



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



NAAC

NATIONAL ASSESSMENT AND
ACCREDITATION COUNCIL



HANDOUT

II Year I Semester

DEPARTMENT OF CSE (AIML)

ACADEMIC YEAR 2025-2026

DEPARTMENT OF CSE (AIML)

HANDOUT-INDEX

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SRIINDU COLLEGE OF ENGINEERING & TECHNOLOGY
B.TECH-CSE(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

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 stake holders.
- IM3** Contribute to the Economical and technological development of the region, state and nation.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

DEPARTMENT VISION

To develop competent engineers in the domain of Artificial Intelligence & Machine Learning for noteworthy contributions to the society.

DEPARTMENT MISSION

- DM1: To strengthen academic collaborations for better exposure.
- DM2: Promote professional environment to imbibe ethical values and entrepreneurial skills
- DM3: Encourage research & development by emphasizing on innovation
- DM4: Facilitate Industry-Institute collaboration for mutual benefit

PROGRAM EDUCATIONAL OBJECTIVES(PEOS)

- PEO1: Generate contributions towards advancements in Artificial Intelligence and Machine Learning
- PEO2: Promote design, research and implementation of products through strong communication skills, leadership and entrepreneurial skills.
- PEO3: Apply basic principles and practices of AIML to successfully complete software related projects to meet customer business objectives and/or productively engage in research.

PROGRAM SPECIFIC OUTCOMES(PSOS)

- PSO1: Register mathematical methodology to crack problems using suitable data structures.
- PSO2: Competence to design and develop software for web based and mobiles androids under real world environment
- PSO3: Skill to design the algorithms for machine learning, data compression can be used in different applications.

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

PO	Description
PO1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)
Program Specific Outcomes	
PSO1	Software Development: To apply the knowledge of Software Engineering, Data Communication, Web Technology and Operating Systems for building IOT and Cloud Computing applications.
PSO2	Industrial Skills Ability: Design, develop and test software systems for world-wide network of computers to provide solutions to real world problems.
PSO3	Project implementation: Analyze and recommend the appropriate IT Infrastructure required for the implementation of a project.

Cos MAPPING WITH Pos & PSOs

Discrete Mathematics

Course Outcomes	Statements	
C221.1	Ability to understand and construct precise mathematical proofs	
C221.2	Ability to use logic and set theory to formulate precise statements	
C221.3	Ability to analyze and solve counting problems on finite and discrete structures	
C221.4	Ability to describe and manipulate sequences	
C221.5	Ability to apply graph theory in solving computing problems	
C221.6	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	PSO 1	PSO 2	PSO 3
C221.1	3	2	-	-	3	-	2	-	-	-	2	2	3	2
C221.2	3	3	-	2	2	-	-	-	-	-	-	3	3	2
C221.3	3	3	-	2	2	-	2	-	-	-	-	3	3	2
C221.4	3	2	3	2	-	-	2	-	-	-	-	3	2	1
C221.5	3	3	3	3	2	-	-	-	3	-	-	3	3	1
C221.6	3	3	3	3	-	-	2	-	3	-	-	3	3	1
C221	3	2.7	1.5	2	1.5	-	1.3	-	1	-	0.3	2.8	2.8	1.5



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Sheriguda (V), Ibrahimpatnam, R.R. Dist, Hyderabad - 501510

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ANNEXURE -III

BR-22

Lr.No.SICET/AUTO/DAE/IInd 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 – IInd Year Students (2024 - 25 Batch), BR-22 Regulation.

I – Semester

S.No.	EVENT	PERIOD	DURATION
1.	Commencement of class work.	01.08.2025 (Monday)	
2.	1 st 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.	2 nd 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.	1 st 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.	2 nd Spell of Instructions for Remaining Two and a half Units.	20.03.2026 – 09.05.2026	7 Weeks
6.	Continuation of remaining 2 nd Spell of Instructions	25.05.2026 – 10.06.2026	4 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)

CALENDAR INCHARGE

HOD

DEPARTMENT CALENDAR
SRI INDU COLLEGE OF ENGINEERING AND TECHNOLOGY(AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AI&ML)
DEPARTMENT CALENDAR–2025-2026(SEMESTER-I)

SUNDAY					SEPTEMBER					DECEMBER		
MONDAY		JULY		1	IV-IMIDIEXAMS					1	IV-IENDEXAMS	
TUESDAY	1	DEPARTMENT MEETING FOR IV-I&III-I2025-2026		2	IV-IMIDIEXAMS		OCTOBER			2	IV-IENDEXAMS	
WEDNESDAY	2			3	IV-IMIDIEXAMS	1	III-ICRTCLASSESS			3	IV-IENDEXAMS	JANUARY
THURSDAY	3		AUGUST	4	IV-ISPELL2CLASSES	2	GANDHIJAYANTI & DASHA RA			4	IV-IENDEXAMS	1
FRIDAY	4		II-ISPELLCLASSESCOMMENCEMENT	5		3	III-ICRTCLASSESS		NOVEMBER	5	IV-IENDEXAMS	2
SATURDAY	5		DEPARTMENT MEETING	6		4	III-ICRTCLASSESS	1	WOKSHOPUND ERAILUB	6	IV-IENDEXAMS	3
SUNDAY	6			7		5		2		7		4
MONDAY	7	IV-ISPELLCLASSES COMMENCEMENT		8		6	III-ICRTCLASSESS	3		8	IV-IENDEXAMS	5
TUESDAY	8			9		7	III-ICRTCLASSESS	4		9	IV-IENDEXAMS	6
WEDNESDAY	9			10	IV-IMIDIEXAMSSUBMISSION	8	III-IMIDIEXAMS & II-IMIDIEXAMS	5		10	IV-IENDEXAMS	7
THURSDAY	10			11		9	III-IMIDIEXAMS & II-IMIDIEXAMS	6		11	IV-IENDEXAMS	8
FRIDAY	11			12	DEPARTMENT MEETING REVIEW ON IV-ISLOW LEARNERS	10	III-IMIDIEXAMS & II-IMIDIEXAMS	7		12	IV-IENDEXAMS	9
SATURDAY	12	AICLUB MEETING	WOKSHOPUND ERAILUB	13	AICLUB MEETING	11		8		13	IV-IENDEXAMS	10
SUNDAY	13			14		12		9		14		11
MONDAY	14	III-ISPELLCLASSES COMMENCEMENT		15	III-ICRTCLASSESS	13	II-I&III-ISPELL2CLASSESS	10		15	II-I&III-IMIDIEXAMS	12
TUESDAY	15			16	III-ICRTCLASSESS	14		11		16	II-I&III-IMIDIEXAMS	13
WEDNESDAY	16			17	III-ICRTCLASSESS	15		12		17	II-I&III-IMIDIEXAMS	14
THURSDAY	17			18	III-ICRTCLASSESS	16	II-I&III-IMIDIEXAMSSUBMISSION	13		18	II-I&III-IMIDIEXAMSSUBMISSION	15

FRIDAY	18		15	INDEPENDENCE DAY	19	III-ICRTCLASSESS	17	DEPARTMENT MEETING REVIEW ON III-I& II- ISLOW LEARNERS	14		19	II-I & III- IPREPARATION & PRACTICAL EXAMS	16	
SATURDAY	19		16		20	III-ICRTCLASSESS	18	AICLU BMEETING	15		20	II-I&III-I PREPARATION & PRACTICAL EXAMS	17	
SUNDAY	20		17		21	BATHUKAMMA	19		16		21		18	
MONDAY	21	BONALU HOLIDAY	18		22	III-ICRTCLASSESS	20	DIWALI	17		22	II-I&III-I PREPARATION & PRACTICAL EXAMS	19	
TUESDAY	22		19		23	III-ICRTCLASSESS	21		18		23	II-I&III- IMIDIIMARKSSUBMISSION III- IPREPARATION & PRACTICAL EXAMS	20	
WEDNESDAY	23		20		24	III-ICRTCLASSESS	22		19	IV-IMIDIEXAMS	24	II-I&III-I PREPARATION & PRACTICAL EXAMS	21	
THURSDAY	24		21		25	III-ICRTCLASSESS	23		20	IV-IMIDIEXAMS	25	CHRISTMAS DAY	22	
FRIDAY	25		22		26	III-ICRTCLASSESS	24		21	IV-IMIDIEXAMS	26	II-I&III-I PREPARATION & PRACTICAL EXAMS	23	
SATURDAY	26		23		27	GANESH CHATURTHI	25	DEPARTMENT MEETING	22	AICLU BMEETING	27	II-I&III-I PREPARATION & PRACTICAL EXAMS	24	
SUNDAY	27		24		28		26		23		28		25	
MONDAY	28	DEPARTMENT MEETING FOR II YR 2025-2026	25		29	III-ICRTCLASSESS	27		24	IV- IPREPARATION & PRACTICAL EXAMS	29	II-I&III- IINDEXAMS	26	
TUESDAY	29		26		30	III-ICRTCLASSESS	28		25	IV- IPREPARATION & PRACTICAL EXAMS	30	II-I&III- IINDEXAMS	27	
WEDNESDAY	30		27				29		26	IV- IPREPARATION & PRACTICAL EXAMS	31	II-I&III- IINDEXAMS	28	
THURSDAY	31		28				30		27	IV- IPREPARATION & PRACTICAL EXAMS			29	
FRIDAY			29				31		28	IV- IPREPARATION & PRACTICAL EXAMS			30	
SATURDAY			30	AICLU BMEETING		WOKSHOP UNDER AILUB			29	IV- IPREPARATION & PRACTICAL EXAMS			31	
SUNDAY			31						30					

