Sri Indu
College of Engineering & Technology
UGC Autonomous Institution
Recognized under 2(f) & 12(B) of UGC Act 1956,
NAAC, Approved by AICTE &
Permanently Affiliated to JNTUH
Estd 2001

NAAC
NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL

HANDOUT

II year
Semester II

DEPARTMENT OF Artificial Intelligence and Data Science

ACADEMIC YEAR 2025-26

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CSE)

HANDOUT- INDEX

S. No	Contents
1	Vision, Mission, PEOs, POs, PSOs & COs
2	Institution Academic Calendar
3	Department Academic Calendar
4	Subject wise
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ii)	Lesson Plan
iii)	Question Bank
iv)	End Examination Questions (Previous 3 Academic Year)
v)	Mid-1 & Mid-2 Questions (Previous 3 Academic Year)

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

B. TECH –COMPUTER SCIENCE AND ENGINEERING (CSE)

INSTITUTION VISION

To be a premier Institution in Engineering & Technology and Management with competency, values and social consciousness.

INSTITUTION MISSION

IM1 Provide high quality academic programs, training activities and research facilities.

IM2 Promote Continuous Industry-Institute interaction for employability, Entrepreneurship, leadership and research aptitude among stakeholders.

IM3 Contribute to the economic and technological development of the region, state and nation.

DEPARTMENT VISION

To be excel in area of cyber security at the regional and global level and to effectively cater to the needs of the society.

DEPARTMENT MISSION

The Department has following Missions:

DM1 Provide high quality academic programmers, training activities and research facilities in cyber security.

DM2 Cultivate continues industry-institute interaction for employability, entrepreneurship, leadership and research aptitude among the learners.

DM3 Contribute to the economic, ethical and technological development of the society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Acquire the proficiency necessary to solve the cyber security problems and be job ready.

PEO 2: Apply cutting-edge solutions with in a professional, legal and ethical framework and will operate effectively in multidisciplinary teams.

PEO 3: Self learning to keep the knowledge and skills up to date and to remind up-to-date of the latest developments in cyber security.

PEO 4: Adhere to ethical practices in professional, societal and strong inspection for lifelong learning.

PROGRAM OUTCOMES (POs) & PROGRAM SPECIFIC OUTCOMES (PSOs)

PO	Description
PO 1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.
PO 3	**Design / development of Solutions:** Design solutions for complex engineering problems and design System components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to Provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding Of the limitations.
PO 6	**The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in Societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse Teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological Change
Program Specific Outcomes	
PSO 1	Diagnose the systems reliability in risk and threat environments.
PSO 2	Design and enforce computing based solutions according to the cyber security requirements.
PSO 3	Identify professional responsibilities and make informed judgments in computing practice based onlegal and ethical principles.

COs MAPPING WITH POs & PSOs

Discrete Mathematics

Course Outcomes	Statements
C211.1	Ability to understand and construct precise mathematical proofs
C211.2	Ability to use logic and set theory to formulate precise statements
C211.3	Ability to analyze and solve counting problems on finite and discrete structures
C211.4	Ability to describe and manipulate sequences
C211.5	Ability to apply graph theory in solving computing problems
C211.6	Ability to apply Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees problems

Course Articulation Matrix:

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C211.1	3	2	-	-	3	-	2	-	-	-	-	2	2	3	2
C211.2	3	3	-	2	2	-	-	-	-	-	-	-	3	3	2
C211.3	3	3	-	2	2	-	2	-	-	-	-	-	3	3	2
C211.4	3	2	3	2	-	-	2	-	-	-	-	-	3	2	1
C211.5	3	3	3	3	2	-	-	-	3	-	-	-	3	3	1
C211.6	3	3	3	3	-	-	2	-	3	-	-	-	3	3	1
C211	**3**	**2.8**	**3**	**2.6**	**2.2**	**-**	**2**	**-**	**3**	**-**	**-**	**2**	**2.8**	**2.8**	**1.5**

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution under UGC, New Delhi)
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Sheriguda (V), Ibrahimpatnam, R.R.Dist, Hyderabad - 501 510

D4

ANNEXURE -III

BR-22

Lr.No.SICET/AUTO/DAE/II B.Tech Academic Calendar/30/2025

B.TECH II-YEAR I-SEM & II-SEM ACADEMIC CALENDAR
(FOR ACADEMIC YEAR : 2025-26)

Academic Calendar for B.Tech – II[nd] Year Students (2024 - 25 Batch), BR-22 Regulation.

I – Semester

S.No.	EVENT	PERIOD	DURATION
1.	**Commencement of class work.**	**01.08.2025**	
2.	1st Spell of Instructions for covering First Two and a half Units.	01.08.2025 –07.10.2025	9 Weeks
3.	I Mid Term Examinations.	08.10.2025 –10.10.2025	3 Days
4.	Submission of I Mid Term Examination Marks.	16.10.2025	
5.	2nd Spell of Instructions for Remaining Two and a half Units.	13.10.2025 – 13.12.2025	9 Weeks
6.	II Mid Term Examinations.	15.12.2025 – 17.12.2025	3 Days
7.	Preparation Holidays and Practical Examinations	18.12.2025 – 27.12.2025	1 Week
8.	Submission of II Mid Term Examination Marks.	23.12.2025	
9.	I Semester End Examinations.	29.12.2025 – 10.01.2026	2 Weeks
Commencement of Class-Work for II B.Tech - II Semester 19.01.2026			

Note: **No of Working/instructional days : 92**

II – Semester

S.No.	EVENT	PERIOD	DURATION
1.	**Commencement of class work.**	**19.01.2026 (Monday)**	
2.	1st Spell of Instructions for covering First Two and a half Units.	19.01.2026 – 14.03.2026	8 Weeks
3.	I Mid Term Examinations.	16.03.2026 – 18.03.2026	3 Days
4.	Submission of I Mid Term Examination Marks.	24.03.2026	
5.	2nd Spell of Instructions for Remaining Two and a half Units.	20.03.2026 – 09.05.2026	7 Weeks
6.	Continuation of remaining 2nd Spell of Instructions	25.05.2026 – 10.06.2026	2 Weeks
7.	II Mid Term Examinations.	11.06.2026 –13.06.2026	3 Days
8.	Preparation Holidays and Project Evaluation.	15.06.2026 – 20.06.2026	1 Week
9.	Submission of II Mid Term Examination Marks.	18.06.2026	
10.	II Semester End Examinations	22.06.2026 – 04.07.2026	2 Weeks

Note: **No of Working/instructional days : 92**

ACE **CE** **DIRECTOR** **PRINCIPAL**

Controller of Examination
Sri Indu College of Engineering & Technology
(An Autonomous Institution Under UGC)
Sheriguda (V), Ibrahimpatnam, R.R. Dist-501510

DIRECTOR
Sri Indu College of Engineering & Technology
(An Autonomous Institution Under UGC)
Sheriguda (V), Ibrahimpatnam, R.R. Dist-501510

PRINCIPAL
Sri Indu College of Engineering & Technology
(An Autonomous Institution Under UGC)
Sheriguda (V), Ibrahimpatnam, R.R. Dist-501510.

Sign: _____
Dr. M.V.S.S. Giridhar
Prof. of CEA; JNTUH Nominee

Sign: _____
Dr. T. Venu Gopal
Prof. of CSE; JNTUH Nominee

Sign: _____
Dr. D. Ramesh
Prof. of CSE; JNTUH Nominee

(Copy to DAP&E and Copy to all the Dept. Heads)

SRI INDU COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT Academic CALENDAR – 2025-2026 (SEMESTER-1)

DAYS													
SUNDAY						SEPTEMBER-25						DECEMBER -25	
MONDAY		JULY-25			1	MID EXAM-I (IV)		OCTOBER-25			1	(IV)I Semester End Examinations.	
TUESDAY	1				2	MID EXAM-I (IV)					2	(IV)I Semester End Examinations	
WEDNESDAY	2				3	MID EXAM-I (IV)	1	DASARA HOLIDAYS			3	(IV)I Semester End Examinations	
THURSDAY	3			AUGUST-25	4	Commencement of Classes (IV Yr)	2	DASARA HOLIDAYS /GANDHI JAYANTHI			4	(IV)I Semester End Examinations	
FRIDAY	4		1	Commencement of Classes (II Yr)	5	MILAD UN-NABI	3	DASARA HOLIDAYS		NOVEMBER-25	5	(IV)I Semester End Examinations	
SATURDAY	5		2		6	GANESH NIMAJANAM	4	DASARA HOLIDAYS	1		6	(IV)I Semester End Examinations	
SUNDAY	6	HOLIDAY	3	HOLIDAY	7	HOLIDAY	5	HOLIDAY	2	HOLIDAY	7	HOLIDAY	
MONDAY	7	Commencement of Classes (IV Yr)	4		8		6		3		8	(IV)I Semester End Examinations	
TUESDAY	8	DRIVE	5		9		7		4		9	(IV)I Semester End Examinations	
WEDNESDAY	9		6		10		8	MID EXAM-I (II&III)	5	GURUNANK JAYANTHI	10	(IV)I Semester End Examinations	
THURSDAY	10		7		11		9	MID EXAM-I (II&III)	6		11	(IV)I Semester End Examinations	
FRIDAY	11		8		12		10	MID EXAM-I (II&IIII)	7		12	(IV)I Semester End Examinatio	

												ns
SATURDAY	12		9	RAKSHA BANDHAN	13	SECOND SATURDAY	11	SECOND SATURDAY	8	SECOND SATURDAY	13	SECOND SATURDAY
SUNDAY	13	HOLIDAY	10	HOLIDAY	14	HOLIDAY	12	HOLIDAY	9	HOLIDAY	14	HOLIDAY
MONDAY	14	Commencement of Classes (III Yr)	11		15		13	Commencement of Classes (II& III Yr)	10		15	MID EXAM-II (II&III)
TUESDAY	15		12		16		14		11		16	MID EXAM-II (II&III)
WEDNESDAY	16		13	MOU SIGNING CEREMONY	17		15		12		17	MID EXAM-II (II&IIII)
THURSDAY	17		14		18		16		13		18	
FRIDAY	18		15	INDEPENDENCE DAY	19		17		14		19	
SATURDAY	19		16	JANMASTHAMI	20		18		15		20	
SUNDAY	20	HOLIDAY	17	HOLIDAY	21	HOLIDAY	19	HOLIDAY	16	HOLIDAY	21	HOLIDAY
MONDAY	21	BONALU	18		22	BATHUKAMMA CELEBRATIONS	20	DIWALI	17		22	II&III YR PRACTICAL EXAM
TUESDAY	22		19		23		21	DIWALI	18		23	II&III YR PRACTICAL EXAM
WEDNESDAY	23	VENDOR CLASSES (IV YR)	20		24		22		19	MID EXAM-II (IV)	24	II&III YR PRACTICAL EXAM
THURSDAY	24		21		25		23		20	MID EXAM-II (IV)	25	II&III YR PRACTICAL EXAM
FRIDAY	25		22		26		24		21	MID EXAM-II (IV)	26	
SATURDAY	26		23		27		25		22		27	
SUNDAY	27	HOLIDAY	24	HOLIDAY	28	HOLIDAY	26	HOLIDAY	23	HOLIDAY	28	HOLIDAY
MONDAY	28		25		29	DASARA HOLIDAYS	27		24		29	(II&III)I Semester End Examinations
TUESDAY	29		26		30	DASARA HOLIDAYS	28		25	IV YR PRACTICAL EXAM	30	(II&III)I Semester End Examinations
WEDNESDAY	30		27	VINAYAKA CHATHURTHI			29		26	IV YR PRACTICAL EXAM	31	(II&III)I Semester End Examinations
THURSDAY	31		28				30		27			

FRIDAY			**29**				**31**		**28**					
SATURDAY			**30**						**29**					
SUNDAY			**31**	**HOLIDAY**					**30**	**HOLIDAY**				
MONDAY														

CALENDAR INCHARGE **HOD/CSE** **DEAN** **PRINCIPAL**

DISCRETE MATHEMATICS

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING	Prepared onRev1: Page:1of9
Sub.Code&Title	R22CSE2111 & DISCRETE MATHEMATICS	
AcademicYear:2023-24	Year/Sem./Section	II/II/A/B/C/D
Faculty Name&Designation	P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF	

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution under UGC, New Delhi)

B.Tech. - II Year – II Semester

L	T	P	C
3	0	0	3

(R22CSE2111) DISCRETE MATHEMATICS

Course Objectives:

- Introduces elementary discrete mathematics for computer science and engineering.
- Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

Course Outcomes:

- Understand and construct precise mathematical proofs
- Apply logic and set theory to formulate precise statements
- Analyze and solve counting problems on finite and discrete structures
- Describe and manipulate sequences
- Apply graph theory in solving computing problems

UNIT - I

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT - II

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT - III

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT - IV

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

UNIT - V

Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel,Teodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE BOOKS:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, Pearsoneducation, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill publishing co.

