

DEPARTMENT OF MATHEMATICS (PG)

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari, Coimbatore – 641021



Syllabus for

M.Sc Mathematics

(I, II, III & IV Semester)

2017-2018 Batch on-wards

Vision and Mission of the Institution:

VISION

A world renowned INDUSTRY-INTEGRATED INSTITUTION that imparts knowledge, skill, and research culture in young men and women to suit emerging young India.

MISSION

To provide quality education at affordable cost, and to maintain academic and research excellence with a keen focus on INDUSTRY-INTEGRATED RESEARCH AND EDUCATION.

MOTTO

Meaningful INDUSTRY-READY education and research by all means

Vision and Mission of the Department:

VISION

The Department aspires to the highest standards of excellence in teaching, through preparing students for learning Pure, Applied and Industrial Mathematics for the Challenging Growth of Science and Technology.

MISSION

The Mission of the Department is to provide an environment where students can learn and become competent users of mathematics and mathematical application. Also to provide Quality Education, Research and Consultancy by Providing Highly Skilled mathematical Knowledge along with the Industrial collaboration.

Program Educational Objectives (PEO)

- PEO1 : To provide opportunities of higher studies in the professional area of Mathematics such as Research.
- PEO2 : To impart knowledge on various theoretical and practical aspects of Mathematics with respect to industry exposure.
- PEO3 : To develop independent learning skills and transferable skills among the students.
- PEO4 : To strengthen the student's logical and analytical ability to deal with the generality and abstraction of mathematical principles.

Mapping of Institute Mission to PEO

Institute Mission	PEO's
Imparting Knowledge and Skill	PEO1, PEO3
Research Culture	PEO1, PEO4
Industry collaboration	PEO2

Mapping of Department Mission to PEO

Department Mission	PEO's
Imparting Critical thinking ability to become more Competency	PEO1, PEO3
Analytical Knowledge with Industry collaboration	PEO2
Research Culture	PEO1, PEO4

Program Outcomes (PO):

- P01** : Able to analyze and interpret outputs and generate new ideas based on the outputs.
- P02** : Able to gain knowledge in foundational areas of Mathematics with respect to Industry needs.
- P03** : Able to design the methodology suitable to the problem encountered.
- P04** : Able to recognize and learn the importance of life-long learning.
- P05** : Able to communicate effectively on complex real life activities with the help of critical thinking.
- P06** : Able to differentiate between valid and invalid mathematical reasoning so as to have individuality among students.
- P07** : Able to develop mathematical ideas based on from basic axioms by means to help non mathematician or layman who don't have knowledge of mathematics to get benefited.

Correlation between the POs and the PEOs

Program Outcomes	PEO1	PEO2	PEO3	PEO4
P01 :	√	√		
P02 :		√	√	
P03 :	√		√	
P04 :			√	
P05 :				√
P06 :			√	√
P07 :	√		√	√

Components considered for Course Delivery is listed below:

1. Class room Lecture
2. Laboratory class and demo
3. Assignments
4. Mini Project
5. Project
6. Online Course
7. External Participation
8. Seminar
9. Internship

Mapping of POs with Course Delivery:

Program Outcomes	Course Delivery								
	1	2	3	4	5	6	7	8	9
PO1	√		√	√	√	√		√	√
PO2	√						√		√
PO3		√		√	√	√			
PO4			√			√		√	
PO5				√	√				√
PO6	√		√			√			
PO7					√		√		√

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

*Scheme of curriculum for
M.Sc Mathematics*
for the students admitted in the Batch during 2017 - 2018

Board of Studies – Mathematics (PG)

S.No	Sem	Part	Type	Subject	Credit	Hour	Int	Ext	Total
1	1	III	Theory	Algebra	4	7	40	60	100
2	1	III	Theory	Real Analysis	4	7	40	60	100
3	1	III	Theory	Ordinary Differential Equations	4	6	40	60	100
4	1	III	Theory	Latex & Mathematica	4	5	40	60	100
5	1	III	Theory	Functional Analysis	4	5	40	60	100
1	2	III	Theory	Complex Analysis	4	5	40	60	100
2	2	III	Theory	Partial Differential Equations	4	5	40	60	100
3	2	III	Theory	Mechanics	4	5	40	60	100
4	2	III	Theory	MATLAB	4	5	40	60	100
5	2	III	Theory	Graph Theory	4	5	40	60	100
6	2	III	Theory	Elective-I	4	5	40	60	100
1	3	III	Theory	Topology	4	6	40	60	100
2	3	III	Theory	Fluid Dynamics	4	6	40	60	100
3	3	III	Theory	Operations Research	4	6	40	60	100
4	3	III	Theory	Mathematical Statistics	4	6	40	60	100
5	3	III	Theory	Elective-II	4	6	40	60	100
6	3	III	Practical	Core Practical – VI – Industrial Training Report	2	-	50	-	50
1	4	III	Theory	Elective-III	4	5	40	60	100
2	4	III	Theory	Fuzzy Logic And Systems	4	5	40	60	100
3	4	III	Practical	Latex & MATLAB Practical	4	5	40	60	100
4	4	III	Theory	Linear Algebra	4	5	40	60	100
5	4	III	Project	Project	8	10	40	160	200
					90				2250

Note :

1. Learning the courses – Packages like Mathematica, Latex and Matlab also Career Enhancement Course – student shall appear for the NSDC Certification.

@ - No End Semester Examination, only Internal Exam.

- No Internal Examination, only End Semester Exam.

Approved in the BOS Meeting held on 11-04-2018

Mapping of Courses and POs:

S- Strong Correlation M – Medium Correlation B – Blank

Course Code	Course Name	Program Outcomes						
		P01	P02	P03	P04	P05	P06	P07
17MMA13A	Algebra	S	S	S		S	S	
17MMA13B	Real Analysis	M		M			S	
17MMA13C	Ordinary Differential Equations	S	S	S	M	S	S	M
17MMA13D	Latex & Mathematica	S	S	S	M	M	S	
17MMA13E	Functional Analysis	M		M			S	
17MMA23A	Complex Analysis	M		M			S	
17MMA23B	Partial Differential Equations	S	S	S	M	S	S	M
17MMA23C	Mechanics	S	S	M	S	S	M	M
17MMA23D	MATLAB	S	S	S	M	M	S	
17MMA23E	Graph Theory	S	S	S	S	S	M	M
17MMA2EA	Elective-I	S	S	S	S	S	S	M
17MMA33A	Topology	S	M	M		M	M	
17MMA33B	Fluid Dynamics	S	S	S	S	S	S	M
17MMA33C	Operations Research	S	S	S	S	S	S	S
17MMA33D	Mathematical Statistics	S	S	S	S	S	S	S
17MMA3EA	Elective-II	S	S	S		M	M	
17MMA33V	Industrial Training Report	S	S	M	M	S	S	S
17MMA4EA	Elective-III	S	S	S	S	S	S	M
17MMA43A	Fuzzy Logic And Systems	S	S	S	S	M	M	
17MMA4EP	Latex & MATLAB Practical	S	S	S	M	M	S	
17MMA43B	Linear Algebra	S	M	S	M		S	M
17MMA43V	Project	S	S	S	S	S	S	S

Semester: I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA13A	Core - I – Algebra	4	6	1	0	Theory

17MMA13A

Introduction: This course concentrates on basic numerical and algebraic skills. Specifically, students cover group theory, ring theory, fields and linear transformation.

Course Outcome:

CO1	: To understand the basic concepts of Group Theory
CO2	: To understand the concepts of Ring Theory
CO3	: To understand the concepts of Fields and Roots of polynomials
CO4	: To understand the concepts of finite Fields
CO5	: To understand the concepts of Linear Transformations

UNIT-I: [12 Periods]

Group Theory: Another counting principle – Sylow’s theorem – Direct products

UNIT-II: [12 Periods]

Ring Theory: Euclidean rings – A particular Euclidean ring – Polynomial rings – Polynomials over the rational field.

UNIT-III: [12 Periods]

Fields: Extension Fields – Roots of polynomials – More about roots.

UNIT-IV: [12 Periods]

Fields: Elements of Galois theory – Finite Fields.

UNIT-V: [12 Periods]

Linear Transformations: Canonical forms: Triangular form – Trace and Transpose – Hermitian, unitary and normal Transformations.

