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Table of Contents

Note : Remove "Table of Content" before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

6. 17CS36 : Discrete Mathematical Structures

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	BE
Year / Semester :	2 / III	Academic Year:	2018-19
Course Title:	Discrete Mathematical Structures	Course Code:	18CS36
Credit / L-T-P:	4 /	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	75 Marks
CIA Marks:	30	Assignment	10
Course Plan Author:	Geetha Megharaj	Sign	Dt:
Checked By:		Sign	Dt:

2. Course Content

Module	Module Content	Teaching Hours	Module Concepts	Blooms Level
1	**Fundamentals of Logic**: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems	10	Propositional and Predicate Logic Proof Techniques	L3,L4
2	**Properties of the Integers**: Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. **Fundamental Principles of Counting:** The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition	10	Counting Principles Mathematical Induction and Recursive Definitions	L4
3	**Relations and Functions**: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. **Properties of Relations**, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence	10	Properties and types of Functions properties and types of	L3,L4

	Relations and Partitions		Relations	
4	**The Principle of Inclusion and Exclusion**: The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangement – Nothing is in its Right Place, Rook Polynomials. **Recurrence Relations:** First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.	10	Generalized Principle of Inclusion and Exclusion Recurrence Relations	L4
5	**Introduction to Graph Theory**: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , **Trees**: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes	10	Graph Theory Properties and Application of Trees	L4

3. Course Material

Module	Details	Available
1	Text books	
	1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5 th Edition, Pearson Education. 2004.	In Lib
2	Reference books	
	1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016 2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6 th Edition, McGraw Hill, 2007. 3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010. 4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.	REQ. GIVEN In LIB
3	Others (Web, Video, Simulation, Notes etc.)	
		Not Available

4. Course Prerequisites

SNo	Course Code	Course Name	Module / Topic / Description	Sem	Remarks	Blooms Level

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

B. OBE PARAMETERS

1. Course Outcomes

After studying this course students will be able to

#	COs	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
18CS36.1	Verify the validity of an argument using Propositional and Predicate Logic	7	Propositional and Predicate Logic	Lecture	Assignment and Unit Test	Validate L4
18CS36.2	Construct proofs by applying Direct proof, Indirect proof and Proof by contradiction methods to establish Mathematical Theorems	03	Proof Techniques	Lecture	Assignment	Construct L5
18CS36.3	Solve problems by applying elementary counting techniques such as Permutation, Combination, Combination with Repetition and Binomial Expansion	07	Counting Principles	Lecture	Assignment and Unit Test	Solve and Apply L3
18CS36.4	Construct proofs by applying Mathematical Induction and to define recursive Definitions for Recursive Functions	03	Mathematical Induction and Recursive Definitions	Lecture	Assignment and Unit Test	Construct L5
18CS36.5	Identify and apply properties of Functions in different areas of computing.	05	Properties and types of Functions	Lecture	Assignment and Unit Test	Apply L3
18CS36.6	Understand and apply properties of relations in different domains of computing.	05	Properties and types of Relations	Lecture and Tutorial	Assignment and Unit Test	Apply L3
18CS36.7	Understand and Apply generalized principle of Inclusion and Exclusion and Rook polynomial to solve problems	08	Generalized Principle of Inclusion and Exclusion	Lecture	Assignment and Unit Test	Understand /Apply L2,L4
18CS36.8	Apply First Order and Second order Linear Recurrence Relation to solve problems in different Domains	02	Recurrence Relations	Lecture	Assignment and Unit Test	Solve / Apply L3
18CS36.09	Understand types and Properties of Graphs and verify Graph Isomorphism, identify Euler circuits.	5	Properties and Types of Graphs	Lecture	Assignment and Unit Test	Understand /Verify L2 ,L4
18CS36.10	Understand the properties and types of trees and apply to construct spanning trees, prefix codes and weighted tree	5	Properties,types and applications of Trees	Lecture	Assignment and Unit Test	understand /Construct L2 L5
-	**Total**	**50**	**-**	**-**	**-**	**-**

Note: Identify a max of 2 Concepts per Module. Write 1 CO per concept.

2. Course Applications

SNo	Application Area	CO	Level
1	Propositional and Predicate Logic used for Designing algorithms and circuits	CO1	L4
2	Proof Techniques to Analyze the Algorithms and prove the facts	CO2	L3
3	Properties of Integers in Cryptography	CO3	L4

4	Able to apply to Prove Theorems	CO4	L4
5	Apply Relation concepts in Database Management Systems	CO5	L4
6	Apply to programming Language and static analysis	CO6	L3
7	Apply to solve counting problems in statistics and probability	CO7	L4
8	used to develop computer Algorithms	CO8	L4
9	Graph Theory concepts applied to design efficient algorithms to solve various Computer network problems	CO9	L4
10	Concepts of Trees applied to design and analyze efficient data structure algorithms.	CO10	L3

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

-	Course Outcomes	Program Outcomes												
#	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Level
18CS36.1	Verify the validity of an argument using Propositional and Predicate Logic Illustrate the basic concepts of mathematical logic and predicate calculus	2	3	3										L4
18CS36.2	Construct proofs by applying Direct proof, Indirect proof and Proof by contradiction methods to establish Mathematical Theorems	3	2											L5
18CS36.3	Solve problems by applying elementary counting techniques such as Permutation, Combination, Combination with Repetition and Binomial Expansion	3	2											L3
18CS36.4	Construct proofs by applying Mathematical Induction and to define recursive Definitions for Recursive Functions	2	2											L5
18CS36.5	Identify and apply properties of Functions in different areas of computing.	3	2	2										L3
18CS36.6	Understand and apply properties of relations in different domains of computing.	2	2											L3
18CS36.7	Understand and Apply generalized principle of Inclusion and Exclusion and Rook polynomial to solve problems	3	3											L2,L4
18CS36.8	Apply First Order and Second order Linear Recurrence Relation to solve problems in different Domains Construct recurrence relations and generating functions.	2	3											L3
18CS36.09	Understand types and Properties of Graphs and verify Graph Isomorphism, identify	3	3	2										L2,L4

	Euler circuits. Analyze the importance of Graph Theory and its real time applications.													
18CS36.10	Understand the properties and types of trees and apply to construct spanning trees, prefix codes and weighted tree	**3**	**3**											L2,L5
Note: Mention the mapping strength as 1, 2, or 3														