DISCRETE MATHEMATICS

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution under UGC, New Delhi)

B.Tech. - II Year – I Semester

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(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 I. Mott, Abraham Kandel, Theodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE BOOKS:

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



SRI INDU COLLEGE OF ENGG & TECH
QUESTION BANK
(Regulation :R22)
DEPARTMENT OF CSE (AIML)

Prepared on
Rev1:2025

Sub.Code &Title **R22CSE2111 & DISCRETE MATHEMATICS**

AcademicYear:2025-26

Year/Sem./Section

II-I

Faculty Name & Designation

Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor

Unit/ Item No.	Topic (s)	Book Reference	Page (s)		Teaching Methodology	Proposed No. of Periods	Actual Date of Handled	CO/RBT
			From	To				
	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	34	37	Powerpoint Presentation	02		CO1,L2
1.4	Normal Forms	T1	38	51	Black board	01		CO1,L2
1.5	Theory of Inference for the Statement Calculus	T1	51	67	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	107	Black board	02		CO2,L4
1.9	Revisionon1 st unit	T1	1	107	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	108	108	Blackboard Presentation	01		CO3,L3

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENT OF CSE (AIML)			Prepared on Rev1:2025
	Sub.Code &Title	R22CSE2111 & DISCRETE MATHEMATICS		
	AcademicYear:2025-26	Year/Sem./Section	II-I	
	Faculty Name & Designation	Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor		

Unit/ Item No.	Topic (s)	Book Reference	Page (s)		Teaching Methodology	Proposed No. of Periods	Actual Date of Handled	CO/RBT
			From	To				
2.2	Sets	T1	108	108	Black board	02		CO 3,L3
2.3	Basic Concepts	T1,R4	109	113	Power point Presentation	01		CO 3,L3
2.2	Set Theory	T1,R4	114	123	Power point Presentation	01		CO 3,L3
2.3	Types	T1	123	124	Black board	01		CO 3,L3
2.4	Representation of Discrete Structures	T1	124	124	Black board	01		CO 3,L3
2.5	Discrete Structures concept and Types	T1	124	124	Black board	02		CO 3,L3
2.6	Relations	T1,R4	128	140	Black board	02		CO 3,L3
2.7	Relations and Their Properties	T1	141	145	Black board	01		CO 3,L3
2.8	Relations and Their Applications	T1	146	148	Black board	01		CO 3,L3
2.9	Representing Relations	T1	149	156	Black board	01		CO 3,L3
2.10	Relations and Ordering	T1	156	156	Black board	02		CO 3,L3
2.11	Function	T1	222	232	Black board	02		CO 3,L3
2.12	Functions Types	T1	233	252	Black board	02		CO 3,L3
2.13	Revisionon2 nd unit	T1	108-252	108-252	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	278	279	Black board	01		CO4,L6
3.3	Algebraic Systems	T1	279	286	Black board	01		CO4,L6



SRI INDU COLLEGE OF ENGG & TECH
QUESTION BANK
 (Regulation :R22)
DEPARTMENT OF CSE (AIML)

**Prepared
onRev1:
2025**

Sub.Code &Title

R22CSE2111 & DISCRETE MATHEMATICS

AcademicYear:2025-26

Year/Sem./Section

II-I

Faculty Name & Designation

Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor

3.4	Induction Semi groups and Monodis	T1,T3, R3	287	333	Powerpoint 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	Revisionon3 rd 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) DEPARTMENT OF CSE (AIML)			Prepared onRev1: 2025
	Sub.Code &Title	R22CSE2111 & DISCRETE MATHEMATICS		
	AcademicYear:2025-26		Year/Sem./Section	II-I
	Faculty Name & Designation		Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor	

UNIT-IV								
IV	Introduction Elementary Combinatorics					15		
4.1	Elementary Combinatorics	T1	352	353	Black board	02		CO5,L6
4.2	An Introduction to Es	T1	353	353	Black board	01		CO5,L6
4.3	Basic of counting	T1	417	427	Black board	01		CO5,L6
4.4	Combinations and Permutations	T1	427	437	Black board	01		CO5,L6
4.5	Enumeration of Combinations And Permutations	T1	437	447	Powerpoint Presentation	01		CO5,L6
4.7	Repetitions	T1	448	463	Black board	01		CO5,L6
4.8	Enumerating Permutation	T1	463	464	Black board	02		CO5,L6
4.9	Constrained Repetitions	T1	464	465	Black board	01		CO5,L6
4.10	Binomial Coefficient	T1	362	366	Black board	01		CO5,L6
4.11	Multinomial Theorems	T1	467	485	Black board	02		CO5,L6
4.12	The Principle of Inclusion-Exclusion	T1	372	400	Black board	01		CO5,L6
4.13	Revisionon4 th unit	T1	352	485	Black board	01		CO5,L6
	Review	Signature of the HOD/Coordinator						
UNIT-V								
V	Graphs					15		
5.1	Graphs and Graph Models		T1	486	486	Black board	01	CO6,L6
5.2	Graph Terminology and Special Types of Graphs		T1	486	493	Powerpoint Presentation	01	CO6,L6

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENT OF CSE (AIML)			Prepared onRev1: 2025
	Sub.Code &Title	R22CSE2111 & DISCRETE MATHEMATICS		
	AcademicYear:2025-26	Year/Sem./Section	II-I	
	Faculty Name & Designation	Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor		

5.3	Representing Graphs and Graph Isomorphism	T1	494	518	Power point Presentation	01		CO6,L6
5.4	Connectivity	T1	555	568	Blackboard	01		CO6,L6
5.5	Euler and Hamilton Paths	T1	583	590	Black board	01		CO6,L6
5.6	Shortest-Path Problems	T1	590	590	Black board	01		CO6,L6
5.7	Planar Graphs,	T1	594	600	Black board	01		CO6,L6
5.8	Graph Coloring	T1	601	603	Black board	01		CO6,L6
5.9	Trees: Introduction to Trees, Applications of Trees	T1	604	616	Black board	02		CO6,L6
5.10	Tree Traversal	T1	616	628	Black board	01		CO6,L6
5.11	Spanning Trees	T1	628	629	Black board	01		CO6,L6
5.12	Minimum Spanning Trees	T1	629	645	Blackboard	02		CO6,L6
5.13	Revision on 5 th unit	T1	486	645	Black board	01		CO6,L6
	Review	Signature of the HOD/Coordinator						

	SRI INDU COLLEGE OF ENGG & TECH QUESTION BANK (Regulation :R22) DEPARTMENT OF CSE (AIML)			Prepared onRev1: 2025
	Sub.Code &Title	R22CSE2111 & DISCRETE MATHEMATICS		
	AcademicYear:2025-26	Year/Sem./Section	II-I	
	Faculty Name & Designation	Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor		

LIST OF TEXTBOOKS AND REFERENCES

TEXTBOOKs:

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

REFERENCEBOOKS:

	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: JoeL. Mott, Abraham Kandel, Theodore P. Baker, 2 nd ed, Pearson Education.
TB3	Discrete Mathematics-Richard Johnson baugh, 7 th Edn.,PearsonEducation.
TB4	Discrete Mathematics with Graph Theory- EdgarG. Goodaire, MichaelM. Parmenter.
TB5	Discrete and Combinatorial Mathematics-an applied introduction: Ralph. P.Grimald, 5 th 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.ensc.concordia.ca/~chvatal/notes/pc.html>



