MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

(Affiliated to Periyar University)

[Accredited by NAAC 'A' Grade & Recognized u/s 2(f) and 12(B) of the UGC act 1956]

KALIPPATTI-637501

MASTER OF SCIENCE

SYLLABUS FOR M.Sc. MATHEMATICS

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS ADMITTED FROM
THE ACADEMIC YEAR 2019 – 2020 ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE

(Autonomous)

(Affiliated to Periyar University)

Department of Mathematics

REGULATIONS FOR M.Sc. MATHEMATICS DEGREE COURSE WITH SEMESTER SYSTEM AND CBCS PATTERN (Effective from the academic year 2019-2020)

PREAMBLE:

Higher Education Provides People with an opportunity to reflect on the critical, social, economic, cultural, moral and spiritual issues facing humanity. It contributes to national development through dissemination of specialized knowledge and skill. Being at the apex of the educational pyramid, it has also a key role in producing teachers for educational system.

I - PROGRAMME EDUCATIONAL OBJECTIVES:

- Graduates are prepared to be creators of new knowledge leading to Innovation and entrepreneurship employable in various sectors such as private, government, and research organizations.
- Graduates are trained to evolve new technologies in their own Discipline.
- Exhibit continuous learning and research for the societal upliftment with human values and ethics.
- Graduates are groomed to engage in lifelong learning process by exploring their knowledge independently.
- Graduates are framed to design and conduct experiments / demos / create models to analyze and interpret data.
- Graduates ought to have the ability to communicate their findings effectively by incorporating the existing knowledge.

II - PROGRAMME OUTCOMES:

1. Higher degree of technical skills in problem solving and application development.
2. Aptitude skills that will help to take up research in pure and applied Mathematics.
3. Reasoning skills required to learn advance mathematics and Probing attitude and a search for deeper knowledge in science.
4. The relevance and applications of Mathematics in scientific phenomenon Positive approach towards Higher Education in Mathematics.
5. Employability Skills that will enable the students to explore career in Teaching and Research in Mathematics.
6. Gaining the basic with strong background to contribute more in basic research .

III – REGULATIONS:

These regulations shall take effect from the academic year 2019-2020, i.e., for the students admitted to the first year of the programme during the academic year 2019-20 and thereafter.

1. **Objectives of the programme :**

   To develop the Post Graduates in Mathematics with strong knowledge of theoretical Mathematics who can be employed in research and development units of industries and academic institutions.

2. **Eligibility for Admission:**

   Candidates who have passed B.Sc., Mathematics / B.Sc., Mathematics (Computer Applications) degree of this University or any of the above degree of any other University accepted by the Syndicate equivalent thereto, subject to such condition as may be prescribed therefore are eligible for admission to M.Sc., Degree Programme and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Mathematics of this University.

3. Duration of the Programme:

The candidates shall complete all the courses of the programme in 2 years from the date of admission. The programme of study shall consist of four semesters and a total period of two years with a minimum of 90 credits. The programme of study will comprise the courses according to the syllabus.

Candidate should complete the Programme at the maximum of n +3 years , where n denotes the duration of the programme in the same syllabi .

4. Programme of Study:

The programme of study for the PG degree programme of all branches shall consist of the following:

(i) Core courses
(ii) Electives courses
(iii) Skill Enhancement Courses
(iv) Extra Disciplinary Course
(v) Project
(vi) Enhancement Compulsory Courses.

5. Examinations:

The programme of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment - CIA) and External (End Semester) theory examinations. The theory examinations shall be conducted for three hours duration at the end of each semester. The candidates failing in any subject(s) will be permitted to appear for the same in the subsequent semester examinations.

6. Structure of the Programme:

SEMESTER: I

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-I	Algebra	M19PMA01	6	-	5	25	75	100
CORE COURSE-II	Real Analysis	M19PMA02	6	-	5	25	75	100
CORE COURSE-III	Classical Mechanics	M19PMA03	6	-	4	25	75	100
CORE COURSE-IV	Ordinary Differential Equations	M19PMA04	5	-	4	25	75	100
SOFT SKILLS-I	Latex	M19PMASS01	2	-	2	100	-	100
ELECTIVE COURSE-I	Elective-I		5	-	4	25	75	100
		Total	**30**	**-**	**24**	**225**	**375**	**600**