4. Mapping Justification

Mapping		Justification	Mapping Level
CO	**PO**	**-**	**-**
CO1	PO1	The Validity and correctness of facts can be verified Using predicate and propositional logic	2
CO1	PO2	Predicate logic identifies sequence of valid statements to produce required outputs in designing algorithms .	3
CO1	PO3	Able to construct logical proofs as logic plays a major role in formal languages and design of hardware and software.	3
CO2	PO1	Proof Techniques used to Analyze the Algorithms and prove the known facts.	3
CO2	PO2	The proof techniques can be used to verify the complex engineering solutions	2
CO3	PO1	Knowledge of Counting techniques required to solve problems of statistics and probability	3
CO3	PO2	Counting techniques applied to solve problems of statistics and probability	2
CO4	PO1	Knowledge of Mathematical Induction required to prove known facts	2
CO4	PO2	The proof techniques can be used to verify the complex engineering solutions	2
CO5	PO1	The knowledge about Functions is required to understand its role in analysis of algorithms	3
CO5	PO2,PO3	Function concepts are used to design and analyse the algorithms.	2
CO6	PO1	The knowledge of Relations required to understand its role in analysis of algorithms	2
CO6	PO2,PO3	concepts of Relations are used to design and analyse the algorithms.	2
CO7	PO1	Knowledge of principle of inclusion and exclusion required to solve counting problems	3
CO7	PO2	principle of inclusion and exclusion applied to solve counting problems	3
CO8	PO1	Knowledge of recurrence relations required to write efficient recursive functions	2
CO8	PO2	Recurrence relations helps to analyze the complexity of algorithms	3
CO9	PO1	Knowledge of Graph theory is required to understand concepts of Computer network.	3
CO9	PO2	Graph theory applied to alalyse efficient algorithms to solve various Computer network problems	3
CO9	PO3	Graph theory used to design and analyze efficient algorithms to	2

		solve various Computer network problems	
CO10	PO1	Knowledge of Trees is required to understand data structure concepts.	3
CO10	PO3	Concepts of Trees is applied to design and analyze efficient data structure algorithms.	3

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

Note: Write Gap topics from A.4 and add others also.

6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Module #	Title	Teaching Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Fundamentals of Logic:	10	2	-	-	1	1	2	CO1, CO2	L4, L3
2	Properties of the Integers, Fundamental Principles of Counting	10	2		-	1	1	2	CO3, CO4	L4
3	Relations and Functions:	10	-	2	-	1	1	2	CO5, CO6	L3, L4
4	The Principle of Inclusion and Exclusion, Recurrence Relations	10	-	2	-	1	1	2	CO7, Co8	L4
5	Introduction to Graph Theory	10	-	-	4	1	1	2	CO9, CO10	L3,L4
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

Note: Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	30	CO1, CO2, CO3, CO4	L2,L3,L4
CIA Exam – 2	30	CO5, CO6, CO7, Co8	L3,L4
CIA Exam – 3	30	CO9, CO10	L1,L2,L3,L4
Assignment - 1	10	CO1, CO2, CO3, CO4	L2,L3,L4
Assignment - 2	10	CO5, CO6, CO7, CO8	L3,L4
Assignment - 3	10	CO9, CO10	L2,L3,L4
Seminar - 1			
Seminar - 2			
Seminar - 3			
Other Activities – define – Slip test			
Final CIA Marks	**40**	**-**	**-**

Note : Blooms Level in last column shall match with A.2 above.

D1. TEACHING PLAN - 1

Module - 1

Title:	**Fundamentals of Logic**:	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Understand and use notations of Propositional Logic, understand and apply rules of Logic to identify logically equivalent expressions, understand and apply Rules of Inference to validate Quantified arguments	CO1	L4
2	Apply Direct, Indirect and Proof by contradiction methods to establish Mathematical Theorems	CO2	L4
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Basic Connectives and Truth Tables.	Co1	L2
2	Logic Equivalence – The Laws of Logic and problems	Co1	L2
3	Logical Implication – Rules of Inference	Co1	L2
4	Problems on Logical Implication – Rules of Inference	Co1	L4
5	Quantifiers	Co1	L2
6	Definition and examples for Quantifiers	Co1	L2
7	The Use of Quantifiers	Co1	L3
8	Definitions and the Proofs of Theorems	Co2	L3
9	Problems on Proof of Theorems	Co2	L4
10	Problems on Proof of Theorems	Co2	L4
11			
12			
13			
14			
15			
16			
c	**Application Areas**	**CO**	**Level**
1	Programming	CO1	L3
2	Analysis of Algorithms	CO2	L4

d	**Review Questions**	-	-
1	Prove the following logical equivalence i)[(pvq) ∧ (pv~q)vq] (pvq) ii)p → (q → r) ↔ (p ∧ q) → r	CO1	L4
2	For any statements p, q prove that i) ~(p ↓ q) (~p ↑ ~q) ii)~(p ↑ q) (~p ↓ ~q)	CO1	L4
3	Write converse, inverse and contrapositive of the statement " if a triangle is not isosceles then it is not equilateral.	CO1	L3
4	Establish validity of the argument. (p → q) ∧ (q → r ∧ s) ∧ (~ r v (~t V u)) ∧ (p∧t) → u	CO1	L4
5	Give indirect proof of the statement "The product of two even integers is an even integer"	CO2	L4
6	Write down negation of the following statements. i) For all integers n, if n is divisible by 2 then n is odd ii) if k, m, n are any integers, where (k-m) and (m-n) are odd then (k-n) is even.	CO1	L3
7	Verify the principle of duality for the following logical equivalence. ~ (pvq) → (~pv (~pvq)) ↔ (~pvq)	CO1	L4
8	Establish validity of the argument (~ pv~q) → (r ∧ s) r → t ~t therefore p	CO1	L4
9	Prove that if m is an even integer then m+7 is odd integer by contradiction proof method.	CO2	L4
10	Test the validity of the argument " If Raju goes out with his friends, he will not study. If Ravi do not study his father become angry.His father is not angry. Therefore Ravi has not gone out with his friends.	CO1	L4
11			
e	**Experiences**	-	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

Module – 2

Title:	Properties of Integers	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Solve counting problems by applying elementary techniques such as Permutation, Combination, Combination with Repetition and Binomial Expansion	CO3	L4
2	State and construct the Principle of Mathematical Induction proofs for arguments involving summations, inequalities, and divisibility and to define recursive Definitions for Recursive Functions	CO4	L4
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	**Properties of the Integers:** Mathematical Induction	CO4	L2
2	The Well Ordering Principle – Mathematical Induction	CO4	L2
3	Recursive Definitions, Examples	CO4	L3
4	Fundamental Principles of Counting: The Rules of Sum and Product,	CO3	L2