Unit/ Item No.	Topic (s)	Book Reference	Page (s) From	Page (s) To	Teaching Methodology	Proposed No. of Periods	Actual Date of Handled	CO/RBT
	UNIT-I							
I	Introduction					14		

1.1	**The Foundations: Logic and Proofs:** Mathematical logic	T1	1	16	Black board	02		CO1, L2
1.2	Statements and Notation	T1	16	25	Black board	01		CO1, L2
1.3	Connectives	T1	25	36	Power point Presentation	02		CO1, L2
1.4	Normal Forms	T1	36	57	Black board	01		CO1, L2
1.5	Theory of Inference for the Statement Calculus	T1	57	69	Black board	01		CO2, L4
1.6	The Predicate Calculus	T1	69	80	Black board	02		CO2, L4
1.7	Inference Theory of the Predicate Calculus	T1	80	92	Black board	02		CO2, L4
1.8		T1	92	109	Black board	02		CO2, L4
1.9	Revision on 1st unit	T1	1	109	Black board	01		CO2, L4
	Review	**Signature of the HOD/Coordinator**						
Unit/ Item No.	**Topic (s)**	Book Reference	Page (s)		Teaching Methodology	Proposed No. of Periods	**Actual Date of Handled**	**CO/RBT**
UNIT –II								
II	**Introduction**					**21**		
2.1	**Set Theory :**Introduction	R4	115	115	Black board Presentation	01		CO3, L3

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING	Prepared onRev1: Page:1of9
Sub.Code&Title	R22CSE2111 & DISCRETE MATHEMATICS	
AcademicYear:2023-24	Year/Sem./Section	II/II/A/B/C/D
Faculty Name&Designation	P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF	

Unit/ Item No.	Topic (s)	Book Reference	Page (s) From	Page (s) To	Teaching Methodology	Proposed No. of Periods	Actual Date of Handled	CO/RBT
2.2	Sets	T1	115	127	Black board	02		CO 3, L3
2.3	Basic Concepts	T1,R4	127	130	Power point Presentation	01		CO 3, L3
2.2	Set Theory	T1,R4	130	133	Power point Presentation	01		CO 3, L3
2.3	Types	T1	133	138	Black board	01		CO 3, L3
2.4	Representation of Discrete Structures	T1	138	156	Black board	01		CO 3, L3
2.5	Discrete Structures concept and Types	T1	156	160	Black board	02		CO 3, L3
2.6	Relations	T1,R4	160	177	Black board	02		CO 3, L3
2.7	Relations and Their Properties	T1	573	583	Black board	01		CO 3, L3
2.8	Relations and Their Applications	T1	583	591	Black board	01		CO 3, L3
2.9	Representing Relations	T1	591	597	Black board	01		CO 3, L3
2.10	Relations and Ordering	T1	597	607	Black board	02		CO 3, L3
2.11	Function	T1	607	618	Black board	02		CO 3, L3
2.12	Functions Types	T1	618	633	Black board	02		CO 3, L3
2.13	Revision on 2nd unit	T1	115-177	573-633	Black board	01		CO 3, L3
	Review	**Signature of the HOD/Coordinator**						
	UNIT- III							
III	**Algebraic Structures**					**13**		
3.1	**Algebraic Structures : Introduction**	R4	191	204	Black board	02		CO4, L6
3.2	Algebraic Brief Explanation	T1, R3	204	218	Black board	01		CO4, L6
3.3	Algebraic Systems	T1	218	232	Black board	01		CO4, L6

3.4	**Induction Semi groups and Monodis**	T1, T3, R3	311	333	Power point Presentation	02		CO4, L6
3.5	Lattices As Partially Ordered Sets	T1	333	344	Black board	02		CO4, L6
3.6	Explain about sets	T1	344	360	Black board	01		CO4, L6
3.7	Boolean Algebra	T1	360	372	Black board	02		CO4, L6
3.8	Boolean types	T1	372	377	Black board	01		
3.9	Revision on 3rd unit	T1	191-232	311-377	Black board	01		
	Review	**Signature of the HOD/Coordinator**						

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING	Prepared onRev1: Page:1of9
	Sub.Code&Title: R22CSE2111 & DISCRETE MATHEMATICS	
	AcademicYear:2023-24 / Year/Sem./Section: II/II/A/B/C/D	
	Faculty Name&Designation: P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF	

UNIT-IV								
IV	Introduction Elementary Combinatorics					15		
4.1	**Elementary Combinatorics**	T1	445	445	Black board	02		CO5, L6
4.2	An Introduction to Es	T1	445	452	Black board	01		CO5, L6
4.3	Basic of counting	T1	452	468	Black board	01		CO5, L6
4.4	Combinations and Permutations	T1	468	477	Black board	01		CO5, L6
4.5	Enumeration of Combinations And Permutations	T1	477	494	Power point Presentation	01		CO5, L6
4.7	**Repetitions**	T1	501	514	Black board	01		CO5, L6
4.8	Enumerating Permutation	T1	514	517	Black board	02		CO5, L6
4.9	Constrained Repetitions	T1	517	527	Black board	01		CO5, L6
4.10	Binomial Coefficient	T1	527	537	Black board	01		CO5, L6
4.11	Multinomial Theorems	T1	537	552	Black board	02		CO5, L6
4.12	The Principle of Inclusion-Exclusion	T1	552	558	Black board	01		CO5, L6
4.13	Revision on 4th unit	T1	445	565	Black board	01		CO5, L6
	Review	**Signature of the HOD/Coordinator**						

UNIT-V								
V	Graphs					15		
5.1	Graphs and Graph Models	T1	641	651	Black board	01		CO6, L6
5.2	Graph Terminology and Special Types of Graphs	T1	651	668	Power point Presentation	01		CO6, L6

5.3	Representing Graphs and Graph Isomorphism	T1	668	678	Power point Presentation	01		CO6, L6
5.4	Connectivity	T1	678	693	Black board	01		CO6, L6
5.5	Euler and Hamilton Paths	T1	693	707	Black board	01		CO6, L6
5.6	Shortest-Path Problems	T1	707	718	Black board	01		CO6, L6
5.7	Planar Graphs,	T1	718	727	Black board	01		CO6, L6
5.8	Graph Coloring	T1	727	735	Black board	01		CO6, L6
5.9	**Trees:** Introduction to Trees, Applications of Trees	T1	745	772	Black board	02		CO6, L6
5.10	Tree Traversal	T1	772	785	Black board	01		CO6, L6
5.11	Spanning Trees	T1	785	797	Black board	01		CO6, L6
5.12	Minimum Spanning Trees	T1	797	803	Black board	02		CO6, L6
5.13	Revision on 5th unit	T1	641	803	Black board	01		CO6, L6
	Review	**Signature of the HOD/Coordinator**						

Sub.Code&Title	R22CSE2111 & DISCRETE MATHEMATICS	
AcademicYear:2023-24	Year/Sem./Section	II/II/A/B/C/D
Faculty Name&Designation	P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF	

LIST OF TEXT BOOKS AND REFERENCES

TEXT BOOKs:

	BOOK TITLE with Author & Edition
TB1	Discrete Mathematics and its Applications with Combinatorics and Graph Theory- Kenneth H. Rosen, 7th Edition, TMH.

REFERENCE BOOKS:

	BOOK TITLE with Author & Edition
TB1	Discrete Mathematical Structures with Applications to Computer Science-J.P. Tremblay and R. Manohar, TMH,
TB2	Discrete Mathematics for Computer Scientists & Mathematicians: Joe L. Mott, Abraham Kandel, Teodore P. Baker, 2nd ed, Pearson Education.
TB3	Discrete Mathematics- Richard Johnsonbaugh, 7Th Edn., Pearson Education.
TB4	Discrete Mathematics with Graph Theory- Edgar G. Goodaire, Michael M. Parmenter.
TB5	Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, 5th edition, Pearson Education.

WEB LINKS

W1. .https://www.cs.sfu.ca/~ggbaker/zju/math/proof.html

W2. https://gcallah.github.io/DiscreteMathematics/app_proplogic.html

W3. https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_sets.htm

W4. https://cse.buffalo.edu/~rapaport/191/seqsum.html

W5. https://www.geeksforgeeks.org/discrete-mathematics-representing-relations/?ref=rp

W6. https://www.geeksforgeeks.org/mathematics-closure-relations-equivalence-relations/

W7. https://www.cs.odu.edu/~toida/nerzic/content/relation/order/order.html

W8. https://faculty.uml.edu/klevasseur/ads/s-matrices-of-relations.html

W9. https://www.geeksforgeeks.org/introduction-to-algorithms/

W10. https://www.cs.odu.edu/~toida/nerzic/content/recursive_alg/rec_alg.html

W11. https://study.com/academy/lesson/recursive-functions-definition-examples.html

W12. https://users.encs.concordia.ca/~chvatal/notes/pc.html

Sri Indu College of Engineering and Technology
(An Autonomous Institution under UGC)
Sheriguda (V), Ibrahimpatnam (M), Ranga Reddy (Dist) – 501 510

Department of Artificial Intelligence & Data Science

ROOM NO: Main 402
Class: II-I SEM (AI& DS)

Time - Table

w.e.f:01-08-2025

Days /Time	9:40 – 10:40 1	10:40 – 11:40 2	11:40 – 12:40 3	12:40 To 1:20	1:20 – 2:15 4	2:15 – 3:10 5	3:10 – 4:00 6
Monday	JAVA	DS	COA		<---------- DS Lab ---------->		
Tuesday	COA	JAVA	JAVA	**L**	OS	COA	DM
Wednesday	DS	COI	DS	**U**	<--------- SDC Lab---------->		
Thursday	<---------- OS Lab ---------->			**N**	DM	DS	JAVA
Friday	<--------- JAVA Lab---------->			**C**	OS	DM	COA
Saturday	OS	JAVA	COA	**H**	COI	DM	OS

SUBJECT CODE	SUBJECT NAME	NAME OF THE FACULTY
R22CSE2111	DISCRETE MATHEMATICS	Mrs. P. PRAVALIKA CHANDAR
R22CSE2213	OPERATING SYSTEMS	Mr. R. MADHAVA REDDY
R22CSE2112	DATA STRUCTURES	Miss. M. SUMANJALI
R22CSE2115	OBJECT ORIENTED PROGRAMMING THROUGH JAVA	Mrs. MA. SHABANA PARVEEN
R22CSE2114	COMPUTER ORGANIZATION AND ARCHITECTURE	Mrs. D. JYOTHI
R22CSE2226	OPERATING SYSTEMS LAB	Mr. R. MADHAVA REDDY/ Mrs. D. JYOTHI
R22CSE2126	DATA STRUCTURES LAB	Miss. M. SUMANJALI/ Mrs. T. TEJASWI
R22CSE2228	JAVA PROGRAMMING LAB	Mrs. MA.SHABANA PARVEEN/ Mrs. P. CHAITHANYA
R22MAC2110	CONSTITUTION OF INDIA	Mr. Dr. SANJAY
R22CSE2129	SKILL DEVELOPMENT COURSE (DATA VISUALIZATION- R PROGRAMMING/POWER BI)	Mrs. T. TEJASWI/ Mrs. D.JYOTHI

CLASS -CO-ORDINATOR
Mrs. MA. Shabana Parveen

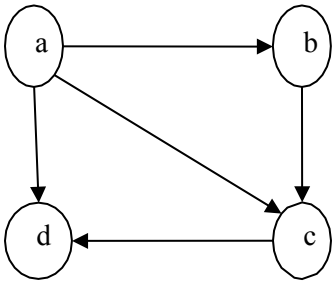
HOD

	SRI INDU COLLEGE OF ENGG & TECH **QUESTION BANK** **(Regulation :R22)** **DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING**	**Prepared onRev1:** **Page:1of9**

Sub.Code&Title	**R22CSE2111 & DISCRETE MATHEMATICS**		
AcademicYear:2023-24		**Year/Sem./Section**	**II/II/A/B/C/D**
Faculty Name&Designation		**P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF**	