SEMESTER :II

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-V	Advanced Algebra	M19PMA05	6	-	4	25	75	100
CORE COURSE-VI	Advanced Real Analysis	M19PMA06	6	-	4	25	75	100
CORE COURSE-VII	Graph Theory **	M19PMA07	6	-	4	25	75	100
ELECTIVE COURSE-II	Elective-II		5	-	4	25	75	100
EXTRA DECIPLINARY COURSE	EDC		5	-	4	25	75	100
ENHANCEMENT COMPULSORY COURSE	Human Rights	M19PHR01	2	-	2	25	75	100
Additional Credit for Online Courses-I (SWAYAM / MOOC)			-	-	-	-	-	-
COMPREHENSIVE EXAMINATION -I		M19PMAC01	-	-	1	100	-	100
		Total	**30**	**-**	**23**	**250**	**450**	**700**

**** - Open book examination.**

SEMESTER:III

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-VIII	Partial Differential Equations	M19PMA08	5	-	4	25	75	100
CORE COURSE-IX	Topology	M19PMA09	6	-	5	25	75	100
CORE COURSE-X	Measure Theory and Integration	M19PMA10	6	-	5	25	75	100
CORE COURSE-XI	Complex Analysis	M19PMA11	6	-	5	25	75	100
SOFT SKILLS-II	SCI Lab	M19PMASS02	2	-	2	100	-	100
ELECTIVE COURSE-III	Elective-III		5	-	4	25	75	100
Additional Credit for Online Courses-II (SWAYAM / MOOC)			**-**	**-**	**-**	-	-	-
		Total	**30**	**-**	**25**	**225**	**375**	**600**

SEMESTER:IV

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE COURSE-XII	Functional Analysis	M19PMA12	6	-	5	25	75	100
CORE COURSE-XIII	Differential Geometry	M19PMA13	6	-	5	25	75	100
CORE COURSE-XIV	Mathematical Probability Theory **	M19PMA14	6	-	5	25	75	100
CORE PROJECT	Project	M19PMAPR1	6	-	3	40	60	100
ELECTIVE COURSE-IV	Elective-IV		6	-	4	25	75	100
COMPREHENSIVE EXAMINATION-II		M19PMAC02	-	-	1	100	-	100
		Total	**30**	**-**	**23**	**240**	**360**	**600**
		GRAND TOTAL	**120**	**-**	**95**	**940**	**1560**	**2500**

**** - Open book examination.**

Summary of Credits, Hours and Mark Distribution:

Course Category	Credits				Total Credits	Total Hours	No. of Courses	Max. Marks
	I	II	III	IV				
Core Course	18	12	18	15	63	82	14	1400
Elective Course	4	4	4	4	16	21	4	400
Soft skills	2	-	2	-	4	4	2	200
Extra Disciplinary Course	-	4	-	-	4	5	1	100
Core Project	-	-	-	4	4	6	1	100
Enhancement Compulsory Course	-	2	-	-	2	2	1	100
Comprehensive Exam	-	1	-	1	2	-	-	200
TOTAL	24	23	24	24	95	120	23	2500

ELECTIVE SUBJECTS FOR M.Sc. MATHEMATICS STUDENTS:
(Students can choose any one course from the given list)

Semester	ELECTIVE – I	
	Course Title	**Course Code**
I	Discrete Mathematics	M19PMAE01
	Number Theory	M19PMAE02
	Programming in C++	M19PMAE03
ELECTIVE – II		
	Course Title	**Course Code**
II	Numerical Analysis	M19PMAE04
	Fluid Dynamics	M19PMAE05
	Practical – C++ Lab	M19PMAE06

ELECTIVE – III		
III	**Course Title**	**Course Code**
	Calculus of Variation and Integral Equations	M19PMAE07
	Optimization Techniques	M19PMAE08
	Difference Equations	M19PMAE09
ELECTIVE – IV		
IV	**Course Title**	**Course Code**
	Design Theory	M19PMAE10
	Stochastic Process	M19PMAE11
	Fuzzy sets and Fuzzy logic	M19PMAE12

EXTRA DISCIPLINARY COURSES OFFERED FOR OTHER DEPARTMENT STUDENTS:

Semester	Course Title	Course Code
II	Quantitative Aptitude	M19EMA01
	Operation Research	M19EMA02

IV SCHEME OF EXAMINATION:

1. Question Paper Pattern for Theory Papers:

Time: Three Hours Maximum Marks: 75

Part A: (10 x 1 = 10)
Answer ALL Questions
(Two Questions from Each Unit)

Part B: (5 x 2 = 10)
Answer ALL Questions
(One Question from Each Unit)

Part C: (5 x 5 = 25)
Answer ALL Questions
(One Question From Each Unit with internal choice)

Part D: (3 x 10 = 30)
Answer Any Three Questions out of Five Questions
(One Question from Each Unit)

2. Question Paper Pattern for Practical Papers:

EXTERNAL MARK: 60
INTERNAL MARK : 40

QUESTION PATTERN

3. Distribution of Marks:

The following are the distribution of marks for external and internal for end Semester Examinations and continuous internal assessment and passing minimum marks for Theory/Practical / Project papers of PG programmes.