5	Permutations, Examples	CO3	L3
6	Combinations, Examples	CO3	L3
7	The Binomial Theorem, Examples	CO3	L3,L4
8	The Binomial Theorem, Examples	CO3	L3,L4
9	Combinations with Repetition, Examples	CO3	L3,L4
10	Combinations with Repetition, Examples	CO3	L2,L3,L4
c	**Application Areas**	**CO**	**Level**
1	Cryptography	CO3	L3
2		CO4	L4
d	**Review Questions**	-	-
1	In how many ways can seven people be arranged in a circular table ? if two people insist on sitting next to each other, how many arrangements are possible ?	CO3	L3
2	find the coefficient of v^2w^4xz in the expansion of $(3v+2w+x+y+z)^8$	CO3	L3
3	A gym teacher must select 9 girls from junior and senior classes for a volleyball team. a) If there are 28 juniors and 25 seniors are there how many selections are possible? If two juniors and one senior are best spikers and must be in team. Then how many ways the rest of the team can be chosen?	O3	L3
4	Prove that $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}.$	CO4	L4
5	A message is made up of 12 different symbols and is to be transmitted through a communication channel. In addition to the 12 symbols, the transmitter will also send a total of 45 spaces between the symbols, with at least 3 spaces between each pair of consecutive symbols. In how many ways can the transmitter send such message ?	CO3	L3
6	Prove by Mathematical Induction that, for every positive integer n, 5 divides n^2-n	CO4	L4
7	A certain question paper contains 3 parts. A,B,C with four questions in part A , 5 questions in part B and 6 questions in part C. It is required to answer several questions selecting at least two questions from each part. In how many ways can a student select his 7 questions for answering	CO3	L3
8	Find an explicit definition of the sequence defined recursively by $a_1=7$, $a_n=2a_{n-1}+1$ for n>=2	CO4	L3
e	**Experiences**	-	-
1		CO1	L2
2			
3			
4		CO3	L3
5			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	17Cs36	Sem:	III	Marks:	30	Time:	75 minutes
Course:	Discrete Mathematical Structures						

-	-	**Note: Answer any 3 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Let p, q be primitives statements for which implication p → q is false. Determine the truth values of the following. i)pVq ii) (p v q) (q v p)	4	CO1	L2
	b	Prove that if m is an even integer then m+7 is odd integer by contradiction proof method.	6	CO2	L4
	c	Establish validity of the argument : p → q $q \rightarrow (r \wedge s)$ $\neg r \vee (\neg t \vee u)$ $p \wedge t$ therefore u	5	CO1	L4
	d				
2	a	Define dual of logical statement. Verify principle of duality for the following logical equivalence $[\neg(p \wedge q) \rightarrow \neg p \vee (\neg p \vee q)] \Leftrightarrow (\neg p \vee q)$	5	CO1	L3
	b	Prove that for all integers k and l, if k and l both are odd, then k+l is even and kl is odd by direct proof.	4	CO2	L4
	c	Define converse, inverse and contrapositive of a conditional statement. Also state converse, inverse and contrapositive of the statement " If a triangle is not isosceles, then it is not equilateral"	6	CO1	L3
	d				
3	a	a) How many arrangements are there of all letters in " SOCIOLOGICAL " b)In how many arrangements A and C are together c)In how many arrangements all Vowels are adjacent ?	4	CO3	L3
	b	Find explicit definition of the sequence defined by a1=7, $a^n=2a^{n-1}+1$ for $n \geqslant 2$	4	CO4	L3
	c	A message is made up of 12 different symbols and is to be transmitted through a communication channel. In addition to the 12 symbols, the transmitter will also send a total of 45 spaces between the symbols, with at least 3 spaces between each pair of consecutive symbols. In how many ways can the transmitter send such message ?	7	CO3	L3
	d				
4	a	By mathematical induction prove that , for every positive integer n,the number $A^n= 5^n+2.3^n-1+1$ is multiple of 8		CO4	L4
	b	Find coefficient of x^4y^4 in the expansion of $(2x^3-3xy^2+z^2)^{16}$		CO3	L3
	c	Find number of possible arrangements of letters of the word " TALLAHASSEE" ?. How many arrangements have no adjacent A's		CO3	L3
	d				

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions

CS

Crs Code:	17CS36	Sem:	III	Marks:	5	Time:	90 – 120 minutes
Course:	Discrete Mathematical Structures						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		Define tautology. Prove that for any propositions p,q,r the following compound proposition is a tautology: $[(p \vee q) \{(p \rightarrow r) \wedge (q \rightarrow r)\}] \rightarrow r$	5	CO1	L3
2		Let p, q be primitives statements for which implication p → q is false. Determine the truth values of the following. i)pVq ii) (p v q) (q v p)		CO1	L2
3		Find inverse, converse and contrapositive of the following If the statement is divisible by 21 then it is divisible by 7		CO1	L2
4		Find inverse, converse and contra positive of the following: if 0+0=0 then 2+2=1	5	CO1	L2
5		Let p,q,r be the propositions having truth values 0,0 and 1respectively.find the truth values of the following compound propositions I) $(p \wedge q) \rightarrow r$ ii)$(p) \rightarrow (q \wedge r)$ iii) $p \wedge (r \rightarrow q)$iv) $p \rightarrow (q \rightarrow (\neg r))$		CO1	L2
6		Establish validity of the following arguments $\forall x, [p(x) \vee q(x)]$ $\exists x, \neg p(x)$ $\forall x, [\neg r(x) \vee r(x)]$ $\forall x, [s(x) \rightarrow \neg r(x)]$ therefore $\exists x \neg s(x)$		CO1	L4
7		Establish validity of the argument : $p \rightarrow q$ $q \rightarrow (r \wedge s)$ $\neg r \vee (\neg t \vee u)$ $p \wedge t$ therefore u		CO1	L4
8		Define dual of logical statement. Verify principle of duality for the following logical equivalence $[\neg(p \wedge q) \rightarrow \neg p \vee (\neg p \vee q)] \Leftrightarrow (\neg p \vee q)$		CO1	L3
9		Define converse, inverse and contrapositive of a conditional statement. Also state converse, inverse and contrapositive of the statement " If a triangle is not isosceles, then it is not equilateral"		CO1	L3
10		Give i)Direct Proof ii) Indirect proof ii) Proof by contradiction, for the statement " If n is an odd integer , then n+11 is an even integer		CO2	L4
11		Prove that for all integers k and l, if k and l both are odd, then k+l is even and kl is odd by direct proof.		CO2	L4
12		Give i)Direct proof ii)proof by contradiction for the following statement. " If n is an odd integer, then n+9 is an even integer		CO2	L4
13		Prove that every positive integer $n \geqslant 24$can be written as sum of 5's and 7's.		CO2	L3
14		Prove that for all real numbers x and y , if x+y > 100, then x>50 or y > 50		CO2	L3

CS

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15		Find number of arrangements of letters of the word "MASSASAUGA"		CO3	L3
16		a) How many arrangements are there of all letters in " SOCIOLOGICAL " b)In how many arrangements A and C are together c)In how many arrangements all Vowels are adjacent ?		CO3	L3
17		A committee of 15 having 9 women and 6 men to be seated at a circular table . In how many ways seats be arranged so that no two men seated next to each other		CO3	L3
18		Find number of possible arrangements of letters of the word " TALLAHASSEE" ?. How many arrangements have no adjacent A's		CO3	L3
*19		In how many ways can we distribute 7 apples and 6 oranges among 4 children so that each child gets at least 1 apple		CO3	L3
20		Derive formula to find number of compositions of 7		CO3	L4
21		Consider compositions of 20 I) how many have each summand Even? ii) how many have each summand multiple of 4		CO3	L3

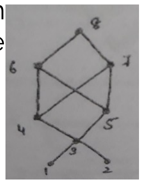
22		How many times print statement executed in the following program segment?
		For i=1 to 20
		for j=1 to I do
		for k=1 to k do
		print((i*j)+(k*m))
				CO3	L3

