SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

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Ready for Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

M.Sc. Mathematics

Sem	Course Code	Course Title	Type	Hrs/ Week	Credits	Marks		
						Int	SE	Total
I	M745	Abstract Algebra	MC	6	5	50	50	100
	M746	Real Analysis	MC	6	5	50	50	100
	M747	Ordinary Differential Equations	MC	6	5	50	50	100
	M748	Mathematical Statistics	MC	6	5	50	50	100
	M749 A M749 B M749 C	A1. Differential Geometry A2. Skill Enhancement Course I – Algebra A3. Coding Theory	ME	6	3	50	50	100
	Total			30	23	250	250	500
II	M848	Advanced Linear Algebra	MC	6	5	50	50	100
	M849	Partial Differential Equations	MC	6	5	50	50	100

	M850	Advanced Graph Theory	MC	6	5	50		50	100
	M851	Classical Dynamics	MC	6	5	50		50	100
	M852 A M852 B M852 C	B1. Mathematical Models in Biology B2. Skill Enhancement Course II – Linear Algebra B3. Numerical Analysis	ME	6	3	50		50	100
	Total					30	23	250	250	500
III	M953	Mathematical Analysis	MC	6	5	50	50	100
	M954	Topology	MC	6	5	50	50	100
	M955	Optimization Techniques	MC	6	5	50	50	100
	M956	Fluid Dynamics	MC	6	5	50	50	100
	M957A M957B M957C	C1. Nonlinear Dynamical Systems C2. Skill Enhancement Course III – Real Analysis C3. Mathematical Physics	ME	6	3	50	50	100
	Total			30	23	250	250	500
IV	M1049	Complex Function Theory	MC	6	5	50	50	100
	M1050	Functional Analysis	MC	6	5	50	50	100
	M1051	Difference Equations	MC	5	4	50	50	100
	M1052A M1052B	D1. Stochastic Processes	ME	5	3	50	50	100

	M1052C	D2. Skill Enhancement Course IV – Complex Analysis D3. Theory of Transforms						
	VE10XX	Human Rights		2	1	50	50	100
	M1053J	Project	MC	6	3	20	80	100
	Total			30	21	270	330	600
	Grand Total			**120**	**90 +10 ***	**1020**	**1080**	**2100**

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: Mathematics

S.No	Course Code	Course Name
1.	M745	Abstract Algebra
2.	M748	Mathematical Statistics
3.	M749B	Skill Enhancement Course I – Algebra (Elective)
4.	M749C	Coding Theory (Elective)
5.	M848	Advanced Linear Algebra
6.	M851	Classical Dynamics
7.	M852B	Skill Enhancement Course II - Linear Algebra (Elective)
8.	M852C	Numerical Analysis (Elective)

Syllabus:

Semester – I

ABSTRACT ALGEBRA

Course Code	**M745**	**Credit**	**5**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**
Course Objective	To study the transformations, Extension Fields and algebraic extensions, Finite Fields and Sylow's theorems, Finite Simple groups, Symmetry groups and Cayley digraphs of groups and Galois Theory in Vector Space. •		

Course Outcomes

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	prove theorems applying algebraic ways of thinking.	K3, K5
CO2	connect groups with graphs and understanding about Hamiltonian graphs.	K4

CO3	compose clear and accurate proofs using the concepts of Galois Theory.	K6
CO4	bringout insight into Abstract Algebra with focus on axiomatic theories.	K1
CO5	demonstrate knowledge and understanding of fundamental concepts including extension fields, Algebraic extension, Finite fields, Class equations and Sylow's theorem.	K2

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	3	2	3	3	2	3	2	2.6
2	3	3	2	2	3	3	3	3	2	2	2.6
3	3	3	3	3	2	3	3	2	3	2	2.7
4	3	3	3	3	2	3	3	3	2	1	2.6
5	3	3	3	2	2	3	3	3	3	2	2.7
Mean Overall Score											**2.64**
Result											**High**

Unit – I: Extension Fields and Algebraic Extensions

The Fundamental Theorem of Field Theory - Splitting Fields - Zeros of an Irreducible Polynomial - Characterization of Extensions – Finite Extensions - Properties of Algebraic Extensions.

(Chapters 20, 21)

Unit – II: Finite Fields and Class Equation

Classification of Finite Fields - Structure of Finite Fields - Subfields of a Finite Field - Conjugacy Classes - The Class Equation - The Probability That Two Elements Commute.