ESE	EA Total	Passing Minimum for EA	CIA Total	Passing Minimum for CIA	Total Marks Allotted	Passing Minimum (ESE)
Theory	75	38	25	12	100	50
Practical	60	30	40	20	100	50
Project	60	30	40	20	100	50

The following are the Distribution of marks for the Continuous Internal Assessment in Theory / Practical papers of PG programmes.

THEORY:

EVALUATION OF INTERNAL ASSESSMENT

Test	: 10 Marks
Seminar	: 05 Marks
Assignment	: 05 Marks
Attendance	: 05 Marks
Total	: 25 Marks

PRACTICAL:

EVALUATION OF INTERNAL ASSESSMENT

Test 1	: 15 Marks
Test 2	: 15 Marks
Record	: 10 Marks
Total	: 40 Marks

PROJECT:

EVALUATION OF INTERNAL ASSESSMENT

Review 1	: 10 Marks
Review 2	: 10 Marks
Review 3	: 10 Marks
Pre-Viva	: 10 Marks
Total	: 40 Marks

4. Passing Minimum:

The Candidates shall be declared to have passed the examination if he/she secures not less than 50 marks in total (CIA mark + Theory Exam mark) with minimum of 38 marks in the End Semester Theory Examinations and 12 marks for theory and 20 marks for practical/project in CIA.

The Candidates shall be declared to have passed the examination if he/she secures not less than 50 marks in total (CIA mark + Practical Exam mark) with minimum of 30 marks in the End Semester Practical Examinations.

5. Submission of Record Note Books for Practical Examinations:

Candidates appearing for practical examinations should submit a bonafide record note books prescribed for practical examinations. The candidates failed to submit the record book shall not be permitted to appear for the practical examinations

6. Project:

The following guidelines to be followed for the Project with Viva-voce:

1. The project should be valued for 60 marks by an external examiner and 20 marks for the viva –voce /evaluated continuously by both internal/external however the Viva-Voce examination should be conducted by both the external examiner appointed by the College and the internal examiner / guide/ teacher concerned.
2. The Project Report may consist a minimum of 30 pages and maximum of 60 pages.

3. The candidate has to submit the Project Report 20 days before the commencement of the IV Semester Examinations.

4. A candidate who fails in the Project/Dissertation or is absent may resubmit the report, on the same topic, with necessary modification / correction / improvements in the subsequent Even Semester Examinations for evaluation and shall undergo viva-voce Examination.

7. Note:

a) SWAYAM / MOOC – Free Online Education:

SWAYAM / MOOC is an instrument for self-actualisation providing opportunities for a life-long learning. Here the student can choose from hundreds of courses, virtually every course taught at the college level, offered by the best teachers in India and elsewhere.

The students can choose an online SWAYAM / MOOC course during their period of study which will earn an extra credit and it will be transferred to the academic records of the students.

b) Comprehensive Examination:

This examination is conducted at the end of every year. Mode of the examination is online. The questions are of objective type and they cover the entire year's syllabus.

c) Open Book Examination:

- Students can bring their own book material for examinations.
- Electronic gadgets are not allowed.

SEMESTER-I

Core-I	M.Sc. Mathematics	2019 - 2020
Code:M19PMA01	ALGEBRA	
Credits: 5		

Objectives:

This course introduces fundamental and advanced level concepts of Algebra. It covers concepts such as Sylows theorem, Direct product, Ideals and Quotient Rings, The field of Quotients of an Integral Domain, Euclidean Rings, Polynomial rings, Vector spaces, Dual spaces, Inner product spaces& modules. It provides technical skills to understand and develop various ideas about algebra.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of various Characterizations in groups. Understand the concept of Sylows theorem.	K1
CO2	Understand the concepts of Direct product, Ideals and Quotient Rings,	K2
CO3	Analyze the field of Quotients of an Integral Domain, Euclidean Rings.	K4
CO4	Develop the Polynomial rings and its theorems.	K3
CO5	Apply the concepts to Vector spaces, Dual spaces, Inner product spaces& modules.	K3

Unit I:

Another counting principle, Sylows theorem.