Text Book:

1. I.N.Herstein, “Topics in Algebra” (II Edition), published by willey 2015.

For Contents :

UNIT I	: Chapter 2	-Sections 2.11 to 2.13.
UNIT II	: Chapter 3	-Sections 3.7 to 3.10.
UNIT III	: Chapter 5	-Sections 5.1,5.3 and 5.5.
UNIT IV	: Chapter 5	-Section 5.6.
	Chapter 7	-Section 7.1.
UNIT V	: Chapter 6	-Sections: 6.4,6.8 and 6.10

Reference Book:

1. J.B.Fraleigh, "A First Course in Abstract Algebra", Narosa Publishing House, New Delhi, 1988
2. M.Artin, "Algebra", Prentice-Hall, Englewood Cliff, 1991.
3. T.W.Hungerford, "Algebra", Springer, New York, 1974

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√			√			
C02		√	√				
C03		√	√		√	√	√
C04		√					
C05		√					

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA13B	Core - II - Real Analysis	4	6	1	0	Theory

Introduction: This paper aims to provide a basic knowledge about the measure theory and the properties of integrals and the functions of several variables.

Course Outcome:

CO1	:	To understand the basic concepts of Riemann Stieltjes Integral
CO2	:	To understand the concepts of Convergence and Continuity
CO3	:	To understand the concepts of Functions Of Several Variables
CO4	:	To understand the concepts of Lebesgue Measure
CO5	:	To understand the concepts of Lebesgue Integral

UNIT-I:

[12 Periods]

RIEMANN STIELTJES INTEGRAL: Definition and Existence of the Integral – properties of the integral – Integration and differentiation – Integration of vector valued function – rectifiable curves.

UNIT-II:

[12 Periods]

Uniform convergence and continuity – uniform convergence and integration - uniform convergence and differentiation – equicontinuous families of functions – The Stone Weirstrass theorem

UNIT-III:

[12 Periods]

FUNCTIONS OF SEVERAL VARIABLES: Linear transformation – contraction principle – Inverse function theorem – Implicit function theorem.

UNIT-IV:

[12 Periods]

LEBESGUE MEASURE: Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Littlewood’s Theorem

UNIT-V:

[12 Periods]

LEBESGUE INTEGRAL: The Lebesgue integral of bounded functions over a set of finite measure – integral of a non – negative function – General Lebesgue Integral.

Text Book:

- 1.W. Rudin, “Principles of Mathematical Analysis“ McGraw Hill, New York, 1976.
- 2.H.L. Roydon, “Real Analysis” Third Edition, Macmillan, New York, 1988.

For Contents:

Unit I –III : Chapters 6, 7, 9 (Book: 1)

Unit IV –V : Chapters 3 and 4 (Book: 2)

Reference Book:

1. R.G.Bartle, "Elements of Real Analysis", 2nd Edition, John Wily and Sons, New York, 1976.
2. W.Rudin, "Real and Complex Analysis", 3rd Edition, McGraw-Hill, New York, 1986

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√			√		√
C02		√			√	√	
C03		√		√	√		√
C04	√		√		√		√
C05	√						√

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA13C	Core - III - Ordinary Differential Equations	4	5	1	0	Theory

Introduction : This paper aims to provide a deeper knowledge about the first and second order linear equations and the concept of successive approximations.

Course Outcome:

C01	: To understand the basic concepts of Second order linear equations.
C02	: To understand the concepts of Existence and Uniqueness Theorem
C03	: To understand the concepts of Non-homogeneous linear systems
C04	: To understand the concepts of Existence and uniqueness of solutions of systems.
C05	: To understand the concepts of linear and non-linear oscillation

UNIT-I:

[12 Periods]

Second order linear equations with ordinary points – Legendre equation and Legendre polynomials – Second order equations with regular singular points – Bessel equation.

UNIT-II:

[12 Periods]

Systems of first order equations – existence and uniqueness theorem – Fundamental matrix.

UNIT-III:

[12 Periods]

Non-homogeneous linear systems – linear systems with constant coefficients – linear systems with periodic co-efficients.

UNIT-IV:

[12 Periods]

Successive approximation – Picard’s theorem - Non-uniqueness of solution – Continuation and dependence on initial conditions, Existence of solutions in the large – Existence and uniqueness of solutions of systems.

UNIT-V:

[12 Periods]

Fundamental results – Sturm’s comparison theorem – Elementary linear oscillations. Comparison theorem of Hille-Winter – oscillations of $x'' + a(t)x = 0$ - Elementary non-linear oscillation.

Text Book:

1. S.G. Deo and V. Raghavendra, “Ordinary Differential Equations and Stability Theory”.

For Contents:

Unit I	-Chapter	- 3 :	Section 3.2 –3.5
Unit II	-Chapter	- 4 :	Section 4.2 –4.4
Unit III	-Chapter	- 4 :	Section 4.5 –4.7
Unit IV	-Chapter	- 5 :	Section 5.3 –5.8
Unit V	-Chapter	- 6 :	Section 6.1 –6.6

Reference Book:

1. E.A.Coddington and N.Levinson, "Theory of Ordinary Differential Equations", McGrawHill, New York, 1955.
2. D.A.Sanchez, "Ordinary Differential Equations and Stability Theory", W.H.Freeman &Co., San Francisco, 1968

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√			√	√	
C02		√	√				√
C03			√				
C04	√			√		√	
C05	√				√		√

SEMESTER I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA13D	Core IV- Latex & Mathematica	4	5	0	0	Theory

Introduction: This paper aims to provide a first approach to the subject of Latex & Mathematica, which is one of the basic subjects of modern mathematics, which provides system oriented knowledge.

Course Outcome:

CO1	:	To Understand and apply the basics of Latex software while preparing a Document.
CO2	:	To Understand and apply Mathematical formulas and Drawing tools of Latex.
CO3	:	To Understand the basic and Need of Mathematica software.
CO4	:	To Understand and apply Numbers and Mathematica Functions.
CO5	:	To Understand and apply computation procedure for Series an limits.

UNIT-I:

[12 Periods]

Special Characters, Document layout and organization – Document class, Page style, Parts of the document, Centering and indenting, Lists, Theorem-like declarations, Boxes, Tables.

UNIT-II:

[12 Periods]

Footnotes and marginal notes, Mathematical formulas – Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine-tuning mathematics, Drawing pictures with LATEX

UNIT-III:

[12 Periods]

INTRODUCTION TO MATHEMATICA - Running Mathematica - Numerical calculations – Building up calculations – Using the Mathematica system – Algebraic calculations - Symbolic mathematics - Numerical mathematics.

UNIT-IV:

[12 Periods]

ADVANCED MATHEMATICS IN MATHEMATICA - Numbers - Mathematical functions – Algebraic manipulation – Manipulating equations - Calculus.

UNIT-V:

[12 Periods]

Series, limits and residues - Linear algebra.

Text Book:

1. H. Kopka and P.W. Daly, "A Guide to LATEX "3rd Edition, Addison – Wesley, UK, 1999.
2. S. Wolfram, "The Mathematica", 4th Edition, Cambridge University Press, Cambridge, 1999.

For Contents:

- Unit I -Chapter 2,3,4 : Section 2.5,3.1-3.3, 4.2,4.3,4.5,4.7,4.8. (Book: 1)
 Unit II -Chapter 4,5 : Section 4.10,5.1-5.5. (Book: 1)
 Unit III -Chapter 1: Section 1.0-1.6 (Book: 2)
 Unit IV -Chapter 3: Section 3.1 –3.5. (Book: 2)
 Unit V -Chapter 3: Section 3.6,3.7. (Book: 2)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√			√			
C02	√			√			
C03	√		√				√
C04		√	√		√	√	√
C05	√		√				√

SEMESTER I						
Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA13E	Core V-Functional Analysis	4	5	0	0	Theory

Introduction: This paper aims to provide a basic knowledge about the Banach space, Conjugate space and the concept of Banach algebra which is one of the fundamental concepts for further research.

Course Outcome:

CO1	:	To acquire knowledge about Banach Spaces and Hahn Banach theorem.
CO2	:	To gain knowledge about Conjugate of an operator and also Orthogonal components.
CO3	:	To gain knowledge about different types of operators with respect to conjugate space.
CO4	:	To have a basic knowledge on Matrices, Determinants of Operator.
CO5	:	To gain knowledge about Application of Banach theorem.

UNIT-I:

[12 Periods]

Banach spaces – The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N^{**} - The open mapping problem.

UNIT II:

[12 Periods]

The conjugate of an operator – Hilbert spaces – The definition and some simple properties – Orthogonal complements - Orthonormal sets.

UNIT III:

[12 Periods]

The Conjugate space H^* - The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections.

UNIT IV:

[12 Periods]

Matrices – Determinants and the spectrum of an operator – The spectral theorem

UNIT V:

[12 Periods]

The definition and some examples of Banach algebra – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius.

Text Book:

1.G.F. Simmons, “Introduction to Topology and Modern Analysis”, McGraw –Hill Book Company, London, 1963.

For Contents:

Unit I: Sections: 46 – 50.

Unit II: Sections: 51 – 54.

Unit III: Sections: 55 – 59.

Unit IV: Sections: 60 – 63.

Unit V: Sections: 64 – 68.