SRIINDUCOLLEGE OF ENGINEERING & TECHNOLOGY

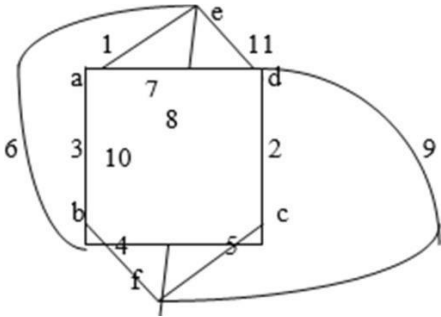
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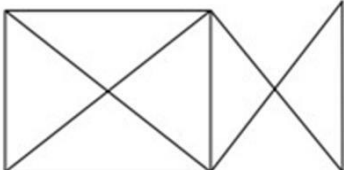
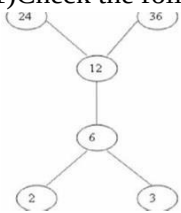
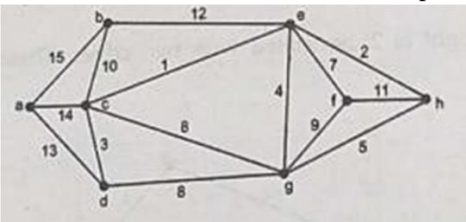
DEPARTMENT OF AIML

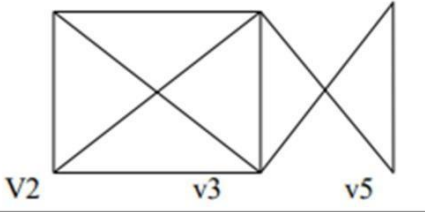
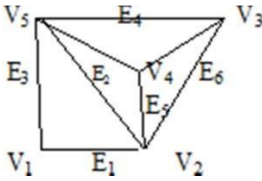
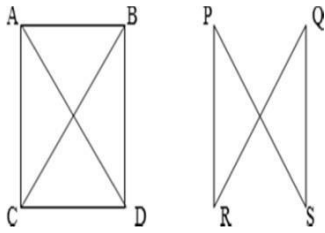
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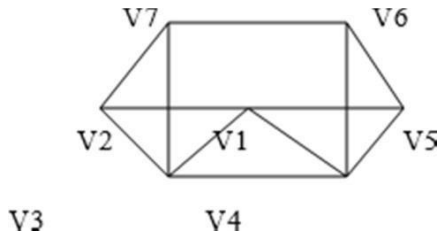
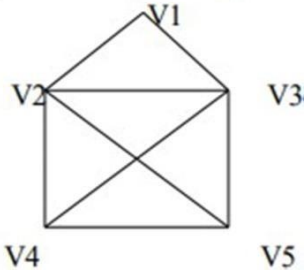
A.Y:2025-2026

SUBJECT NAME: R22CSE2111 – DISCRETE MATHEMATICS

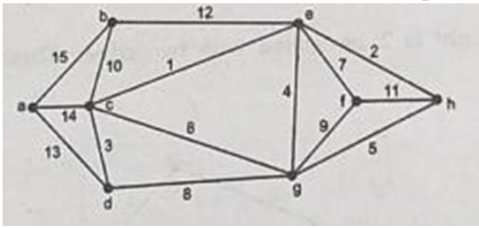
Batch. No	Assignment Questions	Register Number	Course outcome
1.	1) Prove that $\langle G, * \rangle$ is a acyclic group where $g = \{1, -1, i, -i\}$? 2) In how many ways can we distribute 10 identical marbles among 6 distinct containers? 3) If $P(n, r) = 2520$ and $C(n, r) = 21$, then what is the value of $C(n+1, r+1)$? 4) a) Explain about Kruskal's algorithm. (understanding) b) Find the minimal spanning tree by using Kruskal's algorithm for the following given graph. (creating)  5) What is a planar graph? Mention the properties of a planar graph. (analyzing)	23D41A6201 to 23D41A6206	CO3 CO4 CO4 CO5 CO5
2.	1) Show that the relation "greater than or equal to" is a POSET of integers? 2) Find the number of permutations of the letters of the word MATHEMATICS? 3) From a group of 7 men and 6 women, 5 persons are to be selected to form a committee so that at least 3 men are on the committee, in how many ways it can be done? 4) a) Explain about Euler's formula? b) Explain about Euler's circuit's? Eulerian graph? With example 5) a) Explain DFS algorithm. (understanding) b) Apply a BFS algorithm to find a spanning tree. (creating)	23D41A6207 to 23D41A6211	CO3 CO4 CO4 CO5 CO5

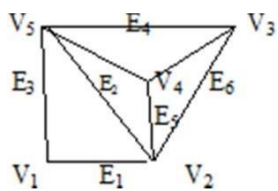
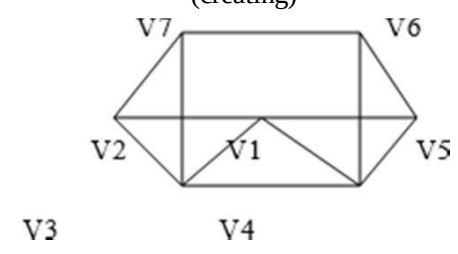
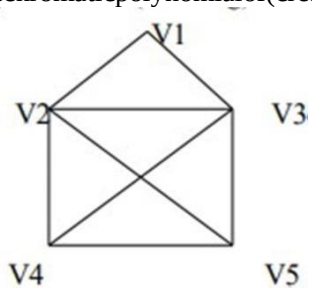
	applying) V1 V4 V6 V7 v2 V3 v5 		
3.	1) Check the following hasse diagram is lattice or not  2) Find the number of permutations of the letters of the word “ENGINEERING”? 3) A certain questions paper contains two parts A and B, each containing 4 Questions how many different ways a student can answer 5 Questions by selecting at least 2 questions from each part? 4) Obtain minimum spanning tree for following graph? obtain total cost of minimum spanning tree?  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)	23D41A6212to 23D41A6217	CO3 CO4 CO4 CO5 CO5
4.	1) Explain about algebraic structure and explain about the properties? 2) How many committees of 4 with a given chairperson can be selected from 12 persons? 3) Find the coefficient of x^{27} in the expansion of $(x^4 + x^5 + x^6 + \dots)^5$ 4) a) Explain BFS algorithm (understanding) b) Apply DFS algorithm to find a spanning tree (applying)	23D41A6218to 23D41A6222	CO3 CO4 CO4 CO5 CO5

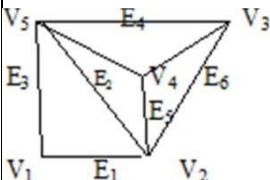
	V1 V4 V6 V7  5) Show that the maximum number of edges in a complete bipartite graph with 'n' vertices is $n^2/4$. (creating)		
5.	1) Draw a Hasse diagram for $\{1, 2, 3, 4, 6, 9\}$. 2) Find out the coefficient of $x^9 \cdot y^3$ in the expansion of $(x+2y)^{12}$. 3) In how many ways can we distribute 12 identical pencils to 5 children so that every child gets at least one pencil? 4) Find an Eulerian cycle in the graph (creating) .  5) a) Explain about Isomorphism. (understanding) b) Show that the following graphs are isomorphic or not. (creating) 	23D41A6223 To 23D41A6227	CO3 CO4 CO4 CO5 CO5
6.	1) Let $L = \{1, 2, 3, 5, 30\}$ and R be a relation "is divisible" defined on L. Show that L is a lattice or not? 2) Find the number of permutations of the letters of the word "MASSAUGA". In how many of these all four A's together? how many of them begin with S? 3) Find out the coefficient of $x^3 \cdot y^3 \cdot z^2$ in the expansion of	23D41A6228 To 23D41A6233	CO3 CO4 CO4 CO5 CO5

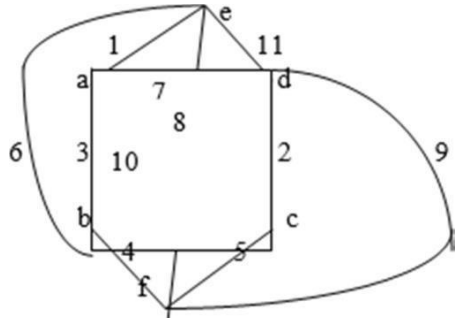
	$(2x-3y+5z)^8$ 4) Find the chromatic number of the following graph. (creating)  5) Find the chromatic polynomial of (creating) 		
7.	1) Explain about Meet semilattice and Join semilattice  explain the following figs satisfies lattice or not 2) a) how many ways are there to sit 10 boys and 10 girls around a circular table? b) how many ways are there 3 persons sit around a round table? c) how many different arrangements of letters in the word BOUGHT? 3) Consider a set of integers from 0 to 499 find out? a) How many of these numbers are divisible by 3 or 5? b) How many of these numbers are divisible by 5 or 11? c) How many of these numbers are divisible by 3 or	23D41A6235 to 23D41A6240	CO3 CO4 CO4 CO5 CO5