Unit II:

Direct product , finite abelian groups , Ideals and Quotient Rings, more Ideals and Quotient Rings.

Unit III:

The field of Quotients of an Integral Domain.Euclidean Rings, A particular Euclidean Ring.

Unit IV:

Polynomial rings – rings over rational field rings over commutative ring.

Unit V:

Vector spaces – Dual spaces – Inner product spaces & modules.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Topics in Algebra	I.N. Herstein	John Wiley and sons, Second Edition	1999

Chapter 2: Sections 2.11, 2.12, 2.13, 2.14.

Chapter 3: Sections 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11

Chapter 4: Sections 4.3 to 4.5)

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Algebra	S.Lang	3rd Edition, Addison Wesley	1993
2	A first course in abstract Algebra	John B.Fraleigh	Addison Wesley	1982
3	Algebra	M.Artin	Prentice Hall of India, NewDelhi.	1991

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	M	M	S	S
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

SEMESTER-I

Core-II	M.Sc. Mathematics	2019 – 2020
Code:M19PMA02	REAL ANALYSIS	
Credits: 5		

Objectives:

This course introduces fundamental and advanced level concepts in Real Analysis. It covers concepts such as Basic Topology, Countable, Compact Sets, Perfect sets, Connected sets, Cauchy Sequences, Some special sequences, Numerical Series, Power series, Summation by Parts, Addition and Multiplication of series, Rearrangement Theorems, Continuity, Continuity and Compactness, Continuity and Connectedness, Differentiation, The Continuity of Derivatives, L'Hospital's Rule & Taylor's Theorem. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of various Characterizations in Basic Topology, Countable, Compact Sets, Perfect sets, Connected sets.	K1
CO2	Understand the concepts of Cauchy Sequences and Some special sequences.	K2
CO3	Analyze the field of Numerical Series, Power series, Summation by Parts, Addition and Multiplication of series, Rearrangement Theorems.	K3
CO4	Develop the Continuity, Continuity and Compactness, Continuity and Connectedness.	K4
CO5	Apply the concepts to Differentiation, The Continuity of Derivatives, L'Hospital's Rule & Taylor's Theorem.	K3

UNIT – I:

Basic Topology – Finite, countable, and Uncountable sets – Metric Spaces – Compact Sets –Perfect sets – connected sets.

UNIT –II:

Numerical Sequences – Convergent sequences – Cauchy Sequences – Upper and Lower Limits – Some special sequences.

UNIT-III:

Numerical Series – Series of nonnegative Terms – The Number e– The Root and Ratio Test –Power series – Summation by Parts – Absolute Convergence – Addition and Multiplication of series – Rearrangement Theorems.

UNIT-IV:

Continuity – Limits of Functions – Continuous Functions – Continuity and Compactness –Continuity and Connectedness.

UNIT-V:

Differentiation – The Derivative of a Real function – Mean Value Theorems – The Continuity of Derivatives – L'Hospital's Rule – Derivative of Higher Orders – Taylor's Theorem.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Principles of Mathematical Analysis, 3rd edition	Walter Rudin	MC Graw Hill Book Co., Kogaskusha	1976

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Mathematical Analysis	T.M. Apostol	Narosa Publ. House, New Delhi	1985
2	Real Analysis	H.L. Royden	Macmillan Publ. Co. Inc. 4th edition, New York	1993
3	Mathematical Analysis	V. Ganapathy Iyer	Tata McGraw Hill, New Delhi	1970

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	S	S	M	S	S
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

SEMESTER-I

Core-III	M.Sc. Mathematics	2019 – 2020
Code:M19PMA03	CLASSICAL MECHANICS	
Credits: 4		

Objectives:

This course introduces fundamental concepts in classical mechanics. It covers concepts such as Mechanical Systems, Lagrange's Equations, Hamilton's Equation, Hamilton – Jacobi Theory and Canonical Transformation. It provides technical skills to understand and develop various ideas about mechanics.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of various Characterizations in Mechanical Systems.	K1
CO2	Analyze the Lagrange's Equation and its problems.	K3
CO3	Understand the concepts of Hamilton's Equation and its problems.	K2
CO4	Develop the Hamilton – Jacobi Theory and its problem.	K4
CO5	Apply the concepts Canonical Transformation and its characterization	K3

Unit I: Mechanical Systems:

The Mechanical System – Generalized co–ordinates – Constraints – Virtual work – Energy and Momentum.