Reference Book:

1. C. Goffman & G. Pedrick, "A First Course in Functional Analysis", Prentice Hall of India, Delhi, 1987.
2. G. Bachman and L. Narici, "Functional Analysis", Academic Press, New York, 1966.
3. L.A. Lusternik and V.J. Sobolev, "Elements of Functional Analysis", Hindustan Publishing Corporation, New Delhi, 1971.
4. A.E.Taylor,"Introduction to Functional analysis", John Wiley and Sons, Newyork,1958.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√		√		√		
C02	√		√		√		√
C03	√			√	√		
C04	√		√			√	
C05		√					√

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA23A	Core VI -Complex Analysis	4	5	0	0	Theory

Introduction: This course will cover the Basic ideas of functions of one complex variable, Introduction to the concept of analytic functions and harmonic functions. Elementary functions of complex variable with their properties, Complex integration and its deduction leading to Taylor’s and Laurent’s series, Theory of residues and its application to evaluate various integrals and Conformal mapping.

Course Outcome:

C01	:	To gain basic knowledge about analytic function with its functions.
C02	:	To acquire skills of applications of Complex integrals.
C03	:	To acquire knowledge about calculus of Residues and it corresponding theorem.
C04	:	To gain knowledge about series and product developments.
C05	:	To have an basic idea about Riemann Mapping and also Boundary Behavior.

UNIT I:

[12 Periods]

Introduction to the concept of analytic function: Limits and continuity – Analytic functions – Polynomials – Rational functions – Conformality: Arcs and closed curves – Analytic functions in regions – Conformal Mapping – Length and Area – Linear Transformations: The Linear group – The Cross ratio – Elementary Riemann Surfaces.

UNIT II:

[12 Periods]

Complex Integration: Line Integrals Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy’s theorem for a rectangle - Cauchy’s theorem in a disk, Cauchy’s Integral formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives Removable singularities, Taylor’s Theorem – Zeros and Poles – The Local Mapping – The maximum principle – Chains and cycles.

UNIT III:

[12 Periods]

The Calculus of Residues: The Residue theorem –The Argument principle – Evaluation of definite integrals. Harmonic functions: The Definitions and basic Properties – Mean value property – Poisson’s Formula.

UNIT IV:

[12 Periods]

Series and Product Developments: Weierstrass Theorem –The Taylor Series –The Laurent Series – Partial fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products.

UNIT V:

[12 Periods]

The Riemann Mapping Theorem–Statement and Proof –Boundary Behavior –Use of the reflection principle –Analytic arcs –Conformal mapping of Polygons: The Behavior at an angle –The Schwarz –Christoffel Formula –Mapping on a rectangle.

Text Book:

1.L.V. Ahlfors, “ Complex Analysis”, Mc Graw Hill, New York,1979.

For Contents :

Unit I: Chapter – 2 Sections 1.1 – 1.4 Chapter – 2,3 Sections 2.1 – 2.4, 3.1, 3.2 and 3.4

Unit II: Chapter – 4 Sections 1.1 – 1.5, 2.1 – 2.3, 3.1 - 3.4 and 4.1

Unit III: Chapter – 4 Sections 5.1 – 5.3, 6.1 – 6.3

Unit IV: Chapter – 5 Sections 1.1 – 1.3, 2.1 – 2.3

Reference Books:

1. W. Rudin, “Real and Complex Analysis “ McGraw-Hill Book Co., 1966.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√	√			√
C02	√	√		√		√	
C03		√				√	
C04		√					√
C05	√				√		√

Subject Code	Subject Title	SEMESTER II			Type
		Credit	Lecture	Tutorial	
17MMA23B	Core VII-Partial Differential Equations	4	5	0	Theory

Introduction: This paper aims to provide a deeper knowledge about the second order and non linear partial differential equations, laplace equation and wave equation.

Course Outcome:

CO1	:	To understand Non Linear partial differential equation of first order.
CO2	:	To understand Non Linear partial differential equation of second order.
CO3	:	To gain knowledge about linear hyperbolic equations and its operations.
CO4	:	To acquire knowledge about Laplace equation with respect application in physics.
CO5	:	To understand and apply concept wave equations.

UNIT I: [12 Periods]

Nonlinear partial differential equations of the first order: Cauchy's method of characteristics- Compatible systems of first order equations – Charpit's method- Special types of first order equations – Jacobi's method.

UNIT II: [12 Periods]

Partial differential equations of second order: The origin of second-order equations – Linear partial differential equations with constant coefficients – Equations with variable coefficients- Characteristic curves of second-order equations- Characteristics of equations in three variables.

UNIT III: [12 Periods]

The solution of linear hyperbolic equations – Separation of variables – The method of integral transforms – Nonlinear equations of the second order.

UNIT IV: [12 Periods]

Laplace's Equation : The occurrence of Laplace's equation in physics- elementary solution of Laplace's equation – Families of equipotential surfaces - boundary value problems – Separation of variables- Problems with axial symmetry.

UNIT V: [12 Periods]

The wave equation: The occurrence of wave equation in physics – Elementary solutions of the one-dimensional wave equation – vibrating membranes: Applications of the calculus of variations – Three dimensional problems.

The diffusion equations: Elementary solutions of the diffusion equation – Separation of variables- The use of integral transforms.

Text Book:

1. I. N. Sneddon, "Elements of Partial Differential Equations" McGraw-Hill Book Company, Singapore, 1957.

For Contents :

Unit I: Chapter – 2 Sections 1.1 – 1.4 Chapter – 3 Sections 2.1 – 2.4, 3.1, 3.2 and 3.4

Unit II: Chapter – 4 Sections 1.1 – 1.5, 2.1 – 2.3, 3.1 - 3.4 and 4.1

Unit III: Chapter – 4 Sections 5.1 – 5.3, 6.1 – 6.3

Unit IV: Chapter – 5 Sections 1.1 – 1.3, 2.1 – 2.3

Unit V: Chapter – 6 Sections 1.1 – 1.4, 2.1 – 2.3

Reference Books:

1. Tyn Myint.U Lokenath Debnath. Partial Differential Equations for Scientists and Engineers, 3rd Edition. 2007
2. L.C.Evans, Partial Differential Equations AMS, Providence, R I, 2003.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√	√		√	√
C02		√		√			
C03	√	√		√			
C04	√				√		√
C05		√			√		

Subject Code	Subject Title	SEMESTER II			Type
		Credit	Lecture	Tutorial	
17MMA23C	Core VIII-Mechanics	4	5	0	Theory

Introduction: This paper aims to provide a first approach to the subject of Mechanics, which is one of the important aspects of advanced mathematics.

Course Outcome:

CO1	:	To become proficient in mechanical system.
CO2	:	To gain knowledge about Lagrange's equation and its derivation.
CO3	:	To become proficient in Hamilton's equations.
CO4	:	To acquire knowledge in Jacobi theory and Jacobi equation.
CO5	:	To gain skills in Canonical Transformations.

UNIT I:

[12 Periods]

Introductory Concepts : Mechanical system – Generalized Coordinates – Constraints –Virtual Work – Energy and Momentum.

UNIT II:

[12 Periods]

Lagrange's Equations : Derivations of Lagrange's Equations : Derivations of Lagrange's Equations – Examples –Integrals of Motion.

UNIT III:

[12 Periods]

Hamilton's Equations: Hamilton's Principle – Hamilton's Equations.

UNIT IV:

[12 Periods]

Hamilton – Jacobi Theory: Hamilton's Principle function – Hamilton – Jacobi Equation – Separability.

UNIT V:

[12 Periods]

Canonical Transformations: Differential forms and Generating Functions – Lagrange and Poisson Brackets.

Text Book:

1. D.T. Greenwood, "Classical Dynamics" Dover Publication, New York, 1997.

For Content :

Unit-I: Chapter 1: Sections 1.1 – 1.5

Unit-II: Chapter 2: Sections 2.1 – 2.3

Unit-III: Chapter 4: Sections 4.1 – 4.2

Unit-IV: Chapter 5: Sections 5.1 – 5.3

Unit-V: Chapter 6: Sections 6.1, 6.3

Reference Books:

1. F. Gantmacher, "Lectures in Analytic Mechanics" MIR Publishers, Moscow, 1975.
2. I.M. Gelfand and S.V. Fomin, "Calculus of Variations", Prentice Hall.
3. S.L. Loney, "An Elementary Treatise on Statics" Kalyani Publishers, New Delhi, 1979.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√		√		√	√
C02		√	√		√		
C03	√	√		√	√	√	
C04		√	√				√
C05	√	√		√			√

Subject Code	Subject Title	SEMESTER II			Type
		Credit	Lecture	Tutorial	
17MMA23D	Core IX-MATLAB	4	5	0	Theory

Introduction: This course is designed to familiarize students with the use of software resources commonly utilized in the mathematical sciences. Students will learn how to use modern computing environments such as MATLAB for the purpose of symbolic and numerical problem solving and visualization.