	11? d) How many of these numbers are divisible by 3 or 5 or 11? e) How many of these numbers are divisible by 3 or 5 but not by 11? f) How many of these numbers are divisible by 5 or 11 but not by 3? g) How many of these numbers are divisible by 3 or 11 but not by 5? h) How many of these integers between 1 and 250 not divisible by 3, or 5, or 11? 4a) How many edges are there in a graph with 10 vertices each of degree 6? b) Define isomorphism of directed graph? 5a) Explain about Kruskal's algorithm. (understanding) b) Find the minimal spanning tree by using Kruskal's algorithm for the following given graph. (creating)		
8.	1) Let $L = \{1, 2, 3, 5, 30\}$ and R be a relation "is divisible" defined on L. Show that L is a lattice or not? 2) Consider a set of integers from 1 to 250. Find out? a) How many of these numbers are divisible by 3 or 5? b) How many of these numbers are divisible by 5 or 7? c) How many of these numbers are divisible by 3 or 7? d) How many of these numbers are divisible by 3 or 5 or 7? e) How many of these numbers are divisible by 3 or 5 but not by 7? f) How many of these numbers are divisible by 5 or 7 but not by 3? g) How many of these numbers are divisible by 3 or 7 but not by 5? h) How many of these integers between 1 and 250 not divisible by 3, 5, and 7?	23D41A6241 to 23D41A6245	CO3 CO4 CO4 CO5 CO5

	3) In how many ways can we distribute 10 identical marbles among 6 distinct containers? 4) What is a planar graph? Mention the properties of a planar graph. (analyzing) 5) a) Explain about Euler's formula? B) Explain about Euler's circuit's? Eulerian graph? with example		
9.	1) Simplify the Boolean Algebra a) $A'BC + AB'C' + A'B'C' + AB'C + ABC$ b) GIVEN $P = (A+B).(A+C)$ 2) Find the number of permutations of the letters of the word MATHEMATICS? 3) From a group of 7 men and 6 women, 5 persons are to be selected to form a committee so that at least 3 men are on the committee, in how many ways it can be done 4) Obtain minimum spanning tree for following graph? obtain total cost of minimum spanning tree?  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)	23D41A6246 To 23D41A6251	CO3 CO4 CO4 CO5 CO5
10.	1) Let $x = \{2, 3, 6, 12, 24, 36\}$ and the relation $<$ and equal to be such that $x < \text{equal to } y$ if x Divides y Draw Hasse diagrams 2) How many committees of 4 with a given chair person can be selected from 12 persons? 3) Find the number of permutations of the letters of the word "ENGINEERING"? 4) Show that the maximum number of edges in a complete bipartite graph with 'n' vertices is $n^2/4$. (creating)	23D41A6252 To 23D41A62556	CO3 CO4 CO4 CO5 CO5

	5) Find an Eulerian cycle in the graph (creating). 		
11.	1) Simplify the Boolean Algebra a) $A'BC + AB'C' + A'B'C' + AB'C + ABC$ b) GIVEN $P = (A+B).(A+C)$ 2) Find the numbers of permutations of the letters of the word "MASSASAUGA". In how many of these all four A's together? how many of them begin with S? 3) Find out the coefficient of $x^3.y^3.z^2$ in the expansion of $(2x-3y+5z)^8$? 4) Find the chromatic number of the following graph. (creating)  5) Find the chromatic polynomial of (creating) 	23D41A6257 To 23D41A6261	CO3 CO4 CO4 CO5 CO5
12.	1) Let $L = \{1, 2, 3, 5, 30\}$ and R be a relation "is divisible" defined on L. Show that L is a lattice or not? 2) Find out the coefficient of $x^3.y^3.z^2$ in the expansion of $(2x-3y+5z)^8$?	23D41A6262 To 24D45A6202 (LE-2)	CO3 CO4 CO4

	3a) how many ways are there to sit 10 boys and 10 girls around a circular table? b) how many ways are there 3 persons sit around a round table? c) how many different arrangements of letters in the word BOUGHT? 4) Show that the maximum number of edges in a complete bipartite graph with 'n' vertices is $n^2/4$. (creating) 5) Find an Eulerian cycle in the graph (creating) 		CO5 CO5
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13	1) Prove that $\langle G, * \rangle$ is a cyclic group where $g = \{1, -1, i, -i\}$? 2) In how many ways can we distribute 10 identical marbles among 6 distinct containers? 3) If $P(n, r) = 2520$ and $C(n, r) = 21$, then what is the value of $C(n+1, r+1)$? 4) a) Explain about Kruskal's algorithm. (understanding) b) Find the minimal spanning tree by using Kruskal's algorithm for the following given graph. (creating)  5) What is a planar graph? Mention the properties of a Planar graph	24D45A6203(LE-3)TO 24D45A6206(LE-6)	CO3 CO4 CO4 CO5 CO5
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FACULTY
M. Mayuri

HOD
G.Uma Maheswari



SRI INDU COLLEGE OF ENGG & TECH
QUESTION BANK
(Regulation :R22)
DEPARTMENT OF CSE (AIML)

Prepared
on Rev1:
2025

Sub.Code & Title

R22CSE2111 & DISCRETE MATHEMATICS

Academic Year: 2025-26

Year/Sem./Section

II-I

Faculty Name & Designation

Ch. Praveen Reddy , M. Mayuri Reddy & Asst. Professor

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

Multiple Choice Questions

		BT Level	Course Outcome
1C-1	Which of the following statement is a proposition? () a) Get me a glass of milkshake b) God bless you! c) What is the time now? d) The only odd prime number is 2	1	CO1
1C-2	Which of the following bits is the negation of the bits "010110"? () a) 111001 b) 001001 c) 101001 d) 111111	1	CO1
1C-3	If $P \rightarrow q$ is logically equivalent to () a) $\neg p \vee \neg q$ b) $p \vee \neg q$ c) $\neg p \vee q$ d) $\neg p \wedge q$	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 "x is your friend" and let the domain be all people. () a) $\forall x (F(x) \rightarrow P(x))$ b) $\forall x (F(x) \wedge P(x))$ c) $\exists x (F(x) \wedge P(x))$ d) $\exists x (F(x) \rightarrow P(x))$	2	CO1
1C-5	$p \leftrightarrow q$ is logically equivalent to () a) $(p \rightarrow q) \rightarrow (q \rightarrow p)$ b) $(p \rightarrow q) \vee (q \rightarrow p)$ c) $(p \rightarrow q) \vee (q \rightarrow p)$ d) $(p \wedge q) \rightarrow (q \wedge p)$	2	CO1

1C-6	“The product of two negative real numbers is not negative.” Is given by? () a) $\exists x \forall y((x < 0) \wedge (y < 0) \rightarrow (x y > 0))$ b) $\exists x \exists y ((x < 0) \wedge (y < 0) \wedge (x y > 0))$ c) $\forall x \exists y((x < 0) \wedge (y < 0) \wedge (x y > 0))$ d) $\forall x \forall y ((x < 0) \wedge (y < 0) \rightarrow (x y > 0))$	2	CO1
1C-7	Which of the following is correct with respect to precedence of logical operators ()? a) $\leftrightarrow, \rightarrow, \wedge, \vee, \sim$ b) $\vee, \wedge, \leftrightarrow, \rightarrow, \sim$ c) $\sim, \wedge, \vee, \rightarrow, \leftrightarrow$ d) $\rightarrow, \wedge, \sim, \leftrightarrow, \vee$	5	CO1
1C-8	A compound proposition that is always tautology () a) True b) False c) Both d) None	2	CO1
1C-9	$p \wedge q$ is logically equivalent to () a) $(p \rightarrow \neg q)$ b) $(\neg p \rightarrow \neg q)$ c) $\neg (p \rightarrow \neg q)$ d) $(\neg p \rightarrow q)$	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	The compound propositions p and q are called logically equivalent then it is a tautology () a) $p \leftrightarrow q$ b) $p \rightarrow q$ c) $\neg(p \vee q)$ d) $\neg p \vee \neg q$	2	CO1
1C-12	State rule of inference $\sim q$ $p \rightarrow q$	1	CO1