(Chapter 22, Chapter 24 (pages 395-397 only))

Unit – III: Sylow's Theorems and Finite Simple Groups

The Sylow's Theorems - Applications of Sylow's Theorems - Historical Background - Non-Simplicity Tests - The Simplicity of A_5.

(Chapter 24 (pages 398-407 only), Chapter 25)

Unit – IV: Generators and Relations and Cayley Digraphs of Groups

Definitions and Notation – Free Group - Generators and Relations - The Cayley Digraph of a Group - Hamiltonian Circuits and Paths - Some Applications.

(Chapter 26 (pages 434- 441 only), Chapter 30).

Unit – V: Galois Theory

Fundamental Theorem of Galois Theory - Solvability of Polynomials by Radicals - Insolvability of a Quintic.

(Chapter 32)

Book for Study

1. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.

Books for Reference

1. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984.
2. I. N. Herstein, *Topics in Algebra*, John Wiley and sons, 2-e, New Delhi, 2006.
3. John B. Fraleigh, *A First Course in Abstract Algebra*, 7-e, Pearson Education Publication, New Delhi 2003.
4. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
5. S. Arumugam and A. Thandapani, *Modern Algebra*, SciTech Publications Pvt. Ltd.
6. Saunders Maclane and Garrett Birkoff, *Algebra*, 2-e, Macmillan Publishing Co.inc, New York, 1979.
7. Serge Lang, *Algebra*, Addition Wesley Publishing Company, London 1965.
8. Surjeeth Singh and QuaziZameeruddin, *Modern Algebra*, 2-e, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.

Syllabus:

Semester: III

Semester – I **Hours/week: 6**
Code: M748 **Credits: 5**

MATHEMATICAL STATISTICS

Objective: To study and apply sampling theory, significance tests, estimation, testing of hypothesis and design of experiments.

Unit– I: Sampling and Sampling Distributions
Sampling – Sample mean – Sampling from the normal distributions.
(Book 1: Chapter 6, Sections: 6.2 to 6.4)

Unit– II: Parametric Point Estimation
Methods of finding Estimators – Properties of Point Estimators – Sufficiency – Unbiased estimation.
(Book 1: Chapter 7, Sections: 7.2 to 7.5)

Unit– III: Parametric Point and Interval Estimation
Baye's estimators – Confidence intervals – Sampling from the normal distribution – Methods of finding confidence intervals–Large sample confidence intervals – Bayesian Interval Estimates.
(Book 1: Chapter 7, Section: 7.7; Chapter8, Sections: 8.2 to 8.6)

Unit–IV: Tests of Hypotheses
Test of hypotheses – Sampling from the normal distribution – Chi-square Tests –Test of Hypotheses and Confidence Intervals.
(Book 1: Chapter 9,Sections: 9.4 to 9.6)

Unit– V: Design of Experiments
Aim of the Design of experiments - Basic Principles of Experimental Design - Some Basic Designs of Experiments - Analysis of variance - Comparison of RBD and LSD - Examples.
(Book 2: Chapter 10: pages 10.1 to 10.25)

Books for Study

1. Alexander M. Mood, Franklin, A. Graybilland Duane C. Boes, *Introduction to the Theory of Statistics*, John Wiley and Sons, 3-e, 1974.
2. Veerarajan T, Probability, Statistics and Random Processes, 3rd Edition – Tata McGraw-Hill, 2012**.**

Books for Reference

1. Ruma Falk, *Understanding Probability and Statistics: A Book of Problems*, A K Peters/CRC Press, 1997.
2. Marek Fisz, *Probability and Mathematical statistics*, Krieger Publishing Company; 3 edition, 1980.
3. Paul G. Hoel, *Introduction to Mathematical Statistics*, 5-e, Wiley, 1984.
4. Simmons and Schuster, *Probability Statistics and Random Process*, 1971.
5. S. P. Gupta & M. P. Gupta, *Business Statistics*, 14th enlarged edition, Sultan Chand and sons, educational publishers, New Delhi, reprint 2007.
6. S. S. Wilks, *Mathematical Statistics*, John Wiley and Sons, 1967.
7. Vijay K. Rohatgi, *An Introduction to Probability Theory and Mathematical Statistics* (Wiley Series in Probability and Statistics), Wiley-Blackwell, 1976.