Course Outcome:

CO1	: To gain basics of Matlab with its basic commands.
CO2	: To apply interactive computation of Matrices and Vectors.
CO3	: To gain knowledge how to apply Scripts an Functions in Matlab.
CO4	: To understand and apply the concept of Plotting Two and Three dimensional plots.
CO5	: To use the Matlab to determine Linear Algebra, Finding Eigen Values and Vectors.

UNIT I: [12 Periods]
Introduction- Basics of MATLAB, Input – Output, File types – Platform dependence – General commands.

UNIT II: [12 Periods]
Interactive Computation: Matrices and Vectors – Matrix and Array operations

UNIT III: [12 Periods]
Programming in MATLAB: Scripts and Functions – Script files – Functions files-Language specific features – Advanced Data objects.

UNIT IV: [12 Periods]
Plotting: Two-dimensional plots - Three-dimensional plots

UNIT V: [12 Periods]
Applications – Linear Algebra - Solving a linear system – Finding Eigen values and Eigen vectors – Matrix Factorizations.

Text Book:

1. Rudra Pratap, Getting Started with MATLAB-A Quick Introduction for Scientists and Engineers, Oxford University Press, 2003.

For Contents:

- Unit I: Chapter 1: Sections 1.6.3-1.6.6
- Unit II: Chapter 3: Sections 3.1, 3.2
- Unit III: Chapter 4: Sections 4.1-4.4.

Unit IV: Chapter 6: Sections 6.1,6.2.

Unit V: Chapter 5: Sections 5.1,5.2.

Reference Books:

1. William John Palm, "Introduction to Matlab 7 for Engineers " McGraw-Hill Professional, 2005.
2. Dolores M. Etter, David C. Kuncicky, "Introduction to MATLAB 7 " Prentice Hall, 2004

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√		√			√
C02	√	√	√		√	√	
C03		√		√			√
C04	√	√		√	√		
C05		√					√

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA23E	Core X - Graph Theory	4	5	0	0	Theory

Introduction: This paper develops the concepts of graphs, sub graphs, trees, connectivity, Euler tours, Hamilton cycles, matching, and coloring of graphs, vertex coloring, and planar graphs.

Course Outcome:

CO1	:	To understand the basic concepts involved in a graph.
CO2	:	To gain knowledge about trees and its applications.
CO3	:	To acquire knowledge about Connectivity and Traversability with application to Eulerian and Hamiltonian graph.
CO4	:	To determine and understand the concept of Matching and coloring.
CO5	:	To have knowledge about planarity off graph.

UNIT I:

[12 Periods]

Graphs: Vertices of graphs, Walks and connectedness, Degrees, Operations on graphs, Blocks, Cut-points, bridges and blocks, Block graphs and cut- point graphs.

UNIT II:

[12 Periods]

Trees: Elementary properties of trees, Centers and Centroids, Block-cut point trees, Independent cycles.

UNIT III:

[12 Periods]

Connectivity and Traversability: Connectivity and line connectivity, Eulerian graph, Hamiltonian graphs.

UNIT IV:

[12 Periods]

Matchings: Matchings coverings in Bipartite Graphs – Perfect Matchings. Edge colourings: Edge chromatic number – Vizing’s theorem. Vertex Colourings: Chromatic Number – Brook’s Theorem

UNIT V:

[12 Periods]

Planarity: Planar graphs, outer planar graphs, Kuratowski’s theorem

Text Book:

1.F. Harary, Graph theory, Narosa Publishing House, New Delhi, 1988.

For Contents:

- Unit I: Chapter 2,3: Sections .1,2.2,2.3,2.7,3.1,3.2,3.3
- Unit II: Chapter 4: Sections 4.1,4.2,4.3,4.4
- Unit III: Chapter 5,7: Sections 5.1,7.1,7.2
- Unit IV: Chapter 10: Sections 10.1,10.2,10.3
- Unit V: Chapter11: Sections 11.1,11.2,11.3.

Reference books:

1. J.A.Bondy and U.S.R. Murthy, Graph Theory and Applications, Macmillan, London, 1976.
2. R. Balakrishnan and K. Renganathan, A textbook of Graph theory, Springer, 2000
3. Bela Bollobas, Modern Graph Theory Springer, 2002
4. G. Chartrand, L. Lesniak, Graphs & digraphs. Fourth edition. Chapman & Hall/CRC, 2005.
5. Robin J. Wilson, Introduction to Graph Theory (4th Edition), Addison Wesley, 1996

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√				√	
C02	√		√	√	√		√
C03			√		√		
C04	√	√		√			√
C05	√	√		√			

SEMESTER II						
Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA2EA	Elective I-Numerical Methods	4	5	0	0	Theory

Introduction: This course contains solution of non linear equations, system of equations, ordinary differential equations, Boundary and Characteristic value problems and Numerical solution of PDE.

Course Outcome:

CO1	:	To gain knowledge about numerical differentiation and integration and its applications.
CO2	:	To learn about solving system of equations through various methods.
CO3	:	To apply various methods for obtaining a better solution for ODE.
CO4	:	To understand the concept of boundary value problems and characteristic equations.
CO5	:	To determine the numerical solution of Partial differential equations.

UNIT I :

[12 Periods]

Solution of nonlinear equations: Newton's method – Convergence of Newton's method – Bairstow's Method for quadratic factors. Numerical differentiation and integration: Derivatives from Differences tables – Higher order derivatives – Divided difference, Central-Difference formulas – Composite formula of Trapezoidal rule – Romberg integration – Simpson's rules.

UNIT II :

[12 Periods]

Solution of system of equations: The Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method – Matrix inversion by Gauss-Jordan method – Methods of Iteration – Jacobi and Gauss Seidal Iteration – Relaxation method – Systems of Nonlinear equations.

UNIT III :

[12 Periods]

Solution of ordinary differential equations: Taylor series method – Euler and Modified Euler methods – Rungekutta methods – Multistep methods – Milne's method – Adams Moulton method.

UNIT IV :

[12 Periods]

Boundary value problems and characteristic value problems: The shooting method – solution through a set of equations – Derivative boundary conditions – Characteristic value problems – Eigen values of a matrix by Iteration – The power method.

UNIT V :

[12 Periods]

Numerical solution of partial differential equations: (Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations) Representation as a difference equation – Laplace's equation on a rectangular region – Iterative methods for Laplace equation – The Poisson equation – Derivative boundary conditions – Solving the equation for time-dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – solving the wave equation by Finite Differences.

Treatment as in:

1. C.F.Gerald and P.O.Wheatley, APPLIED NUMERICAL ANALYSIS' 5th Edition, Addison Wesley, (1998).

For Contents:

- Unit I : Chapter 1: Sections: 1.4, 1.8, 1.11,
Chapter 5: Sections: 5.2, 5.3, 5.6, 5.7.
- Unit II : Chapter 2: Sections: 2.3 - 2.5, 2.7, 2.10 - 2.12.
- Unit III : Chapter 6: Sections: 6.2 - 6.7.
- Unit IV : Chapter 7: Sections: 7.2 – 7.5.
- Unit V : Chapter 7: Sections: 7.6,7.7,
Chapter 8 : Sections: 8.1 -8.4.

Reference Book:

1. S.C. Chapra and P.C. Raymond, "Numerical Methods for Engineers" Numerical Methods for Engineers Tata McGraw Hill, New Delhi, (2000)
2. R.L. Burden and J. Douglas Faires, P.W.S.Kent "Numerical Analysis " Publishing Company, Boston (1989), Fourth Edition.
3. S.S. Sastry, "Introductory methods of Numerical Analysis " Prentice Hall of India, New Delhi, (1998).
4. P.Kandasamy et al., "Numerical Methods", S.Chand & Co.Ltd., New Delhi

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√		√	√	
C02		√	√		√		√
C03	√		√	√			
C04	√	√					√
C05		√	√		√		

Subject Code	Subject Title	SEMESTER II			Type
		Credit	Lecture	Tutorial	
17MMA2EB	Elective II-Cryptography and Network Security	4	5	0	Theory

Introduction: This course aims to design several cryptographic algorithms. It contains OSI Security architecture, Public key cryptography, Authentication and hash function, Network and System level security.

Course Outcome:

C01	:	To gain knowledge about the basic concepts of cryptography to ensure network security.
C02	:	To learn the basic concepts about the encryption techniques
C03	:	To gain knowledge about Authentication functions and its types.
C04	:	To acquire knowledge about Network security and its applications.
C05	:	To understand the need of System level security in order to detection of threads/function.

UNIT I :

[12 Periods]

Introduction: OSI Security Architecture - Classical Encryption techniques - Cipher Principles - Data Encryption Standard - Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES - AES Cipher - Triple DES - Placement of Encryption Function - Traffic Confidentiality

UNIT II:

[12 Periods]

Public key cryptography: Key Management – Diffie -Hellman key Exchange - Elliptic Curve Architecture and Cryptography - Introduction to Number Theory - Confidentiality using Symmetric Encryption - Public Key Cryptography and RSA.