	$\sim p$ a) Modus ponens b) Modus Tollens c) Addition d) None	2	
1C-13	The premises $(p \wedge q) \vee r$ and $r \rightarrow s$ imply which of the conclusion? () a) $p \vee r$ b) $p \vee s$ c) $p \vee q$ d) $q \vee r$	1	CO1
1C-14	The contrapositive of $p \rightarrow q$ is the proposition of () a) $\neg p \rightarrow \neg q$ b) $\neg q \rightarrow \neg p$ c) $q \rightarrow p$ d) $\neg q \rightarrow p$	2	CO1

1C-15	Let P: We should be honest., Q: We should be dedicated., R: We should be overconfident. Then 'We should be honest or dedicated but not overconfident.' is best represented by () a) $\sim P \vee \sim Q \vee R$ b) $P \wedge \sim Q \wedge R$ c) $P \vee Q \wedge R$ d) $P \vee Q \wedge \sim R$	1	CO1
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Fill in the blanks

1F-1	_____ is the proposition "if p then q"	2	CO1
1F-2	The Proposition $q \rightarrow p$ is called _____ of $p \rightarrow q$	2	CO1
1F-3	A compound proposition that is neither a tautology nor a contradiction is called _____	1	CO1
1F-4	An Occurrence of a variable that is not bound by a quantifier or set equal to a particular value is said to be _____	1	CO1
1F-5	The part of the logical expression to which a quantifier is applied is called the _____	4	CO1
1F-6	_____ is a sequence of statements that end with a conclusion	3	CO1
1F-7	A _____ is a statement that is being proposed to be a true statement usually on the basis of some partial evidence	2	CO1
1F-8	Common forms of incorrect reasoning is called _____	2	CO1
1F-9	The converse of $p \rightarrow q$ is the proposition of _____	3	CO1

1F-10	$\forall x p(x)$ is the same as _____	2	CO1
1F-11	_____ is defining the object in statement	1	CO1
1F-12	The symbol of rule UG is _____	2	CO1
1F-13	Formula of distributive law is _____	2	CO1
1F-14	Full form of PDNF is _____	2	CO1
1F-15	The logic based on the analysis of predicate is called _____	1	CO1

Match the following

1M-1	Match the following a) Conjunction () i) It is always false b) Disjunction () ii) Combination of both T & F c) Tautology () iii) $P \wedge Q$ d) Contradiction () iv) $P \vee Q$ e) Contingency () v) It is always true	2	CO1
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1M -2	Match the following a) Commutative law () b) Demorgan's law () c) Associative law () a) Distributive law () b) Absorption law ()	i) $p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$ ii) $p \wedge (q \wedge r) \Leftrightarrow (p \wedge q) \wedge r$ iii) $[p \vee (p \wedge q)] \Leftrightarrow p$ iv) $(p \vee q) \Leftrightarrow (q \vee p)$ v) $\sim(p \wedge q) \Leftrightarrow \sim p \vee \sim q$	2	CO1
1M -3	Match the following a) DNF () b) CNF () c) Universal quantifier () d) Existential quantifier ()	i) Premises ii) $\exists$ iii) $\forall$ iv) Sum of elementary product v) Product of elementary sum	3	CO1
1M -4	Match the following a) Modus ponens () b) Modus tollens () c) Disjunctive syllogism () d) Simplification () e) Hypothetical syllogism ()	i) $[\sim p \wedge (p \rightarrow q)] \rightarrow \sim p$ ii) $(p \wedge q) \rightarrow p$ iii) $[p \wedge (p \rightarrow q)] \rightarrow q$ iv) $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ v) $[(p \vee q) \wedge \sim q] \rightarrow q$	2	CO1
1M -5	Match the following		1	CO1

1M.1	a) Rule-p ()	i) $\underline{P(t) \text{ for all } t} \forall (x)[p(x)]$	1	
1M.2	b) Rule-ES ()	ii) $R \rightarrow S$	2	
1M.3	c) Rule-US ()	iii) Introduce a new step in Derivation	2	
1M.4	d) Rule-CP ()	iv) $\underline{\exists (x)[p(x)]}$ $p(t)$ for some t	3	
1M.5	e) Rule-UG ()	v) $\underline{\forall (x)[p(x)]}$ $\underline{P(t) \text{ for all } t}$	1	

UNIT I-MATHEMATICAL LOGIC :Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, 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.	Give an indirect proof of the theorem “If $3n+2$ is odd, then n is odd.(creating)	6	CO1,CO6
10.	Prove that $p, p \rightarrow q, q \rightarrow r \Rightarrow r$ (Applying)	3	CO1,CO6
PART-B			
1.(a)	<i>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</i>	2	CO1
1. (b)	<i>show that $(p \rightarrow q), (r \rightarrow s), (q \rightarrow t), (s \rightarrow u), \sim (t \wedge u), (p \rightarrow r) \Rightarrow \sim p$</i>	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 $p \rightarrow \{(p \rightarrow q) \wedge \sim (\sim q \vee \sim p)\}$	6	CO1,CO6
3.(b)	Find CNF of the following $[\sim(p \vee q) \leftrightarrow (p \wedge q)]$	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.	<i>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.</i>	2	CO1,CO6
6. (a)	Prove the argument is valid $\forall x, [P(x) \rightarrow \{q(x) \wedge r(x)\}]$ $\forall x, [P(x) \wedge s(x)]$ $\forall x, [r(x) \wedge s(x)]$ (creating)	5	CO1,CO6
6.(b)	Prove that $(P \rightarrow Q) \wedge (R \rightarrow Q) \Leftrightarrow (P \vee R) \rightarrow Q$ (creating)	6	CO1,CO6
7	<i>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) $p \rightarrow q$ (4) $q \rightarrow p$ (5) $(\sim r) \rightarrow (\sim q)$</i>	1	CO1,CO6
8.(a)	Prove that the premises $p \vee q, (p \vee q) \rightarrow r, \sim r$ are inconsistent. (creating)	6	CO1,CO6
8.(b)	Without using truth table find PCNF and PDNF of (Applying) $[P \rightarrow (Q \wedge R)] \wedge [\neg P \rightarrow (\neg Q \wedge \neg R)]$.	3	CO1,CO6
9.(a)	<i>show that p from these premises $(\sim p \vee q) \rightarrow r, r \rightarrow (s \vee t), (\sim s \wedge \sim u), (\sim u \rightarrow \sim t)$ (remembering)</i>	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 $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P) \Leftrightarrow (P \vee Q \vee R) \wedge (P \vee \neg Q \vee R) \wedge (P \vee \neg Q \vee \neg R) \wedge (\neg P \vee Q \vee R) \wedge (\neg P \vee Q \vee \neg R)$. (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



SRI INDU COLLEGE OF ENGG & TECH
QUESTION BANK
(Regulation :R22)
DEPARTMENT OF CSE (AIML)

Prepared
on Rev1:
2025

Sub.Code & Title

R22CSE2111 & DISCRETE MATHEMATICS

Academic Year: 2025-26

Year/Sem./Section

II-I

Faculty Name & Designation

Ch. Praveen Reddy , M. Mayuri Reddy & Asst. Professor

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

Multiple Choice Questions

2C-1	An ordered collection of objects is () a) relation b) function c) set d) proposition	2	CO2
2C-2	The subset of power set of empty set () a) one b) two c) zero d) three	2	CO2
2C-3	Subset of the set $A = \{ \}$ is () a) A b) $\{ \}$ c) $\emptyset$ d) All of the mentioned	2	CO2
2C-4	If x is a set and the set contains an integer which is neither positive nor negative, then the set x is () a) Set is Empty b) Set is Non-empty c) Set is Finite. d) Set is both Non-empty and Finite	1	CO2
2C-5	If $x \in \mathbb{N}$ and x is prime, then x is () a) Infinite set b) Finite set c) Empty set d) Not a set	3	CO2
2C-6	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	1	CO2
2C-7	Which of the following function is not a mathematics function? () a) many to one b) one-to-many c) one to one d) All of the mentioned	1	CO2

