NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI

DEPARTMENT OF MATHEMATICS

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Sc., Mathematics/ 1st Year**		
Course Title	**Linear Algebra**		
Course Code	**MA703**	**No. of Credits**	**03**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**July 2022**	**Section (if, applicable)**	**-**
Name of Faculty	**Dr. I. Jeyaraman**	**Department**	**Mathematics**
Official Email	**jeyaraman@nitt.edu**	**Telephone No.**	**9884164316**
Name of Course Coordinator(s) (if, applicable)	**-**		
Official E-mail	**-**	**Telephone No.**	**-**
Course Type	**√ Core course**	**☐ Elective course**	

Syllabus (approved in BoS)

Review of basic concepts: Vector spaces, Bases, Dimension, Linear Transformations – The matrix representation – Change of basis – Rank and Nullity – System of linear equations.

Characteristic values and characteristic vectors – Eigenspaces – Algebraic and Geometric Multiplicities – Diagonalization - Minimal polynomial – Cayley-Hamilton Theorem.

Invariant subspaces – Direct-sum Decompositions – Invariant Direct sums – The Primary Decomposition Theorem – The Jordan Canonical form.

Basic review of Inner Product Spaces – Adjoint operators – Normal operators – Unitary Operators – Orthogonal projections – The spectral Theorem.

Bilinear forms – Matrix representation – Quadratic forms – Positive definite forms - Sylvester's law of inertia.

ESSENTIAL READINGS : (Textbooks, reference books etc.)

1) Kenneth Hoffman and Ray Kunze, "*Linear Algebra*", PHI, 2010.

2) Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, "*Linear Algebra*", PHI, 2013.

3) Sheldon Axler, "*Linear Algebra Done Right",* Springer, 1997.

4) Steven Roman, "A*dvanced Linear Algebra",* Springer, 2008.

COURSE OBJECTIVES

1. To discuss various decompositions of vector spaces and linear transformations on vector spaces.
2. To study diagonalizable operator on a vector space and characterizations of it using the minimal and characteristic polynomials.
3. To introduce different classes of linear operators on inner product spaces and to study their structures.
4. To learn the concepts of bilinear and quadratic forms on vector spaces.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

Course Outcomes (CO)	Programme Outcomes (PO)
On completion of this course, students will be able to 1. find characteristic values, characteristic vectors and the minimal polynomial of a linear transformation and to determine a linear transformation is diagonalizable. 2. decompose a vector space into a sum of invariant subspaces and a linear transformation into a direct sum of induced operators. 3. Construct the Jordan form of linear transformations and matrices. 4. determine a linear operator is normal, unitary and orthogonal projection and to construct the spectral decomposition of normal and self-adjoint operators. 5. construct the matrix of a bilinear form and to find index, rank and signature of a bilinear form.	(i) progress the critical analysis and problem solving skills required for research and development organization and industry (PO 1). (ii) engage independent and lifelong learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously (PO3). (iii) contribute significantly in academics through teaching and research (PO 4).

COURSE PLAN – PART II

COURSE OVERVIEW

- To discuss diagonalizable operator on a vector space and study characterizations of it using the minimal and characteristic polynomials.
- To explore Direct-sum and Primary decompositions and Jordan form.
- To introduce Adjoint, Normal and Unitary linear operators on inner product spaces and study their structures.
- To illustrate the concepts of bilinear and quadratic forms on vector spaces.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1st , 2nd & 3rd week	Review of basic concepts: Vector spaces, Bases, Dimension, Linear Transformations – The matrix representation – Change of basis – Rank and Nullity – System of linear equations.	Chalk and Talk
2.	4th, 5th & 6th week	Characteristic values and characteristic vectors – Eigenspaces – Algebraic and Geometric Multiplicities – Diagonalization - Minimal polynomial – Cayley-Hamilton Theorem.	Chalk and Talk
3.	7th Week	Assessment - 1	
4.	7th,8th& 9th week	Invariant subspaces – Direct-sum Decompositions – Invariant Direct sums – The Primary Decomposition Theorem – The Jordan Canonical form.	Chalk and Talk
5.	10th,11th& 12th week	Basic review of Inner Product Spaces – Adjoint operators – Normal operators – Unitary Operators – Orthogonal projections – The spectral Theorem.	Chalk and Talk
6.	11th Week	Assessment - 2	
7.	13th & 14th Week	Bilinear forms – Matrix representation – Quadratic forms – Positive definite forms - Sylvester's law of inertia.	Chalk and Talk
8.	15th Week	Final Assessment	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Assessment- 1 (Cycle Test -1)	7th Week	1½ hour	20%
2.	Assessment -2 (Cycle Test - 2)	11th Week	1½ hour	20%

3.	Assessment -3 (Assignments)	6th Week	7 Days	10%
4	Assessment -4 (Assignment/ Seminar)	12th Week	7 Days	10%
CPA	Compensation Assessment	13th Week	1½ hour	20%
5.	Final Assessment (Written Exam)	After 14th Week	3 hours	40%

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Feedback from the students during class committee meetings and in the class after the assessments 1 and 2.
2. Online feedback through questionnaire before the final assessment.
3. Student knowledge about the topics covered in this course will be judged through marks obtained in examination.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email / phone etc)

Students can contact the course faculty for clarifying doubts by fixing appointment through E-mail (jeyaraman@nitt.edu) or mobile (9884164316).

COMPENSATION ASSESSMENT POLICY

a) Students who have missed either Assessment-1 or Assessment-2 or both can register for Compensation Assessment which shall be conducted soon after the completion of the Assessment-2 and before the Final Assessment.

b) The Compensation Assessment shall be conducted for the weightage of 20% comprising the syllabus of both Assessment -1 & Assessment - 2.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HOD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

I. Jeyaraman	P. Saikrishnan 5/09/2022	V. Lakshmana 05/09/2022
Dr. I. Jeyaraman	Prof. P. Saikrishnan	Dr. V. Lakshmana Gomathi Nayagam.
(Course Faculty)	**CC-Chairperson**	**HOD**