NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI

DEPARTMENT OF MATHEMATICS

COURSE PLAN – PART I			
Name of the programme and specialization	M.Sc., Mathematics		
Course Title	Linear Algebra		
Course Code	MA703	No. of Credits	03
Course Code of Pre-requisite subject(s)	NIL		
Session	July 2019	Section (if, applicable)	-
Name of Faculty	Dr. N. Prakash	Department	Mathematics
Email	prakashn@nitt.edu	Telephone No.	7845688072
Name of Course Coordinator(s) (if, applicable)	-		
E-mail	-	Telephone No.	-
Course Type	√ Core course	☐ Elective course	

Syllabus (approved in BoS)

Review of basic concepts: Vector spaces, Bases, Dimension, Linear Transformations - Characteristic values and characteristic vectors – Diagonalization – Eigenspaces – Minimal polynomial – Cayley-Hamilton Theorem.

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

Cyclic subspaces – Cyclic Decomposition Theorem – Rational and Jordan forms – Computation of invariant factors.

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

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

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.

The course objective is to

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

COURSE OUTCOMES (CO)

Course Outcomes	**Aligned 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.	(i) progress the critical analysis and problem solving skills required for R & D organization and industry. (ii) engage independent and lifelong learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously. (iii) contribute significantly in academics through teaching and research.
2. decompose a vector space into a sum of invariant subspaces and a linear transformation into a direct sum of induced operators.	
3. compute the cyclic subspace generated by a vector and to construct the rational and Jordan forms 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.	

COURSE PLAN – PART II

COURSE OVERVIEW

This course will introduce

1. various decompositions of vector spaces and linear transformations on vector spaces.
2. diagonalizable operator on a vector space and characterizations of it using the minimal and characteristic polynomials.
3. different classes of linear operators on inner product spaces and their structures.
4. 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 - Characteristic values and characteristic vectors – Diagonalization – Eigenspaces – Minimal polynomial – Cayley-Hamilton Theorem.	Chalk and Talk
2.	4th & 5th week	Invariant subspaces – Direct-sum Decompositions – Invariant Direct sums – The Primary Decomposition Theorem.	Chalk and Talk
3.	7th Week	Assessment - 2	
4.	6th,7th& 8th week	Cyclic subspaces – Cyclic Decomposition Theorem – Rational and Jordan forms – Computation of invariant factors.	Chalk and Talk
5.	9th& 10th 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 - 4	
7.	11th & 12th Week	Bilinear forms – Matrix representation – Quadratic forms – Sylvester's law of inertia – Principal Axis Theorem - Positive definite forms.	Chalk and Talk
8.	After 12th Week	End Semester Exam	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Assessment - 1 (Assignment/Quiz)	3rd Week	Will be announced while distributing the list of problems	5%
2.	Assessment - 2	7th Week	1 hour	20%
3.	Assessment - 3 (Assignment/Quiz)	6th Week	Will be announced while distributing the list of problems	5%
4.	Assessment - 4	11th Week	1 hour	20%
CPA	Compensation Assessment	12th Week	1 hour	20%
5.	Final Assessment (End Semester Exam)	13th or 14th Week	3 hours	50%

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

1. Students can meet the faculty (with prior appointment) at any stage in the course duration in case he/she finds difficulty in understanding the topic.
2. Feedback form issued to students to express their comments about the course before Assessment -2, and after completing the syllabus. Students are requested to give genuine feedback about the course.
3. Student knowledge about the topic 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 meet the course faculty by fixing appointment through E-mail (prakashn@nitt.edu) between 9:30 am to 5:30 pm from Monday to Friday.

COMPENSATION ASSESSMENT POLICY

Only the students who are absent in any of the Assessment - 2 or Assessment - 4 (or both) with genuine reason will be allowed for the compensation assessment.

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

FOR APPROVAL

N. Prakash 28/8/19

Dr. N. Prakash
(Course Faculty)

29/8/2019
CC-Chairperson

P. Amirtharaj 28/8/19
HOD