UNIT III:

[12 Periods]

Authentication and hash function : Authentication requirements - Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - RIPEMD - HMAC Digital Signatures - Authentication Protocols - Digital Signature Standard

UNIT IV:

[12 Periods]

Network security: Authentication Applications: Kerberos - X.509 Authentication Service - Electronic Mail Security - PGP - S/MIME - IP Security - Web Security.

UNIT V:

[12 Periods]

System level security: Intrusion detection - password management - Viruses and related Threats - Virus Counter measures - Firewall Design Principles - Trusted Systems.

Text Book:

1. William Stallings, "Cryptography And Network Security - Principles and Practices", Prentice Hall of India, Third Edition, 2003

For Contents:

Unit I	1 to 7	1.2-1.6, 2.1-2.3, 3.1-3.5, 5.1,5.2, 6.1, 7.1,7.2
Unit II	9 to 10	9.1,9.2, 10.1-10.4
Unit III	11 to 13	11.1-11.5, 12.1-12.3, 13.1-13.3
Unit IV	14 to 17	14.1,14.2, 15.1,15.2, 16.1,17.1-17.3
Unit V	18 to 20	18.1-18.3, 19.1,19.2, 20.1,20.2

Reference Book:

- 1.Atul Kahate by Cryptography and Network Security, Tata McGraw-Hill, 2003.
- 2.Bruce Schneier by Applied Cryptography, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger and Shari Lawrence Pfleeger, by Security in Computing, Third Edition, Pearson Education, 2003.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√	√		√	√
C02		√	√				√
C03	√		√		√		
C04	√			√			
C05		√		√			√

SEMESTER II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA2EC	Elective III - Astronomy	4	5	0	0	Theory

Introduction: This course focuses on the Solar system, Celestial sphere, Dip-Twilight & Kepler's laws.

Course Outcome:

C01	:	To gain knowledge about general description of Solar system.
C02	:	To gain knowledge about Celestial sphere and Diurnal motion also length of the day.
C03	:	To gain knowledge about Lighting.
C04	:	To gain knowledge about refraction with respect to tangent formula.
C05	:	To gain knowledge about Keplers Law.

UNIT I : [12 Periods]
General description of the Solar system. Comets and meteorites – Spherical trigonometry.

UNIT II: [12 Periods]
Celestial sphere – Celestial co – ordinates – Diurnal motion – Variation in length of the day.

UNIT III: [12 Periods]
Dip – Twilight – Geocentric parallax.

UNIT IV: [12 Periods]
Refraction – Tangent formula – Cassini's formula.

UNIT V: [12 Periods]
Kepler's laws – Relation between true eccentric and mean anomalies.

Text Book:

1. S.Kumaravelu and Susheela Kumaravelu "Astronomy" (Unit I to V).

Reference Book:

1. W.M.Smart. "Text book of Spherical Astronomy "

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√		√		√		√
C02		√	√			√	√
C03	√	√		√	√		√
C04	√						√
C05	√	√		√	√	√	

SEMESTER III						
Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA33A	Core XI - Topology	4	5	1	0	Theory

Introduction: This course introduces topology, covering topics fundamental to modern analysis and geometry. It also deals with subjects like topological spaces and continuous functions, connectedness, compactness, separation axioms, and selected further topics such as function spaces, metrization theorems, embedding theorems and the fundamental group.

Course Outcome:

CO1	:	To gain knowledge about basic terminologies of Topology.
CO2	:	To acquire knowledge about Connectedness and Compactness with its limits.
CO3	:	To have an idea about Countability and Separation Axioms
CO4	:	To gain knowledge about regular spaces.
CO5	:	To acquire knowledge about Spaces and its types.

UNIT I: [12 Periods]
Topological spaces – Basis for Topology – The order Topology – Product Topology – Closed sets and Limit Points – Continuous Functions – Metric Topology.

UNIT II: [12 Periods]
Connectedness and Compactness: Connected Spaces – Connected sets in \mathbb{R} – Components and path components – Local connectedness – Compact Spaces – Limit Point Compactness

UNIT III: [12 Periods]
Countability and Separation Axioms: Countability Axioms – Separation Axioms Urysohn’s Lemma – Urysohn Metrization Theorem.

UNIT IV: [12 Periods]
The Tychonoff Theorem – Completely regular spaces – The stone-Cech Compactification.

UNIT V: [12 Periods]
Complete Metric Spaces – Compactness in Metric Spaces – Pointwise and Compact Convergences – The Compact-Open Topology – Ascoli’s Theorem – Baire Spaces – A Nowhere-Differentiable Function.

Text Book:

1. James R. Munkres, “Topology; A First Course “ Prentice Hall of India Private Limited, New Delhi, 2000.

For Contents:

- Unit I- Chapter2- section (12-20)
- Unit II- Chapter 3- section (23-28)
- Unit III- Chapter 4- section (30-34)
- Unit IV- Chapter 5- section (37,38)
- Unit V- Chapter 7- section (43-47),
Chapter 8- section (48,49)

Reference Book:

1. J. Dugundji, "Topology", Allyn and Bacon, 1966 (Reprinted in India by Prentice Hall of India Private Limited.).
2. George F. Simmons, "Introduction to Topology and Modern Analysis", McGraw Hill Book Company, 1963.
3. J.L. Kelley, "General Topology", Van Nostrand, Reinhold Co., New York, 1995.
4. L. Steen and J. Seebach, "Counter examples in Topology", Holt, Rinehart and Winston, New York, 1970.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√		√	√		√
C02			√	√		√	
C03	√	√					√
C04				√			
C05	√	√			√		

SEMESTER III						
Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA33B	Core XII - Fluid Dynamics	4	5	1	0	Theory

Introduction: This course is designed to give an overview of fluid dynamics from a mathematical viewpoint.

Course Outcome:

CO1	:	To gain knowledge about the basic concept of fluid flow.
CO2	:	To learn about the energy equation of flow of a fluid.
CO3	:	To understand the concept of two dimensional motion of fluid and the lift forces.
CO4	:	To acquire knowledge about the viscous flow and the steady flow of fluids.
CO5	:	To learn and understand about the boundary layer concept and its applications.

UNIT I :

[12 Periods]

Introduction -Velocity -Stream line & path line Stream tubs - fluid body-density-pressure. Differentiation following the fluid -equation of continuous-boundary conditions -kinematical and physical -rate of change of linear momentum-equation of motion of an in viscid fluid.

UNIT II:

[12 Periods]

Introductory Euler's momentum theorem -conservative forces-Bernouli theorem -energy equation for in viscid fluid -circulation -Kelvin's theorem -vortex motion Helmholtz equation .

UNIT III:

[12 Periods]

Two dimensional motion -two dimensional function -complex potential basic singularities-source vortex-doublet circle theorem flow past a circular cylinder with circulation -conformal transformation -Blasius theorem-lift forces.

UNIT IV:

[12 Periods]

Viscous flows- Navier stokes equations-verticity and circulation in viscous fluid -steady flow through an arbitrary cylinder under pressure-steady couette flow between cylinder in relative motion -steady flow between parallel planes.

UNIT V:

[12 Periods]

Laminar boundary layer in incompressible flow -boundary layer concept-boundary layer equation-displacement thickness-momentum thickness-kinetic energy thickness-integral equation of boundary layer-flow parallel to semi infinite plate- Blasius equation and its solution in series.

Text book

- 1.L.M. Milne Thomson, "Theoretical Hydro Dynamics" McMillan Company, 5th Edition (1968).
- 2.N. Curle and H.J. Davies, D Van Nostrand "Modern Fluid Dynamics – (Volume I) " Company Limited., London (1968).

For Contents:

Text book 1: Units I and II

Chapter I: Sections 1.0 – 1.3.

Chapter III: Sections 3.10 – 3.53 (omit 3.32, 3.44)

Text book 2: Units III, IV and V

Chapter III: Sections 3.1 – 3.7.5

Chapter V: Sections 5.1 – 5.5.5

Chapter VI: Sections 6.1 – 6.3.1 (omit 6.2.2.)

Reference books:

1. F.D Shanthi Swarup, "Fluid dynamics ", krishna prakashan private limit ,2000
2. M.D Raisinghania, "Fluid dynamics with hydro dynamics " S.Chanth &co 2003 edition

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√		√	√	√
C02	√	√		√	√		
C03	√		√			√	
C04	√	√	√				
C05	√	√	√		√		√

SEMESTER III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA33C	Core XIII - Operations Research	4	5	1	0	Theory

Introduction: This course discusses Operations Research with specific applications in Linear, Non Linear and Dynamic Programming,

Course Outcome:

CO1	:	To gain knowledge about the basic concepts of linear programming.
CO2	:	To learn about the methods involved in solving linear problems.
CO3	:	To understand the concept of integer and dynamic programming.
CO4	:	To acquire knowledge about optimization techniques for solving problems.
CO5	:	To gain knowledge about the concept of non-linear programming.