2C-8	Which of the following function is also referred to as an injective function? a) Many-to-one c) One-to-One b) Onto d) None of the mentioned	1	CO2
2C-9	The function $(g^{-1} \circ f^{-1})$ is if the function f and g are a) Into function c) onto function b) one to one d) one-to-many function	1	CO2
2C-10	Let $U = \{1, 2, 3, 4, 5\}$ and $A = \{1, 3, 5\}$ then A^c is a) $\{1, 2\}$ c) $\{4, 5\}$ b) $\{3, 4\}$ d) $\{2, 4\}$	1	CO2
2C-11	How many relations exist from set X to set Y if the set X and set Y has 7 and 8 elements a) 2^{56} c) 3^{56} b) 2^{72} d) 56	2	CO2
2C-12	The number of reflexive closure of the relation $\{(0, 1), (1, 1), (1, 3), (2, 1), (2, 2), (3, 0)\}$ on the set $\{0, 1, 2, 3\}$ is a) 36 c) 6 b) 8 d) 2^6	2	CO2
2C-13	The number of transitive closure exists in the relation $R = \{(0, 1), (1, 2), (2, 2), (3, 4), (5, 3), (5, 4)\}$ where $\{1, 2, 3, 4, 5\} \in A$ is a) $\{(0, 1), (0, 2), (1, 2), (2, 2), (3, 4), (5, 3), (5, 4)\}$ c) $\{(0, 1), (1, 2), (2, 2), (3, 4)\}$ b) $\{(0, 0), (4, 4), (5, 5), (1, 1), (2, 2), (3, 3)\}$ d) $\{(0, 1), (5, 3), (5, 4), (1, 1), (2, 2)\}$	2	CO2

2C-14	A relation R on a set P is said to be a partial ordering relation if and only if R is a) Reflexive b) Transitive c) Anti-Symmetric d) All the above	3	CO2
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2C-15	According to the symmetric matrix, which of the following statement is correct? $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 4 & 1 \end{pmatrix}$ a) $A = A^T$ b) All the diagonal elements of a symmetric matrix are One. c) $A = -A^T$ d) All the diagonal elements of a symmetric matrix are Zero	2	CO2
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Fill in the blanks

2F-1	{x: $x \in \mathbb{N}$ and x is prime} then it is _____	1	CO2
2F-2	Two sets are called disjoint if there _____ is the empty set.	2	CO2
2F-3	Power set of empty set has exactly _____ subset	2	CO2
2F-4	The relation between sets A, B, C as shown by Venn diagram is _____	1	CO2
2F-5	Let the sets be A, B, C, D then $(A \cap B) \times (C \cap D)$ is equivalent to _____	1	CO2
2F-6	The set containing all the collection of subsets is known as _____	2	CO2
2F-7	A function is said to be _____ if and only if $f(a) = f(b)$ implies that $a = b$ for all a and b in the domain of f .	1	
2F-8	For an inverse to exist it is necessary that a function should be _____	3	
2F-9	Consider the relation: $R' (x, y)$ if and only if $x, y > 0$ over the set of non-zero rational numbers, then R' is _____	2	CO2
2F-10	Let set $A = \{1, 2\}$ and $B = \{3, 4\}$ then $A \times B$ (Cartesian product of set A and B) is _____	1	CO2
2F-11	If a set contains 3 elements then the number of subsets is _____	2	CO2
2F-12	If $f(x) = y$ then $f^{-1}(y)$ is equal to _____	4	CO2
2F-13	The inverse of function $f(x) = x^3 + 2$ is _____	1	CO2
2F-14	If $n(A) = 20$ and $n(B) = 30$ and $n(A \cup B) = 40$ then $n(A \cap B)$ is _____	5	CO2
2F-15	The cardinality of the set $A = \{1, 2, 3, 4, 6\}$ is _____	2	CO2

	Match the following		
2M-1	1) Null set () a) $A \subseteq B$	1	CO2

	2) single toneset ()	b) A^C or U-A	2	
	3) Subset ()	c) {a}	2	
	4) Universal set ()	d) U	1	
	5) Complement set ()	e) $\{\emptyset\}$	3	
2M-2	1) Union ()	a) A-B	1	CO2
	2) Intersection ()	b) $A \cup B$	2	
	3) Disjoint ()	c) $A \cap B$	1	
	4) Set difference ()	d) $A \times B$	1	
	5) Cartesian product ()	e) $A \cap B = \emptyset$	3	
2M-3	1) Complement ()	a) $(A^C)^C = A$	1	CO2
	2) Idempotent ()	b) $A \cup U = U$ & $A \cap \emptyset = \emptyset$	2	
	3) Domination ()	c) $A \cup A^C = U$	1	
	4) Identity ()	d) $A \cup A = A$ & $A \cap A = A$	2	
	5) Involution ()	e) $A \cup \emptyset = A$	2	
2M-4	1) Reflexive ()	a) $a, b \in A$ and $(a, b) \in R$ then $(b, a) \in R$	2	CO2
	2) Symmetric ()	b) $a \in A$ & $(a, a) \notin R$	3	
	3) Transitive ()	c) $(a, b) \in A$ & $(b, c) \in R$ then $(a, c) \in R$	2	
	4) Asymmetric ()	d) $a \in A$ & $(a, a) \in R$	1	
	5) Irreflexive ()	e) $(a, b) \in R$ & $(b, c) \in R$ Then $(a, c) \in R$	1	
2M-5	1) Identity ()	a) $f(x) = c$	1	CO2
	2) constant ()	b) B	2	
	3) One-One ()	preimage of A is $f^{-1}(A)$	1	
	4) Onto function ()	$f(x) = x$	3	
	5) bijective ()	d) one-one & Onto e) A is image in B	2	

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 diagram of R. iii) Determine in-degree and out-degrees of the each vertex. (creating)	6	CO2
7	Consider the following relations on the set $A = \{1,2,3\}$ $R_1 = \{(1,1), (1,2), (1,3), (3,3)\}$ $R_2 = \{(1,1), (1,2), (2,1), (2,2), (3,3)\}$ and $R_3 = \{(1,1), (1,2), (2,2), (2,3)\}$. Which of these are i) reflexive, ii) symmetric, iii) transitive, 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 $f:A \rightarrow B$ 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 $(P(S), \subset)$ where $S = \{1,2,3,4\}$.(creating)	6	CO2
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 $f^{-1} \circ g^{-1}$ and $g^{-1} \circ f^{-1}$		CO2
13	Let $A = \{1,2,3\}$ and $B = \{2,4,5\}$. Determine the following: (1) $ A \times B $ (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 $\bar{R}, \bar{S}, R \cup S, R \cap S, R^c$ 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

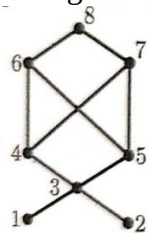
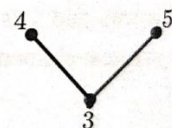
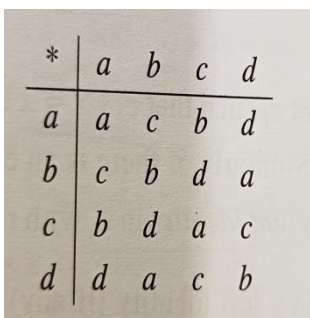
	Let $G = \{1, -1, i, -i\}$ is group under multiplication then the inverse of i is ____.		
3F.2	A non empty set A is termed as an algebraic structure _____	2	CO3
3F.3	An algebraic structure _____ is called a semigroup	2	CO3
3F.4	Condition for monoid is _____	2	CO3
3F.5	A group $(M, *)$ is said to be abelian 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 form is a maxterm.	1	CO3
3F.12	The logic gate that provides high output for same inputs _____	II	CO3
3F.13	If $x \in \mathbb{N}$ 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 c) semigroup	I	CO3

	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) $M.(\sim M+N) = M.N$ b) $M+(N.O) = (M+N)(M+O)$ c) $\sim(M+N) = \sim M.\sim N$ 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. $\{(1, 1), (2, 2), (a, a), (b, b)\}$ c. $\{(1, a), (2, a), (1, b), (2, b)\}$ d. $\{(1, 1), (a, a), (2, a), (1, b)\}$	III	CO3
3C-14	If $n(A) = 20$ and $n(B) = 30$ and $n(A \cup B) = 40$ then $n(A \cap B)$ 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) $(a \wedge b)'$ () c) $a * a = a$ d) Idempotent structure () d) Algebraic e) $S, *1, *2, \dots, *k >$ () e) a, vb'	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) $A * B = A * C \Rightarrow B = C$ 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) $a * 1 = a$ d) Complement law () D) $a * (b + c) = (a * b) + (a * c)$ e) Demorgan law () E) $a + b = b + a$	I	CO3

UNIT-III- ALGEBRAIC STRUCTURES: introduction, Algebraic 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 $B_1 = \{1,2\}$ and $B_2 = \{3,4,5\}$ of		CO3

