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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	
Module – 4	15
E2. CIA EXAM – 2	16
a. Model Question Paper - 2	16
Define a relation R on B as (a, b) R (c, d) if $a + b = c + d$, show that R is an equivale	nce
relations. 1)reflexive 2) symmetric 3) Irreflexive 4) Anti symmetric 5) transitive relations:	17
b. Assignment – 2	17
Define the following with one example for each i) Function ii) one-to one function iii) o	onto
Let f: R $_$ R g: R $_$ R be defined by f(x) = X2 and g(x) = x+5. Determine fog and gof show	that
Let A B C be any three nen empty sets and A-B-C-Iset of real numbers! (B - g; f; B (C	` ha
function defined by $f(a) = a+1$ and $g(b) = b2 + 2$, find f: A gof (-2), b. fog (-2), c. gof(x), d. go	, pe ig(x)
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= $\{(1,2), (2,3), (4,3)\}$ Derive that f and g are inverses of each other	(3,4)
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	t A =
18 [1,2,3,4]. Determine the partition induced	
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	
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
POSE I. Draw its Hasse diagram	
Draw the HasseDiagram representing the positive divisors of 36	_
D3. TEACHING PLAN - 3	19
Module - 5	19
E3. CIA EXAM – 3.	20
a. Model Question Paper - 3	20
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1. Univers	sity Model Qu	estion Paper	

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
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
Draw the Hasse Diagram representing the positive divisors of 36
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 relations23
2. SEE Important Questions

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 / 111	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

Mod	Module Content	Teaching	Module	Blooms
ule		Hours	Concepts	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	L3,L4
			Techniques	
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

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

3. Course Material

Mod	Details	Available
ule		
1	Text books	
	1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5 th Edition,	In Lib
	Pearson Education. 2004.	
2	Reference books	
	1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A	REQ. GIVEN
	Concept based approach, Universities Press, 2016	
	2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6 th Edition,	In LIB
	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	
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.

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1. Course Outcomes

After studying this course students will be able to

#	COs	Teach. Hours	Concept	Instr Method	Assessmen t Method	Blooms' Level
18CS36.1	Verify the validity of an argument using Propositional and Predicate Logic	7	Propositiona l 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	Mathematic al 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
18CS36.0 9	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,ty pes 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

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			-
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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	CO9	L4
	Computer network problems		
10	Concepts of Trees applied to design and analyze efficient data structure	CO10	L3
	algorithms.		

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

_	Course Outcomes	Course Outcomes Program Outcomes												
#	COs	PO1	PO ₂	PO3	PO4	PO ₅	PO	PO7	PO8	PO9	PO1	PO1	PO1	Level
							6				0	1	2	
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

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	Euler circuits														
	Analyze the importance of Grap													l I	
	Theory and	d its real time												Í Í	
	applications.												í I		
18CS36.10	Understand	the properties and	3	3											L2,L5
	types of tre	ees and apply to												l I	
	construct sp	anning trees, prefix												l I	
	codes and w	eighted tree													
Note: Ment	ion the mapp	ing strength as 1, 2,	or 3	•		•									

4. Mapping Justification

Мар	ping	Justification	Mapping
СО	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
COg	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
COg	PO3	Graph theory used to design and analyze efficient algorithms to	2

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

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

Mod	Title	Teaching	No. of question in Exam						CO	Levels
ule		Hours	CIA-1	CIA-2	CIA-3	Asg	Extra	SEE		
#							Asg			
1	Fundamentals of Logic:	10	2	-	-	1	1	2	CO1,	L4, L3
									CO2	
2	Properties of the Integers,	10	2		-	1	1	2	CO3,	L4
	Fundamental Principles of Counting								CO4	
3	Relations and Functions:	10	-	2	-	1	1	2	CO5,	L3, L4
									CO6	
4	The Principle of Inclusion and	10	-	2	-	1	1	2	CO7,	L4
	Exclusion, Recurrence Relations								C08	
5	Introduction to Graph Theory	10	-	-	4	1	1	2	CO9,	L3,L4
									CO10	
-	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.

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2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	СО	Levels
CIA Exam – 1	30	CO1, CO2, CO3, CO4	L2,L3,L4
CIA Exam – 2	30	CO5, CO6, CO7, C08	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	10 Hrs
	Course Outcomes	Time:	Pleame
d	The student should be able to:	-	Loval
-	The student should be able to.	-	Level
	apply rules of Logic to identify logically equivalent expressions, understand and apply Rules of Inference to validate Quantified arguments	COI	L4
2	Apply Direct, Indirect and Proof by contradiction methods to establish Mathematical Theorems	CO2	L4
b	Course Schedule	_	_
Class No	Module Content Covered	СО	Level
1	Basic Connectives and Truth Tables.	C01	L2
2	Logic Equivalence – The Laws of Logic and problems	C01	L2
3	Logical Implication – Rules of Inference	C01	L2
4	Problems on Logical Implication – Rules of Inference	C01	L4
5	Quantifiers	C01	L2
6	Definition and examples for Quantifiers	C01	L2
7	The Use of Quantifiers	C01	L3
8	Definitions and the Proofs of Theorems	C02	L3
9	Problems on Proof of Theorems	C02	L4
10	Problems on Proof of Theorems	C02	L4
11			
12			
13			
14			
15			
16			
	Application Areas	00	l evel
1	Programming	CO1	3
2	Analysis of Algorithms	CO2	

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d	Review Questions	-	-
1	Prove the following logical equivalence	CO1	L4
	i)[(pvq) Λ (pv~q)vq] (pvq) ii)p \rightarrow (q \rightarrow r) \leftrightarrow (p Λ q) \rightarrow r		
2	For any statements p, q prove that	CO1	L4
	i) ~(p↓q) (~p↑~q) ii)~(p↑q) (~p↓~q)		
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 \rightarrow q) \wedge (q \rightarrow r \wedge s) \wedge (~ r \vee (~t \vee u)) \wedge (p \wedge t	CO1	L4
	/→ u		
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	CO1	L3
	and (m-n) are odd then (k-n) is even		
7	Verify the principle of duality for the following logical equivalence.	CO1	L4
	~ (pvq) → (~pv (~pvq)) ↔ (~pvq)		
8	Establish validity of the argument	CO1	L4
	$(\sim pV \sim q) \rightarrow (r \land s)$		
	$\uparrow \rightarrow \downarrow$		
	ri therefore n		
q	Prove that if m is an even integer then m+7 is odd integer by contradiction	CO2	4
	proof method.	001	-1
10	Test the validity of the argument " If Raju goes out with his friends, he will	CO1	L4
	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.		
11			
	E-manian		
e	Experiences	-	-
		001	L2
2			
		CO3	13
5			<u> </u>

