACSB04.18
6	**Describe,** in how many ways we can distribute 12 identical pencils to 4 children such that every children get at least one pencil?	Understand	CO 3	ACSB04.18
MODULE – IV				

MODULE – IV
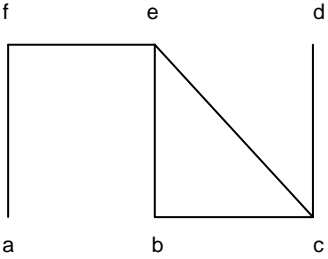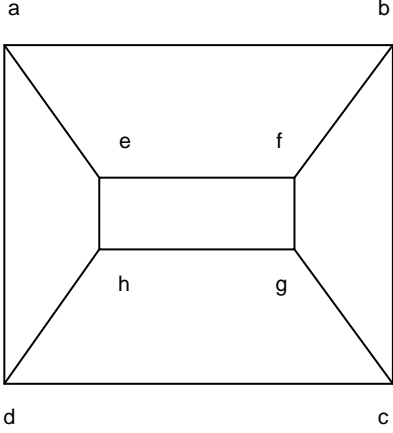
Recurrence Relation

PART - A   (Short Answer Questions)

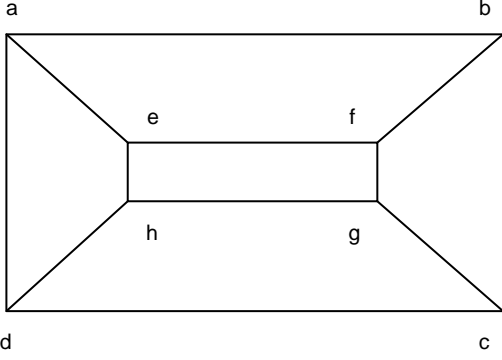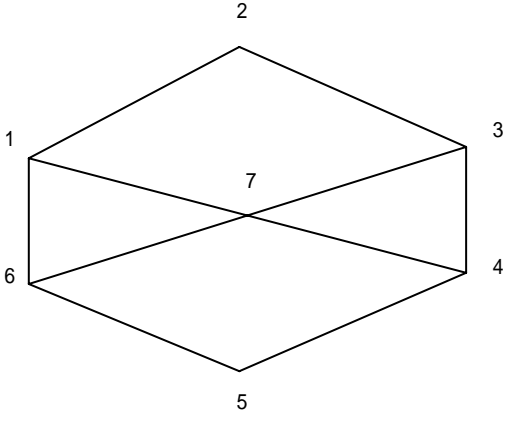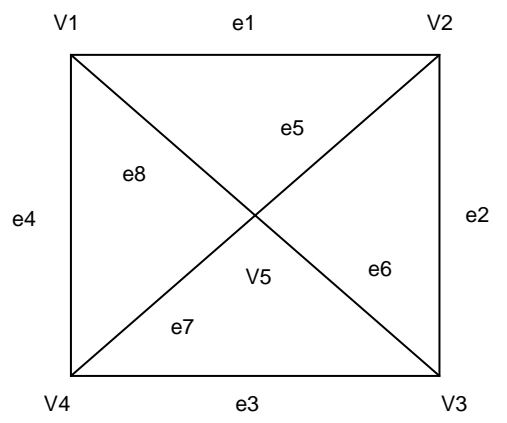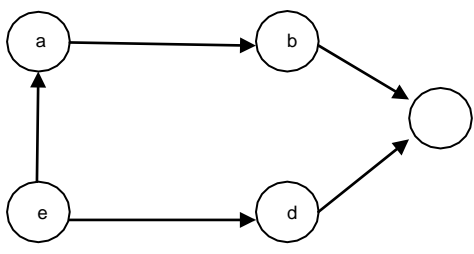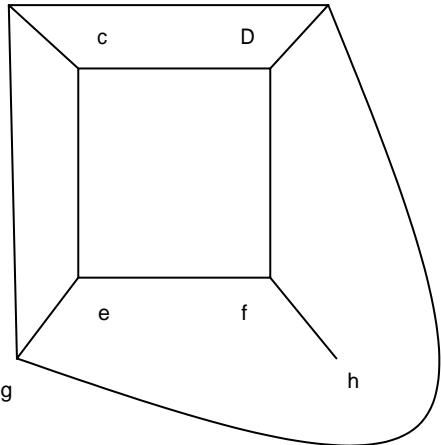| 1	**Discover** the generating function for the following sequence1,2,3,4..	Understand	CO 4	ACSB04.19
2	**Identify** the generating function for the following sequence 1,-2,3,- 4….	Understand	CO 4	ACSB04.19
3	**Predict** the generating function for the following sequence 0,1,2,3...	Understand	CO 4	ACSB04.19
4	**Identify** the generating function for the following sequence 0 ,1,2,3,-4…	Understand	CO 4	ACSB04.19
5	**Estimate** the co-efficient of x^{12} of $x^3(1-2x)^{10}$?	Understand	CO 4	ACSB04.19
6	**Solve** the co-efficient of x^5 of $(1-2x)^{-7}$?	Understand	CO 4	ACSB04.19
7	**Determine** the co-efficient of x^{27} of i)$(x^4+x^5+x^6………….)^5$	Understand	CO 4	ACSB04.19