Course Learning Outcomes
This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand Sampling and Sampling distributions.	K2
CO2	illustrate the methods of finding Estimators	K2
CO3	determine Parametric point and Interval Estimation.	K3
CO4	perform hypothesis testing , justify hypothesis testing to Sampling problems and to determine confidence Intervals.	K3, K4, K6
CO5	define the basic terms used in design of experiments and use appropriate experimental designs to analyze the experimental data.	K1, K5

Mapping of CO with PO and PSO

CO	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
1	3	3	3	2	2	3	3	3	3	2	2.7
2	3	3	3	3	1	3	3	3	3	2	2.7
3	3	3	3	3	2	3	3	3	3	1	2.7
4	3	3	3	3	2	3	3	3	3	1	2.7
5	3	3	3	3	1	3	3	3	2	2	2.6
Mean Overall Score											**2.68**
Result											**High**

E–Learning source: https://ocw.mit.edu/courses/mathematics/18-655-mathematical-statistics-spring-2016/index.htm
http://www.math.uah.edu/stat/

Syllabus:

Semester – I

SKILL ENHANCEMENT COURSE I – ALGEBRA

Course Code	**M749B**	**Credit**	**3**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**
Course Objective	1. To develop broad and balanced knowledge and understanding of definitions, concepts, theorems and principles. 2. To enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problem in Mathematics. 3. To empower students to crack competitive examinations such as NET, SET and TRB and to complement the theoretical content of the subject with exercise problems. .		

Course Learning Outcomes

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	disseminate new and innovative knowledge that will make them fit for any competitions in job opportunities.	K5
CO2	apply new tangents or to exercise their knowledge and skill in other disciplines.	K3
CO3	develop, prioritize, demonstrate display, and disseminate newer versions and to interpret in novel ways.	K4, K6
CO4	bringout the flair for new and continuous learning process.	K1
CO5	build the dexterity.	K3

Mapping of CO with PO and PSO

CO	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
1	2	3	3	3	2	3	3	2	3	3	2.7
2	2	3	3	3	2	3	3	2	3	3	2.7

3	2	3	3	3	2	3	3	2	3	2	2.6
4	2	3	3	3	2	3	3	2	3	2	2.6
5	2	3	3	3	2	3	3	2	3	3	2.7
Mean Overall Score											**2.66**
Result											**High**

Introduction to groups – Groups - finite groups – subgroups.

(Chapters 1 to 3 – examples and exercise)

Unit-II: Cyclic and Permutation groups and Isomorphism

Cyclic groups - permutation groups – isomorphism.

(Chapters 4 to 6 – examples and exercise)

Unit-III: Cosets and Direct Products

Cosets and Lagrange's theorem – external direct products - normal subgroups and factor groups.

(Chapters 7 to 9 – examples and exercise)

Unit-IV: Rings and Ideals

Introduction to rings – integral domains – ideals and factor rings.

(Chapters 12 to 14 – examples and exercise)

Unit-V: Ring Homomorphism and Factorization

Ring homomorphism - polynomial rings – factorization of polynomials.

(Chapters 15 to 17 – examples and exercise)

Book for Study

1. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.

Books for Reference

1. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.

Syllabus:

Semester – I

Coding Theory

Course Code	**M749C**	**Credit**	**3**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**
Course Objective	• To provide students with elementary knowledge of theory of error correcting codes and readable introduction to mathematical aspect of coding.		

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	describe and justify the concept of linear codes and error correcting codes.	K1, K4
CO2	perform encoding and decoding using linear codes.	K6
CO3	construct and decode BCH code.	K3
CO4	summarize different types of codes.	K2
CO5	solve linear coding theory problems	K3

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	3	3	1	3	3	3	1	2	2.5
2	3	3	3	3	1	3	3	3	1	1	2.4
3	3	3	3	3	1	3	3	3	1	2	2.4

4	3	3	3	2	1	3	3	3	1	2	2.4
5	3	3	3	3	2	3	3	3	1	2	2.3
Mean Overall Score											**2.4**
Result											**High**

Unit 1:

Introduction to linear codes and error correcting codes. Encoding and decoding of a linear coe.

Unit 2:

Dual codes. Hamming codes and perfect codes.

Unit 3:

Cyclic codes. Codes with Latin Squares, Introduction to BCH codes.

Unit 4:

Weight enumerators and MDS codes.

Unit 5:

Linear coding theory problems and conclusions.

Books for Study

1. Raymond Hill, *A first course in Coding Theory*, Clarandon Press, Oxford (1986).
2. J.H. Van Lint, *Introduction to Coding Theory*, Springer (1998).