Title:	Properties of Integers	Appr	10 Hrs
		Time:	
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

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5	Permutations, E	xamples	<u> </u>	L3	
0	Compinations, E	zamples	CO3		
/	The Binomial Tr	leorem, Examples	CO3		
0	Combinations w	ith Depetition Examples	CO3		
9	Combinations w	vith Repetition, Examples	CO3		
10		nun Repetition, Examples	03	L2,L3,L4	
C	Application Are	225	00		
1	Cryptography		CO3		
2	Cryptography		CO4		
			004	<u> </u>	
d	Review Questic	ons	_	_	
1	In how many w	ways can seven people be arranged in a circular table ? if	CO3	3	
	two people insi are possible ?	st on sitting next to each other, how many arrangements	005		
2	find the coefficie	ent of v²w⁴xz in the expansion of (3v+2w+x+v+z) ⁸	CO3	L3	
3	A gym teacher volleyball team many selection spikers and mu can be chosen?	must select 9 girls from junior and senior classes for a a. a) If there are 28 juniors and 25 seniors are there how as are possible? If two juniors and one senior are best ust be in team. Then how many ways the rest of the team	03	L3	
4	Prove that $\sum_{i=1}^{n} i^2 = \frac{n(n+1)}{n}$	$\frac{2(2n+1)}{6}$.	CO4	L4	
5	A message is r through a com transmitter will at least 3 space ways can the tra	nade up of 12 different symbols and is to be transmitted imunication channel. In addition to the 12 symbols, the also send a total of 45 spaces between the symbols, with s between each pair of consecutive symbols. In how many ansmitter send such message ?	CO3	L3	
6	Prove by Math divides n²-n	nematical Induction that, for every positive integer n, 5	CO4	L4	
7	A certain questi A , 5 questions several question many ways can	on paper contains 3 parts. A,B,C with four questions in part in part B and 6 questions in part C. It is required to answer ns selecting at least two questions from each part. In how a student select his 7 questions for answering	CO3	L3	
8	Find an explicit an=2an-1+1 for n>=	t definition of the sequence defined recursively by $a_1=7$, 2	CO4	L3	
е	Experiences		-	-	
1			CO1	L2	
2					
3					
4			CO3	L3	
5					

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E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code: 170		17Cs36 Sem: III Marks: 30 Time: 75 r	minute	S	
Cour	Course: Discrete Mathematical Structures				
-	-	Note: Answer any 3 questions, each carry equal marks.	Marks	CO	Level
1	а	Let p, q be primitives statements for which implication $p \rightarrow q$ 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
	С	5	CO1	L4	
	d				
2	a	Define dual of logical statement. Verify principle of duality for the following logical equivalence $[\neg (p \land q) \rightarrow \neg p \lor (\neg p \lor q)] \Leftrightarrow (\neg p \lor q)$	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
	С	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	а	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 $n \ge 2$	4	CO4	L3
	С	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	а	By mathematical induction prove that , for every positive integer n,the number $A^n = 5^n + 2 2^n - 1 + 1$ is multiple of 8		CO4	L4
<u> </u>	b	Find coefficient of x^4v^4 in the expansion of $(2x^3-3xv^2+z^2)^{16}$		СОз	La
	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

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Crs C	ode:	17CS36	Sem:		Marks:	5	Time:	90 - 120	5	
Cours	se:	Discrete	Mathemat	ical Struct	ures					
Note:	Each	student	to answer 2	2-3 assignr	ments. Each as	signmer	nt carries equal ma	ark.		
SNo		USN		As	ssignment De	scription	1	Marks	со	Level
1			Define ta following [(p V q){	utology. F compour $(p \rightarrow r) \Lambda$	Prove that for nd proposition $q \rightarrow r$ []] $\rightarrow r$	any pro n is a taı	positions p,q,r th utology:	e 5	CO1	L3
2			Let p. a be	e primitives	s statements f	or which	implication $p \rightarrow$	a	CO1	L2
			is false. De ∨ q) (q '	v p)	ne truth values	of the fo	ollowing. i)pVq ii) (p		
3			Find inver If the state	se, conver ement is d	rse and contra ivisible by 21 1	apositive then it is	e of the following divisible by 7		CO1	L2
4			Find inver if 0+0=0 th	se, conver en 2+2=1	rse and contra	a positive	e of the following	5	CO1	L2
5			Let p,q,r l 1respective proposition l) ($p \land q$)	oe the pre ely.find the ns → r ii)(<i>p</i>) _	opositions had be truth values $r \rightarrow (q \land r)$ iii) p	ving trut of the fo $\wedge (r \rightarrow q)$	th values 0,0 an Illowing compoun Iiv) $p \rightarrow (q \rightarrow (\neg r)$	d d	CO1	L2
6			Establish v $\forall x, [p(x)] v$ $\exists x, \neg p(x)$ $\forall x, [\neg r(x)]$ $\forall x, [s(x)] \rightarrow$ therefore	$ \frac{1}{\sqrt{q(x)}} \frac{1}{\sqrt{q(x)}} $	he following a	rgument	S		CO1	L4
7			Establish v $p \rightarrow q$ $q \rightarrow (r \land s)$ $\neg r \lor (\neg t \lor p \land t)$ therefore u	alidity of th 1 u)	he argument :				CO1	L4
8			Define dua the followi $[\neg(p \land q)$ -	al of logicang logical $\rightarrow \neg p \mathbf{V}(\neg$	Il statement. V equivalence $p \lor q)] \Leftrightarrow (\neg p$	erify prir $\left(\mathbf{v} \; \boldsymbol{q} ight)$	nciple of duality fo	pr	CO1	L3
9			Define cor statement. the statem equilateral	nverse, inv Also state nent " If a ."	verse and con e converse, in a triangle is no	trapositiv verse an ot isosce	ve of a conditionand contrapositive contrapositive contrapositive contrapositive contraposition is not the second se	al of ot	CO1	L3
10			Give i)Dire for the stat integer	ct Proof ii) tement " If) Indirect proo n is an odd in	f ii) Proc teger , tl	of by contradiction hen n+11 is an eve	n, n	CO2	L4
11			Prove that k+l is even	for all inte and kl is o	egers k and l, i dd by direct p	f k and l roof.	both are odd, the	n	CO2	L4
12			Give i)Dire statement.	ct proof ii) " If n is an)proof by con odd integer, tl	tradictioi nen n+9 i	n for the followin is an even integer	g	CO2	L4
13			Prove that of 5's and 7	every pos 7's.	sitive integer <i>n</i>	≥24car	n be written as sur	n	CO2	L3
14			Prove that or y > 50	for all real	l numbers x ar	nd y , if x	x+y > 100, then x>5	0	CO2	L3