(Chapter 1 Sections 1.1 to 1.5)

Unit II: Lagrange's Equations:

Lagrange's Equation – Derivation of Lagrange's Equations – Examples – Integrals of motion.

(Chapter 2 Sections 2.1 to 2.3)

Unit III: Hamilton's Equation:

Hamilton's Equation – Hamiltons Principle – Hamilton's Equation – Other Variational Principle.

(Chapter 4 Sections 4.1 to 4.3)

Unit IV: Hamilton – Jacobi Theory:

Hamilton – Jacobi Theory – Hamilton Principle Function – Hamilton – Jacobi Equation – Separability.

(Chapter 5 Sections 5.1 to 5.3)

Unit V: Canonical Transformation:

Canonical Transformation – Differential forms and generating functions – Special Transformations – Lagrange and poisson brackets.

(Chapter 6 Sections 6.1 to 6.3)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Classical Dynamics	D. Greenwood	Prentice Hall of India, New Delhi	1985

REFERENCE BOOKS :

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Classical Mechanics	H.Goldstein	Narosa Publishing House, NewDelhi	2001
2	Principles of Mechanics	J.L. Synge and B.A. Griffth	McGraw Hill Book Co. New York	1970
3	Classical Mechanics	N.C. Rane and P.S.C. Joag	Tata McGraw Hill, New Delhi	1991

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	S	S	M	S
CO3	M	S	M	M	S
CO4	S	M	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

SEMESTER-I

Core – IV	M.Sc. Mathematics	2019 - 2020
Code:M19PMA04	ORDINARY DIFFERENTIAL EQUATIONS	
Credits: 4		

Objectives:

This course introduces fundamental concepts in ordinary differential equation. It covers concepts such as Linear Equations with Constant Coefficients, Linear Equations with Variable Coefficients, Linear Equations with Regular Singular Points and First Order Equation – Existence and Uniqueness. It provides technical skills to understand and develop various ideas about differential equations.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the Linear Equations with Constant Coefficients and related problems.	K1
CO2	Analyze Linear Equations with Constant Coefficients and its characterization.	K3
CO3	Understand the concepts of Linear Equations with Variable Coefficients and its problems.	K4
CO4	Develop the Linear Equations with Regular Singular Points and its problem.	K4
CO5	Apply the concepts First Order Equation – Existence and Uniqueness and its characterization	K3

Unit I: Linear Equations with Constant Coefficients:

Introduction – Second order homogeneous equations – Initial value problem – Linear dependence and independence – A formula for the Wronskian. (Chapter 2: Section 1 to 5)

Unit II: Linear Equations with Constant Coefficients (Contd.):

Non-homogeneous equations of order two – Homogeneous and non-homogeneous equations of order n – Initial value problem – Annihilator method to solve a non-homogeneous equation. (Chapter 2: Section 6 to 11)

Unit III: Linear Equations with Variable Coefficients:

Initial value problems for homogeneous equations – solutions of homogeneous equations- Wronskian and linear independence – Reduction of the order ofhomogeneous equation. (Chapter 3: Section 1 to 5)

Unit IV: Linear Equations with Regular Singular Points:

Linear equation with regular singular points – Euler equation – second order equations with regular singular points – solutions and properties of Legendre and Bessel's equation.

(Chapter 3: Section 8 & Chapter 4: Section 1 to 4 and 7 and 8)

Unit V: First Order Equation – Existence and Uniqueness:

Introduction – Existence and uniqueness of solutions of first order equations – Equations with variable separated – Exact equations – Method of successive approximations – Lipchitz Condition – Convergence of the successive approximations. (Chapter 5: Section 1 to 6)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1.	An Introduction to Ordinary Differential Equation	E.A.Coddington	Prentice Hall of India, New Delhi	1994

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1.	Ordinary and Partial differential Equations	M. D. Raisinghania	S Chand & Co. New Delhi	2012
2.	Essentials of Ordinary Differential Equation	R.P Agarwal and Ramesh C.Gupta	McGraw, Hill, New York	1991
3.	Ordinary Differential Equations	D.Somasundram	Narosa Publ.House, Chennai	2002

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	S	M	M	S
CO3	S	M	M	S	M
CO4	S	M	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