ASSIGNMENT

S.No.	Assignment Questions	Course Outcome	Books To be Referred	Date Of Announcement	Date Of Submission
I.	a. Construct the truth table for the compound proposition $(p \rightarrow q) \leftrightarrow (\neg p \rightarrow \neg q)$. b. Construct the truth table for the compound proposition $(p \rightarrow q) \rightarrow (q \rightarrow p)$.	CO1	T1,		
2.	a. Show that $(\rightarrow r) \wedge (q \rightarrow r) (p \vee q) \rightarrow r$ are logically equivalent. b. Show that the propositions $\rightarrow q$ *and* $\neg p \vee q$ are logically equivalent.	CO1, CO4	T1,		
3.	a. Show that $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$ is a tautology b. Is $\neg p \wedge (p \vee q)) \rightarrow q$ a tautology?	CO4	T1		
4.	a. What are the negations of the statements $\forall x\ (x2 > x)$ *and* $\exists x\ (x2 = 2)$? b. Write the negation of the statement$(\exists x)(\forall y)P(x,y)$.	CO4	T1		
5.	.Let A= {1,2,3,4,5,6,12}. 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	CO2	T1		
6.	Let A= {1, 2, 3, 4} and let R be the relation on A defined by xRy if and only if "x divides y", written X | y. i) Write down R as a set of ordered pairs. ii) Draw the diagraph of R. iii)determine in-degree and out-degrees of the each vertex.	CO4	T2, R4		

7.	1. Let a={1, 2, 3} and b= {2, 4, 5}. Determine the following: i) |AxB| ii) Number of relations from A to B iii) Number of binary relations on A. (applying)	CO5	T1, R4		
8.	2. Let A= {1, 2, 3, 4 }. Determine the nature of the following relations on A. R1 = { (1 ,1), (1 ,2), (2 ,1), (2 ,2), (3 ,3), (3 ,4), (4 ,3), (4 ,4) } R2 = { (1,2), (1 ,3), (3 ,1), (1 ,1), (3 ,3), (3 ,2), (1 ,4), (4 ,2), (3 ,4) } , R3 represented by the graph: (analyzing) 	CO6	T1		
9.	Use mathematical induction to show that $1 + 2 + 22 + \cdots + 2n = 2n+1 - 1$ for all nonnegative integers n.	CO5	T1		
10.	Conjecture a formula for the sum of the first n positive odd integers. Then prove your conjecture using mathematical induction.	CO6	T1		

SELF STUDY TOPICS			
S.No.	**Topics**	**Books & Journals**	**Course Outcomes**
1	Discrete Probability and Advanced Counting Technique	"Discrete Mathematics for Computer Scientists & Mathematicians: Joe L. Mott, Abraham Kandel, Teodore P. Baker, 2nd ed, Pearson Education.	CO2
2	Graphs and Trees	Discrete Mathematics- Richard Johnsonbaugh, 7Th Edn., Pearson Education.	CO4

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UNIT I-MATHEMATICL LOGIC : Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculs, The Predicate Calculus, Inference Theory of the Predicate Calculus**.**

	MultiplechoiceQuestions	BTLevel	Course Outcome
1C-1	Whichofthefollowingstatementisa proposition? ( ) a)Getmeaglassof milkshake b)Godbless you! c)Whatisthetimenow? d)Theonlyoddprimenumberis2	1	CO1
1C-2	Whichofthefollowingbitsisthenegationofthebits“010110”? ( ) a)111001 b) 001001 c)101001 d)111111	1	CO1
1C-3	If P→qislogicallyequivalent to ( ) a)¬p∨¬q b)p∨¬q c)¬p∨q d)¬p∧q	2	CO1
1C-4	The statement, “At least one of your friends is perfect”. Let P (x) be “x is perfect” and let F(x) be“xisyour friend”andletthedomainbeallpeople. ( ) a)∀x(F(x)→P(x)) b)∀x (F(x) ∧P(x)) c)∃x(F(x)∧P(x)) d)∃x(F(x)→ P(x))	2	CO1
1C-5	p↔qislogicallyequivalent to ( ) a)(p → q)→(q →p) b)(p→ q)∨(q →p) c)(p → q)∨(q→p) d)(p∧q)→(q∧p)	2	CO1

1C-6	"The product of two negative real numbers is not negative." Is given by? ( ) a) ∃x ∀y((x<0) ∧ (y < 0) → (x y >0))b) ∃x ∃y ((x < 0) ∧ (y < 0) ∧ (x y > 0)) c) ∀x ∃y((x<0) ∧ (y < 0) ∧ (x y >0))d) ∀x ∀y ((x < 0) ∧ (y < 0) → (x y > 0))	2	CO1
1C-7	Which of the following is correct with respect to precedence of logical operators ( )? a) ↔, →, ^, v, ~ b) v, ^, ↔, →, ~ c) ~, ^, v, →, ↔ d) →, ^ ~, ↔, v	5	CO1
1C-8	A compound proposition that is always tautology ( ) a) True b) False c) Both d) None	2	CO1
1C-9	p ∧ q is logically equivalent to ( ) a) (p →¬ q) b) (¬p → ¬q) c) ¬ (p →¬q) d) (¬p → q)	2	CO1
1C-10	Let P (x) denote the statement "x >7." Which of these have truth value true? ( ) a) P (0) b) P (4) c) P (6) d) P (9)	3	CO1
1C-11	Thecompoundpropositionspandqarecalledlogicallyequivalentthenitisa tautology ( ) a) p↔ q b) p→ q c) ¬(p∨ q) d) ¬p∨ ¬q	2	CO1
1C-12	State rule of inference ~q p—>q	1	CO1

	~~p~~ a)Modusponens b)ModusTollens c)Addition d)None	2	
1C-13	Thepremises(p∧q)∨randr→simplywhichoftheconclusion? ( ) a)p∨r b)p∨s c)p∨q d)q∨r	1	CO1
1C-14	Thecontrapositiveofp→qisthepropositionof ( ) a)¬p→¬q b)¬q→¬p c)q→p d)¬q→p	2	CO1
1C-15	Let P: We should be honest., Q: We should be dedicated., R: We should be overconfident.Then'WeshouldbehonestordedicatedbutnotoverconfidentisbeIst represented by ( ) a)~P V ~QVR b) P∧~Q∧R c) PVQ∧R d) PVQ∧~R	1	CO1
	Fillintheblanks		
1F-1	_____isthe proposition"if pthenq"	2	CO1
1F-2	The Proposition q -> pis called _____ofp->q	2	CO1
1F-3	Acompoundpropositionthatisneitheratautologynoracontradictioniscalled	1	CO1
1F-4	AnOccurrenceofavariablethatisnotboundbyaquantifierorsetequaltoaparticularvalue is said to be_____	1	CO1
1F-5	The part of the logical expression to which a quantifier is applied is called the _____ of quantifier	4	CO1
1F-6	_____isasequenceofstatementsthat endwithaconclusion	3	CO1

1F-7	A _____isastatementthatisbeingproposedtobeatruestatementusuallyonthe basis of some partial evidence	2	CO1
1F-8	Commonformsof incorrectreasoningiscalled_____	2	CO1
1F-9	The converse ofp → qis the proposition of_____	3	CO1
1F-10	∀x p(x)is the same as _____	2	CO1
1F-11	_____isdefiningtheobjectinstatement	1	CO1
1F-12	The symbol of rule UG is_____	2	CO1
1F-13	Formulaofdistributive lawis_____	2	CO1
1F-14	FullformofPDNFis_____	2	CO1
1F-15	The logic basedonthe analysisof predicateiscalled_____	1	CO1

Matchthefollowing

1M-1	Matchthe following a) Conjunction ( ) b) Disjunction ( ) c) Tautology ( ) d) Contradiction ( ) e) Contingency ( ) i) Itisalways false ii) CombinationofbothT&F iii) P∧Q iv) PVQ V)Itisalways true	2	CO1
1M -2	Matchthe following)Commutativelaw ( ) b) Demorganslaw ( ) c) Associativelaw ( ) a) Distributive law ( ) b) Absorptionlaw ( ) i) pV(q∧r)⟺(pVq)∧(pV r) ii) p∧(q∧r)⟺(p ∧q)∧r iii) [pV(p∧q)]⟺p iv) (pVq)⟺ (qVp) v) ~(p∧q)⟺~pV ~q	2	CO1
1M -3	Matchthe following a) DNF ( ) b) CNF ( ) c) Universal quantifier ( ) d) Existential quantifier ( ) (p1∧p2∧p3∧……∧pn)→C ( ) i) Premises ii) ∃ iii) ∀ iv) Sum ofelementaryproduct v) Productofelementarysum	3	CO1

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1M -4	Matchthe following a) Modusponens ( ) i)[~p∧(p→q)]→~p b) Modustollens ( ) ii) (p∧q)→p c) Disjunctivesyllogism ( ) iii) [p∧(p→q)]→q d) Simplification ( ) iv) [(p→q) ∧(q→r)]→(p→r) e) Hypotheticalsyllogism ( ) V)[(pVq)∧~q]→q	2	CO1
1M -5	Matchthe following	1	CO1

1M.1	a) Rule-p	( )	i)P(t)forall t ∀(x)[p(x)]	1	
1M.2	b) Rule-ES	( )	ii)R→S	2	
	c) Rule-US	( )	iii)IntroduceatanystepinDerivation		
1M.3	d) Rule-CP	( )	iv)∃(x)[p(x)] p(t)forsomet	2	
1M.4					
1M.5	e) Rule-UG	( )	v)∀(x)[p(x)] P(t)forallt	3 1	

UNIT I-MATHEMATICL LOGIC : Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculs, The Predicate Calculus, Inference Theory of the Predicate Calculus**.**

PART-A

Q No.	Questions	Bloom's Taxonomy Level	Course Outcomes
1.	Construct the truth table for the compound proposition $(p\rightarrow q)\leftrightarrow(\neg p\rightarrow\neg q)$. (remembering)	1	CO1, CO6
2.	Construct the truth table for the compound proposition $(p\rightarrow q)\rightarrow(q\rightarrow p)$. (understanding)	2	CO1, CO6
3.	What are the contra positive, the converse and the inverse of the conditional statement "If you work hard then you will be rewarded". (understanding)	2	CO1, CO6
4.	Find the truth table for the statement $p\rightarrow\neg q$. (remembering)	1	CO1,CO6
6.	Write the symbolic representation and give its contra positive statement of "If it rains today, then I buy an umbrella". (understanding)	2	CO1,CO6
7.	When do you say that two compound propositions are equivalent ? (remembering)	1	CO1,CO6
8.	Show that $(\sim r)\wedge(q\rightarrow r)$, $(p\vee q)\rightarrow r$are logically equivalent. (remembering)	1	CO1,CO6
9.	Gi ve an indirect proof of the theorem "If$3n$+2 is odd, then n is odd.(creating)	6	CO1,CO6
10.	Prove that $p, p\rightarrow q, q\rightarrow r\Longrightarrow r$ (Applying)	3	CO1,CO6

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PART–B

1.(a)	*prove that* $[(p \vee q) \wedge \sim(\sim p \wedge (\sim q \vee \sim r))] \vee (\sim p \wedge \sim q) \vee (\sim p \wedge \sim r)$ *is a tautology*	2	CO1
1. (b)	*show that* $(p \to q), (r \to s), (q \to t), (s \to u), \sim(t \wedge u), (p \to r) \Rightarrow \sim p$	2	CO1
2(a)	Define Tautology. Draw the truth table for tautology.	2	CO1,CO6
2(b)	State the Laws of Logic.	2	CO1,CO6
3. (a)	Find the DNF of the following **p→{(p→ q) ^ ~(~q v ~p)}**	6	CO1,CO6
3.(b)	Find CNF of the following **[~(pvq) ↔(p^q)]**	2	CO1,CO6
4.(a)	Show that $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ without using truth table. (remembering)	1	CO1,CO6
4.(b)	Show that $\forall x P(x) \wedge \exists x Q(x)$ is equivalent to $\forall x \exists y (P(x) \wedge Q(y))$ (remembering)	1	CO1,CO6
5.	*State the converse,inverse and contrapositive of the following conditional*: (1) *if a quadrilateral is a parallelogram, then its diagonals bisect each other* (2) *if a real number* x^2 *is greater than zero,then x is not equal to zero* (3) *if a triangle is not isosceles, then it is not equilateral.*	2	CO1,CO6
6. (a)	Prove the argument is valid $\forall x,[P(x) \to \{q(x) \wedge r(x)\}]$, $\forall x,[P(x) \wedge s(x)]$ $\therefore \forall x,[r(x) \wedge s(x)]$ (creating)	5	CO1,CO6
6.(b)	Prove that $(P \longrightarrow Q) \wedge (R \longrightarrow Q) \Leftrightarrow (P \vee R) \longrightarrow Q)$ (creating)	6	CO1,CO6
7	*consider the following propositions concerned with a certain triangle ABC* *p*:*ABC is isosceles*. *q*:*ABC is equilateral*. *r*:*ABC is equiangular*. *write down the following compound propositions in words*. (1) $p \wedge (\sim q)$ (2) $(\sim p) \vee q$ (3) $p \to q$ (4) $q \to p$ (5) $(\sim r) \to (\sim q)$	1	CO1,CO6
8.(a)	Prove that the premises p∨q,(p∨q)→r,~r are inconsistent. (creating)	6	CO1,CO6
8.(b)	Without using truth table find PCNF and PDNF of $[P \longrightarrow (Q \wedge R)] \wedge [\neg P \to (\neg Q \wedge \neg R)]$. (Applying)	3	CO1,CO6
9.(a)	*show that p from these premises* $(\sim p \vee q) \to r, r \to (s \vee t), (\sim s \wedge \sim u), (\sim u \to \sim t)$ (remembering)	1	CO1,CO6
9.(b)	Show that the premises "One student in this class knows how to write program in JAVA", and "Everyone who knows how to write the program in JAVA can get a high paying job imply a conclusion "someone in this class can get a high paying job". (remembering)	1	CO1,CO6
10.(a)	Show that $(\neg P \longrightarrow R) \wedge (Q \leftrightarrow P) \Longleftrightarrow (P \vee Q \vee R) \wedge (P \vee \neg Q \vee R) \wedge (P \vee \neg Q \vee \neg R) \wedge (\neg P \vee Q \vee R) \wedge (\neg P \vee Q \vee \neg R)$. (remembering)	1	CO1,CO6

10.(b)	Use the quantifiers to express following statements. (Applying) 1. There is a student in the class who can speak Hindi. 2. Every student in this class knows how to drive a car. 3. Some student in this class knows has visited Alaska but not visited Hawaii. 4. All students in this class have learned at least one programming language.	3	CO1,CO6

UNIT II - SET THEORY: Basic Concepts of Set Theory,Representation of Discrete Structures, Relations and Ordering, Functions.