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15		Find "MAS	number of arrangements of letters of the word SSASAUGA"		03	L3
16		a) H	ow many arrangements are there of all letters in "	(CO3	L3
		SOCI	OLOGICAL "			
		b)In ł	now many arrangements A and C are together			
		c)in r	now many arrangements all vowels are adjacent?		00-	1.0
17		A col	mmittee of 15 having 9 women and 6 men to be seated at		03	L3
		a circ	cular lable . In now many ways seals be arranged so that			
18		Find	number of possible arrangements of letters of the word "	($^{\circ}$	12
		ТАЦ	AHASSEE" ? How many arrangements have no adjacent		003	L)
		A's				
*19		In hc	w many ways can we distribute 7 apples and 6 oranges	(CO3	L3
		amoi	ng 4 children so that each child gets at least 1 apple		-	-
20		Deriv	e formula to find number of compositions of 7	(CO3	L4
21		Cons	ider compositions of 20		CO3	L3
		I) hov	w many have each summand Even?			
		ii) ho	w many have each summand multiple of 4			
22		How	many times print statement executed in the following		03	L3
		prog	ram segment?			
			FOI 1=1 to 20			
			for $k=1$ to k do			
			print((i*i)+(k*m))			
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 a²b³c²d⁵ in the expansion of (a+2b-3c+2d+5) ¹⁶	(CO3	L3
27		Prov	e by mathematical Induction that, for every positive	(CO4	L4
		integ	ler n, 5 divides n⁵-n			
28		By r	nathematical induction prove that , for every positive		CO4	L4
		integ	er n,the number A"= 5"+2.3"-1 + 1 is multiple of 8			
29		How	many positive integers in can we form using the digits		03	L3
20		3,4,4, For F	5,5,0,7 If we want in to exceed 5,000,000		$^{\circ}$	14
30			$\frac{1}{1} \int \frac{1}{1 + \sqrt{E}} \frac{1}{2} \int \frac{1}{2} \int$		004	64
		Fn= -	$\frac{1}{\sqrt{2}}\left[\left(\frac{(1+\sqrt{5})}{\sqrt{2}}\right) - \left(\frac{(1-\sqrt{5})}{\sqrt{2}}\right)\right]$			
		1	$\sqrt{5}$ (2) (2)			
31		lf Lo,	L1,L2 are Lucas numbers, prove that		CO4	L4
			$((1+\sqrt{5}))^n ((1-\sqrt{5}))^n$			
		Ln =l	$\left \frac{1}{2}\right + \left \frac{1}{2}\right $			
32		Prové	e that for each $nn \in z^{+ii}$	(CO4	1
		1100	1			- 1
		1 ² +2 ²	$+3^{2} + \dots + n^{2} = \frac{1}{C} n (n+1) (2n+1)$			
			U			
22		Find	explicit definition of the sequence defined by 21-7		<u>^</u>	12
33		a ⁿ =22	$n^{n-1} + 1$ for $n \ge 2$			<u> </u>
2/		Ohta	in recursive definition for the sequence an in each of the	(COA	2
J4		follo	wina			<u>د</u> ے
		I) a _n =	5^{n} ii) $a_{n} = 2 - (-1)^{n}$			
40		Give	i)Direct Proof ii) Indirect proof ii) Proof by contradiction,			L4
		for th	ne statement " If n is an odd integer , then n+11 is an even			-
		integ	er			
41						

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T 111		A	
l itle:	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
h	Course Schedule		
	Course Schedule Medule Content Covered	00	Loval
	Polations and Eurotions: Cartasian Products and Polations		
2	Functions – Plain One-to-One and Onto	C5	
2	The Digeon hale Principle Evernles	C:	
3	The Pigeon-hole Principle, Examples	<u> </u>	
4	Proportion of Polations Computer Percentition - Zoro Ono	 	
<u>5</u>	Matrices and Directed Graphs	<u>С</u> 5	<u>_</u> 3
7	Partial Orders – Hasse Diagrams	<u> </u>	
8	Equivalence Relations and Partitions	 	
0 0	Problems Equivalence Relations	 C6	
10	Problems Inverse Functions	C6	L3
11			
12			
13			
14			
15			
16			
С	Application Areas	CO	Level
1	Programming	CO1	L3
2	Data Structures and Analysis of Algorithms	CO2	L4
	Deview Questiens		
1	Review Questions	-	-
	Let A={2,3,4,6,8,12,24} and let<= denotes the partial order of divisibility	000	3
	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		
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 $f:A \rightarrow B$ and $g:B \rightarrow C$ are invertible function then g of $:A \rightarrow C$ is	Co5	L4
	an invertible function and $(gof)^{-1}=f^{-1}og^{-1}$.	-	
4	Let A={1,2,3,4,5}.Define a relation then AXA by (x1,y1) R (x2,y2) if and only if	Co5	L4
	X1+Y1=X2+Y2.		
	Determine whether R is an equivalence relation on AXA.		
	II)Determine equivalence class ((1,2)) ((2,5)).	<u> </u>	
5	identical containers with some container(s) possibly empty	05	L4
6	Let f a he functions from 7 to 7 defined by	Cor	
<u> </u>	Let i, g, i be functions from z to z defined by	005	∟4

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	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)=(f0)g)0h).		
7	Consider a Pos is given below following figure a) All upper bo b)All lower bou c) The least up d)The greatest e)Is this a lattic	set whose Hassee diagram c. Consider B={3,4,5} for the below. Find: unds of B per bound of B lower bound of B e.	Co6	L3
⁸ (Afo	⁸ (Afo For any non-empty sets A,B,A,prove the following results:			L4
)U(B	1) AX(BUC)=(A	AXB)U(AXC) 2) (AUB)XC=(AXC)U(BXC)		
	$2)\Delta X(B\cap C) = (\Delta C)$			
	5)AX(B-C)=(A)	(B)-(AXC)		
е	experiences			
1				
2				
3				
4				
5				

Title:	Principle of Inclusion and Exclusion	Appr	10 Hrs
		Time:	
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.	C07	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	CO8	L4
	Constant Coefficients		
10	Problems	CO8	L4
11			
12			
13			