8	**Identify** the generating function for the following sequence $1^2,2^2,3^2,……….$	Understand	CO 4	ACSB04.19
9	**Discover** the generating function for the following sequence $0^2, 1^2,2^2,3^2,……………$	Understand	CO 4	ACSB04.19
10	**Solve** the co-efficient of x^{27} of $(x^4+2x^5+3x^6………….)^5$	Understand	CO 4	ACSB04.19
11	**Determine** the generating functions for the following sequence $1^3,2^3,3^3,……………$	Understand	CO 4	ACSB04.19
12	**Solve** the recurrence relation $a_n=a_{n-1}+n^3$,n>=1 where a_0=5 by using substitution method ?	Remember	CO 4	ACSB04.21
13	**Solve** the recurrence relation $a_n=a_{n-1}+3n^2 +3n+1$,n>=1 where a_0=5 by using substitution method ?	Remember	CO 4	ACSB04.21
14	**Determine** the generating function for the following sequence $0^3, 1^3,2^3,3^3$,------------	Understand	CO 4	ACSB04.19
15	**Solve** the recurrence relation $a_{n+1}=8a_n$,n>=0 where a_0=4	Remember	CO 4	ACSB04.20
16	**Solve** the recurrence relation $a_{n+1}=8a_n$,n>=0 where a_0=6	Remember	CO 4	ACSB04.20
17	**Determine** the generating function for the following sequence 1,1,0,1,1,1….	Understand	CO 4	ACSB04.19
18	**Determine** the generating function for the following sequence 1,1,,1,1,1….	Understand	CO 4	ACSB04.19