Books for Reference

1. W. Cary Huffman and Versa Pless, *Fundamentals of Error Correcting Codes*, Cambridge University Press (2003).
2. W.W. Peterson, *Error Correcting Codes*, Cambridge, MA MIT Press (1961).
3. V. Pless, W.C. Huffman and R.A. Brualdi, *An Introduction to Algebraic Codes*, in Hand book of coding theory, Eds. Amsterdam Elsevier (1998)

Syllabus:

SEMESTER- II

ADVANCED LINEAR ALGEBRA

Course Code	**M848**	**Credit**	**5**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**
Course Objective	• To give the students a thorough knowledge of the various aspects of Linear Algebra. To train the students in problem-solving as a preparatory for competitive exam.		

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand linear transformations and represent in matrix form.	K2
CO2	compute minimal polynomial and characteristic polynomial of linear transformation.	K3
CO3	find applicability of the inner product spaces.	K5
CO4	outline and formulate the theory of the course to solve variety of problems at an appropriate level of difficulty	K4, K6
CO5	examine bi-linear and Jordan canonical forms.	K1

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	3	2	2	2	3	2	2	2.4
2	3	3	2	3	2	1	3	3	2	2	2.4
3	1	1	2	2	1	2	2	3	1	2	1.7

4	2	2	1	2	1	2	2	3	2	2	1.9
5	2	2	1	2	1	2	2	3	2	2	1.9
										Mean Overall Score	**2.06**
										Result	**High**

Unit – I: Linear transformations

The algebra of linear transformations- Isomorphism – Representations of Transformations by Matrices – Linear Functionals.

(Book – 1, Chapter 3, Sections: 3.2 to 3.5)

Unit – II: Algebras of Polynomials

Algebras - The algebra of polynomials – Lagrange-Interpolation – Polynomial Ideals – The Prime factorization of a polynomial.

(Book – 1, Chapter 4, Sections: 4.1 to 4.5)

Unit – III: Inner Product Spaces

Inner Products and Norms – The Gram – Schmidt Orthogonalization Process and Orthogonal Complements – The Adjoint of a Linear Operator – Normal and Self – Adjoint Operators.

(Book – 2, Chapter 6, Sections: 6.1 to 6.4)

Unit – IV: Orthogonal System

Unitary and Orthogonal Operators and their Matrices - Orthogonal Projections and the Spectral Theorem – Bilinear and quadratic forms.

(Book – 2, Chapter 6, Sections: 6.5, 6.6, 6.8)

Unit – V: Canonical Forms

Jordan Canonical form I – Jordan Canonical form II-The minimal polynomial.

(Book – 2, Chapter 7, Sections: 7.1 to 7.3)

Books for Study

1. Kenneth Hoffman and Ray Alden Kunze, *Linear Algebra*, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2010.
2. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra*, Fourth Edition, Prentice Hall of India Private Limited, New Delhi, 2007.

Books for Reference

1. A. R. Rao, P. Bhimashankaram, *Linear Algebra*, Second Edition, Tata McGraw Hill, 2000.
2. Edgar G. Goodaire, *Linear Algebra-Pure & Applied World Scientific*, Cambridge University Press India Ltd, 2014.
3. I. N. Herstein, *Topics in Algebra*, 2-e, Vikas Publishing House Pvt., Ltd,Chennai-6, 2006.
4. P. P Gupta, S. K. Sharma, *Linear Algebra*, S.Chand and Company Ltd, New Delhi,1982.
5. S. Kumaresan, *Linear Algebra: A Geometric Approach*, Prentice – Hall of India Ltd, 2004.
6. V. Krishnamurthy, V. P. Mainra, J. L. Arora, *Introduction to Linear Algebra*, East West Press Ltd, 1985.

Syllabus:

Semester – II

Classical Dynamics

Course Code	**M851**	**Credit**	**5**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**
Course Objective	• To study mechanical systems under generalized coordinate, virtual work, energy and momentum, also to study the mechanics developed by Newton, Lagrange, Hamilton and Jacobi.		