UNIT I : [12 Periods]

Introduction to L.P. –Graphical L.P. Solution – Sensitivity analysis Simplex Method – L.P. solution space in equation form –Transition from graphical to algebra solution – The simplex method – artificial starting solution – Special cases in simplex method applications. Duality – Primal and Dual – relationships - additional simplex algorithm for L.P.

UNIT II: [12 Periods]

Advanced Linear Programming – Generalized simplex tableau in matrix form – Decomposition algorithm –Matrix definition of dual problem –optimal dual solution.

UNIT III: [12 Periods]

Integer L.P. and Dynamic Programming – Integer Programming – Gomory cutting plane algorithm – Branch and Bound algorithm – Deterministic Dynamic programming – Recursive nature of computation in D.P. –Forward and Backward recursion.

UNIT IV: [12 Periods]

Classical optimization Theory – unconstraint – Necessary and sufficient Conditions –The Newton - Raphson method –constrained problems – Equality constraints (Jacobi method and Lagrangian method).

UNIT V: [12 Periods]

Non - linear programming - Direct search method –Gradient method–Separable programming – Quadratic programming.

Text Book:

1. Hamdy A Taha, Operations Research (Seventh Edition) –Prentice Hall of India Private Limited, New Delhi (2004).

For Contents:

- Unit-I: Chapter 2: 2.2, 2.3, omit 2.2.3 and 2.3.3.
Chapter 3: 3.1 –3.5 omits 3.3.3.
Chapter:4: 4.2 and 4.4
Unit-II: Chapter 7: 7.1.2, 7.4 and 7.5
Unit-III: Chapter 9: 9.2 and 9.3, omit 9.2.2 and 9.2.4.
Chapter 10: 10.1 and 10.2
Unit-IV: Chapter 20: 20.1, 20.12, 20.2.1.
Unit-V: Chapter 21: 21.1, 21.2.1, 21.2.2

References:

- 1.G.Dantzig, Linear Programming and Extension, Princeton University Press, Princeton , 1963.
- 2.S.Ross, A Course in Simulation, Macmillan, New York, 1990.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√	√		√	
C02	√	√	√		√		√
C03	√	√	√		√		√
C04		√	√				
C05		√	√	√		√	√

SEMESTER III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA33D	Core XIV - Mathematical Statistics	4	5	1	0	Theory

Introduction: This course is designed to make students to understand mathematical aspects of applied statistics.

Course Outcome:

CO1	:	To gain knowledge about the concept of random variables.
CO2	:	To learn about the probability function and study their properties.
CO3	:	To understand about the properties of estimator with respect to C-R inequality.
CO4	:	To acquire knowledge about the concept of curve fitting.
CO5	:	To learn about the concept of statistical modeling.

UNIT I:

[12 Periods]

Random Variables - Discrete and continuous random variables - Distribution function properties-Probability Mass Function-Probability Density Function-Mathematical Expectation - Theorems on Expectations.

UNIT II:

[12 Periods]

Discrete and continuous probability distribution function and its Moment generating function - binomial and Poisson and normal distribution and their properties, simple problem.

UNIT III:

[12 Periods]

Unbiasedness, Consistency, efficiency and sufficiency of estimators, factorization theorem and Rao-Blackwell theorem, Cramer- Rao inequality.

UNIT IV:

[12 Periods]

Curve fitting and principles of least squares -fitting of curves- straight line-second degree parabola and power curve-correlation and regression analysis.(simple problems).

UNIT V:

[12 Periods]

Student t-test, F-test, Chi-Square test for independence of Attributes, Analysis of Variance-One-way, Two-way Classification.

Text Books:

1. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan chand & sons Educational publishers (2007), New Delhi.
2. S.P.Gupta, "Statistical Methods", Sultan chand & sons Educational publishers (2015), New Delhi.

For Contents:

- Unit-I: Text Book-1(Chapter-5)
- Unit-II: Text Book-1(Chapter-8, 9)
- Unit-III: Text Book-1(Chapter-17)
- Unit-IV: Text Book-1(Chapter-10, 11)
- Unit-V: Text Book-2 (Chapter- 5,6,7)

Reference Books:

1. S.C.Gupta & V.K.Kapoor, "Fundamentals of Applied Statistics", Sultan chand & sons, Educational publishers (2012), New Delhi.
2. R.S.N. Pillai and V. Bagavathi, "Statistics", Sultan chand & sons Educational publishers (2007), New Delhi.
3. G.V. Shenoy, U.K. Srivastava, S.C. Sharma, "Business Statistics", New Age International Pvt Ltd Publishers (2014), New Delhi.
4. R.S. Bhardwaj, "Business Statistics", Anurag Jain For Excel books Publishers (Second Edition-2008), New Delhi.
5. D.N. Elhance, "Fundamentals of Statistics", Kitab Mahal Publishers (2002), New Delhi.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√		√	√			√
C02	√	√			√		
C03		√		√			√
C04		√				√	√
C05	√	√					

SEMESTER III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA3EA	Elective II-Control Theory	4	5	1	0	Theory

Introduction: This course is an introduction to analysis and design of control systems, including classical control theory in the time and frequency domain, Observability, Controllability, Stability, Optimal control.

Course Outcome:

CO1	:	To learn and understand the basic concepts of observability.
CO2	:	To acquire knowledge about the controllability of linear and non-linear systems.
CO3	:	To apply the concept of stability for linear and non-linear systems.
CO4	:	To use the stabilization concept for linear control.
CO5	:	To acquire knowledge about the optimal control of varying and non-varying systems.

UNIT I : [12 Periods]
Observability: Linear Systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear Systems

UNIT II: [12 Periods]
Controllability: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems

UNIT III: [12 Periods]
Stability: Stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear time varying systems – Perturbed linear systems – Nonlinear systems

UNIT IV: [12 Periods]
Stabilizability: Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilization with restricted feedback

UNIT V: [12 Periods]
Optimal control: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems

Text Book:

1.Elements of Control Theory by K.Balachandran and J.P.Dauer, Narosa, New Delhi, 1999.

For Contents:

Unit -I : Chapter 2.

Unit -II : Chapter 3: Sections: (3.1 - 3.3)

Unit - III: Chapter 4.

Unit - IV: Chapter 5.

Unit - V : Chapter 6.

Reference Books:

1. R.Conti, "Linear Differential Equations and Control " Academic Press, London, 1976.
2. R.F.Curtain and A.J.Pritchard, ""Functional Analysis and Modern Applied Mathematics Academic Press, New York, 1977.
3. J.Klamka, "Controllability of Dynamical Systems " Kluwer Academic Publisher, Dordrecht, 1991.
4. D.L.Russell, "Mathematics of Finite Dimensional Control Systems "Marcel Dekker, New York, 1979.
5. E.B. Lee and L. Markus, "Foundations of optimal Control Theory "John Wiley, New York, 1967

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√		√			√
C02	√	√	√		√	√	
C03		√		√		√	√
C04	√	√	√		√		√
C05	√	√		√			√

SEMESTER III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA3EB	Elective II - Differential Geometry	4	5	1	0	Theory

Introduction: This course will introduce basic concepts from differential geometry, emphasizing calculation methods and illustrating their utility by drawing examples from physics.

Course Outcome:

CO1	:	To gain knowledge about Analytic representation through curves.
CO2	:	To gain knowledge about General solution of Natural equations.
CO3	:	To acquire knowledge about Evolutes and Involutives also theory of surface.
CO4	:	To gain knowledge about First & Second Fundamental form of Normal,
CO5	:	To gain knowledge about Mesniers, Eulers Theorem of some surfaces.

UNIT I: [12 Periods]

Curves: Analytic representation - Arc Length – Osculation plane.

UNIT II: [12 Periods]

Curvature torsion – Formulas of Ferret - Contact – Natural equations – Helices – General solutions of Natural equations.

UNIT III: [12 Periods]

Evolutes and Involutives - Elementary theory of surface: Analytic representation.

UNIT IV: [12 Periods]

First fundamental form – Normal, Tangent plane – Developable surfaces - Second fundamental form.

UNIT V: [12 Periods]

Meusnier’s theorem – Euler’s Theorem – Dupin’s indicatrix –Some surfaces.

Text Book:

1. D. Struik, Lectures on Classical Differential Geometry, Addison Wesley Publishing Company, 1961.(Unit I to V)

For Contents

Unit I: Chapter 1: Sections:1.0-1.3.

Unit II: Chapter 1: Sections:1.4-1.10.