19	**Determine** the generating function for the following sequence 1,-1,1,-1……..	Understand	CO 4	ACSB04.19
20	**Estimate** the co-efficient of x^{27} of $(x^4+x^5+x^6…………)^5$	Understand	CO 4	ACSB04.19
21	**Solve** recurrence relation $a_n=a_{n-1}+n^3$,$n\geq1$ where $a_0=5$ by using substitution method ?	Remember	CO 4	ACSB04.21
22	**Solve** recurrence relation $a_n=a_{n-1}+n$,$n\geq1$ where $a_0=2$ by using substitution method ?	Remember	CO 4	ACSB04.21
	PART-B (Long Answer Questions)			
1	**Identify** the generating functions for the following sequences i)1,2,3,4 ii)1,-2,3,-4 iii)0,1,2,3 iv)0 ,1,-2,3,-4	Understand	CO 4	ACSB04.19
2	**Estimate** the generating function for the following sequence i)$1^2,2^2,3^2$,----------- ii)$0^2, 1^2,2^2,3^2$,-----------	Understand	CO 4	ACSB04.19
3	**Predict** the generating function for the following sequence i)$1^3,2^3,3^3$,-------------ii)$0^2, 1^3,2^3,3^3$,-------------	Understand	CO 4	ACSB04.19
4	**Determine** the generating function for the following sequence 1,1,0,1,1,1	Understand	CO 4	ACSB04.19
5	**Identify** the co-efficient of x^{12} of $x^3(1-2x)^{10}$?	Understand	CO 4	ACSB04.19
6	**Discover** the co-efficient of x^5 of $(1-2x)^{-7}$?	Understand	CO 4	ACSB04.19
7	**Identify** the co-efficient of x^{27} of i)$(x^4+x^5+x^6…………)^5$ ii)$(x^4+2x^5+3x^6…………)^5$	Understand	CO 4	ACSB04.19
8	**Solve** the recurrence relation $a_n=a_{n-1}+n^3$,$n>=1$ where $a_0=5$ by using substitution method ?	Remember	CO 4	ACSB04.21
9	**Solve** the recurrence relation $a_n=a_{n-1}+3n^2$ +3n+1 ,$n>=1$ where $a_0=5$ by using substitution method?	Remember	CO 4	ACSB04.21
10	**Solve** the recurrence relation $a_{n+1}=8a_n$,$n>=0$ where $a_0=4$	Remember	CO 4	ACSB04.20
11	**Solve** the recurrence relation $a_n-7a_{n-1}+10a_{n-2}=0$ $n>=2$,$a_0=10$ $a_1=41$	Remember	CO 4	ACSB04.20
12	**Solve** the recurrence relation $a_n-9a_{n-1}+26a_{n-2}+24a_{n-3}=0$ $n>=3$,$a_0=0$ $a_1=1$ $a_2=10$	Remember	CO 4	ACSB04.20
13	**Solve** the recurrence relation $a_n=3a_{n-1}+2n$ $a_1=3$	Remember	CO 4	ACSB04.21
14	**Solve** the recurrence relation $a_n-3a_{n-1}=n$, $n>=1$ $a_0=1$ by using generating function ?	Remember	CO 4	ACSB04.21
15	**Solve** the recurrence relation $a_{n+1}-a_n=3^n$, $n>=0$ $a_0=1$ by using generating function?	Remember	CO 4	ACSB04.21
16	**Identify** the co-efficient of x^{15} of $x^3(1+x)^4 / (1-x)^4$?	Understand	CO 4	ACSB04.19
17	**Identify** the co-efficient of x^{10} of($x^3-5x) / (1-x)^3$?	Understand	CO 4	ACSB04.19
18	**Solve** the recurrence relation $a_n+a_{n-1}-6a_{n-2}=0$, $n>=2$ $a_0= -1$, $a_1=8$	Remember	CO 4	ACSB04.21
	PART-C (Problem Solving and Critical Thinking Questions)			
1	**Solve** the recurrence relation $a_n-6a_{n-1}+8a_{n-2}=9$, $n>=2$ $a_0=10$, $a_1=25$ by using generating function ?	Remember	CO 4	ACSB04.21
2	**Solve** the recurrence relation $a_{n+2}-7a_{n-1}+10a_n=7*3^n+4^n$, $n>=0$ by using generating function ?	Remember	CO 4	ACSB04.21
3	**Solve** the recurrence relation $a_{n+2}-2a_{n+1}+a_n=2^n$,$n>=0$ $a_0=1$,$a_1=2$ using generating function ?	Remember	CO 4	ACSB04.21
4	**Identify** the co-efficient of x^{52} of i. $(x^4+x^5+x^6…………)^5$ ii. $(x^4+2x^5+3x^6…………)^5$	Remember	CO 4	ACSB04.19
5	**Solve** the recurrence relation $a_n-3a_{n-1}-2a_{n-2}=0$, $n>=2$ where $a_0=5$, $a_1=3$	Remember	CO 4	ACSB04.21
6	**Solve** the recurrence relation $a_{n+3}-3a_{n+2}+3a_{n+1}- a_n =3+5n$, $n>=0$	Remember	CO 4	ACSB04.21
	MODULE – V			
	Graphs and Trees			
	PART - A (Short Answer Questions)			
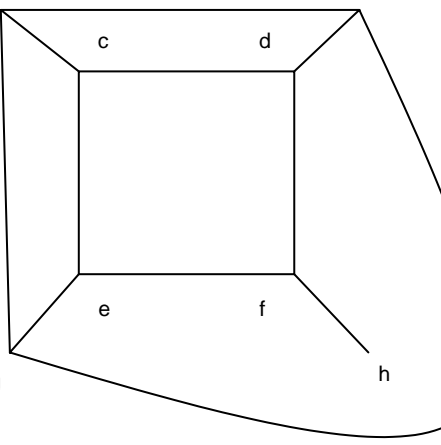
1	**Explain tree** and spanning tree?	Understand	CO 5	ACSB04.22
2	**State** the definition of order and size of a graph?	Understand	CO 5	ACSB04.22