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14					
15					
16					
<u> </u>	Application Aroas	0			
	Application Aleas				
1	Apply to solve counting problems	000	L3		
2	used to develop computer Algorithms	07	L4		
d	Review Questions				
1	Evolution Constrained Dringiple Inclusion and Evolution	CO7	14		
1	Explain Generalization of Philople inclusion and Exclusion.	 			
2	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	0	L4		
3					
4	Solve the recurrence relation $a_{n+2}-6a_{n+1}+9a_n=3\cdot 2^n+7\cdot 3^n$ for n>=0,given $a_n=1,a_1=4$.	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 or 5	CO7	L4		
7	Find the number of permutations of the digits 1 through 9 in which (a) the blocks 22 57 468 do not appear	CO7	L4		
8	Find the number of permutations of the letters a,b,c,,x,y,z in which none	CO7	L4		
	Determine the number of integers between 1 and 200(inclusive) which	CO7	14		
9	are (i) divisible by exactly two of 5,6,8 and (ii) divisible by atleast two of 5,6,8.	007	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.	C07	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	CO8	L4		
14	determine the number of virus affected files in the system after one day. Solve the recurrence relation $a_{n+2}-8a_{n+1}+16a_n=8(5^n)+6(4_n)$ where,n>=0 and	CO8	L4		
	a ₀ =12,a ₁ =5.				
15	Solve the recurrence relation $a_{n+1}-a_n=3'', n>=0, a_0=1.$	CO8	L4		
е	Experiences	-	-		
1		CO7	L2		

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2						
3						
4			CO8	L3		
			· · · · · · · · · · · · · · · · · · ·			

E2. CIA EXAM – 2

5

a. Model Question Paper - 2

Crs C	Code:	CS501PC	Sem:	I	Marks:	30	Time: 7	5 minute	s	
Cour	rse:	Design and	Analysis of	Algorithms				_		
-	-	Note: Answ	ver any 2 qu	estions, ead	ch carry eq	ual marks.		Marks	со	Level
1	а	Let A= {1,2, belongs to symmetric	3,4} and let A, x<=y}.Det or transitive	R be the re termine wh	elation definether R is	ned by R = { reflexive, sy	{(x,y) x,y mmetric, Anti	4	CO5	L3
	b	Define a re R is an eq Anti symm	elation R or juivalence re etric 5) trans	n B as (a, b elations. 1)r sitive relatio	o) R (c, d) i eflexive 2) ons:	f a + b = c symmetric	+ d. show tha 3) Irreflexive 2	t 6 µ)	CO5	L3
	Let	A={2,3,4,6,1 b. Prove th relation.	12,}.On A,def at R is a par	ine the rela tial order o	ition R by a n A. Draw t	Rb if and or he Hasse di	nly if a divides iagram for this	5	CO6	L3
	a									
2	а	For the defined on	equivalence the set A={1,;	relation 2,3,4},deterr	R={(1,1),(1,2 nine the pa),(2,1)((2,2),(3, rtition induce	4),(4,3),(3,3),(4,4 ed.)} 4	CO6	L3
	b	Let f: R→R i)Determine ii)Also prov least one o	be defined be e f(5/3),f ⁻¹ (3), /e that if 30 f the dictiona	by f(x)={3x-5 f ⁻¹ ([-5,5]). dictionaries ary must ha	,for x>0 and contain a t ve at least 2	d -3x+1,for > otal of 61,32 2045 pages.	x<=0}. ?7 pages,then a	6 It	CO5	L4
	С	Let A={1,2,3 if and only i	,4,5,6,7,8,9,10 if x-y is a mu	0,11,12].On the ltiple of 5.V	nis set defir erify that R	e the relations an equiva	on R by (x,y) ∈ lence relation.	२ 5	CO6	L3
	d									
3	а	Out of 30 s study Geog Show that 7	students in a graphy. It is 7 or more stu	hostel,15 s known tha idents stud	tudy Histor t 3 student y none of th	y,8 study Eo s study all nese subject	conomics,and these subjects s.	6 5 5.	CO7	L4
	b	The numbe this increa determine	er of virus af ses 250% e the number	fected files every two of virus affe	in a syster hours.Use cted files in	n is 1000 (to a recurrer the system	start with) and nce relation to after one day.	d 4 o	CO8	L4
	С	Find the roo	ok polynomi	al for the sh	aded part.			6	CO7	L3
	d									
		In how man		wo diatrik.	to 24 papa:	cto 1 obileir	on co that and		<u> </u>	
4	d	child gets a	atleast 3 pen	cils but not	more than a	s to 4 childr B.	en so that eac	4		L4
	b	Solve the a₀=1,a₁=4.	recurrence	e relation	a _{n+2} -6a _{n+1} +9	a _n =3·2 ⁿ +7·3 ⁿ	for n>=0,give	n 5	CO8	L4
	С	Find the r derangeme i)the eleme ii)the eleme	number of ent. Ints in the firs ents in the fir	the intege st k places a st n-k place	ers from 1 are 1,2,3,k i es are k+1,K+	to n such n some orde 2,,,,n in some	n that in eac er. e.order.	h 6	Co7	L4