Unit III: Chapter 1,2: Sections:1.11, 2.0,2.1.

Unit IV: Chapter 2: Sections:2.2-2.5.

Unit V: Chapter 2: Sections:2.5-2.8.

Reference Books:

1. M. Spivak, "A Comprehensive Introduction to Differential Geometry" Publish or Perish, 1979.
2. J. A. Thorpe, "Elementary Topics in Differential Geometry " Springer-Verlag, 1994

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√		√	√	√
C02	√	√		√			
C03	√	√		√		√	√
C04		√		√	√		√
C05		√			√		√

SEMESTER III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA3EC	Elective II-Probability Theory	4	5	1	0	Theory

Introduction: This paper develops the building blocks of probability theory that are necessary to understand statistical inference.

Course Outcome:

CO1	:	To gain knowledge about Probability and its basic axioms.
CO2	:	To acquire knowledge about independence and strong convergence.
CO3	:	To determine and apply Law of large numbers and also random walk.
CO4	:	To gain knowledge about conditional expectations and its characteristic.
CO5	:	To understand and apply the concept of Central Limit theorem.

UNIT I: [12 Periods]

What is Probability? Random Variables and Measurability Results, Expectations and the Lebesgue Theory, Image Measure and the Fundamental Theorem of Probability.

UNIT II: [12 Periods]

Independence and strong convergence-independence – convergence concepts, series and inequalities.

UNIT III: [12 Periods]

Law of Large Numbers, Applications to Empiric Distributions, Densities, Queuing and Random walk.

UNIT IV: [12 Periods]

Conditional Expectation, Conditional Probabilities. Probability Distributions and Characteristic Functions - Distribution Functions and Selection - Principle – Characteristic Functions, Inversion, and Levy’s Continuity Theorem

UNIT V: [12 Periods]

Weak limit Laws – Classical Central Limit theorems.

Text Book:

1. M.M. Rao, “Probability Theory with Applications “ Academic Press, 1984. (Unit I to V)

Reference Books:

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.
3. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York,1996.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√		√		√
C02		√		√		√	√
C03	√	√	√	√	√	√	√
C04		√				√	√
C05	√	√	√		√		√

SEMESTER IV						
Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA43A	Core XV- Fuzzy Logic and System	4	5	0	0	Theory

Introduction: This course presents some fundamental knowledge of fuzzy sets, fuzzy logic, fuzzy decision making and fuzzy control systems.

Course Outcome:

CO1	:	To understand the basic concepts of Fuzzy sets.
CO2	:	To gain knowledge about Fuzzy relations.
CO3	:	To acquire knowledge about Fuzzy measures and Probability measures.
CO4	:	To gain knowledge about Uncertainty and Information.
CO5	:	To learn about the applications of Fuzzy sets in various fields.

UNIT I: [12 Periods]

CRISP SETS AND FUZZY SETS: Introduction-Crisp sets: The Notion of Fuzzy Sets-basic concepts of Fuzzy sets – Classical Logic: complement-Fuzzy Union-Fuzzy interaction – Combination of operations– General aggregation of operations.

UNIT II: [12 Periods]

FUZZY RELATIONS: Crisp and Fuzzy relations – Binary relations – Binary relations on a single set – Equivalence and similarity relations – Compatibility on Tolerance Relations – Orderings Morphism – Fuzzy relations Equations.

UNIT III: [12 Periods]

FUZZY MEASURES: General discussion – Belief and plausibility Measures –Probability measures – Possibility and Necessity measures – Relationship among Classes of Fuzzy Measures.

UNIT IV: [12 Periods]

UNCERTAINTY AND INFORMATION: Types of uncertainty – Measures of Fuzziness-Classical Measures of Uncertainty – Measures of Dissonance-Measures of Confusion – Measures of Non-Specificity – Uncertainty and Information – Information and Complexity – Principles of Uncertainty and information.

UNIT V: [12 Periods]

APPLICATIONS: Natural, life and Social Sciences - Engineering - Medicine - Management and decision making – Computer Sciences-System Science-Other Applications.

Text Book:

- George J. Klir and Tina A. Folger, Fuzzy Sets, Uncertainty and Information, Prentice- Hall of India Private Limited-Fourth printing-June 1995.

For Contents:

Unit I: Chapter 1: 1.1-1.5 , Chapter 2: 2.2 – 2.6

Unit II: Chapter 3: 3.1-3.8

Unit III: Chapter 4: 4.1-4.5

Unit IV: Chapter 5: 5.1 -5.9

Unit V: Chapter 6: 6.2 -6.8

Reference Book:

1. George J. Klir and Boyuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice-Hall of India Private Limited.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√		√		√
C02	√	√	√			√	
C03		√		√		√	
C04	√	√	√		√		√
C05	√	√		√		√	

SEMESTER IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA43P	Latex and MATLAB Practical	4	5	0	0	Theory

Introduction: This course is designed to familiarize students with the use of software resources commonly utilized in the mathematical sciences. Students will learn how to use modern computing environments such as Latex and MATLAB for the purpose of symbolic and numerical problem solving and visualization.

Course Outcome:

CO1	: To understand and apply basic operation for Latex.
CO2	: To learn to prepare list and tables in Latex.
CO3	: To apply the Latex operations for splitting and displaying equations.
CO4	: To perform various matrix operations in Matlab.
CO5	: To learn about plotting curves and finding eigen values of matrices.

List of Practical's:

1. Different Font Sizes in LATEX and Preparation of Title page in LATEX
2. Divide the Document With Sectioning Hierarchy of Book Environment in LATEX
3. Making Lists Using Itemize Environment in LATEX
4. Preparing Table in LATEX
5. Splitting The Equations in LATEX
6. Equation Using Left Cases in LATEX
7. To find the addition of two matrices, Transpose of a matrix and matrix multiplication in matlab
8. Finding the determinant of a matrix.
9. Plotting a function.
10. Polar plot.
11. Straight line fit.
12. Exponential curve fitting.
13. Finding Eigen values and Eigen vectors of a matrix.
14. Matrix Factorizations.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√			√		√
C02	√	√	√	√		√	√
C03	√	√		√	√	√	√
C04	√	√	√		√	√	√
C05	√	√		√	√		√

SEMESTER IV						
Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA43B	Core XVI - Linear Algebra	4	5	0	0	Theory

Introduction: This course enables the students to understand the concepts of matrices, vector and dual spaces and linear transformation.

Course Outcome:

CO1	:	To gain knowledge about matrices and characteristic roots .
CO2	:	To understand the concept of quadratic forms and its types.
CO3	:	To acquire knowledge about the basic concepts of vector spaces.
CO4	:	To learn about the concept of dual and inner product spaces.
CO5	:	To gain knowledge about the linear transformation.

Unit I:

[12 Periods]

Systems of linear Equations – Matrices and Elementary Row operations – Row - Reduced echelon Matrices – Matrix Multiplication – Invertible Matrices – Vector spaces – Subspaces – Bases and Dimension – Computations concerning Subspaces.

Unit II:

[12 Periods]

The algebra of linear transformations – Isomorphism of Vector Spaces – Representations of Linear Transformations by Matrices - Linear Functional's - The Double Dual – The Transpose of a Linear Transformation.

Unit III:

[12 Periods]

The algebra of polynomials – Lagrange Interpolation – Polynomial Ideals – The prime factorization of a polynomial, Commutative rings – Determinant functions – Permutations and the uniqueness of determinants – Classical Adjoint of a (Square) matrix – Inverse of an invertible matrix using determinants.

Unit IV:

[12 Periods]

Characteristic values – Annihilating polynomials, Invariant subspaces – Simultaneous triangulation and simultaneous Diagonalization – Direct-sum Decompositions.

Unit V:

[12 Periods]

Invariant Direct sums – The Primary Decomposition Theorem – Cyclic subspaces – Cyclic Decompositions and the Rational Form.

Text Book:

- 1.Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice – Hall of India Private Limited, New Delhi :1975.

For Contents:

Unit – I - Chapters 1 and 2

Unit – II - Chapter 3

Unit – III - Chapter 4 and Chapter 5: Sections 5.1 to 5.4

Unit – IV - Chapter 6: Sections 6.1 to 6.6

Approved in the BOS Meeting held on 11-04-2018

Unit – V - Sections 6.7 and 6.8 and Chapter 7: Sections 7.1 to 7.4

Reference Books:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, New Delhi, 1975.
2. I.S. Luther and I.B.S. Passi, Algebra, Vol.I – Groups, Vol.II- Rings, Narosa Publishing House (Vol.I – 1996, Vol.II- 1999)
- 3 N. Jacobson, Basic Algebra, Vols. I & II, Freeman, 1980 (also published by Hisdustan Publishing Company)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√			√		√
C02		√	√	√		√	
C03	√		√		√		√
C04		√	√				
C05	√	√				√	

SEMESTER IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA4EA	Elective III - Stochastic Processes	4	5	0	0	Theory

Introduction: This course explanations and expositions of stochastic processes concepts which they need for their experiments and research. It also covers theoretical concepts pertaining to handling various stochastic modelling.