23		Find coefficient of a^5b^2 in the expansion of $(2a-3b)^7$		CO3	L3
24				CO3	L3
25		Find coefficient of x^4y^4 in the expansion of $(2x^3-3xy^2+z^2)^{16}$		CO3	L3
26		Find coefficient of $a^2b^3c^2d^5$ in the expansion of $(a+2b-3c+2d+5)^{16}$		CO3	L3
27		Prove by mathematical Induction that, for every positive integer n, 5 divides n^5-n		CO4	L4
28		By mathematical induction prove that , for every positive integer n,the number A^n= 5^n+2.3^n-1 + 1 is multiple of 8		CO4	L4
29		How many positive integers n can we form using the digits 3,4,4,5,5,6,7 if we want n to exceed 5,000,000		CO3	L3
30		For Fibonacci sequence F0,F1,F2..........Prove that Fn= $\frac{1}{\sqrt{5}}[\left(\frac{(1+\sqrt{5})}{2}\right)^n-\left(\frac{(1-\sqrt{5})}{2}\right)^n]$		CO4	L4
31		If L0,L1,L2... are Lucas numbers, prove that Ln =$[\left(\frac{(1+\sqrt{5})}{2}\right)^n+\left(\frac{(1-\sqrt{5})}{2}\right)^n]$		CO4	L4
32		Prove that for each n$n \in z^{+¿¿}$ $1^2+2^2+3^2+..........+n^2 = \frac{1}{6}n(n+1)(2n+1)$		CO4	L4
33		Find explicit definition of the sequence defined by a1=7, a^n=$2a^{n-1}$ + 1 for $n \geqslant 2$		CO4	L2
34		Obtain recursive definition for the sequence an in each of the following I) $a_n=5^n$ ii) $a_n=2-(-1)^n$		CO4	L3
40		Give i)Direct Proof ii) Indirect proof ii) Proof by contradiction, for the statement " If n is an odd integer , then n+11 is an even integer			L4
41					

D2. TEACHING PLAN - 2

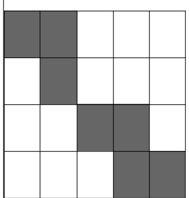
Module – 3

Title:	Relations and Functions	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	State and Identify plain, one to one and onto Functions, composition and Inverse Functions and use of Pigeon Hole principle to solve mapping problems.	CO5	L3
2	Understand Relations and their types, Identify partition induced by an Equivalence relation and Hasse Diagram representation of Partial Order Relations and External elements of POSET	CO6	L4
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	**Relations and Functions:** Cartesian Products and Relations	C5	L2
2	Functions – Plain, One-to-One and Onto	C5	L3
3	The Pigeon-hole Principle, Examples	C5	L4
4	Function Composition and Inverse Functions	C5	L4
5	Properties of Relations, Computer Recognition – Zero-One	C5	L3
6	Matrices and Directed Graphs	C5	L3
7	Partial Orders – Hasse Diagrams	C6	L4
8	Equivalence Relations and Partitions.	C6	L4
9	Problems Equivalence Relations	C6	L4
10	Problems Inverse Functions	C6	L3
11			
12			
13			
14			
15			
16			
c	**Application Areas**	**CO**	**Level**
1	Programming	CO1	L3
2	Data Structures and Analysis of Algorithms	CO2	L4
d	**Review Questions**	-	-
1	Let A={2,3,4,6,8,12,24} and let<= denotes the partial order of divisibility that is x<=y means x|y. Let B = {4,6,12}. Determine: a)All upper bounds of B , b) All lower bounds of B, c) Least upper bound of B, d)Greatest lower bound of B	CO6	L3
2	Let A={1,2,3,4,6} and R be the relation on A defined by(a,b) belongs to R if and only if a is a multiple of b. write down R as a set of ordered pairs.	CO6	L3
3	Prove that if f:A→B and g:B→C are invertible functionn then g of :A→C is an invertible function and $(gof)^{-1}=f^{-1}og^{-1}$.	Co5	L4
4	Let A={1,2,3,4,5}.Define a relation then AXA by (x1,y1) R (x2,y2) if and only if x1+y1=x2+y2. i)Determine whether R is an equivalence relation on AXA. ii)Determine equivalence class [(1,2)] [(2,5)].	Co5	L4
5	Find the number of ways of distributing four distinct objects among three identical containers,with some container(s) possibly empty.	Co5	L4
6	Let f,g,h be functions from Z to Z defined by	Co5	L4

	f(x)=x-1,g(x)=3x, h(x)= { 0, if x is even and 1, if x is odd. Determine (f0(g0h))(x) and verify that f0(g0h)=(f0g)0h).		
7	Consider a Poset whose Hassee diagram is given below. Consider B={3,4,5} for the following figure below. Find:  a) All upper bounds of B b)All lower bounds of B c) The least upper bound of B d)The greatest lower bound of B e)Is this a lattice.	Co6	L3
8(Afo)U(B	For any non-empty sets A,B,A,prove the following results: 1) AX(BUC)=(AXB)U(AXC) 2) (AUB)XC=(AXC)U(BXC) 3)AX(B∩C)=(AXB)∩ (AXC) 4)(A∩B)XC=(AXC)∩(BXC) 5)AX(B-C)=(AXB)-(AXC)	Co5	L4
e	experiences		
1			
2			
3			
4			
5			

Module – 4

Title:	Principle of Inclusion and Exclusion	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-		-	**Level**
1	Understand and Apply generalized principle of Inclusion and Exclusion and Rook polynomial to solve problems	CO7	L4
2	Apply First Order and Second order Linear Recurrence Relation to solve problems on integer series	CO8	L4
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	The Principle of Inclusion and Exclusion:	CO7	L2
2	Problems Principle of Inclusion and Exclusion.	CO7	L3
3	Generalizations of the Principle.	CO7	L3
4	Derangements – Nothing is in its Right Place,	CO7	L4
5	Derangements – examples Contd.....	CO7	L4
6	Rook Polynomials.	CO7	L3
7	Problems Rook polynomial	CO7	L4
8	Recurrence Relations: First Order Linear Recurrence Relation,	CO8	L4
9	The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients	CO8	L4
10	Problems	CO8	L4
11			
12			
13			