Course Learning Outcomes

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	demonstrate the knowledge of core principles in mechanics	K2
CO2	interpret and consider complex problems of classical dynamics in a systematic way	K3, K5
CO3	apply the variation principle for real physical situations	K4
CO4	explore different applications of these concepts in the mechanical and electromagnetic fields.	K6

CO5	describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle.	K1

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	2	2	1	3	3	3	2	1	2.2
2	3	2	2	2	1	3	3	3	2	1	2.2
3	3	3	3	2	1	2	2	3	2	1	2.2
4	3	3	2	2	1	3	3	3	2	1	2.3
5	3	3	2	2	1	3	3	2	2	1	2.2
Mean Overall Score											**2.22**
Result											**High**

Unit – I: Mechanical Systems

The mechanical system – Generalized co-ordinates – Configuration space – Constraints – Virtual work – Principle of virtual work – D'Alembert's Principle – Generalized force – Energy – Momentum.

(Chapter 1, Sections: 1.1 to 1.5)

Unit – II: Lagrange's Equations

Derivation of Lagrange's equations – Examples – Integrals of the motion – Ignorable co-ordinates – The Routhian function – Conservative systems – Natural systems.

(Chapter 2, Sections: 2.1 to 2.3)

Unit – III: Hamilton's Equation

Hamilton's principle – Derivation of Hamilton's equations – The Legendre transformation– Modified Hamilton's principle – Principle of least action.

(Chapter 4, Sections: 4.1 to 4.3)

Unit – IV: Hamilton Jacobi Theory

Hamilton's principal function – Pfaffian differential forms – The Hamilton-Jacobi equation – Jacobi's theorem – Separability.

(Chapter 5, Sections: 5.1 to 5.3)

Unit – V: Canonical Transformation

Differential forms and generating functions - Special Transformations - Lagrange and Poisson brackets.

(Chapter 6, Sections: 6.1 to 6.3)

Book for Study

1. Donald T. Greenwood, *Classical Dynamics*, Prentice Hall of India Pvt. Ltd., New Delhi, 1985.

Books for Reference

1. D. E. Rutherford, *Classical Mechanics*, Oliver Boyd, New York, 2000.
2. H. Goldstein, *Classical Mechanics*, Second edition, Narosa Publishing House, New Delhi, 1994.
3. J. L. Synge and B. A Grifth, *Principles of Mechanics*, 3e, McGraw Hill Book Company, New York, 1959.
4. J. L. Synge and P. S. C. Joag, *Classical Mechanics*, Tata McGraw Hill, New Delhi, 1991.
5. P. G. Bergmann, *Introduction to Theory of Relativity*, Prentice Hall of India, Eddington, New Delhi, 1969.

Syllabus:

Semester – II

SKILL ENHANCEMENT COURSE II – LINEAR ALGEBRA

Course Code	**M852B**	**Credit**	**3**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**

Course Objective	1. To develop broad and balanced knowledge and understanding of definitions, concepts, theorems and principles. 2. To enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problem in Mathematics. 3. Toempower students to crack competitive examinations such as NET, SET and TRB and to complement the theoretical content of the subject with exercise problems.

Course Learning Outcomes

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	disseminate new and innovative knowledge that will make them fit for any competitions in job opportunities.	K5
CO2	analyze new tangents or to exercise their knowledge and skill in their own disciplines.	K4
CO3	develop, give examples, demonstrate display, and disseminate newer versions and to interpret in novel ways.	K2, K6
CO4	bringout the flair for new and continuous learning process.	K1
CO5	build the dexterity.	K3

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	3	3	1	3	3	2	3	2	2.5
2	2	3	3	2	2	3	3	3	3	2	2.6
3	2	3	2	3	2	3	3	2	3	2	2.6
4	2	3	3	2	2	3	3	2	3	2	2.5
5	2	3	3	2	2	3	3	2	3	2	2.5
Mean Overall Score											**2.54**

Result	**High**

Unit – I: Linear Transformations and Matrices

Linear transformations – null spaces – ranges – matrix representation of a linear transformation – composition of linear transformations – matrix multiplication – invertibility – isomorphism – change of coordinate matrix – dual spaces.

(Chapter 2; Sections 2.1 to 2.6 – examples and exercise)

Unit – II: Elementary Matrix Operations and Systems of Linear Equations

Elementary matrix operations – elementary matrices – rank of a matrix – matrix inverses – system of linear equations.

(Chapter 3; Sections 3.1 to 3.4 – examples and exercise)

Unit – III: Diagonalization

Eigen values and Eigen vectors – diagonalizability – invariant subspaces and the Cayley-Hamilton Theorem.

(Chapter 5; Sections 5.1, 5.2, 5.4 – examples and exercise)

Unit – IV: Inner Product Spaces

Inner products and norms – Gram-Schmidt orthogonalization process – orthogonal complements – adjoint of a linear operator.