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d						

b. Assignment – 2

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

					Mode	el Assignn	nent	Question	ns					
Crs C	ode:	CS501P0	C Sem:			Marks:		5 / 10	Tir	ne:	90 - 120) – 120 minutes		
Cours	se:	Design a	and Analys	sis of A	lgorith	nms								
Note:	Each	student	to answer	2-3 as	signm	ents. Each	n assię	gnment	carries	equal m	ark.			
SNo		USN			Ass	ignment	Desc	ription			Marks	СО	Level	
1		A= {1	,2,3,4} B={2 4) (AUB)X	2,5} C= C 5) (A	{3,4,7 XC)U	} Determi (BXC)	ne: 1)	AXB 2)	BXA 3	AU (BX	C)	CO5	L4	
2		A = {:	l, 2, 3] find 3), (3, 2)] c.	a. R ₁ = . R ₃ = A	{(1, 1) (x x A	(2, 2) (3, 3)]	ł b. R₂	= {(1, 2) (2, 1) (1,	3) (3, 1) (2	,	CO5	L4	
3			Let a fund of A1={2,3},	ction f: A ₂ ={-2	R → R I ,0,3},A	be defined ₃ =(0,1) and	d by I A4=[-	f(x)=x²+1. ·6,3].	Find t	he image	es	Co5	L4	
4			Define th one-to on	e follo [.] e func	wing v tion iii	with one e	examp nctior	ole for e	each i)	Function	ii)	Co5	L4	
5		Let	f: R 👝 R g Determine function is	:R _ F e fog a s not c	R be de nd go ommu	efined by f show tha utative.	f(x) = at he	X² and g compos	g(x) = x+ sition c	[.] 5. f two		Co5	L4	
6			State the Show tha same mo	e pigec It at le nth of	onhole ast 2 d the ye	e principle of them w ear.	e. An o vill ha	office er ive birth	nploys ndays (3 13 clerk during th	s. e	Co5	L4	
7			let A,B,C real num! and g(b) = gog(x)	be any pers} (= b2 + 2	v three B , g: 1 2, find	e non-em f: B (C be f: A gof (-2	pty se func 2), b. f	ets and tion def og (-2), d	A=B=C îned b c. gof(x	={set of y f(a) = a+) , d.	1	Co5	L4	
8			Let A={1,2, (2,1) (3,2)(4 inverses c	3,4,} f a .,3)} g= of each	and g ł {(1,2) (2 other	oe functio 2,3) (3,4) (4,	ns frc ,1)} Pr	m A to / ove that	A giver f and g	n by: f={(1,, g are	4)	Co5	L4	
9			What is t (4,3),(3,3),(partition i	he pa (4,4)} d nduce	rtition efinec d.	of a set? I on the s	? If R set A	= {(1,1),(= {1,2,3,4	(1,2),(2,: \$]. Dete	1),(2,2),(3,. ermine th	4) e	Co6	L3	
10			lf R = {(1,1 A= {1,2,3,4	.),(1,2),(}. Dete	2,1),(2, ermine	2),(3,4)(4,3 the parti	3),(3,3 tion i),(4,4)} d nduced	efined	on the s	et	Co6	L3	
11			Define pa by X R Y diagram.	irtial o if x y.p	rder. If rove t	f R is a rel hat (A,R) i	latior is a P	on A ={ OSET. [{1,2,3,4 Draw its	defined s Hasse		Co6	L3	
12			Draw the 36	Hassel	Diagra	m represe	enting	the pos	sitive d	ivisors of		Co6	L3	
13			Let A= {1,2 (x1,y1)R(x2	2,3,4,5} 2,y2) if	. Defir and o	ne a relati nly if x1+y:	ion R 1=x2+	on AXA y2	by			Co6	L3	
14			In how m CORRESP i)there is r ii)There ar	iany w ONDE 10 pair 7e exac	ays ca NTS so of cor tly two	an one ar o that nsecutive i o pairs of o	range identi conse	e the lef cal lette ecutive i	tters in ers? dentica	the wor	rd ,	Co7	L4	
15			An apple distributed not wish	e,a bai d to fo to hav	nana,a ur boy e app	1 mango /s B1,B2,B3 le,the boy	and and y,B ₃ c	an ora B₄.The b oes not	ange a boys B₁ t want	are to b and B₂ c banana (be lo pr	Co7	L4	

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Copyright	t ©2017. cA	AS. All rights reserved	No and D refuses ereans in heavy means swere the			
		mang	Jo and B4 refuses orange. In now many ways the			
16		Doto	rming the number of positive integers n such that		C07	1.4
10		1<=n<	$r_{=100}$ and n is not divisible by 2.2 or 5		007	∟4
17			$\frac{100}{100}$ and $\frac{113}{100}$ arising by 2,3 or 3		<u> </u>	11
-/		that f	is not in the first place 2 is not in the second place and		007	
		so or	h_{a} , and 10 is not in 10 th place.			
18		Find	the number of the integers from 1 to n such that in each		Co7	L4
		derar	ngement.			
		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				
19		There	e are eight letters to eight different people to be placed		Co7	L4
		in eiç	ght different addressed envelopes. Find the number of			
		ways	of doing this so that at least one letter gets to the right			
20		perso Find	the real networking for the ata beard y using the		C 07	
20		FILLU	nsion formula		07	∟4
21		Solve	the recurrence relation a=2a=-2a=o for n>=2 given that		Co8	
		a₁=5 a	and $a_2=3$.		000	
22		Find	the generating function for recurrence relation a_{n+1} -		Co8	L4
		a _{n₌} n²,	n>=0 and a₀=1.			
23		A ba	nk pays a certain % of annual interest on deposits,		Co8	L4
		comp	pounding the interest once in 3 months.If a deposit			
		doub	les in 6 years and 6 months, what is the annual % of			
		intere	est paid by the bank.			
24		Find	the number of permutations of English letters which			
		conta	ain exactly two of the patterns car dog, pun or byte.			
25		A giri	sudent has sarees of 5 airrerent colors Blue Green red			
		white	e and reliow. On Mondays she does not wear Green, On days Rive or Red, on Wednosdays Rive or Green, On			
		Thurs	sdays Bide of Ked , off wednesdays bide of dieen. Off			
		can s	he dress without repeating a color during a week?			
26						
27						
·						

D3. TEACHING PLAN - 3

Title:	Introduction to Graph Theory	Appr	10 Hrs
		Time:	
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		

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Copyright ©201	7. cAAS. All rights reserved. Dout od Troos, Troos, and Sorting		
0	Weighted Trees and Drefy Codes		
10	Prefix Codes Examples		
11			
12			
13			
14			
15			
16			
С	Application Areas	СО	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	COg	L4
	decode text messages		
	Deview Overstiens		
a	Review Questions	-	-
1	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	COg	L2
4	Obtain optimal prefix code for the message ROAD IS GOOD	COg	L4
5	Define optimal tree and construct optimal tree for a given set of weights		L2
	[4,15,25,5,8,16]		
6			L5
7			L2
8			L3
9			L4
10			L1
11			L4
e	Experiences	-	-
2			LŹ
2			
		000	2
5			
	1		