	A as shown in the figure below.  (A, R) (a) Fig 1  B_1 (b) Fig 2  B_2 (c) Fig 3		
2	On the set $A=\{a,b,c,d\}$, a binary operation $*$ defined as described in the following table:  Is $*$ commutative? Associative?		CO3
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 $\langle A, * \rangle$ is a semigroup or a Monoid or neither. 1) $\begin{array}{c cc} * & a & b \\ \hline a & b & a \\ b & a & b \end{array}$ 2) $\begin{array}{c cc} * & a & b \\ \hline a & a & a \\ b & b & b \end{array}$ 3) $\begin{array}{c cc} * & a & b \\ \hline a & a & b \\ b & a & a \end{array}$		CO3
5.	If N denotes the set of all natural numbers, and $+$ and $\times$ are the usual addition and multiplication operations, show that $\langle N, +, \times \rangle$ 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 $\langle G, * \rangle$ is abelian group.		CO3
9.	Write the properties of Lattices and explain special types of Lattices with example.		CO3



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Prepared
onRev1:
2025

Sub.Code & Title

R22CSE2111 & DISCRETE MATHEMATICS

AcademicYear:2025-26

Year/Sem./Section

II-I

Faculty Name & Designation

Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor

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? a) $11P6$	III	CO4

	b) $11!$ c) $11! \times 11P_6$ d) $10! \times 11P_6$		
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) ${}^{15}C_6 \times {}^{15}C_9 + {}^{15}C_7 \times {}^{15}C_8 + {}^{15}C_8 \times {}^{15}C_7 + {}^{15}C_9 \times {}^{15}C_6$ b) ${}^{15}C_8 \times {}^{15}C_9 + {}^{15}C_7 \times {}^{15}C_8 + {}^{15}C_9 \times {}^{15}C_8$ c) ${}^{15}C_7 \times {}^{15}C_8 + {}^{15}C_8 \times {}^{15}C_7 + {}^{15}C_9 \times {}^{15}C_6$ d) ${}^{15}C_5 \times {}^{15}C_{10} + {}^{15}C_6 \times {}^{15}C_9 + {}^{15}C_7 \times {}^{15}C_8 + {}^{15}C_8 \times {}^{15}C_7 + {}^{15}C_9 \times {}^{15}C_6 + {}^{15}C_5 \times {}^{15}C_{10}$	II	CO 4
4C-8	What is the coefficient of the 5th term in the expression $(6x^{411} - x^{43})^5$? a) -720106920 b) -525106920 c) -72021384 d) -52521384	III	CO 4
4C-9	. Who invented the concept of inclusion-exclusion principle? a) Abraham de Moivre b) Daniel Silva c) J.J. Sylvester d) Sieve	III	CO 4
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	CO 4
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. a) 22 b) 25 c) 26 d) 33	II	CO 4
4C-12	. Determine the independent term of x^7 in the expansion of $(3x^2 + 4)^{12}$. a) 220×4^6 b) 230 c) $548 \times 3!$ d) $220 \times 3^6 \times 4^6$	I	CO 4

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	CO 4
4C-14	Calculate the value of ${}^8C_5$. a) 79 b) 43 c) 120 d) 56	I	CO 4
4C-15	Find the number of permutations of word DEPENDENT . a) 132400 b) 1512500 c) 1663200 d) 1723400	I	CO 4
	FILL IN THE BLANK QUESTIONS	BT Level	Cours e Outco me
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	${}^nP_r = {}^nC_r * \text{_____}$	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) $n=6$	II	CO4

	c) ${}^nP_r()$ c) $n!$ d) $6!$ () d) 1 e) ${}^nP_3 = 4 \cdot {}^nP_2$. () e) 720		
4M-2	a) Bayes theorem () a) $P(A B) = P(A \cap B) / P(B)$ b) Conditional probability () b) $P(A B) = [P(B A)P(A)] / P(B)$ c) $(x+y)^n()$ c) $nC_0 x^n y^0 + nC_1 x^{n-1} y^1 + \dots$ d) modular lattice. () d) $a^{b \vee (a^d)} = (a^b)(a^d)$	III	CO4
4M-3	a) distributive lattice () a) $n!$ b) $P(n, n-1)$ () b) $x \wedge (y \vee z) = (x \wedge y) \vee (x \wedge z)$ c) $2^5 \cdot 3^6 \cdot 5^2$ () 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 following words: (analyzing) (dsc-pno-369) i) DISCRETE MATHEMATICS 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 (applying) 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)		CO4

	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)		
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.	<i>A survey of 500 television viewers of a sports channel produced the 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?</i>		CO4
		2	CO3



SRI INDU COLLEGE OF ENGG & TECH
QUESTION BANK
 (Regulation :R22)
DEPARTMENT OF CSE (AIML)

Prepared
 onRev1:
 2025

Sub.Code & Title

R22CSE2111 & DISCRETE MATHEMATICS

AcademicYear:2025-26

Year/Sem./Section

II-I

Faculty Name & Designation

Ch. Praveen Reddy , M. Mayuri Reddy& Asst. Professor

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

**Objective
Questions**

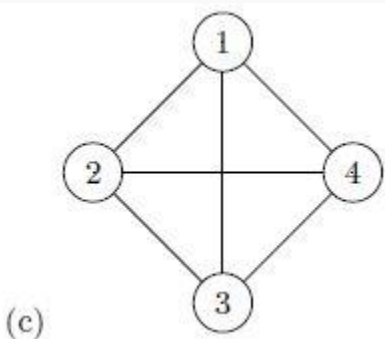
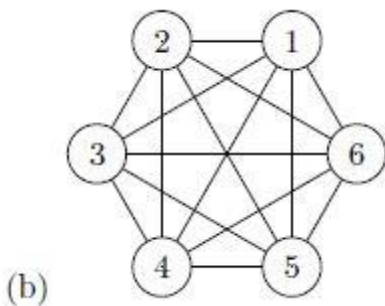
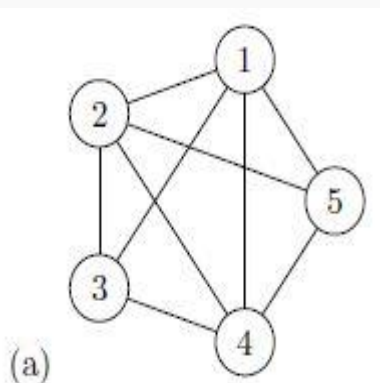
**BT
Level**

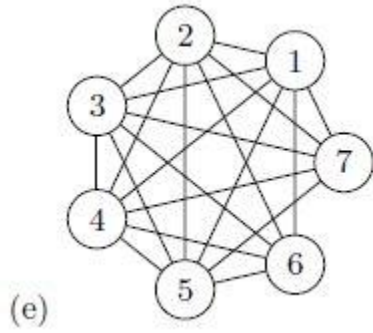
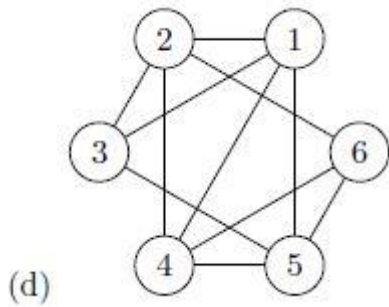
**Course
Outcome**

5C-1 Which of the following graphs are not complete graphs?

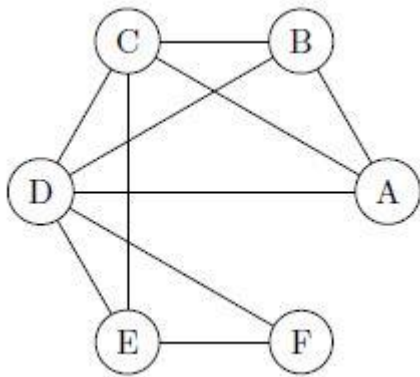
III

CO5





5C-2 What is the degree sequence of the given graph?



- a) $\langle 4,3,2,2,2,2 \rangle$
- b) $\langle 5,4,3,3,3,2 \rangle$
- c) $\langle 4,3,2,2,2,2 \rangle$
- d) $\langle 5,4,3,3,2,1 \rangle$

5C-3 Which of the following sequences is not a graphic sequence?