(Chapter 6; Sections 6.1 to 6.3 – examples and exercise)

Unit – V: Linear Operator on Inner Product Spaces

Normal, self-adjoint operators - unitary and orthogonal operators – orthogonal projections – spectral theorem.

(Chapter 6; Sections 6.4 to 6.6 – examples and exercise)

Book for Study

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence**,** *Linear Algebra*, Fourth Edition, Prentice Hall of India, New Delhi, 2007.

Books for Reference

1. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
2. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005.
3. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.
4. I.N. Herstein, *Topics in Algebra*, John Wiley and sons, 2-e, New Delhi, 2006.
5. S. Arumugam and A.Thandapani, *Modern Algebra*, SciTech Publications Pvt. Ltd.
6. John B. Fraleigh, *A First Course in Abstract Algebra*, 7-e, Pearson Education Publication, New Delhi 2003.
7. Saunders Maclane and Garrett Birkoff, *Algebra*, 2-e, Macmillan Publishing Co.inc, New York, 1979.
8. Santiago, *Modern Algebra*, Arul Publications, Madras, 1988.
9. Serge Lang, *Algebra*, Addition Wesley Publishing Company, London 1965.
10. Surjeeth Singh and Quazi Zameeruddin, *Modern Algebra* 2-e, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.

Syllabus:

SEMESTER – II

Numerical Analysis

Course Code	**M852C**	**Credit**	**3**
Instruction Hours per Week	**6**	**Marks**	**CIA (50) / SE (50)**
Course Objective	• To provide the student an understanding of the basic principles of numerical methods and to apply them in solving algebraic equations and ordinary differential equations numerically; To introduce various difference operators to enable the students to apply them in interpolation and numerical differentiation and integration.		

Course Learning Outcomes

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	Understand the need for numerical methods in real life situations.	K2
CO2	Apply the methods to solve problems and find the size errors in each method.	K3
CO3	critically analyse the accuracy of each method in solving algebraic, transcendental system of equations.	K4
CO4	identify and implement numerical methods in various physical problems and find its efficacy in real life.	K1,K5
CO5	develop and demonstrate the theoretical and practical aspects of numerical methods.	K3, K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	3	2	2	2	3	3	2	2	2.4
2	3	3	3	3	2	3	3	3	2	2	2.7
3	3	3	3	2	1	3	3	3	2	2	2.5
4	3	3	3	3	2	3	3	3	1	2	2.6
5	3	3	3	3	2	3	3	3	2	2	2.7
Mean Overall Score											**2.58**
Result											**High**

Unit – I: Transcendental and Polynomial Equations

Introduction - Bisection method - Iteration methods based on first degree equation - Iteration methods based on second degree equation – Polynomial equations - Methods for complex roots.

(Chapter 2: Sections 2.1 – 2.4, 2.8 - 2.9)

Unit – II: System of Linear Algebraic Equations and Eigenvalue Problems

Introduction - Direct methods - Iteration methods - Eigen values and Eigen vectors – Model problems.

(Chapter 3: Sections 3.1 – 3.2, 3.4 –3.6)

Unit – III: Interpolation and Approximation

Introduction - Lagrange and Newton Interpolations - Finite difference operators - Interpolating polynomials using finite differences - Hermite interpolation - Piecewise and spline interpolation.

(Chapter 4: Sections 4.1 – 4.6)

Unit – IV: Differentiation and Integration

Introduction - Numerical Differentiation - Extrapolation methods - Partial Differentiation - Numerical integration - Methods based on interpolation - Composite integration methods - Romberg Integration.

(Chapter 5: Sections 5.1, 5.2, 5.4 - 5.7, 5.9 - 5.10)

Unit – V: Ordinary Differential Equations

Introduction - Numerical methods - Single step methods, Multi step methods.

(Chapter 6: Sections 6.1 – 6.4)

Book for Study

1. M.K.Jain, S.R.K. Iyengar and R.K.Jain, *Numerical Methods for Scientific and Engineering Computation*, New Age International Publishers 2007, Fifth Edition.

Books for Reference

1. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, Addison Wesley Hill Fifth Edition, 2008.
2. Samuel D Conte and Carl de Boor , *Elementary Numerical Analysis*, Tata MacGraw Hill Pvt. Ltd Stall, New Delhi Third Edition, 1980.