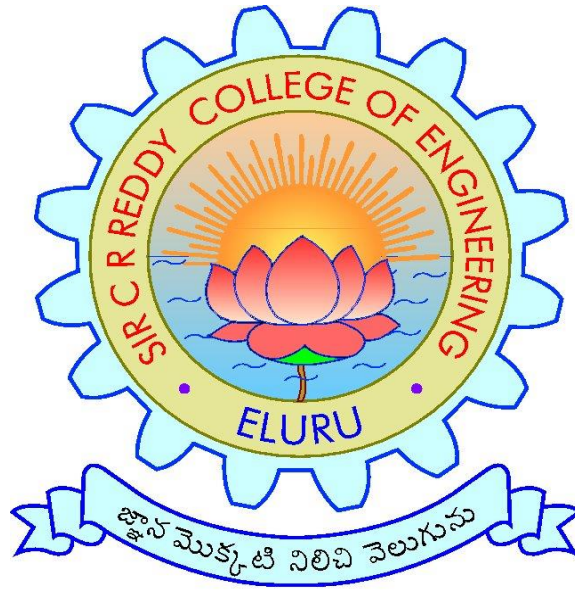**SIR C R REDDY COLLEGE OF ENGINEERING, ELURU**

DEPARTMENT OF INFORMATION TECHNOLOGY

DISCRETE MATHEMATICS AND GRAPH THEORY COURSE HANDOUT

SUBJECT: DISCRETE MATHEMATICS AND GRAPH THEORY

CLASS: II/IV B.Tech (A & B sections)Semester-I, A.Y.2023-24

INSTRUCTOR: Mr G Vihari

Course Handout Index

S. No	Description
1	College Vision & Mission
2	Department Vision & Mission
3	Program Educational Objectives (PEOs)
4	Program Outcomes (POs)
5	Program Specific Outcomes (PSOs)
6	JNTUK Academic Calendar
7	Department Academic Calendar
8	Course Description
9	Course Objectives
10	Course Outcomes
11	Syllabus
12	Lesson Plan
13	Evaluation Pattern
14	Timetable
15	Unit wise Questions and Programs

College Vision & Mission

Vision: To emerge as a premier institution in the field of technical education and research in the state and as a home for holistic development of the students and contribute to the advancement of society and the region.

Mission: To provide high quality technical education through a creative balance of academic and industry oriented learning; to create an inspiring environment of scholarship and research; to instill high levels of academic and professional discipline; and to establish standards that inculcate ethical and moral values that contribute to growth in career and development of society in general.

Department Vision & Mission

Vision: To be a premier department in the region in the field of Information Technology through academic excellence and research that enable graduates to meet the challenges of industry and society.

Mission: To Provide dynamic teaching-learning environment to make the students industry ready and advancement in career; to inculcate professional and leadership quality for better employability and entrepreneurship; to make high quality professional with moral and ethical values suitable for industry and society.

Program Educational Objectives (PEOs)

PEO1: Solve real world problems through effective professional skills in Information Technology industry and academic research.

PEO2: Analyze and develop applications in Information Technology domain and adapt to changing technology trends with continuous learning.

PEO3: Practice the profession in society with ethical and moral values.

Program Outcomes (POs)

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, society, and environmental considerations.

PO4: 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.

PO5: 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.

PO6: 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.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in society and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: 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.

PO11: 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 multi-disciplinary environments.

PO12: 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 (PSOs)

PSO1: Design Skill: Design and develop softwares in the area of relevance under realistic constraints.

PSO2: New Technology: Adapt new and fast emerging technologies in the field of Information Technology.

JNTUK Academic Calendar

Directorate of Academic Planning
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA-533003, Andhra Pradesh, INDIA
(Established by AP Government Act No. 30 of 2008)

Lr. No. DAP/AC/II Year /B. Tech/2023   Date 01.08.2023

Dr. KVSG Murali Krishna,
M.E, Ph.D.,
Director, Academics & Planning
JNTUK, Kakinada

To
All the Principals of Affiliated Colleges,
JNTUK, Kakinada.