	MultiplechoiceQuestions		
2C-1	An ordered collection of objects is ( ) a) relation b) function c)set d) proposition	2	CO2
2C-2	Thesubsetofpower set of empty set ( ) a) one b) two c)zero d) three	2	CO2
2C-3	Subsetoftheset A={}is ( ) a)A b){} c)∅ d)All ofthementioned	2	CO2
2C-4	Ifxisasetandthesetcontainsanintegerwhichisneitherpositivenornegative, then the set x is ( ) a)Setis Empty b)SetisNon -empty c)SetisFinite. d)SetisbothNon-emptyandFinite	1	CO2
2C-5	If x∈Nandxis prime,thenx is () a)Infiniteset b)Finiteset c)Emptyset d)Nota set	3	CO2

2C-6	Whichof thefollowingisasubsetofset{1,2,3,4}? () a){1,2} b){1,2,3} c){1} d) Allofthementioned	1	CO2
2C-7	Whichofthefollowingfunctionisnot amathematics function? () a)manytoone b)one-to-many c)oneto one d)Allofthe mentioned	1	CO2
2C-8	Whichofthe followingfunctionisalsoreferredtoasaninjective function?() a)Many-to-one b) Onto c)One-to-One d)Noneofthementioned	1	CO2
2C-9	Thefunction($g^{-1}Of^{-1}$)isif thefunction fandgare ( ) a)Intofunction b)oneto one function c)ontofunction d)one-to-manyfunction	1	CO2
2C-10	LetU={1,2,3,4,5}andA={1,3,5}then$A^c$is() a){1,2} b){3,4} c) {4,5} d){2,4}	1	CO2

2C-11	HowmanyrelationsexistfromsetXtosetYifthesetXandsetYhas7and8 elements ( ) a)2^{56} b)2^{72} c)3^{56} d)56	2	CO2
2C-12	Thenumberofreflexiveclosureoftherelation{(0,1),(1,1),(1,3),(2,1),(2,2), (3,0)} onthe set {0, 1,2,3} is ( ) a)36 b)8 c)6 d)2^6	2	CO2
2C-13	Thenumberoftransitiveclosureexistsintherelation R={(0,1),(1,2),(2,2) ,(3,4), (5,3), (5,4)} where {1, 2, 3, 4, 5} ∈ A is ( ) a){(0,1),(0,2),(1,2),(2,2),(3,4),(5,3),(5,4)} b){(0,0),(4,4),(5,5),(1,1),(2,2),(3,3)} c){(0,1),(1,2),(2,2),(3,4)} d){(0,1),(5,3),(5,4),(1,1),(2,2)}	2	CO2
2C-14	ArelationR onasetP issaidtobepartialorderingrelationifandonlyifR ( ) a)Reflexive b)Transitive c)Anti-Symmetric d)Alltheabove	3	CO2

2C-15	Accordingtothesymmetricmatrix,which ofthefollowingstatementis correct? () a)$A=A^T$ b)Allthediagonalelementsofasymmetricmatrixare One. c)$A=-A^T$ d)Allthediagonalelementsofasymmetricmatrixare Zero	2	CO2
	Fillinthe blanks		
2F-1	{x: x∈Nand xisprime}then itis_____	1	CO2
2F-2	Twosetsarecalleddisjointifthere_____istheemptyset.	2	CO2
2F-3	Powersetofemptysethasexactly_____subset	2	CO2
2F-4	TherelationbetweensetsA,B,Casshownbyvenuediagramis_____	1	CO2
2F-5	LetthesetsbeA, B,C,Dthen(A∩B)X(C∩D)isequivalentto _____	1	CO2
2F-6	Thesetcontainingallthecollectionofsubsetsisknownas_____	2	CO2
2F-7	A function is said to be _____ifandonlyiff(a)=f(b)impliesthata= b for all a and b in thedomain of f.	1	
2F-8	Foraninversetoexistitisnecessarythatafunctionshouldbe_____	3	
2F-9	Considertherelation:R'(x,y)ifandonlyifx,y>0overthesetofnon-zero rational numbers, then R' is _____	2	CO2
2F-10	LetsetA={1,2}andB={3,4}thenAXB(CartesianproductofsetAandB) is_	1	CO2
2F-11	Ifasetcontains3elementsthen thenumberofsubsetsis _____	2	CO2
2F-12	Iff(x)=ythenf^{-1}(y)isequalto_____	4	CO2
2F-13	Theinverseoffunctionf(x)=x^3+2is_____	1	CO2
2F-14	If n(A)=20andn(B)=30andn(AUB)=40thenn(A∩B)is_____	5	CO2
2F-15	ThecardinalityofthesetA={1,2,3,4,6}is_____	2	CO2

	Matchthefollowing		
2M-1	1) Null set ( ) a)A⊆B 2) single toneset ( ) b)A^C orU-A 3)Subset ( ) c){a} 4)Universalset ( ) d) U 5) Complement set ( ) e){∅}	1 2 2 1 3	CO2
2M-2	1)Union ( ) a)A-B 2)Intersection ( ) b)AU B 3)Disjoint ( ) c) A∩B 4)Setdifference ( ) d)AXB 5) Cartesianproduct ( ) e)A∩B=∅	1 2 1 1 3	CO2
2M-3	1) Complement ( ) a) $(A^C)^c$=A 2) Idempotent ( ) b) AUU=U&A∩ ∅=∅ 3)Domination ( ) c)A UA^C =U 4)Identity ( ) d)AUA=A∩ A=A 5)Involution ( ) e)AU∅ =A	1 2 1 2 2	CO2
2M-4	1)Reflexive ( ) a) a, b∈Aand(a,b)∈Rthen(b, a)∈R 2)Symmetric ( ) b)a∈A&(a, a)∉R 3)Transitive ( ) c) (a, b)∈A&(a,b) ∈Rthen(b,a)∉R 4)Asymmetric ( ) d)a∈A& (a, a)∈R 5)Irreflexive ( ) e) (a,b)∈R&(b,c)∈RThen(a,c)∈R	2 3 2 1 1	CO2
2M-5	1)Identity ( ) a) f(x)=c 2)constant ( ) b)B 3)One-One ( ) preimageofA c) 4)Ontofunction ( ) f(x)=x 5)bijective ( ) d)one-one&Onto e) AimageinB	1 2 1 3 2	CO2

	SRI INDU COLLEGE OF ENGG & TECH **QUESTION BANK** **(Regulation :R22)** **DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING**	**Prepared onRev1: Page:1of9**

Sub.Code&Title	**R22CSE2111 & DISCRETE MATHEMATICS**		
AcademicYear:2023-24		**Year/Sem./Section**	**II/II/A/B/C/D**
Faculty Name&Designation		**P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF**	

UNIT II - SET THEORY: Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

	PART-A		
1.	What is Binary Relation? (understanding)	2	CO2
2.	Define Equivalence Relation? (remembering)	1	CO2
3.	Define Compatibility Relation? (remembering)	1	CO2
4.	Write Partial Ordering Relation with example. (evaluating)	5	CO2
5.	Define Function and types of Function (remembering)	1	CO2
6.	Define Inverse Function (remembering)	1	CO2
7.	Define set, subset, proper subset (remembering)	5	CO2
8.	What is Unary, Binary, N-ary Structures ? (understanding)	2	CO2
9.	Define Symmetric, Asymmetric, Anti Symmetric Relation. (remembering)	1	CO2
10.	What is Cartesian Product of a set? (understanding)	2	CO2
	PART-B		
1	Let A= {1,2,3,4,5,6,12,24,27,30}. 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.(creating)	6	CO2
2.	Explain the properties of Equivalence relation with example. (understanding)	2	CO2
3.	Define and explain Hasse diagram pictorially with an example.(remembering)	1	CO2
4.	Explain Compatibility relation with example. (understanding)	2	CO2
5.	Explain the properties of Partial ordering relation and give two examples. (understanding)	2	CO2
6.	Let A= {1, 2, 3, 4} and let R be the relation on A defined by xRy if and only if "x divides y", written X | y. i) Write down R as a set of ordered pairs. ii) Draw the diagraph of R. iii) Determine in-degree and out-degrees of the each vertex. (creating)	6	CO2
7	Consider the following relations on the set A = {1,2,3 } R1 = { (1 ,1), (1 ,2), (1 ,3), (3 ,3) }R2 = { (1 ,1), (1 ,2), (2 ,1), (2 ,2), (3 ,3) } and R3 = { (1,1), (1 ,2), (2 ,2), (2 ,3) }. Which of these are i) reflexive, ii) symmetric, iii) transitive, iv) anti symmetric? (remembering)	1	CO2
8	Let A ={ {1, 2, 3, 4 }, and R = { (1,1), (1 ,2), (2 ,1), (2 ,2), (3 ,1), (3 ,3), (1 ,3), (4 ,1), (4 ,4) } be a relation on A. Is R an equivalence relation?(analyzing)	4	CO2
9.	Let A = {1,2,3,4,5,6} and B = {6,7,8,9,10}. If a function f:A->B is defined by f= {(1 ,7), (2 ,7), (3 ,8), (4 ,6), (5 ,9), (6 ,9) } determine $f^{-1}(6)$ and $f^{-1}(9)$. If B_1 = {7,8 } and B_2 = {8,9,10}, $f^{-1}(B_1)$ and $f^{-1}(B_2)$.(applying)	3	CO2
10	Draw the Hasse diagram for the poset (p(S),⊂) where	6	CO2

	s={1,2,3,4}.(creating)		
11	What is function and explain different types of functions with examples		
12	Let f(x)=x+5 and g(x)=x^2+1 then find out $f^{-1}og^{-1}$ and $g^{-1}of^{-1}$		CO2
13	*let* $A=\{1,2,3\}$ *and* $B=\{2,4,5\}$ *.Determine the following*: (1) $\lvert A\times B\rvert$ (2) *Number of relations from A to B.* (3) *Number of binary relations on A.* (4) *Number of relations from A to B that contain* $(1,2)$ *and* $(1,5)$. (5) *Number of relations from A,B that contain exactly five ordered pairs*		CO2
14	*Consider the sets* $A=\{a,b,c\}$ *and* $B=\{1,2,3\}$ *and the relations.* $R=\{(a,1),(b,1),(c,2),(c,3)\}$ *and* $S=\{(a,1),(a,2),(b,1),(b,2)\}$ *from A to B.Determine* $R,S,R\cup S,R\cap S,R^c$ *and* S^c.		CO2
15	*if* $A=\{1,2,3,4\}$ *and R,S are relations on A defined by* $R=\{(1,2),(1,3),(2,4),(4,4)\}$ S $=\{(1,1),(1,2),(1,3),(1,4),(2,3),(2,4)\}$ *find RoS,SoR,*R^2,S^2*,write down their matrices.*		CO2