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs	Code:	CS501PC	Sem:		Marks:	30	Time:	75 minute	S	
Cou	Course: Design and Analysis of Algorithms									
-	-	Note: Answ	/er any 2 qu	estions, ead	ch carry eq	ual marks.		Marks	СО	Level
1	a	Discuss the	solution of I	Konigsberg	bridge pro	blem		3	CO9	L1
	b	Define the f I) Complete	efine the following terms Complete Graph ii) Bipertite Graph iii) Spanning Tree iv) SubGraph						CO9	L2
	С	Define Grap	bh Isomorphi	sm. Verify t	he two Gra	phs are Ison	norphic	8	CO9	L3

l	Logo	
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			i aye	. 21 / 2	0
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	d				
		OR			
2	а	Find Euler circuit for the following Graph	5	CO9	L3
		a b c · · · · · · · · · · · · · · · · · · ·			
	b	Mergesort the list -1, 7, 4, 11, 5, 8, 15, -2, 6, 10, 3	3	CO9	L4
	С	Find DFS and BFS spanning tree for the following Graph	7	CO9	L4
		a t c p			
	d				
3	а	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
	С	Show that Tree with n vertices has n-1 edges	4	CO10	L3
	d				
		OR			
4	а	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 {	6	CO10	L2
		14, 5, 15, 5, 18, 36,10 }			
	С	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	Assignn	nent	Ques	tions						
Crs C	ode:	17CS36	Sem:			Marks:		5	Tim	ne:	90 - 120	minute	S		
Cours	se:	Discrete	Mathematic	al Str	ructures	5									
Note:	Each	n student i	to answer 2-;	3 ass	ignmen	ts. Each	ı assi	gnme	ent carries	equal ma	ark.				
SNo		USN			Assig	nment l	Desc	riptio	n		Marks	СО	Level		
1			Obtain opti RECIEVED	mal	prefix	code	for	the	message	LETTE	R 5	CO10	L2		
2			Let G(V,E) is that i) $m \leq \frac{1}{2}$ r ii) how many ii) for comple	simp 1 (n-1 verti ete G	ile grap) ices and raph Kr	h with r d edges ı, m=n(n	n edg are 1 -1)/2	ges a :here	nd n vertic for K _{4.7} and	es . Prov d K _{7,11}	e 5	CO9	L3		
3															
4	4 Define the following terms I) Spanning Tree ii) self Complementary Graph iii)Hypercube iv)Isomorphism				e 5	CO9	L2								
5	5 Prove that if Graph is self complementary then n or (n-1) must be multiple of 4.				st 6	CO9	L4								
6	6 Prove that in a Graph number of vertices of odd Degree is Even				is 4	CO9	L3								
7			If a tree has two vertices pendant ver	4 v€ of d tices	ertices o egree 4 does it	of degre 4, one v have ?	ee 2, vertex	one < of c	vertex of 0 legree 5, h	degree 3 10w man	, б У	C10	L3		

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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 /2	2018
Crs (Code:	17CS36 Sem: III Marks: 80 Time:		180 mi	inutes
-	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	4	CO1	L2
		$) (p \land q) \rightarrow r \text{ii})(p) \rightarrow (q \land r) \text{iii}) \ p \land r \rightarrow q \text{iv}) \ p \rightarrow (q \rightarrow (\neg r))$			
	b	Define Tautology. Prove that for any propositions p,q,r the compound proposition $((p \land q) \land ((p \rightarrow r) \land (q \rightarrow r))) \rightarrow r$ is tautology	4	CO1	L3
	С	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.	e 6	CO2	L3
		OR			
-	a	Test the validity of the argument "If Raju goes out with his friends, he wil not study. If Ravi do not study his father become angry. His father is no angry. Therefore Ravi has not gone out with his friends.	l 5 t	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
	С	Establish validity of the argument (~ pv~q) → (r ∧ s) r → t ~t therefore p	5	CO1	L4
	d	Define dual of logical statement. Verify principle of duality for the following logical equivalence $[\neg(p \land q) \rightarrow \neg p \lor (\neg p \lor q)] \Leftrightarrow (\neg p \lor q)$	e 4	CO1	L3
2	a	Find coefficient of a ⁵ b ² in the expansion of (2a-3b) ⁷	5	C03	L3
	b	If L0,L1,L2 are Lucas numbers, prove that	5	CO4	L3

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		$Ln = \left[\frac{\left(1 + \sqrt{5}\right)}{2} \right]$	$\binom{n}{2} + \left(\frac{(1-\sqrt{5})}{2}\right)^n l$					
	С	c Find explicit definition of the sequence defined by a1=7, $a^n=2a^{n-1}+1$ for $n > 2$						
	d	How many tir	mes print statement executed in the following program	5	Co3	L3		
		segment? For i	=1 to 20					
		for j=1	to I do					
		for k=	1 to k do					
		prin	t((i*j)+(k*m))					
			OR					
-	а	In how many children so tha	ways can we distribute 7 apples and 6 oranges among 4 at each child gets at least 1 apple	4	CO3	L3		
	b	Prove by mat divides n⁵-n	hematical Induction that, for every positive integer n, 5	5	CO4	L3		
	С	Find number of	of arrangements of letters of the word "MASSASAUGA"	4	CO3	Lγ		
	d	Find explicit c	lefinition of the sequence defined by $a_1=7$. $a^n=2a^{n-1}+1$ for	6	CO3	 		
	-	$n \ge 2$		-				
3	а			6	C:06	13		
	u	Let A={2,3,4,6,	8,12,24} and let<= denotes the partial order of divisibility	0	000			
		that is x<=y m	eans x y. Let B = {4,6,12}. Determine: a)All upper bounds					
		of B , b) All lov	wer bounds of B, c) Least upper bound of B, d)Greatest					
		lower bound	of B					
	b	$ f D = \{(1,1), (1,2)\}$	(2,1)(2,2)(2,4)(4,2)(2,2)(4,4) defined on the set A = [1,2,2,4]	5	CO6	L3		
		$\Pi R = [(1,1),(1,2)]$	7,(2,1),(2,2),(3,4)(4,3),(3,3),(4,4)) defined off the set A- [1,2,3,4]					
		Determine the	e partition induced.		C06			
	с	Define partial x y.prove that	order. If R is a relation on A ={1,2,3,4} defined by X R Y if (A,R) is a POSET. Draw its Hasse diagram.	5	000	∟3		
	d	State the pige	eonhole principle. An office employs 13 clerks. Show that	4	CO5	L3		
		at least 2 of t year.	hem will have birthdays during the same month of the					
			OR					
-	Pra	w the Hasse Di	agram representing the positive divisors of 36	8	CO6	L3		
	h			1	COF	12		
	D D	Let A= {1,2,3,4	and let R be the relation defined by $R = [(x,y) x,y]$	4	005			
		belongs to A,	x<=y].Determine whether R is reitexive, symmetric, Anti irransitive					
		symmetric of i	I di Isilive.					
	C			8	C06	14		
	C	Define a relat	tion R on B as (a, b) R (c, d) if a + b = c + d. show that	0	000	L4		
		R is an equiv	alence relations. 1)reflexive 2) symmetric 3) irreflexive 4)					
	d	Anu symmetr	IC 5/ Iransilive relations.					
	u							
	2	Define Derand	ament. Find the number of derangement of 1.2.2.4 list all	6	C07			
4	a	the derangem	ent	0	007			
	ઉ૦	ve the recurre	nce relation a_{n+1} -3 ⁿ ,n>=0 with a_0 =1 by using method of	4	CO8	L3		
\vdash	5 %-	generaling fu	nculon	-	<u> </u>			
	eino	the number (or permutations of the letters a,b,c,,X,Y,Z in which hone of	/	C07	L4		
	Ø.		2 Da Da who arrivo lato for a dinner party find that only and	6	C07			
	αοι	chair at oach	2,F3,F4 WHO attive late for a unifier party liftu trial only one of five tables T1 22T2 T2 T4 T5 is vacant D1 will not sit at T1	U		∟4		
		otr T2 P2 will r	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.					
1								

