CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF SCIENCES
MATHEMATICAL SCIENCES
MA253: DISCRETE MATHEMATICS AND ALGEBRA
B. TECH. 3rd SEMESTER (CE/IT/CSE)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	-	4	4
Marks	100	-	100	

A. Objective of the Course:

Discrete Mathematics and Algebra have many applications in Computers Engineering and Information Technology. This course contains many concepts which are applicable to subjects like Theory of Computation, Artificial Intelligence, Data Structure and Algorithms, Compiler Constructions, Algorithm Analysis and Design, Digital Electronics etc.

B. Outline of the course:

Sr No.	Title of the unit	Minimum number of hours
1.	Predicate Calculus	08
2.	Relations and Lattice	10
3.	Graph Theory	12
4.	Recurrence Relations	05
5.	Abstract Algebra	09
6.	Linear Algebra	16
	Total Hours	60

C. Detailed Syllabus:

1.	**Predicate Calculus:**		08 Hours 13 %
	1.1	Revision: Propositions, connectives, converse, inverse, contrapositive, tautology, contradiction.	
	1.2	Logical equivalence.	
	1.3	Minimal functionally complete set of connectives.	
	1.4	Principle conjunctive normal forms and Principle disjunctive normal forms.	
	1.5	Predicate calculus using rules of inferences.	
2.	**Relations and Lattice:**		10 Hours 17%
	2.1	Revision of properties of relations on sets.	
	2.3	Representations of relations: graphical and matrix representation.	
	2.4	Equivalence relation, covering of a set, partition of a set.	
	2.5	Partially ordered sets, totally ordered sets, Hasse diagram.	
	2.6	Lattices, sub lattices.	
	2.7	Properties of lattices (without proof).	
	2.8	Complete lattices, bounded lattices, distributive lattices, complemented lattices and complemented distributive lattices.	
3.	**Graph Theory:**		12 Hours 20%
	3.1	Basic terminologies, Simple graph, Types of graphs.	
	3.2	Degree of a vertex, matrix representations of graph.	
	3.3	Path and connectivity.	
	3.4	Eulerian and Hamiltonian graph.	
	3.5	Subgraphs, spanning subgraphs, isomorphic graphs.	
	3.6	Planar graphs.	
	3.7	Matching in graphs.	
	3.8	Graph coloring.	
4.	**Recurrence Relations:**		05 Hours 08%
	4.1	Solutions of recurrence relation by direct methods.	
	4.2	Generating functions and solutions of recurrence relation.	
5.	**Abstract Algebra:**		09 Hours 15%
	5.1	Groupoid, semi group, monoid, group.	
	5.2	Order of group, order of an element, Lagrange's theorem.	
	5.3	Subgroup, cyclic subgroup, permutation group.	
6.	**Linear Algebra:**		16 Hours 27%
	6.1	Vector space: definition and examples. Subspaces.	
	6.2	Linear combinations, linearly dependence and linearly independence.	
	6.3	Basis and dimension of a vector space.	
	6.4	Linear transformations. Null space and range of a linear transformation. Rank - nullity theorem. Isomorphisms.	

D. Instructional Method and Pedagogy:

- At the starting of the course, the course delivery pattern, prerequisite of the subject must be discussed.
- Lectures may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures/laboratory which carries a 5% component of the overall evaluation.
- Minimum two internal tests/ unit tests must be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.
- Two Quizzes (surprise tests)/ oral test / viva will be conducted which carries 5% component of the overall evaluation.

E. Student Learning Outcomes:

- At the end of the course the students would be able to frame the fundamental algorithms of Discrete Mathematics/Graph theory and their applications in Computer Engineering and Information Technology.

F. Recommended Study Material:

❖ **Text Books:**

1. Rosen, Kenneth H., and Kamala Krithivasan. Discrete mathematics and its applications. Vol. 6. New York: McGraw-Hill, 1995.
2. Swapan Kumar Sarkar, A Text Book of Discrete Mathematics, S. Chand and Co. New Delhi 2008.
3. H. Anton and C. Rorres; Elementary Linear Algebra, Application version, Wiley Edition 2010.

❖ **Reference Books:**

1. Tremblay, Jean-Paul, and Rampurkar Manohar. Discrete mathematical structures with applications to computer science. New York: McGraw-Hill, 1975.
2. McAllister, D. F., and D. F. Stanat. Discrete Mathematics in Computer Science. Prentice-Hall, Inc. 1977.
3. Deo, Narsingh, Graph theory with applications to engineering and computer science. Courier Dover Publications, 2016.
4. B. Kolman and R. C. Busby, Discrete Mathematical Structures for Computer Science, 2nd edition, Prentice-Hall, Englewood Cliffs, New Jersey 1987.
5. Malik, D. S., and Mridul K. Sen. Discrete mathematical structures: theory and applications. Course Technology, 2004.
6. Thomas H. Cormen, Leiserson, C. E., Rivest, R. L., & Stein, C. Introduction to algorithms (Vol. 6). Cambridge: MIT press,2001.

❖ **URL Links:**

Lecture Notes:

1. http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf
2. http://home.iitk.ac.in/~arlal/book/mth202.pdf
3. https://web.stanford.edu/class/cs103x/cs103x-notes.pdf
4. https://www.cs.cornell.edu/~rafael/discmath.pdf
5. http://www-sop.inria.fr/members/Frederic.Havet/Cours/matching.pdf
6. http://www-sop.inria.fr/members/Frederic.Havet/Cours/coloration.pdf

Video Lectures:

7. http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html
8. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/video-lectures/