	UNIT-III- ALGEBRAIC STRUCTURES: introduction, Algebaic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.		
	MultiplechoiceQuestions	**BTLevel**	**Course Outcome**
3C.1	(S, *) is said to be semigroup if ( ) a) * is binary operation on S a) both A and B b) * is associative on s b) S has an identity element with resp	1	CO3
3C.2	If a*(b*c) = (a*b) * c ∀ a, b, c ∈S then * is said to be on s ( ) a) Closed c) associate b) Commutative d) distributive	2	CO3
3C.3	If any set S there exist e ∈S such that a*e=e*a=a, ∀a ∈S then e is called ( ) (a) an unique element c) an inverse element (b) an identity element d) a proper element	1	CO3
3C.4	For any set S if a*b=b*a, ∀a, b ∈S then * is said to be ( ) (a) Closed c) distributive (b) Associative d) commutative	2	CO3

	Let G= {1, -1, i,-i} is group under multiplication then how many elements Are self-invertible in G? ( ) (a) 1 c) 3 (b) 2 d) 4	2	CO3
3C.6	Let G= (ℤ6, +6) is an Abelian group then how many self-invertible elements in G? ( ) (a) 1 c) 3 (b) 2 d) 4	2	CO3
3C.7	G= (ℤ5, ×5) is ( ) (a) semi group c) group (b) Monoid d) group	1	CO3
3C.8	Let (G, *) be a group then for all a, b in G (a*b)-1 is ( ) (a) a-1*b-1 c) a*b (b) a-1*b d) $b^{-1}*a^{-1}$	1	CO3
	Fill In the Blanks	**BTLevel**	**Course Outcome**
3F.1	Let G={1,-1,i,-i} is group under multiplication then the inverse of i is _	1	CO3
3F.2	A non empty set A is termed as an algebraic structure _____	2	CO3
3F.3	An algebraic structure _____ is called a semigroup	2	CO3
3F.4	Condition for monoid is _____	2	CO3

3F.5	A group (M, *) is said to be abelian if _____	1	CO3
3F.6	A cyclic group is always _____	4	CO3
3F.7	How many properties can be held by a group_____	2	CO3
3F.8	_____ and _____ are the two binary operations defined for lattices.	2	CO3
3F.9	. A _____ value is represented by a Boolean expression	2	CO3
3F.10	F (X, Y, Z, M) = X`Y`Z`M`. The degree of the function is _____	1	CO3
3F.11	The _____ of all the variables in direct or complemented from is a maxterm.	1	CO3
3F.12	The logic gate that provides high output for same inputs _____	II	CO3
3F.13	If x ∈ N and x is prime, then x is _____ set.	1	CO3
3F.14	If x is a set and the set contains the real number between 1 and 2, then the set is _____.	2	CO3
3F.15	Power set of empty or Null set has exactly _____ subset.	1	CO3
3F.16	The difference of {1, 2, 3, 6, 8} and {1, 2, 5, 6} is the set _____	1	CO3

3F.17	The function (gof) is _____ , if the function f and g are onto function?	2	CO3
3F.18	The cardinality of the set of even positive integers less than 20 is_____?	2	CO3
3F.19	Universal logic gate is_____.	1	CO3
3F.20	The sum of two symmetric matrices is also a symmetric matrix. _____.	1	CO3
3F.21	The vertices in the Hasse diagram are denoted by . _____. rather than by. _____.	2	CO3
	Objective Questions	BT Level	Course Outcome
3C-1	. A non empty set A is termed as an algebraic structure _____ a) with respect to binary operation * b) with respect to ternary operation ? c) with respect to binary operation + d) with respect to unary operation –	III	CO3
3C-2	An algebraic structure _____ is called a semigroup. a) (P, *) b) (Q, +, *) c) (P, +) d) (+, *)	I	CO3
3C-3	Condition for monoid is _____ a) (a+e)=a b) (a*e)=(a+e) c) a=(a*(a+e) d) (a*e)=(e*a)=a	I	CO3
3C-4	Matrix multiplication is a/an _____ property. a) Commutative b) Associative c) Additive d) Disjunctive	I	CO3
3C-5	A cyclic group can be generated by a/an _____ element. a) singular b) non-singular c) inverse d) multiplicative	II	CO3
3C-6	A cyclic group is always _____ a) abelian group b) monoid	I	CO3

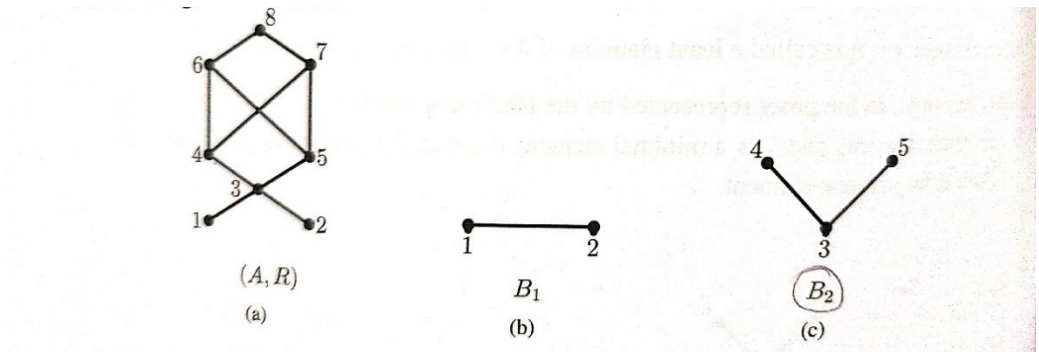
	c) semigroup d) subgroup		
3C-7	If every two elements of a poset are comparable then the poset is called _____ a) sub ordered poset b) totally ordered poset c) sub lattice d) semigroup	II	CO3
3C-8	A free semi lattice has the _____ property. a) intersection b) commutative and associative c) identity d) universal	II	CO3
3C-9	Algebra of logic is termed as _____ a) Numerical logic b) Boolean algebra c) Arithmetic logic d) Boolean number	I	CO3
3C-10	Which of the following is/are the universal logic gates? a) OR and NOR b) AND c) NAND and NOR d) NOT	II	CO3
3C-11	Which of the following is a Simplification law? a) M.(~M+N) = M.N b) M+(N.O) = (M+N)(M+O) c) ~(M+N) = ~M.~N d) M.(N.O) = (M.N).O	II	CO3
3C-12	Which of the following is a subset of set {1, 2, 3, 4}? a) {1, 2} b) {1, 2, 3} c) {1} d) All of the mentioned	I	CO3
3C-13	What is the Cartesian product of set A and set B, if the set A = {1, 2} and set B = {a, b}? ( ) a. {(1, a), (1, b), (2, a), (b, b)} b. {(1, 1), (2, 2), (a, a), (b, b)}	III	CO3

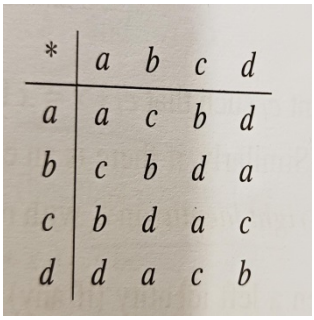
	c. {(1, a), (2, a), (1, b), (2, b)} d. {(1, 1), (a, a), (2, a), (1, b)}		
3C-14	If n(A) = 20 and n(B) = 30 and n (A U B) = 40 then n (A ∩ B) is? ( ) a. 20 b. 30 c. 40 d. 10	II	CO3
3C-15	Euler's integral of the first kind, which is a proper integral, is used to define the gamma function. ( ) a) True b) False	I	CO3
	MATCH THE FOLLOWING	BT Level	Course Outcome
3M-1	a) Least upper bound ( ) a) 4 b) properties of lattices ( ) b) " a" joint "b" c) (a ^b)' ( ) c) a*a=a d) Idempotent ( ) d) Algebraic structure e)S,*1,*2,.....*k> ( ) e) a, ∨b'	II	CO3
3M-2	a)A cyclic group is always ( ) a) associative property b) . Matrix multiplication is ( ) b) abelian group c)A monoid is called a group ( ) c)For designing of the digital computers d)Boolean algebra can be used ( ) d) Arithmetic logic e)Algebra of logic is termed as ( ) e) (a*c)=(c*a)=e	II	CO3
3M-3	A)Meet semi lattice ( ) A) A*B=A*C=>B=C B)Join semi lattice ( ) B)LUB C)Cancellation property ( ) C)GLB D)POSET ( ) D) partially ordered set	I	CO3
3M-4	A)LUB ( ) a)OR B)GLB ( ) b)AND C) POS ( ) c)SUM OF PRODUCT D) SOP ( ) d)SUM OF PRODUCT	I	CO3
3M-5	a) Commutative law ( ) A) (a*b)'=a'+b' b) Distributive law ( ) B) a*a'=0 c) Identity law ( ) C) a*1=a	I	CO3

	d) Complement law ( )	D) a*(b+c)=(a*b)+(a*c)		
	e) Demorgan law ( )	E)a+b=b+a		

UNIT-III- ALGEBRAIC STRUCTURES: introduction, Algebaic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

PART-A

1.	*what is binary operation*?		CO3
2.	*what is* ***n−ary operation*** ?		CO3
3	*define semigroup and abelian semigroup*?		CO3
4	*what is Monoid*?		CO3
5	*define Commutative Ring*		CO3
6	Define Lattice and Sub Lattice. (evaluating)		CO3
7	Define Total order.		CO3
8	Define Group.		CO3
9	Define Integral domain.		CO3
10	Define Commutative Ring.		CO3
11	Define Algebraic system with examples. **(understanding)**		CO3
	PART-B		
1.	Consider the set A = {1,2,3,4,5,6,7,8}and a partial order on A whose Hasse diagram is as shown below. Consider the subsets B1= {1,2} and B2 = {3,4,5} of A as shown in the figure below.  Fig 1 Fig 2 Fig 3		CO3
2	On the set A={a,b,c,d}, a binary operation * defined as described in the following table:		CO3

	 Is * commutative? Associative?		
3.	On the set Q of all rational numbers, the operation * is defined by a*b= a + b - ab. Show that, under this operation, Q forms a commutative monoid.		CO3
4	In each of the following cases a binary operation * on set A={a,b} is defined through a multiplication table. Determine whether $< A, * >$ is a semigroup or a Monoid or neither. 1) 2) 3)		CO3
5.	If N denotes the set of all natural numbers,and + and × are the usual addition and multiplication operations, show that$< N, +, \times >$ *is not a ring*.		CO3
6	Explain Some Standard Algebraic Structures with example.		CO3
7.	What is binary operation and write the properties of binary operations?		CO3
8.a	Define group and abelian group		CO3
8.b	*Let G be the set of all non−zero real nubers and let* $a*b = \frac{1}{2}ab$*.show* $< G,* >$ *is abelian group.*		CO3
9.	Write the properties of Lattices and explain special types of Lattices with example.		CO3

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UNIT-IV: Elementary combinatorics: Basics of Counting, Combinations and permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

	Objective Questions	**BT Level**	**Course Outcome**
4C-1	Let H and T denotes head and tail side of an unbiased coin. Ankit tossed this coin three times and wants at least two heads. How many such outcomes are possible? a) 2 b) 3 c) 4 d) 5	III	CO4
4C-2	Determine the coefficient of the x^5y^7 term in the polynomial expansion of $(m+n)^{12}$. a) 792 b) 439 c) 382 d) 630	III	CO4
4C-3	In how many ways 5 students can be arranged to sit in an examination center with 9 seats? a) 9P5 b) 5C5 c) 5! **d)** 5P4	I	CO4
4C-4	A basket contains 5 oranges 8 apples and 7 guavas, in how many ways can 3 fruits be chosen such that all the fruits are of different families? a) 240 b) 20 c) 280 d) 28	III	CO4
4C-5	In how many ways the word can 'CHAMPION' be arranged such that the letter 'P' always comes to the left of 'H'? a) 5040 b) 40320 c) 10080 d) 20160	III	CO4
4C-6	In how many ways 6 boys and 11 girls can be seated at a round table if two boys are not allowed to sit together?	III	CO4

	a) 11P6 b) 11! c) 11!×11P6 d) 10!×11P6		
4C-7	In the Deep Learning examination, you are given 30 questions divided into two parts, Section A and Section B. Each part consists of 15 questions. You are asked to answer any 15 questions in total but it is mandatory to answer at least 6 questions from each section. In how many ways can the student select questions? a) 15C6×15C9+15C7×15C8+15C8×15C7+15C9×15C6 b) 15C8×15C9+15C7×15C8+15C9×15C8 c) 15C7×15C8+15C8×15C7+15C9×15C6 d) 15C5×15C10+15C6×15C9+15C7×15C8+15C8×15C7+15C9×15C6+15C5×15C10	II	CO4
4C-8	What is the coefficient of the5th? term in the expression (6x411−x43)5 ? a) −720106920 b) −525106920 c) −72021384 d) −52521384	III	CO4
4C-9	. Who invented the concept of inclusion-exclusion principle? a) Abraham de Moivre b) Daniel Silva c) J.J. Sylvester d) Sieve	III	CO4
4C-10	Using the inclusion-exclusion principle, find the number of integers from a set of 1-100 that are not divisible by 2, 3 and 5. a) 22 b) 25 c) 26 d) 33	II	CO4
4C-11	Using the inclusion-exclusion principle, find the number of integers from a set of 1-100 that are not divisible by 2, 3 and 5.	II	CO4