3	**Define**
	  i. Null graph?
	  ii. Isolated vertex?
		Understand	CO 5	ACSB04.22

4	**Define** graph? V1 e1 V2 e4 e2 V3 e3 V4 Write the matrix representation of the above graph.	Understand	CO 5	ACSB04.22
5	**Determine** all spanning trees of given graph? f e d a b c	Understand	CO 5	ACSB04.24
6	**Interpret** the degree of each vertex for the given graph below? V1 V2 V6 V5 V3 V4	Understand	CO 5	ACSB04.22

7	**Enumerate**
	  i) Pendent vertex
	  ii) self-loop
	
	V1 e1 V2
	e5
	e8
	e4 e2
	V5 e6
	e7
	V4 e3 V3
		Understand	CO 5	ACSB04.22

	What are the pendent vertices in the above graph?			
8	**Determine** order, size for the above graph?	Understand	CO 5	ACSB04.22
9	**Define** complete graph?	Understand	CO 5	ACSB04.22
10	**Construct** Hamiltonian graph for the given below graph?	Remember	CO 5	ACSB04.23
11	**Assign** the proper coloring for the below given graph?	Remember	CO 5	ACSB04.22
12	**Identify** chromatic number of given graph?	Remember	CO 5	ACSB04.22

13	**Enumerate** regular graph?	Understand	CO 5	ACSB04.22
14	**Define** multi graph?	Understand	CO 5	ACSB04.22

15	**Determine** order |V| of the graph G=(V,E) in the following cases:
	  i. G is a cubic graph with 9 edges.
	  ii. G is a regular graph with 15 edges.
		Understand	CO 5	ACSB04.22

16	**Define** planar graph? Count the orders and sizes of given graph? 	Understand	CO 5	ACSB04.22
17	**Describe** the matrix representation of graph?	Understand	CO 5	ACSB04.22
18	**Explain** the incidence matrix of graph?	Understand	CO 5	ACSB04.22
19	**Write** the linked list representation of graph? 	Remember	CO 5	ACSB04.22
20	**Define** In-degree and Out-degree of a graph.	Understand	CO 5	ACSB04.22
21	**Define** Loop edges and multiple edges	Understand	CO 5	ACSB04.22
	PART-B (Long Answer Questions)			

1	**Define** graph? explain
	  i) matrix representation
	  ii) incidence matrix
		Understand	CO 5	ACSB04.22

	iii) Linked list representation of graph?			
2	**Explain** tree and spanning tree, find all spanning trees of given graph below? 	Understand	CO 5	ACSB04.24
3	**Discuss** Breadth first search algorithm with an example?	Understand	CO 5	ACSB04.24

4	**Show** that the given graphs are planar?
	    i. A graph of order 5 and size 8.
	    ii. A graph of order 6 and size 12.
		Understand	CO 5	ACSB04.23

5	**Discuss** prim"s algorithm with an example?	Understand	CO 5	ACSB04.25
6	**Explain** krushkal"s algorithm with an example?	Understand	CO 5	ACSB04.25
7	**Define** eulerian graph and explain Euler path and Euler circuit?	Understand	CO 5	ACSB04.23
8	**Enumerate** Hamiltonian graph? **Define** proper coloring and chromatic number of a graph?	Remember	CO 5	ACSB04.23
9	**Demonstrate** isomorphism with an example?	Remember	CO 5	ACSB04.22
10	**Enumerate** a)graph b)simple graph c)degree of vertex d)null graph e)isolated vertex f)pendent vertex g)self-loop h)order i)size j)regular graph k)complete graph	Remember	CO 5	ACSB04.22
11	**Define** Bipartite and Complete Bipartite graphs with Examples.	Remember	CO 5	ACSB04.22
12	**Define** Isolated vertex and Pendant vertex and identify them by taking an example graph.	Remember	CO 5	ACSB04.22
<td colspan="4" align="center">PART-C (Analytical Questions)</td>				
1	**Construct** the spanning tree of given graph by using BFS 	Remember	CO 5	ACSB04.24
3	**Construct** the minimal cost spanning tree for the given below graph using Kruskal"s algorithm?	Remember	CO 5	ACSB04.25

	a 15 b 5 15 3 d 5 g c 18 4 5 15 h 15 f 15 e			
4	a 5 b 14 1 10 4 1 d 8 c e 12 9 6 7 f 2 g **Construct** the minimal cost spanning tree for the above graph using Prim‟s algorithm?	Remember	CO 5	ACSB04.25
5	**Construct** the spanning tree for the below graph by using DFS with vertex in the ordering "**abcfjihdegl**"? B C L A E F D I G H J M K	Remember	CO 5	ACSB04.24

6	**Define** the following
	  i. Walk
	  ii. Trial
	  iii. Circuit
	  iv. Path
	  v. Cycle
		Remember	CO 5	ACSB04.23

HOD, IT