SRI GURU TEGH BAHADUR KHALSA COLLEGE

University of Delhi-110007

Teacher's Name: Dr. RUCHI ARORA
Department: Mathematics
Course: B.Sc. (H) Mathematics
Semester: V
Paper: MA-5.3, Algebra-IV

Books Recommended:

1. Contemporary Abstract Algebra by Joseph A. Gallian, Fourth Edition, Narosa Publishing House.
2. Linear Algebra by Friedberg, Insel and Spence, Fourth Edition, PHI Learning Private Limited.

NOTE: Students are welcome for Interactions to clear doubts & queries and for Discussions of Innovative Project Works in the following time slots available besides regular lectures and tutes:

Day	Time Slot
Tuesday	10:30 a.m.-11:30 a.m.
Wednesday	12:45 p.m.-1:45 p.m.
Thursday	10:30 a.m.- 12:30 p.m.

Academic Calendar July-Dec 2016

Teaching Plan

Week	Topic	Specific Topics for Lecture	Hours	Task for Tutorials	Test/Prsn
1st &2nd	Basic understanding of diagonalizable linear operator	➢ Introduction to diagonalizibility of a linear operator ➢ Definitions: Eigen values, Eigen vectors & characterstic polynomials of a L.O and of a matrix. ➢ Common examples illustrating the concepts introduced. ➢ Establishing the result relating diagonalizibility of an operator to its eigen vectors.	07	Doubts about the new topics introduced	
3rd	Eigen values and Eigen vectors of a linear operator	➢ To relate eigen vectors of a L.O to null space of a related L.O. ➢ To relate eigen vector of a linear operator to its matrix representation. ➢ Examples illustrating the results established.	05	Exercises of section 5.1[2]	Prsn : Diagonalization-I
4th	Diagonalizibility in terms of multiplicity of eigen values	➢ Definitions: Splitting polynomial over a field, Eigen space of a linear operator, Algebraic multiplicity and geometric multiplicity of a L.O. ➢ Relation between algebraic and geometric multiplicity. ➢ Relation between algebraic multiplicity and diagonalizibility	05	Exercises of section 5.1…(ctd) [2]	Test 1
5th	Test for diagonalizibility	➢ General steps to be followed for testing diagonalizibility of a L.O. ➢ Examples to demonstrate the use of the test stated.	03	Exercises of section 5.2[2]	Prsn: Diagonalization-II

6th	Invariant subspaces	➢ Definitions: T- invariant subspaces, T-cyclic subspace generated by non zero vector. ➢ Examples illustrating the above concepts. ➢ Divisibility of characterstic polynomial of a L.O and its T-invariant subspace.	04	Exercises of section 5.2…(ctd) [2]	Prsn: Diagonalization-III
7th	Cayley Hamilton theorem	➢ To construct the characterstic polynomial and basis for a T-inavriant subspace. ➢ Cayley Hamilton theorem for L.O ➢ Cayley Hamilton theorem for matrices ➢ Verification of Cayley Hamilton Theorem for operators and matrices.	05	Exercises of section 5.4[2]	Test 2

Week	**Topic**	**Specific Topics for Lecture**	**Teaching hours**	**Task for Tutorials**	**Test/ Prestn**
7th	Minimal polynomial of a linear operator	➢ Definition of minimal polynomial of a linear operator and a matrix. ➢ Minimal polynomial is unique and divides the characterstic polynomial of linear operator T ➢ Relation between Characterstic polynomial and minimal polynomial: they have same zeros and same degree ➢ Diagonalizibility in terms of minimal polynomial. ➢ Examples illustrating the above results.	05	Exercises of section 5.4….(ctd) [2]	Prsn: Invariant Subspaces-I
8th	Inner Product spaces	➢ Definition of Inner product and Inner product space. ➢ Examples of Inner product spaces. ➢ Properties of Inner product In an IPS ➢ Definition of norm of a vector in terms of inner product and its properties. ➢ Definition of orthogonal and	05	Exercises of section 7.3[2]	Test 3

		orthonormal vectors and examples.			
9th	Gram-Schmidt orthogonalization process	➢ To write a vector as a linear combination of orthogonal vectors. ➢ To construct an orthogonal set of vectors from a linearly independent set by Gram Schmidt process. ➢ Examples illustrating Gram Schmidt process.	04	Exercises of section 6.1[2]	Prsn: Invariant Subspaces-II
10th	Gram-Schmidt orthogonalization process…(ctd)	➢ To write a vector as a linear combination of vectors of orthonormal basis for the vector space. ➢ Orthogonal complement of a subset of an IPS. ➢ Unique expression of a vector as a sum of elements of its subspace and its orthogonal complement. ➢ Extension of an orthonormal set to form an orthonormal basis for the IPS. ➢ Examples illustrating the above results.	05	Exercises of section 6.1 [2] (ctd)	Prsn: Inner Product spaces-I
11th	Adjoint of a linear operator	➢ Definition and existence of adjoint of a linear operator. ➢ Relation between matrix representations of the linear operator and its adjoint. ➢ Properties of adjoints of operators. ➢ Examples illustrating the above results. ➢ Method of least square approximations.	05	Exercises of section 6.2[2]	Prsn: Inner Product Sapces-II
12th& 13th	Dual Spaces	➢ Definition of Dual Space of a vector space. ➢ Expression of linear functional of a vector space in terms of linear functionals of dual space ➢ Definition of Dual basis and double dual. ➢ Isomorphism between a FDVS V and its double dual.	07	Exercises of section 6.3[2]	Prsn: Dual spaces

Week	Topic	Specific Topics for Lecture	Teaching hours	Task for Tutorials	Test/ Prestn
14th	Extension Fields	➢ Fundamental theorem of field theory ➢ Splitting fields : Definition, existence & uniqueness ➢ Zeros of an irreducible polynomial ➢ Perfect field ➢ Examples illustrating the above concepts and results.	05	Exercises of section 2.6[2]	Prsn: Applications of fields-I
15th	Algebraic extensions	➢ Types of extensions ➢ Characterizations of extensions ➢ Degree of extension ➢ Finite extension implies algebraic extension ➢ Primitive element theorem ➢ Properties of algebraic extension.	05	Exercises of Ch-20 [1]	Applications of Fields-II
16th	Finite fields and Geometric constructions	➢ Structure of finite fields ➢ Subfields of a finite field ➢ Examples illustrating the above concepts ➢ Constructible numbers	05	Exercises of Ch-21 [1]	Test(optional)
17th	Revision	➢ Linear Algebra[2] ➢ Fields[1]	05	Exercises of Ch-22, 23 [1]	