	a) 22 b) 25 c) 26 d) 33		
4C-12	. Determine the independent term of x^7 in the expansion of $(3x^2 + 4)^{12}$. a) $220 * 4^6$ b) 230 c) 548* 3! d) $220 * 3^6 * 4^6$	I	CO4
4C-13	How many 4-digit numbers can be formed by using 2, 4, 6, 8, 10, 12 without repetition of digits? a) 15 b) 42 c) 70 d) 127	II	CO4
4C-14	Calculate the value of ${}^8C_5$. a) 79 b) 43 c) 120 d) 56	I	CO4
4C-15	Find the number of permutations of word **DEPENDENT**. a) 132400 b) 1512500 c) 1663200 d) 1723400	I	CO4
	FILL IN THE BLANK QUESTIONS	**BT Level**	**Course Outcome**
4F-1	Determine n if ${}^{2n}C_3 : {}^nC_3 = 9:1$._____	I	CO4
4F-2	If ${}^{14}C_r = 14$ and ${}^{15}C_r = 15$. Find the value of ${}^{14}C_{r-1}$._____	II	CO4
4F-3	10010!=18!+x9!. Find x. = _____	I	CO4
4F-4	If an event can occur in 'm' different ways, following which another event can occur in 'n' different ways, then the total numbers of occurrence of the events in the given order is _____	II	CO4
4F-5	The number of permutations of n different objects taken r at a time, where repetition is allowed is _____	II	CO4
4F-6	Find the number of 5 letter words that can be formed from word **IMAGE** using permutations if repetition is allowed. = _____	II	CO4
4F-7	Set which contains all possible outcomes is _____	I	CO4
4F-8	Which symbol denote impossible event? _____	II	CO4
4F-9	If an event has only one sample point then it is called _____	I	CO4

4F-10	If ${}^6C_2 = {}^6C_x$ then find possible values of x._____	II	CO4
4F-11	${}^nP_r = {}^nC_r$ * _____	I	CO4
4F-12	What are the coefficients of the first and the last term of $(a + b)^n$? = _____	II	CO4
4F-13	What is the expansion of the series $(xy + 2)^2$? = _____	I	CO4
4F-14	_____ is one of the most useful principles of enumeration in combinationatorics and discrete probability.	II	CO4
4F-15	Who invented the concept of inclusion-exclusion principle? = _____	II	CO4
	MATCH THE FOLLOWING		CO4
4M-1	a) ${}^nP_0$ ( ) a) n!(n−r)! b) ${}^nP_n$ ( ) b)n=6 c) ${}^nP_r$ ( ) c) n! d) 6! ( ) d) 1 e) ${}^nP_3 = 4*{}^nP_2$. ( ) e)720	II	CO4
4M-2	a)Bayes theorem ( ) a)P(A|B) = P(A∩B) / P(B) b)Conditional probability ( ) b) P(A|B) = [P(B|A)P(A)] / P(B) c)**(x+y)n** ( ) c) **nC0 xny0 + nC1 xn1y1……..** d)modular lattice. ( ) d) a^(b∨(a^d)) = (a^b)(a^d)	III	CO4
4M-3	a)distributive lattice ( ) a)n! **b)P(n,n-1)** ( ) **b)**x ∧ (y ∨ z) = (x ∧ y) ∨ (x ∧ z) c)2^5*3^6*5^2 ( ) c) 56 d)${}^{18}C_r = {}^{18}C_{r+2}$, find ${}^rC_5$. ( ) d) 24	II	CO4

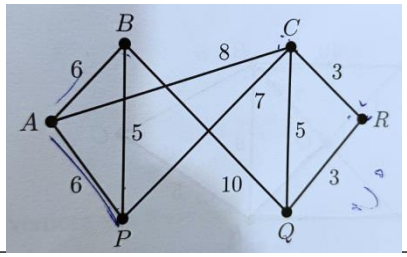
UNIT-IV: Elementary combinatorics: Basics of Counting, Combinations and permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

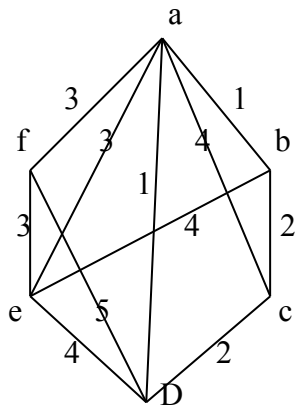
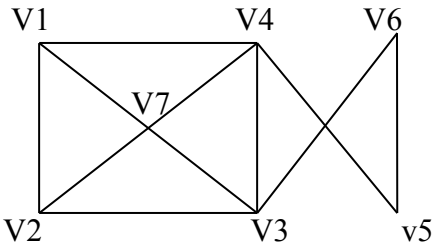
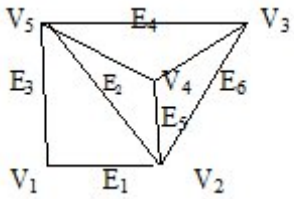
PART-A

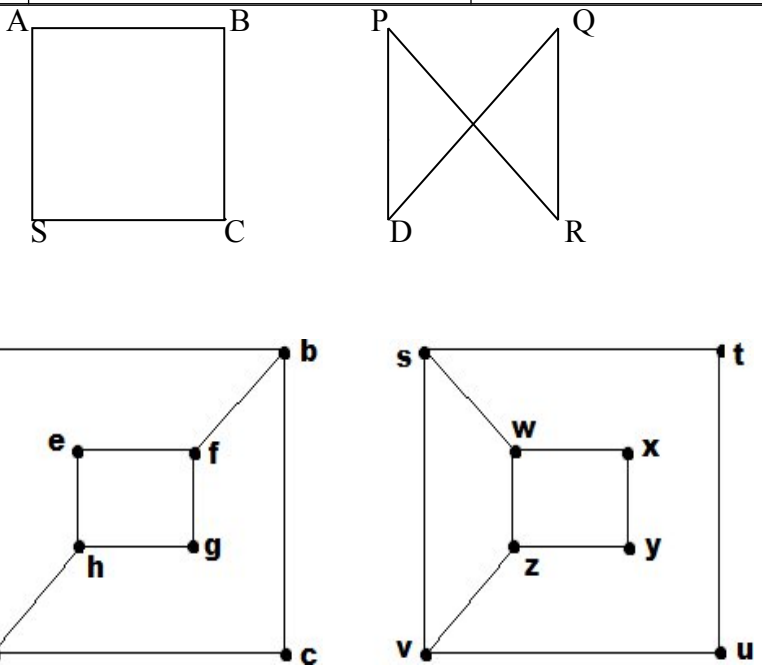
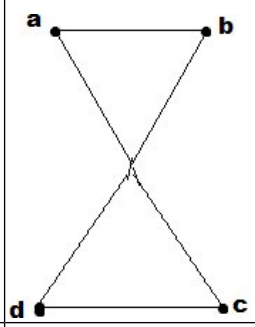
1.	Mention the types of counting principles. (remembering)		CO4
2.	Define Permutations with an example. (understanding)		CO4
3.	What is the formula for restricted permutations? (remembering)		CO4
4.	Write the formula for principle of Inclusion-Exclusion for two sets. (understanding)		CO4
5.	Mention the formula for Binomial theorem. (remembering)		CO4
6.	Mention the formula for Multinomial theorem. **(remembering)**		CO4
7.	Write about sum and product rule.		CO4
8	Define Combinations with an example. (understanding)		CO4

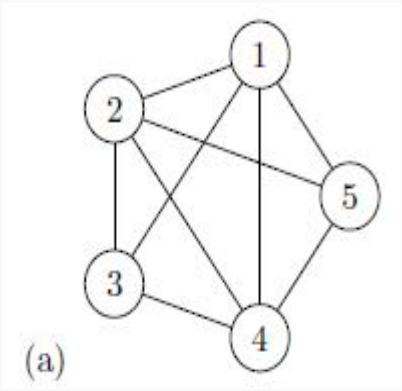
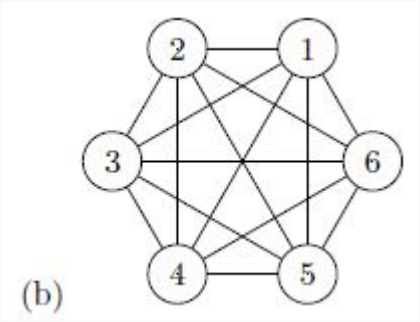
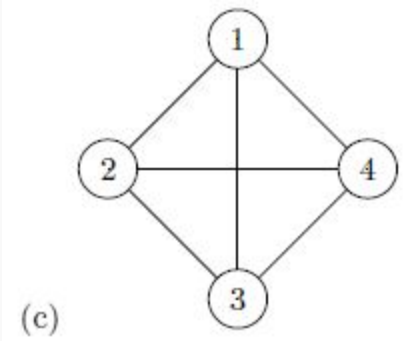
9	Mention the formula for Combinations with Repetitions?		CO4
10	Write the formula for Principle of disjunctive counting for two sets.		CO4
	PART-B		
1.	Give a formula for the number of elements in the union of four sets. (Remembering)	1	CO4
2.	What is the probability that a positive integer selected at random from the set of positive integers not exceeding 100 is divisible by either 2 or 5? (Remembering)	1	CO4
3.	How many positive integers not exceeding 1000 or divisible by 7 or 11? By using inclusion-exclusion . (understanding)	2	CO4
4.	Find the number of distinguishable permutation of the letters in the followin words: (analyzing) (dsc-pno-369) i)DISCRETEMATHEMATICS ii)ENGINEERING iii)CALCULUS iv)STRUCTURES v)PASCAL		CO4
5.	1. In how many ways can 6 men and 6 women be seated in a row **(applyin** i) If any person may sit next to any other? ii) If men and women must occupy alternate seats?(dsc.pno-367)		CO4
6.	Determine the coefficient of **(remembering)** i) xyz^2 in the expansion of $(2x-y-z)^4$, and ii) $a^2b^3c^2d^5$ in the expansion of $(a+2b-3c+2d+5)^{16}$.(dsc.pno-383)		CO4
7.	2. A woman has 11 close relatives and she wishes to invite 5 of them to dinner . In how many ways can she invite them in following situations: **(analyzing)** (dsc.pno-374) i) There is no restriction on the choice. ii) Two particular persons will not attend separately. iii) Two particular persons will not attend together.		CO4
8.	3. There are five different roads from the city A to the city B, three different roads from the city B to the city C, and three different roads that go directly from A to C. (i) How many different ways are there from A to C altogether? (ii) How many different trips are there from A to C and back to A that visit B at least once? (applying) (kandel p.no:138)		CO4
9.	Explain Binomial and Multinomial Theorems	2	CO4
10.	*A survey of* 500 *television viewers of a sports channel produced the*		CO4

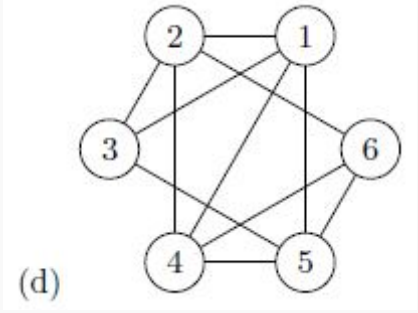
	following information:285 *watch cricket*,195 *watch hockey*,115 *watch football*, 45 *watch cricket and football*,70 *watch cricket and hockey*, 50 *watch hockey and football and* 50 *do not watch any of the three kinds of games*. (*a*) *how many viewers in the survey watch all three kinds of games*? (*b*) *how many viewers watch exactly one of the sports*?		
		2	CO3