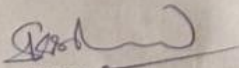### Academic Calendar for II Year - B. Tech for the AY 2023-24

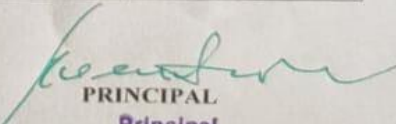| I SEMESTER			
Description	**From**	**To**	**Weeks**
Commencement of Class Work	**07.08.2023**		
I Unit of Instruction	07.08.2023	30.09.2023	8W
I Mid Examinations	25.09.2023	30.09.2023	
II Unit of Instructions	02.10.2023	25.11.2023	8W
II Mid Examinations	20.11.2023	25.11.2023	
Preparation & Practicals	27.11.2023	09.12.2023	2W
End Examinations	11.12.2023	23.12.2023	2W
Commencement of II Semester Class Work	**27.12.2023**		
II SEMESTER			
I Unit of Instructions	**27.12.2023**	17.02.2024	8W
I Mid Examinations	12.02.2024	17.02.2024	
II Unit of Instructions	19.02.2024	13.04.2024	8W
II Mid Examinations	08.04.2024	13.04.2024	
Preparation & Practicals	15.04.2024	27.04.2024	2W
End Examinations	29.04.2024	11.05.2024	2W
Summer Internship	13.05.2024	06.07.2024	8W
Commencement of III- I Class Work	08.07.2024		

Director
Academic Planning
JNTUK Kakinada

Director,
Academics & Planning,
JNTUK

Copy to the Secretary to the Hon'ble Vice Chancellor, JNTUK
Copy to Rector, JNTUK
Copy to Registrar, JNTUK
Copy to Director Academic Audit, JNTUK
Copy to Director of Evaluation, JNTUK

Department Academic Calendar

SIR C R REDDY COLLEGE OF ENGINEERING

ELURU-534007, WEST GODAVARI DIST, ANDHRA PRADESH, INDIA
(Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada)
Telephone No: 08812-230840, 230565, Fax: 08812-224193
Website: www.sircrrengg.ac.in

IQAC

DEPARTMENT OF INFORMATION TECHNOLOGY
II/IV ACADEMIC CALENDAR 2023 – 2024

EVENTS / ACTIVITIES	I- SEMESTER	II- SEMESTER
Registration of Credits/Electives	15-07-2023 to 5-07-2023	10-12-2023 To 24-12-2023
Commencement of classes	7-08-2023	27-12-2023
Class work – 1st Phase of Instruction (From… To…)	07-08-2023 To 30-09-2023	27-12-2023 To 17-02-2024
Class Review Committee Meeting-I/Parent-Teachers Meet	September 2023	February 2024
Guest Lecture/Seminar/Workshop	September 2023	February 2024
Assignment - I	10-09-2023	01-01-2023
MID Examination – I & Quiz - I	25-09-2023 To 30-09-2023	12-02-2024 To 17-02-2024
Mid-Semester Feedback	1-10-2023	18-02-2024
Last date for display of Marks/Answer Scripts	8-10-2023	25-02-2024
Class work – 2nd Phase of Instruction (From… To…)	02-10-2023 To 25-11-2023	19-02-2024 To 13-04-2024
Remedial classes	After 1st MID	After 1st MID
Class Review Committee Meeting-II	November 2023	April 2024
Guest Lecture/Seminar/Workshop	November 2023	March 2024
Assignment - II	01-11-2023	22-03-2024
MID Examination – II & Quiz - II	20-11-2023 To 25-11-2023	08-04-2024 To 13-04-2024
Class work last working day	18-11-2023	05-04-2024
End-Semester Feedback & Course End Survey	26-11-2023	14-04-2024
Last date for display of Marks/Answer Scripts	30-11-2023	21-04-2024
Preparation holidays and Semester End Practical Examinations	27-11-2023 To 09-12-2023	15-04-2024 To 27-04-2024
Semester End Theory Examinations	11-12-2023 To 23-12-2023	29-04-2024 To 11-05-2024
Summer Internship	--	13-05-2024 To 06-07-2024

HOD

HEAD OF THE DEPARTMENT
Information Technology
Sir C.R.R. College of Engg.
ELURU-534 007

PRINCIPAL

Principal
Sir C.R.R.College of Engineering
ELURU - 534 007

Course Objectives

The learning objectives of this course are:

• To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning

• To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science

Course Outcomes

After the completion of the course, student will be able to

CO	CO Description	Level
CO1	Students are able to **Apply** the Propositional Calculus and Predicate	L3
CO2	Students will able to **Employ** Set Theory and Group Theory concepts.	L3
CO3	Students will able to **Apply** Combinatorics and Number Theory.	L3
CO4	Students will able to **Solve** different Recurrence Relations.	L3
CO5	Students will able to **Construct** Graphs using Graph Theory.	L3

Syllabus

UNIT I

Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT II

Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive

Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.

UNIT III

Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems

UNIT IV

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations

UNIT V

Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees

Text Books:

1) Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2) Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3) Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

References Books:

1) Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2) Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.

3) Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.

4) Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill

Lesson Plan

Unit	Topics	Teaching Aids	CO
I	**Introduction**- Discrete Mathematics And Graph Theory	BB/PPT	1
	Course Outcomes	BB/PPT	1
	Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives	BB/PPT	1
	Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law	BB/PPT	1
	Tautological Implications, Normal Forms,	BB/PPT	1
	Theory of Inference for Statement Calculus,	BB/PPT	1
	Consistency of Premises, Indirect Method of Proof,	BB/PPT	1
	Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers,	BB/PPT	1
	Free and Bound Variables, Inference Theory for Predicate Calculus.	BB/PPT	1
II	Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion .	BB/PPT	2
	Relations: Properties, Operations, Partition and Covering .	BB/PPT	2
	Transitive Closure, Equivalence.	BB/PPT	2
	Compatibility and Partial Ordering, Hasse Diagrams,	BB/PPT	2
	Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions.	BB/PPT	2
	Lattice and its Properties.	BB/PPT	2
	Algebraic Structures: Algebraic Systems, Properties.	BB/PPT	2

	Semi Groups and Monoids, Group	BB/PPT	2	
	Subgroup and Abelian Group, Homomorphism, Isomorphism.	BB/PPT	2	
III	Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions.	BB/PPT	3	
	Circular and Restricted Permutations.	BB/PPT	3	
	Combinations, Restricted Combinations.	BB/PPT	3	
	Binomial and Multinomial Coefficients and Theorems.	BB/PPT	3	
	Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor.	BB/PPT	3	
	Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers,	BB/PPT	3	
	The Fundamental Theorem of Arithmetic, Modular Arithmetic.	BB/PPT	3	
	Fermat's Theorems.	BB/PPT	3	
	Euler's Theorems.	BB/PPT	3	
IV	Recurrence Relations: Generating Functions, Function of Sequences.	BB/PPT	4	
	Partial Fractions, Calculating Coefficient of Generating Functions.	BB/PPT	4	
	Recurrence Relations, Formulation as Recurrence Relations.	BB/PPT	4	
	Solving Recurrence Relations by Substitution.	BB/PPT	4	
	Solving Recurrence Relations by Generating Functions.	BB/PPT	4	
	Method of Characteristic Roots.	BB/PPT	4	
	Solving Inhomogeneous Recurrence Relations	BB/PPT	4	
V	Graph Theory: Basic Concepts, Graph Theory and its Applications.	BB/PPT	5	
	Sub graphs, Graph Representations: Adjacency and Incidence Matrices.	BB/PPT	5	
	Isomorphic Graphs, Paths and Circuits.	BB/PPT	5	

	Eulerian and Hamiltonian Graphs.	BB/PPT	5
	Multigraphs, Bipartite and Planar Graphs.	BB/PPT	5
	Euler's Theorem, Graph Colouring and Covering, Chromatic Number.	BB/PPT	5
	Spanning Trees, Prim's and Kruskal's Algorithms.	BB/PPT	5
	BFS and DFS Spanning Trees	BB/PPT	5

Evaluation Pattern

S. No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project	-	50	50
5	Project Work	60	140	200

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥ 90	≥ 45	Outstanding	A+	10
≥ 80 to <89	≥ 40 to <44	Excellent	A	9
≥ 70 to <79	≥ 35 to <39	Very Good	B	8
≥ 60 to <69	≥ 30 to <34	Good	C	7
≥ 50 to <59	≥ 25 to <29	Fair	D	6
≥ 40 to <49	≥ 20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

Timetable

Day/Time	09.00-09.50	09.50-10.40	11.00-11.50	11.50-12.40	01.40-02.30	02.30-03.20	03.20-04.10	04.10-05.00
Mon	B		A					
Tue	A					B		
Wed		A						
Thu	B			A(T)				
Fri				B		B(T)		A&B(M)
Sat		A				A&B(R)		