RAGHU ENGINEERING COLLEGE

AUTONOMOUS

(Approved by AICTE, New Delhi, Accredited by NBA (CIV,ECE,MECH,CSE), NAAC with 'A+' grade & Permanently Affiliated to JNTU-GV, Vizianagaram)

Dakamarri, Bheemunipatnam Mandal, Visakhapatnam Dist. – 531 162 (A.P.)

Ph: +91-8922-248001, 248002 Fax: + 91-8922-248011

E-mail: principal@raghuenggcollege.com website: www.raghuenggcollege.com

RAGHU ENGINEERING COLLEGE (AUTONOMOUS)

VISAKHAPATNAM

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INSTITUTE VISION

Envisioning to be a world class technical institution by synergizing quality education with ethical values.

INSTITUTE MISSION

- To encourage training and research in cutting-edge technologies.
- To develop and strengthen strategic links with the industry.
- To kindle the zeal among the students and promote their quest for academic excellence.
- To encourage extra-curricular activities along with good communication skills.

QUALITY POLICY

RAGHU Engineering College underscores ethical values along with innovative teaching through an interactive, activity-based pedagogy; establishes the best of infrastructural facilities, inculcates engineering temper among the students through the use of the latest Information and Communication Technologies, and strives for an efficient, responsive and transparent administration in all areas.

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Department of Computer Science and Engineering

VISION

To generate competent professionals to become part of the industry and research organizations at the national and international levels.

MISSION

To impart high quality professional training in undergraduate level with emphasis on basic principles of computer science and Engineering and to foster leading edge research in the fast-changing field.

To inculcate professional behavior, strong ethical values, innovative research capabilities and leadership abilities in the young minds so as to work with a commitment.

- M1:To impart high quality professional training at undergraduate level with emphasis on basic principles of computer science and Engineering and to foster leading edge research in the fast-changing field.
- M2:To inculcate innovative research capabilities and leadership abilities in the young minds so as to work with a commitment.
- M3:To inculcate professional behavior, strong ethical values in the young minds so as to work with a commitment.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

PEO 1: To produce graduates with a strong foundation in mathematics, science, engineering fundamentals, laboratory and work-based experiences to formulate and solve engineering problems in computer science engineering domains and shall have proficiency in implementation software tools and languages.

PEO 2: To progressively impart training to the students for success in various engineering positions within the core areas in computer science engineering, computational or adapting to the latest trends by learning themselves.

PEO 3: To produce graduates having the ability to pursue advanced higher studies and research. To have professional and communication skills to function as leaders and members of multidisciplinary teams in engineering and other industries with strong work ethics, organizational skills, teamwork, and understanding of the importance of being a thorough professional.

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MAPPING OF MISSION STATEMENTS WITH PEOs

MS/PEO	PEO 1	PEO 2	PEO 3
MS 1	3	2	2
MS 2	2	3	2
MS 3	2	2	3

1-Slight , **2**- Moderate, **3**- Substatial

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PROGRAM OUTCOMES	
Graduates of Computer Science and Engineering Will:	
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to solve complex engineering problems.
PO 2	**Problem analysis:** Identity, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and the cultural, societal, and environmental concerns.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods, including design of experiments, analysis, interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to

	engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Apply the concepts and techniques of the Computer Science & Engineering branch and the Mathematical foundations in the significant domains to address the complex engineering problems.

PSO 2: Employ emerging computer languages, computer networks, database management systems and platforms in developing innovative career prospects as an entrepreneur.

PS0 3: Apply the knowledge of interdisciplinary skills, and domain-specific tools in working system processes to implement and deploy a quality-based software product to meet evolving needs.

Mapping of PEOs with POs and PSOs

PEO/PO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
PEO 1	3	3	3	3	2	2	2	2		2		3	3	2	2
PEO 2	2	3	3	3	2	2	2	2	3	2	3	3	3	3	3
PEO 3	3	2	2	3	2	2	2	3	3	3	3	3	3	3	3

1-Slight , **2**- Moderate, **3**- Substatial

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23BS110 – DISCRETE MATHEMATICS AND GRAPH THEORY							
(Common to CSE , CSM, CSD , CSC , CSO)							
Programme &Branch	**B.Tech. & CSE , CSM, CSD , CSC , CSO**		**Category**				**Credit**
Prerequisites	**23BS101 - LA & C** **23BS102 - DE & VC**		**HSS**				**3**

Course Objectives :

- To familiarize students with the concepts and procedures of combinatorial thinking and discrete methods.
- To present a wide variety of applications. Discrete mathematics relies heavily on the algorithmic method to problem solving, which strengthens the connections between the field and computer science.
- To apply fundamental counting methods to solve combinatorial problems
- To investigate significant graphs and properties, including planarity, Eulerian and Hamiltonian routes, and to use these ideas to address theoretical and practical issues.

Preamble :	Discrete Mathematics and Graph Theory are fundamental essential components of modern mathematics and computer science, supporting numerous areas of theoretical and applied research. This course introduces students to the ideas and methodology of discrete structures and graph theory, which are critical for understanding complex system behavior and solving a wide range of practical issues.

Course Contents:

Unit-1	Title : **Mathematical Logic**	Contact Hours: 9

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

Unit-2	Title : **Relations & Algebraic Structures**	Contact Hours: 9

Relations ,Properties of binary relations in a set, Relation Matrix and Graph of a Relation ,Partition and covering of a set, equivalence relations, compatibility relations, composition of binary relations, Partial order relation, partially ordered set, Hasse diagram.

Algebraic structure, group, Abelian group, subgroup definitions and examples

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Unit-3	Title : **Elementary Combinatorics**	Contact Hours: 9
Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems. The Principle of Inclusion-Exclusion, Pigeon hole principle.		
Unit-4	Title : **Recurrence Relations**	Contact Hours: 9
Recurrence Relations: Formulation as Recurrence Relations, Solving Recurrence Relations - Substitution and Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations; Generating Functions: Generating Functions of Sequences, Calculating Coefficient of expansions.		
Unit-5	Title : **Graph Theory**	Contact Hours: 9
Basic Concepts of Graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices,Sub graphs Paths and Circuits, Isomorphic Graphs, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Kruskal's and Prim's Algorithm for finding minimal spanning trees. (Problems Only and Theorems without Proofs)		
Total Hours: 45		
Text Books:		
J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.		
Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.		
Reference Books:		
Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.		
Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.		
Web References :		
https://www.youtube.com/watch		
http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf		

COURSE OUTCOMES: Upon completion of the course, students shall have ability to		**BT Mapped** (Highest Level)
CO 1	Apply mathematical logic to solve problems.	L2, L3
CO 2	Understand the concepts and perform the operations related to sets, relations and functions. Gain the	L3, L5

	conceptual background needed and identify structures of algebraic nature.	
CO 3	Apply basic counting techniques to solve combinatorial problems.	L3
CO 4	Formulate problems and solve recurrence relations.	L2, L3
CO 5	Apply Graph Theory in solving computer science problems	L3, L5

Mapping of Cos with POs and PSOs

COs/POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO 1	2	1	1	1											1
CO 2	2	2	1	1											1
CO 3	3	2	1	1											1
CO 4	2	1	1	1											1
CO 5	2	1	1	1											1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATERN – THEORY							
TEST	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
MID-1	**6**	**9**	**85**				**100**
MID-2	**6**	**9**	**85**				**100**
SEE	**10**	**10**	**80**				**100**
***± 3% may be varied**							

(Signature)
Head of the Department
(Seal/Stamp)

(Signature)
Principal
(Seal/Stamp)