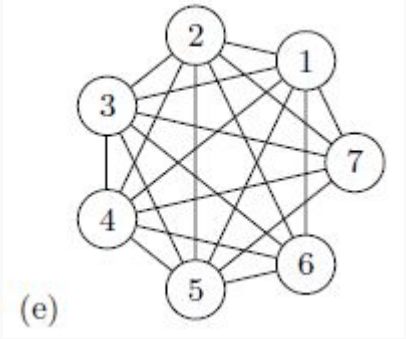
UNIT-V: Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties,Spanning Trees, Binary Trees, Planar Graphs,Euler's Formula,Multi-graphs and Euler Circuits,Hamiltonian Graphs,Chromatic Numbers, The Four-Color Problem.			
PART-A			
1.	1. Define a Graph.(understanding) 2. Define a Sub graph with examples**.** (understanding)	2	CO5
2.	What are the various types of graph? (remembering)	1	CO5
3.	Define a Bipartite and complete bipartite graph with one example.(applying)	3	CO5
4.	What is connected graph and disconnected graph? (analyzing)	4	CO5
5.	What is a Spanning tree? (remembering)	1	CO5
6.	a. Define a Sub graph with examples. (understanding) b. Define graph Isomorphism.(understanding)	1	CO5
7.	a. Define graph Isomorphism.(understanding) b. Distinguish between Euler path and Euler circuit? (evaluating)	5	CO5
8.	a. Define Hamiltonian cycle and Hamilton path.(understanding) b. How chromatic number help in map coloring?(applying)	2	CO5
9.	a. What is Graph coloring. b. Define Rooted tree.(understanding)	2	CO5
10.	What is Spanning trees. .(understanding)	2	CO5
PART-B			
1.	a) Explain about Kruskal's algorithm.(understanding) b) Find the minimal spanning tree by using Kruskal's algorithm for the following given graph. (creating) 	2	CO5
2.	a. Explain about Prim's algorithm. (applying) b. Find the minimal spanning tree by using prim's algorithm for the	3	CO5

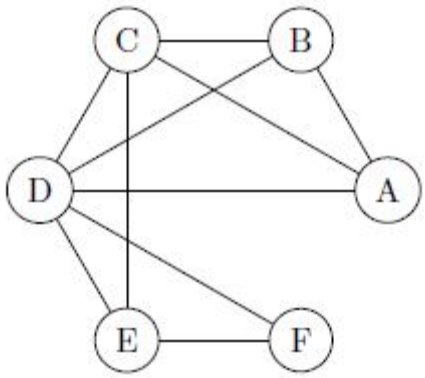
	following given graph. (creating) \  		
3.	What is a planar graph? Mention the properties of a planar graph. (analyzing)	4	CO5
4.	a) Explain DFS algorithm. (understanding) b) Apply a BFS algorithm to find a spanning tree. (applying)  		CO5
5.	a) Draw a complete binary tree with 19 vertices. (creating) b) A complete binary tree has 25 leaves. How many vertices does it have? (creating)	6	CO5
6.	Show that the maximum number of edges in a complete biparticle graph with ‘n’ vertices is n2/4. (creating).		CO5
7.	Find an Eulerian cycle in the graph. (creating)  	6	CO5
8.	a) Explain about Isomorphism. (understanding) b) Show that following graphs are Isomorphic or not. (creating)	2	CO5

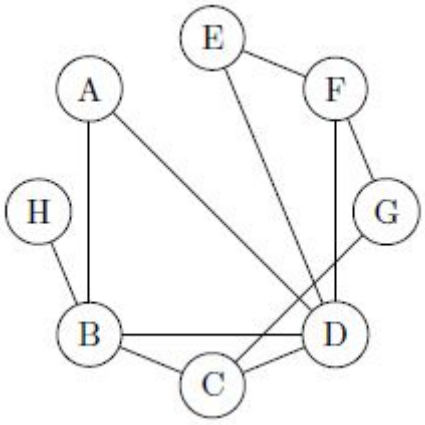
			
9.	How many paths of length four are there from *a* to *d* in the simple graph *G* given below. (creating) 	6	CO5
10.	Draw the complete graph *K*5 with vertices A, B, C, D, E. Draw all complete sub graph of *K*5 with 4 vertices. (analyzing)	4	CO5

	Objective Questions	BT Level	Course Outcome
5C-1	Which of the following graphs are not complete graphs?   	III	CO5





5C-2	What is the degree sequence of the given graph?  a) ⟨4,3,2,2,2,2⟩ b) ⟨5,4,3,3,3,2⟩ c) ⟨4,3,2,2,2,2⟩ d) ⟨5,4,3,3,2,1⟩	I	CO5
5C-3	Which of the following sequences is not a graphic sequence?	I	CO5

	a) ⟨7,6,6,4,4,3,2,2⟩ b) ⟨5,5,3,3,2,1,1⟩ c) ⟨7,6,5,4,4,3,2,1⟩ d) ⟨8,7,7,6,4,2,1,1⟩		
5C-4	Which of the following statement is False? a) A path is a walk with no repeated vertex b) Circuit with no repeated vertex is called a cycle. c) The sum of the degrees of all the vertices of a graph is thrice the number of edges in the graph d) Circuits refer to the closed trails	II	CO5
5C-5	Observe the following graph. (MSQ)  Choose the correct option(s) from below. a) {D−E−F−G−C−D} is a cycle b) {A−B−D−A} is not a cycle c) {A−B−D−C−G−F−D−A} is a circuit d) {A−B−D−C−D−F} is a trail e) {H−B−D−C−G−F−D−A} is a trail	II	CO5

5C-6	Let T be a tree having n vertices. How many distinct paths are there from vertex v1 to vertex v2 ? a) n(n−1)2 b) n−1 c) n d) 1	I	CO5
5C-7	For a simple graph with vertices, how many subgraphs can be constructed, such that the subgraph is an induced subgraph as well as a spanning subgraph? a) 0 b) N c) 1 d) n−1	I	CO5
5C-8	Which of the following statements is/are true? I If there is a walk from P to Q then, there must be a path from P to Q. II A graph can have an odd number of odd–degree vertices. III The number of edges in a tree is equal to one less than the number of vertices. a) Only I b) Only II c) Only III d) I and II e) I and III f) I, II and III	I	CO5
5C-9	Which of the following graph has a cut vertex?	IV	CO5

	a) Cn b) Kn c) Regular graph d) Tree		
5C-10	Arrange the following elements in ascending order using Bubble sort. And no of iterations required ---------- 12, 40, 3, 13, 47,55, 10. a) 6 b) 7 c) 5 d)4	III	CO5
5C-11	An n-vertex graph has _____ edges. a) n^2 b) n-1 c) n*n d) n*(n+1)/2	III	CO5
5C-12	The tree elements are called _____ a) vertices b) nodes c) points d) edge	III	CO5
5C-13	An undirected graph G which is connected and acyclic is called _____ a) bipartite graph b) cyclic graph c) tree d) forest	II	CO5
5C-14	A linear graph consists of vertices arranged in a line. a) false b) true c) either true or false d) cannot determined	II	CO5
5C-15	What is a bipartite graph? a) a graph which contains only one cycle b) a graph which consists of more than 3 number of vertices c) a graph which has odd number of vertices and even number of edges d) a graph which contains no cycles of odd length	III	CO5
	FILL IN THE BLANKS		**Course**

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING	Prepared onRev1: Page:1of9
Sub.Code&Title	R22CSE2111 & DISCRETE MATHEMATICS	
AcademicYear:2023-24	Year/Sem./Section	II/II/A/B/C/D
Faculty Name&Designation	P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF	

		BT Level	Outcome
5F-1	The travelling salesman problem can be solved using _____	I	CO5
5F-2	_____ is the maximum number of edges in an acyclic undirected graph with k vertices.	I	CO5
5F-3	Consider a complete graph G with 4 vertices. The graph G has ____ spanning trees.	II	CO5
5F-4	Dijkstra's Algorithm is used to solve _____ problems.	II	CO5
5F-5	The minimum number of edges in a connected cyclic graph on n vertices is _____	II	CO5
5F-6	The maximum number of times the decrease key operation performed in Dijkstra's algorithm will be equal to _____	I	CO5
5F-7	Any subset of edges that connects all the vertices and has minimum total weight, if all the edge weights of an undirected graph are positive is called _____	II	CO5
5F-8	the definition of graph according to graph theory _____	I	CO5
5F-9	the chromatic number for an empty graph having n vertices _____	I	CO5
5F-10	the correct technique for finding a maximum matching in a graph _____	I	CO5
5F-11	A node is said to be _____ if it has a possibility of reaching a complete solution.	II	CO5
5F-12	G is a simple undirected graph and some vertices of G are of odd degree. Add a node n to G and make it adjacent to each odd degree vertex of G. The resultant graph is _____	I	CO5
5F-13	A graph is found to be 2 colorable. What can be said about that graph _____	II	CO5
5F-14	Which term defines all the complete bipartite graph that are trees_____	I	CO5
5-15	The Data structure used in standard implementation of Breadth First Search is_____	II	CO5
	MATCH THE FOLLOWING		CO5
5M-1	a)Simple Graph ( ) a) every edge of E joins a vertex in V1 to a v2 b) Regular Graph ( ) b) A graph with no cycles c)Cyclic Graph ( ) c) A graph with no loops andno paralleledges d) Acyclic Graph ( ) d) if all its vertices have the same degree. e) Bipartite Graph ( ) e) A graph with at least one	I	CO5

5M-2	a)star tree ( ) a) directed acyclic graph b) polytree ( )b) An undirected graph G which is connected and acyclic c) Spanning tree ( ) c) A tree having a single internal vertex and n-1 leaves d) simple graph ( ) d) representing universal relation e) complete digraph ( ) e) no multiple edges, self-loops and parallel edges	II	CO5
5M-3	a)Time complexity of Prim's algorithm ( ) a) priority queue data structure b)time complexity of Kruskal's algorithm ( )b)O(ElogV) c) Prim's algorithm can be implemented ( ) c) O((V+E) logV) d) AVL ( ) d)∑(deg(v))=2×E e) Hand shaking ( ) e)every node need to follow balance factor	II	CO5
5M-4	A. Directed graph ( ) a)some edges are directed and un directed B. Undirected graph ( ) b) some parallel edges and loops C. Isolated graph ( ) c)**edges have a specific direction**. D. Mixed graph ( ) d) no **concept** of a **"parent" or "child"** E. Multi graph ( ) e) no edges	III	CO5
5M-5	A. Connected graph ( ) a)depends of edges ,number of vertices B. Disconnected graph ( ) b) At latest one edge b/w every pair of vertices C. Planar graph ( ) c) Any path doesn't exist b/w every pair of vertices D. Regular graph ( ) d) Drawn in separate plane without any edge crossings E. Graph ( ) e) Same degree	III	CO5

	SRI INDU COLLEGE OF ENGG & TECH **QUESTION BANK** **(Regulation :R22)** **DEPARTMENTOFCOMPUTER SCIENCE ENGINEERING**	**Prepared onRev1:** **Page:1of9**

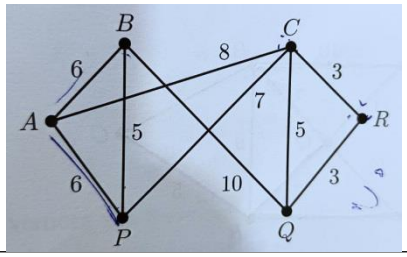
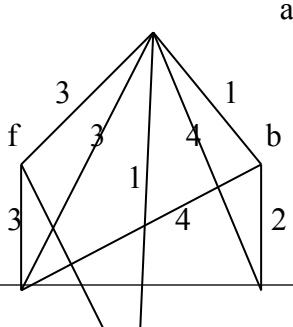
Sub.Code&Title	**R22CSE2111 & DISCRETE MATHEMATICS**		
AcademicYear:2023-24		**Year/Sem./Section**	**II/II/A/B/C/D**
Faculty Name&Designation		**P.PRAVALLIKA CHANDAR & K.KRISHNA ASST PROF**	

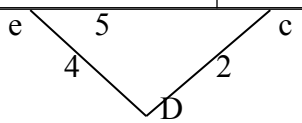
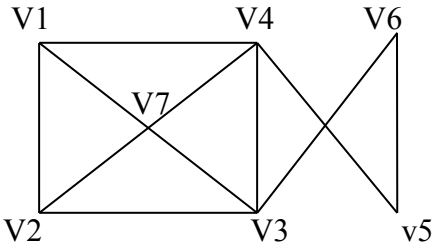
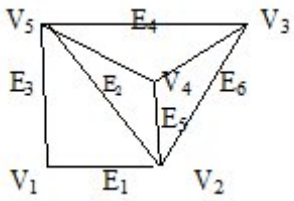
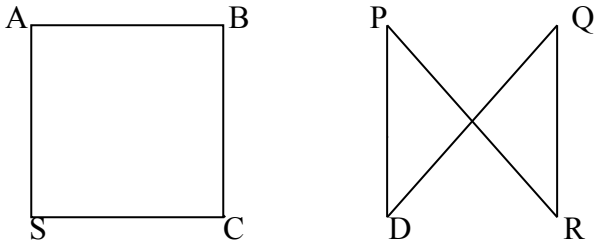
UNIT-V: Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties,Spanning Trees, Binary Trees, Planar Graphs,Euler's Formula,Multi-graphs and Euler Circuits,Hamiltonian Graphs,Chromatic Numbers, The Four-Color Problem.