SEMESTER-I

Soft skills-I	**M.Sc. Mathematics**	**2019 - 2020**
Code:M19PMASS01	**LATEX**	
Credits: 2		

Objectives:

This course introduces fundamental concepts in Latex theory. It covers concepts such as Basic LaTex , Sample document and Key Concepts, type style , environments , Lists , Contering , tables , verbatim , vertical and horizontal spacing, Typesetting Mathematics, Equation environments, Fonts, hats and underlining, braces, arrays and matrices, Math miscellaxy, Math Styles, Bold Math, Symbols for number sets, binomial coefficient, classes and the overall structure, titles for documents, Sectioning commands, Spacing, Accented characters , Dashes and hyphens, quotation marks , Pinpointing the error, common errors and warning messages. It provides technical skills to understand and develop various ideas about document preparation.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	**Statement**	**Knowledge Level**
CO1	Identify the logic behind the Basic LaTex , Sample document and Key Concepts, type style , environments , Lists , Cantering , tables , verbatim , vertical and horizontal spacing	K1
CO2	Analyze the typesetting Mathematics, Equation environments, Fonts, hats and underlining, braces, arrays and matrices and its characterization.	K3
CO3	Understand the concepts of Math miscellany, Math Styles, Bold Math, Symbols for number sets, binomial coefficient, classes and the overall structure	K3
CO4	Develop the titles for documents, Sectioning commands, Spacing, Accented characters ,.	K4
CO5	Apply the concepts Dashes and hyphens, quotation marks , Pinpointing the error, common errors and warning messages	K3

UNIT I:

Basic LaTex – Sample document and Key Concepts – type style – environments – Lists – Contering –tables – verbatim – vertical and horizontal spacing.
(Chapter 2 Sections 2.1. to 2.4.)

UNIT II:

Typesetting Mathematics – Examples – Equation environments – Fonts, hats and underlining – braces – arrays and matrices – Customized commands – theorems like environments.
(Chapter 3 Sections3.1. to 3.7.)

UNIT III:

Math miscellany – Math Styles – Bold Math – Symbols for number sets – binomial coefficient.
(Chapter 3 Sections 3.8)

UNIT IV:

Further essential LaTex – Document classes and the overall structure – titles for documents – Sectioning commands.
(Chapter 4 Sections 4.1. to 4.3.)

UNIT V:

Miscellaneous extras – Spacing – Accented characters – Dashes and hyphens – quotation marks – trouble shooting – Pinpointing the error – common errors – warning messages.
(Chapter 4 Sections4.4 to 4.5.)

TEXT BOOK:

David F Griffiths and Desmond J. Higham, Learning LaTex, SIAM (Society for Industrial and Applied Mathematics) Publishers, Phidel Phia, 1996.

REFERENCE BOOKS:

1. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study, Practice, and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.
2. L. Lamport. LATEX: A Document Preparation System, User's Guide and ReferenceManual. Addison-Wesley, New York, second edition, 1994.

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	M	S	S	M
CO3	S	S	M	S	M
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

SEMESTER-I

Elective-I	**M.Sc. Mathematics**	**2019 – 2020**
Code:M19PMAE01	**DISCRETE MATHEMATICS**	
Credits: 4		

Objectives:

This course focuses on discrete concepts and to develop a set theory application. It implements the concepts such as Theory of inference, Set Theory, Algebraic Structures, Lattices and Boolean algebra, Graph Theory. In addition, it also covers the methods to process the set construction.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	**Statement**	**Knowledge Level**
CO1	Define the Theory of inference concepts for building theory based applications.	K1
CO2	Illustrate the Set Theory and related results.	K2
CO3	Demonstrate the Algebraic Structures.	K3
CO4	Implement Lattices and Boolean algebra ideas.	K3
CO5	Apply the Graph Theory concept and its theorem.	K3

Unit I: Theory of inference:

Consistency of premises validity using truth table – Consistency of premises – Predicates –Statement function, Variables and quantifiers – Predicate formulae – Free and bound variables – Theory of inference for the predicate calculus .

(Chapter 1: Sections 1- 4.1, 1 - 4.2, 1 - 5.1, 1 - 5.2,1 - 5.3, 1 - 5.4, 1 - 6.4)

Unit II: Set Theory:

Functions – Definition and introduction – Composition of functions – Inverse functions – Binary and n-ary Operations – Characteristic function of a set – Hashing functions – Peuno axioms and mathematical induction – