DEPARTMENT OF MATHEMATICS

Semester : IV **Integrated M.Sc. Mathematics** **Academic Year : 2016-17**

Subject : 060090407 GE4 Application of Algebra

Teaching Schedule

Course Objectives: To apply concepts of Algebra for solving real world problems and to conclude value of different areas of science.

Unit	Sub Unit	No. of Lect.(s)	Topics	Reference Chapter/ Additional Reading	Teaching Methodology to be used
Unit 1: Balanced Incomplete Block Designs (BIBD)					**[17]**
1	1.1	2	Definitions and results	Ch#2 Topics in Applied Abstract Algebra S. R. Nagpaul & S. K. Jain	Chalk & Talk
	1.2	3	Incidence matrix of a BIBD		
	1.3	3	Construction of BIBD from difference sets		
	1.4	3	Construction of BIBD using quadratic residues		
	1.5	3	Difference set families		
	1.6	3	Construction of BIBD from finite fields.		
Unit 2: Coding Theory					**[15]**
2	2.1	1	Introduction to error correcting codes	Ch#3 Topics in Applied Abstract Algebra S. R. Nagpaul & S. K. Jain	Chalk & Talk
	2.2	2	Linear codes		
	2.3	3	Generator and parity check matrices		
	2.4	3	Minimum distance		
	2.5	3	Hamming Codes		
	2.6	3	Decoding and cyclic codes		
Unit 3: Symmetry Groups and Colour Patterns					**[13]**
3	3.1	2	Review of permutation groups	Ch#5 Topics in Applied Abstract Algebra S. R. Nagpaul & S. K. Jain	Chalk & Talk
	3.2	2	Groups of symmetry and action of a group on a set		
	3.3	3	Colouring and colouring patterns		
	3.4	3	Polya theorem and pattern inventory		
	3.5	3	Generating functions for non-isomorphic graphs.		
Unit 4: Special Types of Matrices					**[20]**
4	4.1	2	Idempotent, Nilpotent, Involution, and Projection tri diagonal matrices	Ch#4 Matrix theory Fuzhen Zhang	Chalk & Talk
	4.2	2	Circulant matrices, Vandermonde matrices, Hadamard matrices		
	4.3	3	Permutation and doubly stochastic matrices		
	4.4	3	Frobenius- König theorem, Birkhoff theorem		
	4.5	4	Positive Semi-definite matrices: positive semi-definite matrices, square root of apositive semi-definite matrix, a pair of positive semi-definite matrices, and their simultaneous diagonalization		
	4.6	6	Symmetric matrices and quadratic		

			forms: diagonalization of symmetric matrices, quadratic forms, constrained optimization, singular value decomposition, and applications to image processing and statistics		

Text books:

1. S. R. Nagpaul and S. K. Jain, Topics in Applied Abstract Algebra, Thomson Brooks and Cole, Belmont, 2005.
2. I. N. Herstein and D. J. Winter, Primer on Linear Algebra, Macmillan Publishing Company, New York, 1990.

Reference books:

1. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press LLC, Boca Raton, 2000.
2. David C. Lay, Linear Algebra and its Applications. 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. Fuzhen Zhang, Matrix theory, Springer-Verlag New York, Inc., New York, 1999