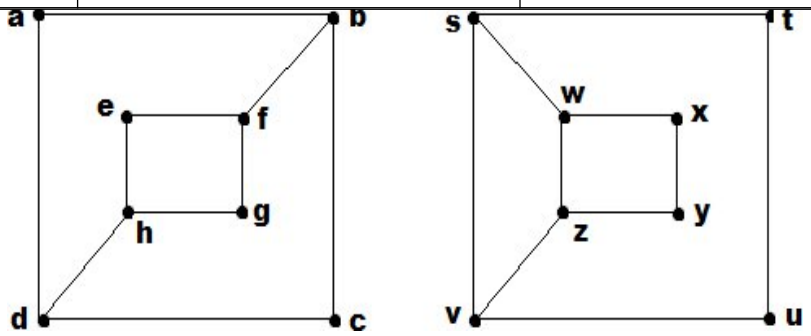
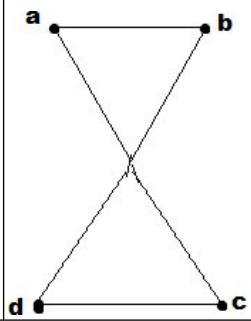
PART-A

1.	3. Define a Graph.(understanding) 4. Define a Sub graph with examples**.** (understanding)	2	CO5
2.	What are the various types of graph? (remembering)	1	CO5
3.	Define a Bipartite and complete bipartite graph with one example.(applying)	3	CO5
4.	What is connected graph and disconnected graph? (analyzing)	4	CO5
5.	What is a Spanning tree? (remembering)	1	CO5
6.	a. Define a Sub graph with examples. (understanding) b. Define graph Isomorphism.(understanding)	1	CO5
7.	a. Define graph Isomorphism.(understanding) b. Distinguish between Euler path and Euler circuit? (evaluating)	5	CO5
8.	a. Define Hamiltonian cycle and Hamilton path.(understanding) b. How chromatic number help in map coloring?(applying)	2	CO5
9.	a. What is Graph coloring. b. Define Rooted tree.(understanding)	2	CO5
10.	What is Spanning trees. .(understanding)	2	CO5

PART-B

1.	a) Explain about Kruskal's algorithm.(understanding) b) Find the minimal spanning tree by using Kruskal's algorithm for the following given graph. (creating) 	2	CO5
2.	a. Explain about Prim's algorithm. (applying) b. Find the minimal spanning tree by using prim's algorithm for the following given graph. (creating) 	3	CO5

			
3.	What is a planar graph? Mention the properties of a planar graph. (analyzing)	4	CO5
4.	a) Explain DFS algorithm. (understanding) b) Apply a BFS algorithm to find a spanning tree. (applying) 		CO5
5.	c) Draw a complete binary tree with 19 vertices. (creating) d) A complete binary tree has 25 leaves. How many vertices does it have? (creating)	6	CO5
6.	Show that the maximum number of edges in a complete biparticle graph with ‘n’ vertices is n2/4. (creating).		CO5
7.	Find an Eulerian cycle in the graph. (creating) 	6	CO5
8.	a) Explain about Isomorphism. (understanding) b) Show that following graphs are Isomorphic or not. (creating) 	2	CO5

			
9.	How many paths of length four are there from *a* to *d* in the simple graph *G* given below. (creating) 	6	CO5
10.	Draw the complete graph *K*5 with vertices A, B, C, D, E. Draw all complete sub graph of *K*5 with 4 vertices. (analyzing)	4	CO5

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SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi) - Recognized under 2(f) and 12(B) of UGC Act 1956

II B.Tech. I Semester (REGULAR) End Examinations, FEBRUARY – 2024.

(R22CSE2111) DISCRETE MATHEMATICS

02/02/2024 (For AIML, AIDS & IoT) Day- 3 (FN)

Duration: 3 Hrs **Maximum Marks: 60M**

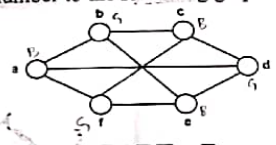
Blooms Taxonomy : (I-Remembering, II-Understanding, III-Applying, IV-Analyzing, V-Evaluating and VI-Creating)

Course Outcomes : CO

PART – A

Answer ALL the following questions. **(10Qx1M=10M)**

1.	a)	Write the truth table for Implication rule.	I	CO1
	b)	Define logical form of Modus ponens rule.	I	CO1
	c)	List out all possible number of elements in a standard POSET notation [D30,/]	IV	CO2
	d)	Give the definition of equal sets with an example.	II	CO2
	e)	Define the Semigroup and give an example.	II	CO3
	f)	Define Lattice and give an example.	II	CO3
	g)	State principle of Inclusion and Exclusion.	I	CO4
	h)	How many ways can 20 similar books be placed on 5 different shelves.	III	CO4
	i)	Define Complete Graph with an example.	I	CO5
	j)	Identify the chromatic number to the following graph	III	CO5



PART – B

Answer FIVE questions choosing at least one from each unit. **(5Qx10M=50M)**

UNIT-I

2a.	Verify the following inference is valid or not. i) If there is was a barigate, then the travelling was difficult. ii) If they arrive on time, then travelling was not difficult. iii) They arrived on time, hence there was no barigate.		III	CO1
	(OR)			
2b.	Construct the truth table for the statement and state the statement is tautology or not. $[p \vee q \wedge (\sim r)] \leftrightarrow q$.		IV	CO1

UNIT-II

3a.	Show that the relation "congruence modulo 5' is an equivalence relation on the set of integers $R = \{(a,b) / a = b(\text{mod } 5)\}$		I	CO2
	(OR)			
3b.	Construct the Hasse diagram for S=[{2,3,5,6,8,10,12,15,24},/] and also find minimal and maximal elements.		VI	CO

UNIT-III

4a. Show that the relation $\leq$ defined on a set of positive integers I_+ is a partial order relation. IV CO3

(OR)

4b. A committee of three experts for deciding the accepting or rejection of photographs for exhibition is provided with burgers which members of the committee push to indicate. Design a circuit, so that a bell will ring when there is a majority vote for acceptance. II CO3

UNIT-IV

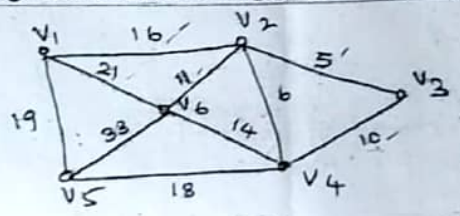
5a. Find the number of integers between 1 and 500 inclusive that are not divisible by 5, 6, and 8. II CO4

(OR)

5b. Find the number of ways the letters {5a,4b,3c} be arranged, so that all the letters of same type is not in same block. II CO4

UNIT-V

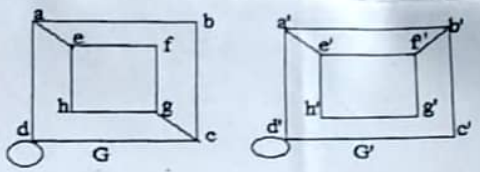
6a. Find a minimal spanning tree for the following graph using Kruskal's algorithm. I CO5



(OR)

6b. (i) Show that there is no simple graph with degree sequence (1,1,3,3,3,4,6,7). VI CO5

(ii) Verify the following two graphs are isomorphic or not.



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BR-22 **SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY** D4

II B.Tech - II Semester - I Mid Term Examination, April – 2024

(R22CSE2111) DISCRETE MATHEMATICS

-(For CSE,IT,CSIT,CS and DS)

Duration: 2 Hrs **Dt: 08-04-2024, Day-1 (FN)** **Max Marks: 30M**

Part – A

Answer *All* multiple choice questions. **Marks: 10Qx1/2M = 5M**

*** (L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating.)**

			*Blooms Taxonomy Levels	Course Outcomes
1.	Which of the following bits is the negation of the bits"010110"? A)111001 B) 001001 C)101001 D)111111	[ ]	I	CO1
2.	Which of the following state mentisa proposition? A) Getmeag lass of milkshake B) God bless you! C) What is the time now? D) The only odd prime number is 2	[ ]	I	CO1
3.	If P→q is logically equivalent to A)¬p∨¬q B)p∨¬q C)¬p∨q D)¬p∧q	[ ]	II	CO1
4.	The statement, "At least one of your friends is perfect". Let P (x) be "x is perfect" and let F(x) be "x is your friend" and let the domain be all people. A)∀x(F(x)→P(x)) B)∀x (F(x) ∧P(x)) C)∃x(F(x)∧P(x)) D)∃x(F(x)→ P(x))	[ ]	II	CO1
5.	If p↔q is logically equivalent to A) (p → q)→(q →p) B)(p→ q)∨(q →p) C) (p → q)∨(q→p) D) (p∧q)→(q∧p)	[ ]	II	CO1
6.	"The product of two negative real numbers is not negative." is given b A) ∃x ∀y((x<0) ∧ (y < 0) → (x y >0)) B) ∃x ∃y ((x < 0) ∧ (y < 0) ∧ (x y > 0)) C) ∀x ∃y((x<0) ∧ (y < 0) ∧ (x y >0)) D) ∀x ∀y ((x < 0) ∧ (y < 0) → (x y > 0))	[ ]	II	CO1
7.	A nor dered collection of objects is A) Relation B) Function C) Set D) Proposition	[ ]	II	CO2
8.	The sub set of power set of empty set has exactly A) One B) Two C) Zero D) Three	[ ]	II	CO2
9.	S, *) is said to be semigroup if A)* is binary operation on S B) both A and B C)* is associative on S D) S has an identity element with respect to *	[ ]	I	CO3
10.	If a*(b*c) = (a*b) * c ∀ a, b, c ∈S then * is said to be on s A) Closed B) associate C) Commutative D) distributive	[ ]	II	CO3

Answer *All* fill in the blank questions. **Marks: 6Qx1/2M = 3M**

11.	_____is the proposition "if p then q"		II	CO1
12.	The Proposition q -> p is called _____of p->q		II	CO1
13.	{x: x∈N and x is prime} then it is_____		I	CO2
14.	Two sets are called disjoint if there_____ is the empty set.		II	CO2
15.	Let G={1,-1,i,-i} is group under multiplication then the inverse of i is _____.		I	CO3
16.	A non empty set A is termed as an algebraic structure _____		II	CO3

P.T.O.

Answer *All* Match the following questions. **Marks: 2Qx1M = 2M**

17.

1.	Conjunction	A)	It is always false	I	CO1
2.	Disjunction	B)	Combination of both T&F		
3.	Tautology	C)	P∧Q		
4.	Contradiction	D)	PVQ		
5	Contingency	E)	It is always true		

18.

1.	Union	A)	A-B	I	CO2
2.	Intersection	B)	AU B		
3.	Disjoint	C)	A∩B		
4.	Set difference	D)	AXB		

Part – B

Answer any *FOUR* questions. **Marks: 4Qx5M = 20M**

19 a) *prove that* $[(p \vee q) \wedge \sim (\sim p \wedge (\sim q \vee \sim r))] \vee (\sim p \wedge \sim q) \vee (\sim p \wedge \sim r)$ *is a tautology* — II CO2

b) *show that* $(p \rightarrow q), (r \rightarrow s), (q \rightarrow t), (s \rightarrow u), \sim (t \wedge u), (p \rightarrow r) \Rightarrow \sim p$ — II CO1

20 a) Find the DNF of the following p→{(p→ q) ^ ~(~q v ~p)} — VI CO1

b) Find CNF of the following [~(pvq) ↔(p^q)]

21 a) Prove the argument is valid $\forall x,[P(x) \rightarrow \{q(x) \wedge r(x)\}]$ — II CO1

$\forall x,[P(x) \wedge s(x)]$ — V CO1

$\therefore \forall x,[r(x) \wedge s(x)]$

b) Prove that $(P \rightarrow Q) \wedge (R \rightarrow Q) \Leftrightarrow (P \vee R) \rightarrow Q)$

22 Let A= {1, 2, 3, 4} and let R be the relation on A defined by xRy if and only if "x divides y", written X | y. — VI CO1

i) Write down R as a set of ordered pairs. — VI CO2

ii) Draw the diagraph of R.

iii) Determine in-degree and out-degrees of the each vertex.

23 Consider the following relations on the set A = {1,2,3 }

R_1 = { (1 ,1), (1 ,2), (1 ,3), (3 ,3) } — I CO2

R_2 = { (1 ,1), (1 ,2), (2 ,1), (2 ,2), (3 ,3) } and

R_3 = { (1,1), (1 ,2), (2 ,2), (2 ,3) }.

Which of these are i) reflexive ii) symmetric iii) transitive and iv) anti symmetric?

24 What is binary operation and write the properties of binary operations? — I CO3

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