14			
15			
16			
c	**Application Areas**	**CO**	**Level**
1	Apply to solve counting problems	CO8	L3
2	used to develop computer Algorithms	CO7	L4
d	**Review Questions**	-	-
1	Explain Generalization of Principle Inclusion and Exclusion.	CO7	L4
2	Five teachers T1,T2,T3,T4,T5 are to be made class teachers for 5 classes C1,C2,C3,C4,C5, one teacher for each class. T1, T2 do not wish to become the class teachers for C1 or C2. T3 and T4 for C4 or C5. And T5 for C3 or C4 or C5. In how many ways can the teachers be assigned work without displacing any teachers	CO7	L4
3			
4	Solve the recurrence relation $a_{n+2}-6a_{n+1}+9a_n=3\cdot2^n+7\cdot3^n$ for n>=0,given $a_0=1,a_1=4$.	CO8	L4
5	Solve the recurrence relation $a_{n+1}-3^n$,n>=0 with $a_0=1$ by using method of generating function.	CO8	L4
6	Determine the number of positive integers n such that 1<=n<=100 and n is not divisible by 2,3,0r 5.	CO7	L4
7	Find the number of permutations of the digits 1 through 9 in which (a) the blocks 23,57,468 do not appear.(b)the blocks 36,78,672 do not appear.	CO7	L4
8	Find the number of permutations of the letters a,b,c,….,x,y,z in which none of the patterns spin,game or net occurs.	CO7	L4
9	Determine the number of integers between 1 and 300(inclusive) which are (i) divisible by exactly two of 5,6,8 and (ii) divisible by atleast two of 5,6,8.	CO7	L4
10	In how many ways can we distribute 24 pencils to 4 children so that each child gets atleast 3 pencils but not more than 8.	CO7	L4
11	Define Derangement.Find the number of drangements of 1,2,3,4.List all the drangements.	CO7	L4
12	Four persons P1,P2,P3,P4 who arrive late for a dinner party find that only one chair at each of five tables T1,??T2,T3,T4,T5 is vacant.P1 will not sit at T1 otr T2,P2 will not sit at T2,P3 will not sit at T3 or T4 and P4 will not sit at T4 or T5.Find the number of ways they can occupy the vacant chairs. 	CO7	L4
13	The number of virus affected files in a system is 1000 (to start with) and this increases 250% every two hours. Use a recurrence relation to determine the number of virus affected files in the system after one day.	CO8	L4
14	Solve the recurrence relation $a_{n+2}-8a_{n+1}+16a_n=8(5^n)+6(4_n)$ where,n>=0 and $a_0=12,a_1=5$.	CO8	L4
15	Solve the recurrence relation $a_{n+1}-a_n=3^n$,n>=0,$a_0=1$.	CO8	L4
e	**Experiences**	-	-
1		CO7	L2

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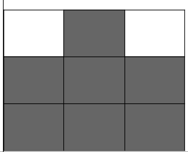
2			
3			
4		CO8	L3
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	CS501PC	Sem:	I	Marks:	30	Time:	75 minutes
Course:	Design and Analysis of Algorithms						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Let A= {1,2,3,4} and let R be the relation defined by R = {(x,y)| x,y belongs to A, x<=y}.Determine whether R is reflexive, symmetric, Anti symmetric or transitive.	4	CO5	L3
	b	Define a relation R on B as (a, b) R (c, d) if a + b = c + d. show that R is an equivalence relations. 1)reflexive 2) symmetric 3) Irreflexive 4) Anti symmetric 5) transitive relations:	6	CO5	L3
	c	Let A={2,3,4,6,12,}.On A,define the relation R by aRb if and only if a divides b. Prove that R is a partial order on A. Draw the Hasse diagram for this relation.	5	CO6	L3
	d				
2	a	For the equivalence relation R={(1,1),(1,2),(2,1)((2,2),(3,4),(4,3),(3,3),(4,4)} defined on the set A={1,2,3,4},determine the partition induced.	4	CO6	L3
	b	Let f: R→R be defined by f(x)={3x-5,for x>0 and -3x+1,for x<=0}. i)Determine f(5/3),$f^{-1}(3)$,$f^{-1}([-5,5])$. ii)Also prove that if 30 dictionaries contain a total of 61,327 pages,then at least one of the dictionary must have at least 2045 pages.	6	CO5	L4
	c	Let A={1,2,3,4,5,6,7,8,9,10,11,12}.On this set define the relation R by (x,y) ∈ R if and only if x-y is a multiple of 5.Verify that R is an equivalence relation.	5	CO6	L3
	d				
3	a	Out of 30 students in a hostel,15 study History,8 study Economics,and 6 study Geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects.	5	CO7	L4
	b	The number of virus affected files in a system is 1000 (to start with) and this increases 250% every two hours.Use a recurrence relation to determine the number of virus affected files in the system after one day.	4	CO8	L4
	c	Find the rook polynomial for the shaded part. 	6	CO7	L3
	d				
4	a	In how many ways can we distribute 24 pencils to 4 children so that each child gets atleast 3 pencils but not more than 8.	4	CO7	L4
	b	Solve the recurrence relation $a_{n+2}-6a_{n+1}+9a_n=3\cdot2^n+7\cdot3^n$ for n>=0,given $a_0=1,a_1=4$.	5	CO8	L4
	c	Find the number of the integers from 1 to n such that in each derangement. i)the elements in the first k places are 1,2,3,...k in some order. ii)the elements in the first n-k places are k+1,K+2,,,,n in some order.	6	Co7	L4

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	d				

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	CS501PC	Sem:	I	Marks:	5 / 10	Time:	90 – 120 minutes
Course:	Design and Analysis of Algorithms						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

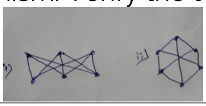
SNo	USN	Assignment Description	Marks	CO	Level
1		A= {1,2,3,4} B={2,5} C= {3,4,7} Determine: 1)AXB 2) BXA 3) AU (BXC) 4) (AUB)XC 5) (AXC)U(BXC)		CO5	L4
2		A = {1, 2, 3} find a. R_1 = {(1, 1) (2, 2) (3, 3)} b. R_2 = {(1, 2) (2, 1) (1, 3) (3, 1) (2, 3), (3, 2)} c. R_3 = A x A		CO5	L4
3		Let a function f:R→R be defined by f(x)=x^2+1. Find the images of A_1={2,3}, A_2={-2,0,3},A_3=(0,1) and A4=[-6,3].		Co5	L4
4		Define the following with one example for each i) Function ii) one-to one function iii) onto function.		Co5	L4
5		Let f: R ▭ R g: R ▭ R be defined by f(x) = X^2 and g(x) = x+5. Determine fog and gof show that he composition of two function is not commutative.		Co5	L4
6		State the pigeonhole principle. An office employs 13 clerks. Show that at least 2 of them will have birthdays during the same month of the year.		Co5	L4
7		let A,B,C be any three non-empty sets and A=B=C={set of real numbers} (B , g: f: B (C be function defined by f(a) = a+1 and g(b) = b2 + 2, find f: A gof (-2), b. fog (-2), c. gof(x) , d. gog(x)		Co5	L4
8		Let A={1,2,3,4,} f and g be functions from A to A given by: f={(1,4) (2,1) (3,2)(4,3)} g={(1,2) (2,3) (3,4) (4,1)} Prove that f and g are inverses of each other.		Co5	L4
9		What is the partition of a set? If R = {(1,1),(1,2),(2,1),(2,2),(3,4) (4,3),(3,3),(4,4)} defined on the set A = {1,2,3,4}. Determine the partition induced.		Co6	L3
10		If R = {(1,1),(1,2),(2,1),(2,2),(3,4)(4,3),(3,3),(4,4)} defined on the set A= {1,2,3,4}. Determine the partition induced.		Co6	L3
11		Define partial order. If R is a relation on A ={1,2,3,4} defined by X R Y if x|y.prove that (A,R) is a POSET. Draw its Hasse diagram.		Co6	L3
12		Draw the HasseDiagram representing the positive divisors of 36		Co6	L3
13		Let A= {1,2,3,4,5} . Define a relation R on AXA by (x1,y1)R(x2,y2) if and only if x1+y1=x2+y2		Co6	L3
14		In how many ways can one arrange the letters in the word CORRESPONDENTS so that i)there is no pair of consecutive identical letters? ii)There are exactly two pairs of consecutive identical letters?		Co7	L4
15		An apple,a banana,a mango and an orange are to be distributed to four boys B_1,B_2,B_3 and B_4.The boys B_1 and B_2 do not wish to have apple,the boy,B_3 does not want banana or		Co7	L4