Course Outcome:

CO1	:	To acquire knowledge in defining properties of various Stochastic process models.
CO2	:	To become proficient in Bernoulli and Markov stochastic process.
CO3	:	To gain skills in Markov process with discrete time and Poisson process.
CO4	:	To become proficient in Markov process with continuous time.
CO5	:	To gain knowledge in Stochastic process in Queuing system.

UNIT I: [12 Periods]

Stochastic processes: Some notions - Introduction-Specification of stochastic processes – stationary processes – Martingales – Difference equation: Differentiable- Difference equations. Markov chain -Definition and examples – High transition probabilities.

UNIT II: [12 Periods]

Generalization of independent Bernoulli trials: sequence of chain dependent trials – Classification of states and chain: Determination of higher transition probabilities – Stability of Markov system – Graph theoretic approach – Markov chain with denumerable number of states.

UNIT III: [12 Periods]

Markov processes with discrete state space: Poisson process and its extensions: Poisson process – Poisson process and related distributions – Generalizations of Poisson process – Birth death process.

UNIT IV: [12 Periods]

Markov processes with discrete state space (continuous time Markov chains)- Randomization Derived Markov chain – Erlang process. Markov process with continuous state space: Introduction: Brownian motion – Wiener process – Differential equations for a Wiener process – Kolmogorov equation.

UNIT V: [12 Periods]

Stochastic Processes in Queueing system: General concepts – The queueing model M/M/1 : Steady state behavior. Transient behavior of M/M/1 model – Birth and death processes - The model M/M/S.

Text Book :

1. J.Medhi, Stochastic Processes, Wiley Eastern Limited.

For Contents:

Unit I :Chapter 2(Sec 2.1-2.4), Appendix A(A.2, A.2.1-A.2.4, A.3) & Chapter 3(Sec 3.1,3.2)

Unit II : Chapter 3 (Sec 3.3 - 3.8)

Unit III : Chapter 4 (Sec 4.1 - 4.4)

Unit IV : Chapter 4 (Sec 4.5 - 4.7) & Chapter 5 (Sec 5.1 - 5.4)

Unit V : Chapter 10 (Sec 10.1 - 10.3, 10.4 (only 10.4.1, 10.4.2, 10.4.2.1))

Reference Book:

1., S.Karlin and M.Taylor, "A First course in Stochastic Process" Second Edition, Academic Press, Newyork (1975).

2.U, Narayan Bhat, "Elements of Applied Stochastic processes " 2nd edition, Wiley, New York (1968)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√		√		√	√
C02		√	√		√	√	√
C03		√	√	√			
C04	√				√		
C05		√		√		√	√

SEMESTER IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA4EB	Elective III Number Theory	4	5	0	0	Theory

Introduction: This course enables the students to understand the concepts of divisibility, functions, groups and basic properties.

Course Outcome:

CO1	:	To understand the basic concept of Numbers and need of Number theory.
CO2	:	To be able to understand about Mobius function.
CO3	:	To gain knowledge about Chebyshev's functions and its connections.
CO4	:	To acquire the basic knowledge about properties of Congruenes and also reduced residue system.
CO5	:	To understand the concept of Groups and sub groups.

Unit I:

[12 Periods]

Introduction, Divisibility, Greatest common divisor, Prime numbers, The fundamental theorem of arithmetic, The series of reciprocals of the primes, The Euclidean algorithm, The greatest common divisor of more than two numbers.

Unit II:

[12 Periods]

Introduction, The Mobius function $\mu(n)$, The Euler totient function $\varphi(n)$, A relation connecting φ and μ , A product formula for $\varphi(n)$, The Dirichlet product of arithmetical functions, Dirichlet inverses and the Mobius inversion formula, The Mangoldt function $\Lambda(n)$, Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function $\lambda(n)$.

Unit III:

[12 Periods]

Introduction, Chebyshev's functions $\psi(x)$ and $\vartheta(x)$, Relations connecting $\vartheta(x)$ and $\pi(x)$, Some equivalent forms of the prime number theorem, Inequalities for $\pi(n)$ and p_n , Shapiro's Tauberian theorem, Applications of Shapiro's theorem, An asymptotic formula for the partial sums $\sum_{p \leq x} (1/p)$, The partial sums of the Mobius function, Brief sketch of an elementary proof of the prime number theorem, Selberg's asymptotic formula.

Unit IV:

[12 Periods]

Definition and basic properties of congruences, Residue classes and complete residue systems J09, Linear congruences, Reduced residue systems and the Euler-Fermat theorem, Polynomial congruences module p. Lagrange's theorem, Applications of Lagrange's theorem, Simultaneous linear congruences. The Chinese remainder theorem, Applications of the Chinese remainder theorem, Polynomial congruences with prime power moduli.

Unit V:

[12 Periods]

Definitions, Examples of groups and subgroups, Elementary properties of groups, Construction of subgroups, Characters of finite abelian groups, The character group, The orthogonality relations for characters, Dirichlet characters, Sums involving Dirichlet characters.

Text Book:

1.T.M. Apostol, Introduction to Analytic Number Theory, Springer Verlag, 1976.

For Contents:

Unit I: Chapter1: Sections:1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8.

Unit II: Chapter 2: Sections:2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10,2.11,2.12.

Unit III: Chapter 4: Sections: 4.1,4.2,4.3,4.4,4.5,4.6,4.7,4.8,4.9,4.10,4.11.

Unit IV : Chapter 5: Sections: 5.1,5.2,5.3,5.4,5.5,5.6,5.7,5.8,5.9.

Unit V : Chapter 6: Sections: 6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8,6.9.

Reference:

1. Ivan Nivan and Herberts Zucherman, “ An Introduction to Theory of Numbers”, Third Edition, 1972, Wiley Eastern Limited, New Delhi.

2.Kennath and Rosan, “Elementary Number Theory and its Applications”, Addison Wesley Publishing Company, 1968.

3.George E. Andrews, “Number Theory”, Hindustan Publishing, New Delhi, 1989.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√	√	√		√	√	√
C02		√		√	√		
C03		√	√		√		
C04	√		√		√		√
C05		√	√	√		√	

SEMESTER IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA43C	Elective III Operator Theory	4	5	1	0	Theory

Introduction: This paper aims to understand the concept of dual spaces, reflectivity, Banach space and Hilbert space.

Course Outcome:

C01	:	To gain knowledge about Spaces of type Dual.
C02	:	To acquire basic concepts about Reflexivity and Re-convergence.
C03	:	To gain knowledge about Compact Operators and it Characteristics.
C04	:	To apply the Banach space operators for mapping problems.
C05	:	To acquire knowledge about Operators and Hilbert Space.

Unit-I:

[12 Periods]

Dual space considerations: Representation of Dual space- Dual of $l^p(n)$ -Dual of some sequence spaces-Duals of $C[a,b]$ and $L^p[a,b]$ - Separability revisited.

Unit-II:

[12 Periods]

Reflexivity and reconvergence: Reflexivity- Best approximation in reflexive space.

Unit-III:

[12 Periods]

Compact operators- Some characterizations - Space of compact operators- Further properties.

Unit-IV:

[12 Periods]

Spectral result for Banach space operators- Eigen Spectrum and approximate eigen spectrum- Spectrum and resolvent set- Spectral radius-Spectral mapping theorem- Gelfand mazar theorem and spectral radius formula.

Unit-V:

[12 Periods]

Operators and Hilbert space -Adjoint of an operators- Compactness of the adjoint operators- Sesquilinear function - self adjoint, normal and Unitary operator- Numerical range and Numerical radius- Some characterizations.

Text Book:

1.M.thamban Nair, "Function Analysis A First course" 2002,New Delhi, Prentice hall of India.

For Contents:

Unit-I: Chapter 8-section 8.1

Unit-II: Chapter 8-section 8.2

Unit-III: Chapter 9-section 9.1 to 9.3

Unit-IV: Chapter 10-section 10.1 to 10.2

Unit-V: Chapter 11-section 11.1 to 11.2

Reference Books:

1. G.M.Simmons, "Introduction to Topology and Modern Analysis " 1963, Tokyo, MEC Graw Hills.
2. V.S. Sundhar, "Functional Analysis: Spectral Theory " 1997, New Delhi, Hindustan Agency.
3. A.E. Tailor and D.C. Lay, " Introduction to functional Analysis" 1980, 2nd Edition, Newyork, Willey.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes						
	P01	P02	P03	P04	P05	P06	P07
C01	√		√			√	√
C02	√	√	√		√		
C03		√		√		√	√
C04	√	√	√		√		√
C05		√		√			√