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			OR			
-	а	An apple,a ba boys B1,B2,B3 a boy,B3 does n many ways the	nana,a mango and an orange are to be distributed to four and B4.The boys B1 and B2 do not wish to have apple,the ot want banana or mango and B4 refuses orange. In how e distribution can be made so that no boy is displeased?	8	CO7	L4
	b	Find the numb two of the patt	per of permutations of English letters which contain exactly terns car, dog,pun, byte	6	C07	L3
	С	A girl student Yellow. On M Red , on Wec Fridays Red. Ir during a week	has sarees of 5 different colors Blue Green red White and ondays she does not wear Green, On Tuesdays Blue or Inesdays Blue or Green. On Thursdays Red or Yellow, on In how many ways can she dress without repeating a color ?	6	CO8	L3
	d					
5	ab	Define the follo I) Spanning Isomorphism Define Graph Verify the tw Isomorphic	owing terms Tree ii) self Isomorphism. /o Graphs are	4	CO9 CO9	L2 L4
	С	Obtain optima	I prefix code for the message ROAD IS GOOD	6	CO10	L3
	a	Prove that If G	raph is self complementary then n or (n-1) must be multiple	4	CUG	L4
$\left - \right $		01 4.	OP			
$\left - \right $	2	If a tree bas 4	vertices of degree 2 one vertex of dogree 2 two vertices	Л	CO10	10
	d	of degree 4, o have ?	ne vertex of degree 5, how many pendant vertices does it	4	010	L3
	b	Show that Tree	e with n vertices has n-1 edges	4	CO10	L4
	С	Define optima {	l tree and construct optimal tree for a given set of weights }	8	C010	L3
	d	Let G(V,E) is s $m \leq \frac{1}{2}$ n (n-1) ii) how many v ii) for complete	simple graph with m edges and n vertices . Prove that i) ertices and edges are there for $K_{4.7}$ and $K_{7.11}$ e 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 mir		nutes
	Note	Answer all FIVE full questions. All questions carry equal marks.						-	-	
Мо	Qno.	Important Ques	stion					Marks	СО	Year
dul										
е										

Doc CodeKIT. Physic/F02Date: 1:0-20:0811Let p,r be propositions having truth values 0.0.1 respectively. Find the truth values of the following compound propositions. II $p \land q \mid -r$ iib $p \rightarrow q \land r \mid iib p \land r \mid -q \mid vip p - (q \rightarrow (-r r))$ C012Establish 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 bace to be made. NoC0120173Give didirect proceed then refunds would have bace to be made. NoC0220174Prove that for any three propositions p.q.r5C0120189Define loopen sentence ilQuantifiers for the following statement. If his divides n ⁴ -n.C01201721By mathematical induction prove that , for every positive integer n. 5C02201821By mathematical induction prove that , for every positive integer n. 5C03201821By mathematical induction prove that , for every positive integer n. 5C0320183For Fibonacci sequence For F1F2Prove that $Fn = \frac{1}{\sqrt{5}} (\frac{ 1+\sqrt{5} }{2})^n - (\frac{ 1-\sqrt{5} }{2})^n$ 5C03201731Let f RR be defined by f(0-13x-5, for xoo and -3x+1 for x<-0). Dibetermine ff(x) Di odd (xip x-5, for xoo and -3x+1 for x<-0). Dibetermine ff(x) Di odd (xip x-5, for xoo and -3x+1 for x<-0). Dibetermine ff(x) Di odd (xip x-5, for xoo and -3x+1 for x<-0). Dibetermine ff(x) Di odd (xip x-5, for xoo and -3x+2, for x+1 for d A + Lot 23, ABDE fiber a relation then AXA b	Logo		INST Teaching Process Rev No.: 1.0					
TitleCourse PlanPage: 25 / 2611Let p.q.r be propositions having truth values 0.0.1 respectively. Find the thru values of the following compound propositions. D $ p Aq - r ib p - (q A r ib p A r - q M p - (q - (\neg r))$ 4C0120172Establish 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 head to be made. No refunds were made. Therefore the band could play rock music a an odd integer then neg is an even integer.5C0120173Give idirect proof and ii proof by contradiction for the statement " if n is a no dol integer then neg is an even integer.4C0220175Define loopen sentence ii Quantifiers for the following statements, the universe comprises all nonzero integers. Determine the truth values of each statement. If $3 \times 30 \text{ (or)} \pm 100 \times 3 \times 30 \text{ (or)} \pm 100 \times 30 \text{ (or)} $	_		Doc Code:	SKIT .Ph5b1.F02	Date: 1	11-07-2	2018	
$\begin{array}{c} \begin{tabular}{l l l l l l l l l l l l l l l l l l l $			Title: Course Plan				5	
1 Let p d, 1 be proposition having that values out respectively. Find the true is the following compound propositions. 4 CO1 201 2 Establish values of the following compound propositions. 5 CO1 2017 2 Establish value been canceled and Alucia would have been angy. If the party were canceled , then refinds would have been angy. If the party were canceled and Alucia would have been angy. If the party were canceled in the refinds would have had to be made. No refunds were made. Therefore the band could play rock music 5 CO1 2017 3 Give bifteret proof and ii proof by contradiction for the statement 'f in is an ord integer then n-9 is an even integer. 4 CO2 2017 5 Define Dopen sentence iiDouantifiers for the following statements, the universe comprises all nonzero integers. Determine the truth values of each statement 1 b X. 3 (you-1) ii X. X (you-1) iii X. X (x-y-1) 5 CO4 2018 2 1 By mathematical induction prove that , for every positive integer n , 5 5 CO4 2018 3 For Fibonacci sequence Fo.Fi.F2Prove that 5 CO4 2017 8 4 a) How many arrangements are there of all letters in "SOCIOLOGICAL." 4 CO3 2017 5 Fibonacci sequence fo.Fi.F2Prove that for exploy thy D K (x) (Y (Copyrig	ht ©2017.	cAAS. All rights reserved	Koncettiene hering twith velves 2.24 respectively. Find the		<u> </u>	0047	
Inter values of the formaling compound polycesions:b) p A (= r ii p = (A r iii) p A (r = q iv p = (q → (-r))2222233333444756677888899 <td></td> <td>1</td> <td>Let p,q,r be p</td> <td>topositions having truth values 0,0,1 respectively. Find the</td> <td>4</td> <td>CO1</td> <td>2017</td>		1	Let p,q,r be p	topositions having truth values 0,0,1 respectively. Find the	4	CO1	2017	
P[pAq] + Tinp = (qAr) mp P(l + q mp P(l) + (q + q) + +				$\left(a \wedge r \right) = \left(a \wedge r \right) = \left(a \wedge r \right)$				
 2 Establish validity of the argument. If the band could not play rock music or the refreshment's 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 hear box music 3 Give idirect proof and ii) proof by contradiction for the statement "if n is an odd integer then n-g is an even integer. 4 Prove that for any three propositions p.q.r 5 CO1 2018 5 Define itopen sentence iii (Datantifiers for the following statements, the universe comprises all nonzero integers. Determine the truth values of each statement. B.x. ∃y (xy-1) iii ∃x. Y (xy-1) iii ∃x. (xy-1) 2 I By mathematical induction prove that , for every positive integer n. 5 5 CO4 2018 a divides n²-n. 2 Find coefficient of 0 x'y' in the expansion of (2x-3y)¹⁰ 3 For Fibonacci sequence Fo.F1.F2Prove that for any arrangements are there of all letters in "SOCIOLOGICAL" bin how many arrangements are there of all letters in "SOCIOLOGICAL" bin how many arrangements at Uvwels are adjacent ? 4 a) How many arrangements at 20 Ag pages. 2 Let A.f1.2.3.4.5.0.4(x)-1.3.5. 3 CO4 2017. 4 Let f R R be defined by f(0/-13x-5, for xo0 and -3x+1.for x<-0). 3 Determine f6x/3/1*(3).7*(-5,5). 3 1 Let f R R be defined by f(0/-13x-5, for xo0 and -3x+1.for x<-0). 5 CO6 2018 2 Let A.f1.2.3.4.5.Define a relation then AXA by (x1,y1) R (x2,y2) if and only if 5 CO6 2018 3 Consider a Poset whose Hassee diagram is given below. Consider a b. 2.4.4.2.0.3.4.4.(-0.0) and A4+1-6.3. 4 Let f and g be the functions from R to R defined by f(0/-ax+b and g(x) = 1-5 CO5 2018 5 Let a function fR - R be defined by f(0/-x*1.1 Find the images of A12.31 4 CO5 2017 A1.2.0.3.1.A.*(-0.0) and A4+1-6.3. 4 Let f and g be the			$p(p \land q) \rightarrow r$	$p \to (q \land r) \implies p \land (r \to q) \bowtie p \to (q \to (\neg r))$				
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c) The least upper bound of B d) The greatest lower bound of B e) Is this a lattice. $4 = 1 + \frac{1}{2} + \frac{1}{$			b)All lower bo	unds of B				
d) The greatest lower bound of B e) Is this a lattice.4Let f and g be the functions from R to R defined by $f(x)=ax+b$ and $g(x)=1-5$ CO520184Let f and g be the functions from R to R defined by $f(x)=ax+b$ and $g(x)=1-5$ 5CO520185Let a function $f:R \rightarrow R$ be defined by $f(x)=x^2+1$. Find the images of $A_1=[2,3]$, 4CO520176Let a function $f:R \rightarrow R$ be defined by $f(x)=x^2+1$. Find the images of $A_1=[2,3]$, 4CO5201741Five 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 orCO72018			c) The least up	oper bound of B	į l			
of B e)Is this a lattice.4 4 3 3 4CO520184Let f and g be the functions from R to R defined by $f(x)=ax+b$ and $g(x)=1-5$ 5CO52018 $x+x^2$. if $g \circ f(x)=gx^2-gx+3$. Determine a,b5Let a function $f:R \rightarrow R$ be defined by $f(x)=x^2+1$. Find the images of $A_1=[2,3]$, 4CO520175Let a function $f:R \rightarrow R$ be defined by $f(x)=x^2+1$. Find the images of $A_1=[2,3]$, 4CO5201741Five 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 orCO72018			d)The greates	st lower bound				
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A2=1-2,0,31,A3=(0,1) and A4=1-0,31. 4 1 Five teachers T1,T2,T3,T4,T5 are to be made class teachers for 5 classes 6 CO7 2018 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		5	Let a function	$f: \mathbb{R} \to \mathbb{R}$ be defined by $f(x)=x^2+1$. Find the images of $A_1=\{2,3\}$,	4	CO5	2017	
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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		1	Five teachers	T1 T2 T2 T4 T5 are to be made class togehere for 5 classes	6	C07	2010	
the class teachers for C1 or C2. T3 and T4 for C4 or C5. And T5 for C3 or	4	T		5, one teacher for each class T1 T2 do not wish to become	0	007	2010	
			the class teac	hers for C1 or C2. T3 and T4 for C4 or C5. And T5 for C3 or				

Lo	ogo	INST	Teaching Process		Rev No.: 1.0		
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		C4 or C5. In he					
		displacing any	/ teachers				
	2	Determine the number of positive integers n such that 1<=n<=100 and n is			CO8	2017	
		not divisible b					
	3	An apple,a banana,a mango and an orange are to be distributed to four			CO7	2017	
		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	e distribution can be made so that no boy is displeased?				
	4	Find the numb	per of permutations of English letters which contain exactly	5 CO	CO7	2018	
		two of the patterns car, dog,pun, byte					
	5	A girl student has sarees of 5 different colors Blue Green red White and				2017	
		Yellow. On M	ondays 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 ?					
5	1	Define the foll	owing terms	4	CO9	2017	
I) Bipartite Graph ii) Complete Bipertite Graph iii		I) Bipartite Gra	ph ii) Complete Bipertite Graph iii) Regular iv) Connected				
		Graph with an example					
				_	001		
	2	Discuss the solution of Konigsberg bridge problem		5	COg	2018	
	3	Define Graph	Isomorphism. Verify the	5	CO9	2018	
		two Graphs ar	e Isomorphic				
			c 3 4				
		R R					
	4	Show that I ree with n vertices has n-1 edges		5	CO10	2018	
	5	Obtain optimal prefix code for the message ROAD IS GOOD			CO10	2017	