		mango and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased?			
16		Determine the number of positive integers n such that 1<=n<=100 and n is not divisible by 2,3 or 5		Co7	L4
17		In how many ways can we arrange the numbers 1,2,3,4,.....10 so that 1 is not in the first place,2 is not in the second place,and so on,and 10 is not in 10^{th} place.		Co7	L4
18		Find the number of the integers from 1 to n such that in each derangement. i)the elements in the first k places are 1,2,3,...k in some order. ii)the elements in the first n-k places are k+1,K+2,,,,n in some order.		Co7	L4
19		There are eight letters to eight different people to be placed in eight different addressed envelopes. Find the number of ways of doing this so that at least one letter gets to the right person.		Co7	L4
20		Find the rook polynomial for the 3*3 board y using the expansion formula.		Co7	L4
21		Solve the recurrence relation $a_n=3a_{n-1}-2a_{n-2}$ for n>=2 given that $a_1=5$ and $a_2=3$.		Co8	L4
22		Find the generating function for recurrence relation $a_{n+1}-a_n=n^2$,n>=0 and $a_0=1$.		Co8	L4
23		A bank pays a certain % of annual interest on deposits, compounding the interest once in 3 months.If a deposit doubles in 6 years and 6 months,what is the annual % of interest paid by the bank.		Co8	L4
24		Find the number of permutations of English letters which contain exactly two of the patterns car dog, pun or byte.			
25		A girl student has sarees of 5 different colors Blue Green red White and Yellow. On Mondays she does not wear Green, On Tuesdays Blue or Red , on Wednesdays Blue or Green. On Thursdays Red or Yellow, on Fridays Red. In how many ways can she dress without repeating a color during a week ?			
26					
27					

D3. TEACHING PLAN - 3

Module – 5

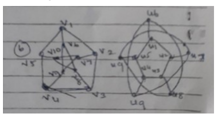
Title:	Introduction to Graph Theory	Appr Time:	10 Hrs
a	***Course Outcomes***	-	**Blooms**
-		-	**Level**
1	Understand types and Properties of Graphs and verify Graph Isomorphism, identify Euler circuits.	CO9	L3
2	Understand the properties and types of trees, construction of spanning trees, prefix codes and weighted tree	CO10	L4
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction to Graph Theory: Definitions and Examples		
2	Sub graphs, Complements		
3	Graph Isomorphism, Examples		
4	Vertex Degree		
5	Euler Trails and Circuits		
6	Trees: Definitions, Properties.		
7	Examples		

8	Routed Trees, Trees and Sorting,		
9	Weighted Trees and Prefix Codes		
10	Prefix Codes Examples		
11			
12			
13			
14			
15			
16			
c	**Application Areas**	**CO**	**Level**
1	Able to apply Graph theory for Computer network	CO10	L3
2	Able to apply tree concepts to generate prefix codes to encode and decode text messages	CO9	L4
d	**Review Questions**	-	-
1	Define i)Bipertite Graph ii)Complete Bipertite Graph iii)Regular Graph iv) Complete Graph	CO10	L1
2	Define Graph Isomorphism. Verify the two Graphs are Isomorphic 	CO10	L3
3	Show that Tree with n vertices has n-1 edges	CO9	L2
4	Obtain optimal prefix code for the message ROAD IS GOOD	CO9	L4
5	Define optimal tree and construct optimal tree for a given set of weights { 4,15,25,5,8,16 }		L2
6			L5
7			L2
8			L3
9			L4
10			L1
11			L4
e	**Experiences**	-	-
1		CO10	L2
2			
3			
4		CO9	L3
5			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	CS501PC	Sem:	I	Marks:	30	Time:	75 minutes

Course:	Design and Analysis of Algorithms				
-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Discuss the solution of Konigsberg bridge problem	3	CO9	L1
	b	Define the following terms I) Complete Graph ii) Bipertite Graph iii) Spanning Tree iv) SubGraph	4	CO9	L2
	c	Define Graph Isomorphism. Verify the two Graphs are Isomorphic 	8	CO9	L3

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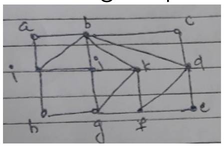
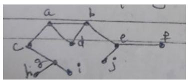
	d				
		OR			
2	a	Find Euler circuit for the following Graph 	5	CO9	L3
	b	Mergesort the list -1, 7, 4, 11, 5, 8, 15, -2, 6, 10, 3	3	CO9	L4
	c	Find DFS and BFS spanning tree for the following Graph 	7	CO9	L4
	d				
3	a	Obtain optimal prefix code for the message LETTER RECEIVED	5	CO10	L3
	b	If a tree has 4 vertices of degree 2, one vertex of degree 3 , two vertices of degree 4, one vertex of degree 5, how many pendant vertices does it have ?	6		L2
	c	Show that Tree with n vertices has n-1 edges	4	CO10	L3
	d				
		OR			
4	a	Obtain optimal prefix code for the message ROAD IS GOOD	5	CO10	L3
	b	Define optimal tree and construct optimal tree for a given set of weights { 14, 5, 15, 5, 18, 36,10 }	6	CO10	L2
	c	Prove that in a Graph number of vertices of odd Degree is Even	4	CO9	L3
	d				

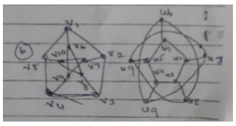
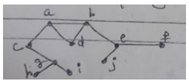
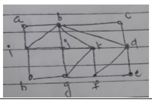
b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	17CS36	Sem:	III	Marks:	5	Time:	90 – 120 minutes
Course:	Discrete Mathematical Structures						

Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.

SNo	USN	Assignment Description	Marks	CO	Level
1		Obtain optimal prefix code for the message LETTER RECIEVED	5	CO10	L2
2		Let G(V,E) is simple graph with m edges and n vertices . Prove that i)$m \leqslant \frac{1}{2}$n (n-1) ii) how many vertices and edges are there for $K_{4,7}$ and $K_{7,11}$ ii) for complete Graph Kn, m=n(n-1)/2	5	CO9	L3
3					
4		Define the following terms I) Spanning Tree ii) self Complementary Graph iii)Hypercube iv)Isomorphism	5	CO9	L2
5		Prove that if Graph is self complementary then n or (n-1) must be multiple of 4.	6	CO9	L4
6		Prove that in a Graph number of vertices of odd Degree is Even	4	CO9	L3
7		If a tree has 4 vertices of degree 2, one vertex of degree 3 , two vertices of degree 4, one vertex of degree 5, how many pendant vertices does it have ?	6	C10	L3

8		Define Graph Isomorphism. Verify the two Graphs are Isomorphic 	5	CO9	L3
9		Find DFS and BFS spanning tree for the following Graph 	6	CO10	L3
10		Find Euler circuit for the following Graph 	4	CO9	L3
11					
12					
13					

F. EXAM PREPARATION

1. University Model Question Paper

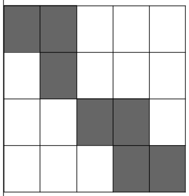
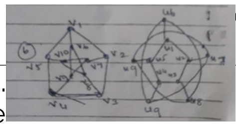
Course:	Discrete Mathematical Structures					Month / Year	Dec /2018
Crs Code:	17CS36	Sem:	III	Marks:	80	Time:	180 minutes

-	**Note**	Answer all FIVE full questions. All questions carry equal marks.	**Marks**	**CO**	**Level**
1	a	Let p,q,r be the propositions having truth values 0,0 and 1respectively.find the truth values of the following compound propositions I) $(p \wedge q) \to r$ ii)$(p) \to (q \wedge r)$ iii) $p \wedge (r \to q)$iv) $p \to (q \to (\neg r))$	4	CO1	L2
	b	Define Tautology. Prove that for any propositions p,q,r the compound proposition $((p \wedge q) \wedge ((p \to r) \wedge (q \to r))) \to r$ is tautology	4	CO1	L3
	c	Define the following terms with example for each a) Tautology b)contradiction c) Proposition d) dual of the statememnt	4	CO1	L2
	d	Write converse, inverse and contrapositive of the statement " if a triangle is not isosceles then it is not equilateral.	6	CO2	L3
		OR			
-	a	Test the validity of the argument " If Raju goes out with his friends, he will not study. If Ravi do not study his father become angry.His father is not angry. Therefore Ravi has not gone out with his friends.	5	CO1	L4
	b	Write down negation of the following statements. i) For all integers n, if n is divisible by 2 then n is odd ii) if k, m, n are any integers, where (k-m) and (m-n) are odd then (k-n) is even.	6	CO2	L3
	c	Establish validity of the argument $(\sim p \vee \sim q) \to (r \wedge s)$ $r \to t$ $\sim t$ therefore p	5	CO1	L4
	d	Define dual of logical statement. Verify principle of duality for the following logical equivalence $[\neg(p \wedge q) \to \neg p \vee (\neg p \vee q)] \Leftrightarrow (\neg p \vee q)$	4	CO1	L3
2	a	Find coefficient of a^5b^2 in the expansion of $(2a-3b)^7$	5	C03	L3
	b	If L0,L1,L2... are Lucas numbers, prove that	5	CO4	L3

		Ln =[$\left(\frac{(1+\sqrt{5})}{2}\right)^n + \left(\frac{(1-\sqrt{5})}{2}\right)^n$]			
	c	Find explicit definition of the sequence defined by a1=7, $a^n=2a^{n-1}+1$ for $n \geqslant 2$	5	CO4	L3

	d	How many times print statement executed in the following program segment?
		For i=1 to 20
		for j=1 to I do
		for k=1 to k do
		print((i*j)+(k*m))
			5	Co3	L3

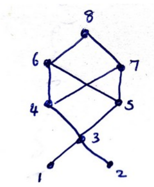
		OR			
-	a	In how many ways can we distribute 7 apples and 6 oranges among 4 children so that each child gets at least 1 apple	4	CO3	L3
	b	Prove by mathematical Induction that, for every positive integer n, 5 divides n^5-n	5	CO4	L3
	c	Find number of arrangements of letters of the word "MASSASAUGA"	4	CO3	L3
	d	Find explicit definition of the sequence defined by a1=7, $a^n=2a^{n-1}+1$ for $n \geqslant 2$	6	CO3	L3
3	a	Let A={2,3,4,6,8,12,24} and let<= denotes the partial order of divisibility that is x<=y means x|y. Let B = {4,6,12}. Determine: a)All upper bounds of B , b) All lower bounds of B, c) Least upper bound of B, d)Greatest lower bound of B	6	CO6	L3
	b	If R = {(1,1),(1,2),(2,1),(2,2),(3,4)(4,3),(3,3),(4,4)} defined on the set A= {1,2,3,4}. Determine the partition induced.	5	CO6	L3
	c	Define partial order. If R is a relation on A ={1,2,3,4} defined by X R Y if x|y.prove that (A,R) is a POSET. Draw its Hasse diagram.	5	CO6	L3
	d	State the pigeonhole principle. An office employs 13 clerks. Show that at least 2 of them will have birthdays during the same month of the year.	4	CO5	L3
		OR			
-	a	Draw the Hasse Diagram representing the positive divisors of 36	8	CO6	L3
	b	Let A= {1,2,3,4} and let R be the relation defined by R = {(x,y)| x,y belongs to A, x<=y}.Determine whether R is reflexive, symmetric, Anti symmetric or transitive.	4	CO5	L2
	c	Define a relation R on B as (a, b) R (c, d) if a + b = c + d. show that R is an equivalence relations. 1)reflexive 2) symmetric 3) Irreflexive 4) Anti symmetric 5) transitive relations:	8	CO6	L4
	d				
4	a	Define Derangement. Find the number of derangement of 1,2,3,4.List all the derangement	6	CO7	L2
	b	Solve the recurrence relation a_{n+1}-3^n,n>=0 with a_0=1 by using method of generating function	4	CO8	L3
	c	Find the number of permutations of the letters a,b,c,....,x,y,z in which none of the patterns spin,game or net occurs.	7	C07	L4
	d	Four persons P1,P2,P3,P4 who arrive late for a dinner party find that only one chair at each of five tables T1,??T2,T3,T4,T5 is vacant.P1 will not sit at T1 otr T2,P2 will not sit at T2,P3 will not sit at T3 or T4 and P4 will not sit at T4 or T5.Find the number of ways they can occupy the vacant chairs.	6	CO7	L4