- a) $\langle 7,6,6,4,4,3,2,2 \rangle$
- b) $\langle 5,5,3,3,2,1,1 \rangle$
- c) $\langle 7,6,5,4,4,3,2,1 \rangle$
- d) $\langle 8,7,7,6,4,2,1,1 \rangle$

I

CO5

I

CO5

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?	I	CO5

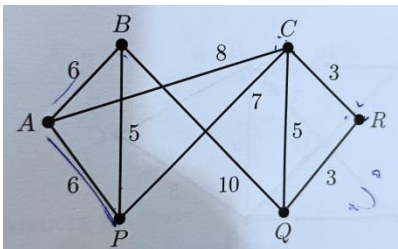
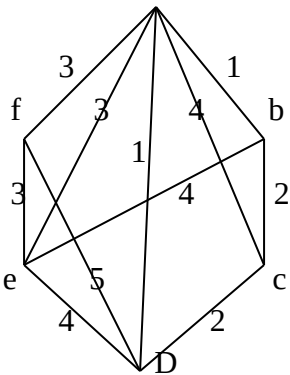
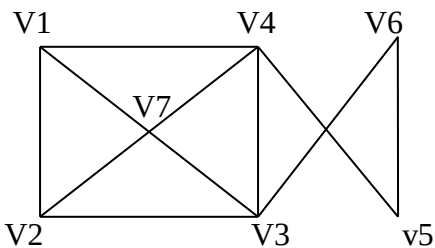
	a) 0 b) N c) 1 d) n-1		
5C-8	Which of the following statements is/are true? I If there is a walk from P to Q then, there must be a path from P to Q. II A graph can have an odd number of odd-degree vertices. III The number of edges in a tree is equal to one less than the number of vertices. a) Only I 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? a) C_n b) K_n c) Regular graph d) Tree	IV	CO5
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	II	CO5

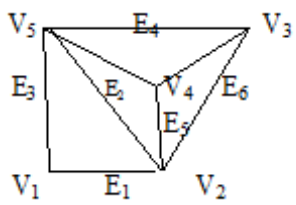
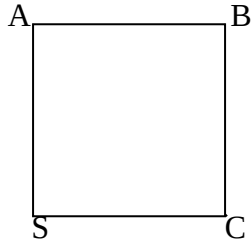
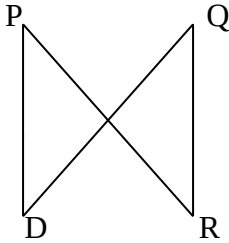
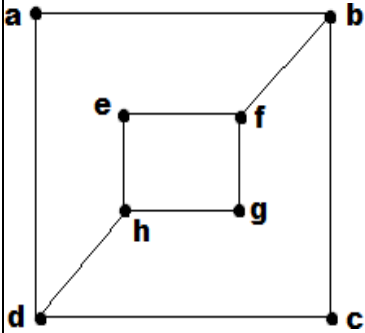
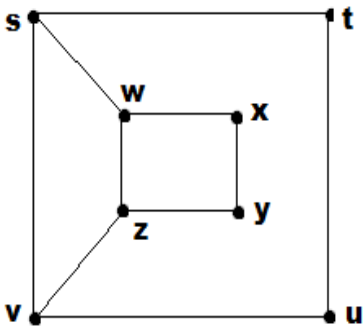
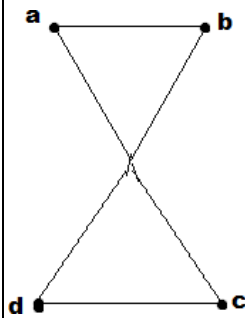
	c) tree d) forest		
5C-14	A linear graph consists of vertices arranged in a line. a) false b) true c) either true or false d) cannot determined	II	CO5
5C-15	What is a bipartite graph? a) a graph which contains only one cycle b) a graph which consists of more than 3 number of vertices c) a graph which 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	BT Level	Course 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	I	CO5

	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		
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) $\sum(\deg(v))=2\times E$ 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

UNIT-V: Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties,Spanning Trees, Binary Trees, Planar Graphs,Euler’sFormula,Multi-graphs and Euler Circuits,HamiltonianGraphs,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)	5	CO5

	b. Distinguish between Euler path and Euler circuit? (evaluating)		
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.	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 bipartite graph with 'n' vertices is $n^2/4$. (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

BR-22

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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)

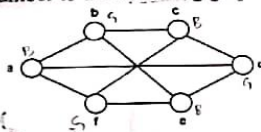
Course Outcomes: CO**PART – A**

(10Qx1M=10M)

Answer ALL the following questions.

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

I	CO1
I	CO1
IV	CO2
II	CO2
II	CO3
II	CO3
I	CO4
III	CO4
I	CO5
III	CO5

**PART – B**

(5Qx10M=50M)

Answer FIVE questions choosing at least one from each unit.**UNIT-I**

III CO1

- 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.

(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 $S = [\{2, 3, 5, 6, 8, 10, 12, 15, 24\}, \mid]$ 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)

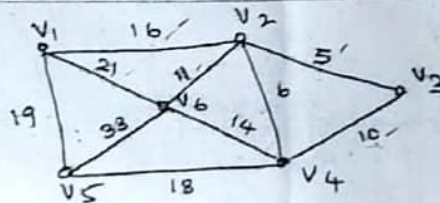
- 5b. Find the number of ways the letters $\{5a, 4b, 3c\}$ be arranged, so that all the letters of same type is not in same block.

II CO4

UNIT-V

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

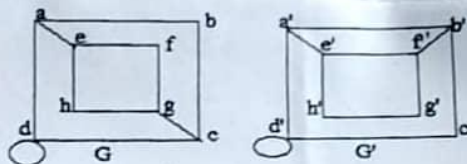
I CO5



(OR)

- 6b. (i) Show that there is no simple graph with degree sequence $(1, 1, 3, 3, 3, 4, 6, 7)$.
(ii) Verify the following two graphs are isomorphic or not.

VI CO5



BR-22

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY
II B.Tech - II Semester - I Mid Term Examination, April - 2024
(R22CSE2111) DISCRETE MATHEMATICS

D4

Duration: 2 Hrs

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

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.)

- | 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 $P \rightarrow q$ is logically equivalent to | A) $\neg p \vee \neg q$ | B) $p \vee \neg q$ | C) $\neg p \vee q$ | D) $\neg p \wedge q$ | [] | 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) $\forall x(F(x) \rightarrow P(x))$ | B) $\forall x(F(x) \wedge P(x))$ | C) $\exists x(F(x) \wedge P(x))$ | D) $\exists x(F(x) \rightarrow P(x))$ | [] | II | CO1 |
| 5. If $p \leftrightarrow q$ is logically equivalent to | A) $(p \rightarrow q) \rightarrow (q \rightarrow p)$ | B) $(p \rightarrow q) \vee (q \rightarrow p)$ | C) $(p \rightarrow q) \vee (q \rightarrow p)$ | D) $(p \wedge q) \rightarrow (q \wedge p)$ | [] | II | CO1 |
| 6. "The product of two negative real numbers is not negative." is given b | A) $\exists x \forall y((x < 0) \wedge (y < 0) \rightarrow (x y > 0))$ | B) $\exists x \exists y((x < 0) \wedge (y < 0) \wedge (x y > 0))$ | C) $\forall x \exists y((x < 0) \wedge (y < 0) \wedge (x y > 0))$ | D) $\forall x \forall y((x < 0) \wedge (y < 0) \rightarrow (x y > 0))$ | [] | 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 $a*(b*c) = (a*b)*c \forall a, b, c \in S$ 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 $q \rightarrow p$ is called _____ of $p \rightarrow q$ | II | CO1 |
| 13. $\{x: x \in \mathbb{N} \text{ and } x \text{ is prime}\}$ 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)	$P \wedge Q$		
	4. Contradiction	D)	$P \vee Q$		
	5. Contingency	E)	It is always true		

18.	1. Union	A)	$A - B$	I	CO2
	2. Intersection	B)	$A \cup B$		
	3. Disjoint	C)	$A \cap B$		
	4. Set difference	D)	$A \times B$		

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 $p \rightarrow \{(p \rightarrow q) \wedge \sim (\sim q \vee \sim p)\}$ VI CO1
 b) Find CNF of the following $[\sim(p \vee q) \leftrightarrow (p \wedge q)]$ II CO1
- 21 a) Prove the argument is valid $\forall x, [P(x) \rightarrow \{q(x) \wedge r(x)\}]$ V CO1
 $\forall x, [P(x) \wedge s(x)]$
 $\wedge \forall x, [r(x) \wedge s(x)]$
- b) Prove that $(P \rightarrow Q) \wedge (R \rightarrow Q) \Leftrightarrow (P \vee R) \rightarrow Q$ VI CO1
- 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 CO2
- i) Write down R as a set of ordered pairs.
- ii) Draw the diagram of R.
- iii) Determine in-degree and out-degrees of the each vertex.
- 23 Consider the following relations on the set $A = \{1, 2, 3\}$ I CO2
 $R_1 = \{(1, 1), (1, 2), (1, 3), (3, 3)\}$
 $R_2 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3)\}$ 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