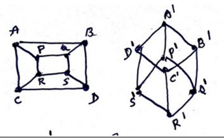
					
		OR			
-	a	An apple,a banana,a mango and an orange are to be distributed to four boys B_1,B_2,B_3 and B_4.The boys B_1 and B_2 do not wish to have apple,the boy,B_3 does not want banana or mango and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased?	8	CO7	L4
	b	Find the number of permutations of English letters which contain exactly two of the patterns car, dog,pun, byte	6	CO7	L3
	c	A girl student has sarees of 5 different colors Blue Green red White and Yellow. On Mondays she does not wear Green, On Tuesdays Blue or Red , on Wednesdays Blue or Green. On Thursdays Red or Yellow, on Fridays Red. In how many ways can she dress without repeating a color during a week ?	6	CO8	L3
	d				
5	a	Define the following terms I) Spanning Tree ii) self Graph iii)Hypercube iv) Isomorphism	4	CO9	L2
	b	Define Graph Isomorphism. Verify the two Graphs are Isomorphic 	6	CO9	L4
	c	Obtain optimal prefix code for the message ROAD IS GOOD	6	CO10	L3
	d	Prove that if Graph is self complementary then n or (n-1) must be multiple of 4.	4	CO9	L4
		OR			
	a	If a tree has 4 vertices of degree 2, one vertex of degree 3 , two vertices of degree 4, one vertex of degree 5, how many pendant vertices does it have ?	4	CO10	L3
	b	Show that Tree with n vertices has n-1 edges	4	CO10	L4
	c	Define optimal tree and construct optimal tree for a given set of weights { 4,15,25,5,8,16 }	8	C010	L3
	d	Let G(V,E) is simple graph with m edges and n vertices . Prove that i) $m \leqslant \frac{1}{2}$n (n-1) ii) how many vertices and edges are there for $K_{4,7}$ and $K_{7,11}$ ii) for complete Graph Kn, m=n(n-1)/2	4	CO9	L4

2. SEE Important Questions

Course:	Discrete Mathematical Structures					Month / Year	May /2018
Crs Code:	17CS36	Sem:	3	Marks:	100	Time:	180 minutes

	Note	Answer all FIVE full questions. All questions carry equal marks.	-	-	
Module	Qno.	Important Question	**Marks**	**CO**	**Year**

1	1	Let p,q,r be propositions having truth values 0,0,1 respectively. Find the truth values of the following compound propositions. I) $(p \wedge q) \rightarrow r$ ii) $p \rightarrow (q \wedge r)$ iii) $p \wedge (r \rightarrow q)$ iv) $p \rightarrow (q \rightarrow (\neg r))$	4	CO1	2017
	2	Establish validity of the argument. If the band could not play rock music or the refreshments were not delivered on time, then the new year party would have been canceled and Alucia would have been angry. If the party were canceled , then refunds would have had to be made. No refunds were made. Therefore the band could play rock music	5	CO1	2017
	3	Give i)direct proof and ii) proof by contradiction for the statement " if n is an odd integer then n+9 is an even integer.	4	CO2	2017
	4	Prove that for any three propositions p,q,r $[p \rightarrow (q \wedge r)] \Leftrightarrow (p \rightarrow q) \wedge (p \rightarrow r)$	5	CO1	2018
	5	Define i)open sentence ii)Quantifiers for the following statements, the universe comprises all nonzero integers. Determine the truth values of each statement. I) ∃x, ∃y (xy=1) ii) ∃x, ∀y (xy=1) iii) ∀x ∃x, (xy=1)	4	CO1	2017
2	1	By mathematical induction prove that , for every positive integer n , 5 divides n^5-n.	5	CO4	2018
	2	Find coefficient of I) $x^9 y^3$ in the expansion of $(2x-3y)^{12}$ ii) x^{12} in the expansion of $x^3(1-2x)^{10}$	5	CO3	2018
	3	For Fibonacci sequence F0,F1,F2..........Prove that Fn= $\frac{1}{\sqrt{5}}[\left(\frac{(1+\sqrt{5})}{2}\right)^n - \left(\frac{(1-\sqrt{5})}{2}\right)^n]$	5	CO4	2017,18
	4	a) How many arrangements are there of all letters in " SOCIOLOGICAL " b)In how many arrangements A and C are together c)In how many arrangements all Vowels are adjacent ?	4	CO3	2017
	5	Find explicit definition of the sequence defined by a1=7, $a^n=2a^{n-1}+1$ for $n \geqslant 2$	4	CO4	2017
3	1	Let f: R→R be defined by f(x)={3x-5,for x>0 and -3x+1,for x<=0}. i)Determine f(5/3),$f^{-1}(3)$,$f^{-1}([-5,5])$. ii)Also prove that if 30 dictionaries contain a total of 61,327 pages,then at least one of the dictionary must have at least 2045 pages.	5	CO5	2018
	2	Let A={1,2,3,4,5}.Define a relation then AXA by (x1,y1) R (x2,y2) if and only if x1+y1=x2+y2. i)Determine whether R is an equivalence relation on AXA. ii)Determine equivalence class [(1,2)] [(2,5)].	5	CO6	2018
	3	Consider a Poset whose Hassee diagram is given below. Consider B={3,4,5} for the following figure below. Find: a) All upper bounds of B b)All lower bounds of B c) The least upper bound of B d)The greatest lower bound of B e)Is this a lattice. 	5	CO6	2018
	4	Let f and g be the functions from R to R defined by f(x)=ax+b and g(x) = 1-x+x^2. if $g \circ f$(x)= $9x^2$-9x+3. Determine a,b	5	CO5	2018
	5	Let a function f:R→R be defined by f(x)=x^2+1. Find the images of A_1={2,3}, A_2=[-2,0,3],A_3=(0,1) and A4=[-6,3].	4	CO5	2017
4	1	Five teachers T1,T2,T3,T4,T5 are to be made class teachers for 5 classes C1,C2,C3,C4,C5, one teacher for each class. T1, T2 do not wish to become the class teachers for C1 or C2. T3 and T4 for C4 or C5. And T5 for C3 or	6	CO7	2018

		C4 or C5. In how many ways can the teachers be assigned work without displacing any teachers			
	2	Determine the number of positive integers n such that 1<=n<=100 and n is not divisible by 2,3,or 5.	4	CO8	2017
	3	An apple,a banana,a mango and an orange are to be distributed to four boys B_1,B_2,B_3 and B_4.The boys B_1 and B_2 do not wish to have apple,the boy,B_3 does not want banana or mango and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased?	5	CO7	2017
	4	Find the number of permutations of English letters which contain exactly two of the patterns car, dog,pun, byte	5	CO7	2018
	5	A girl student has sarees of 5 different colors Blue Green red White and Yellow. On Mondays she does not wear Green, On Tuesdays Blue or Red , on Wednesdays Blue or Green. On Thursdays Red or Yellow, on Fridays Red. In how many ways can she dress without repeating a color during a week ?	4	CO7	2017
5	1	Define the following terms I) Bipartite Graph ii) Complete Bipertite Graph iii) Regular iv) Connected Graph with an example	4	CO9	2017
	2	Discuss the solution of Konigsberg bridge problem	5	CO9	2018
	3	Define Graph Isomorphism. Verify the two Graphs are Isomorphic 	5	CO9	2018
	4	Show that Tree with n vertices has n-1 edges	5	CO10	2018
	5	Obtain optimal prefix code for the message ROAD IS GOOD	4	CO10	2017

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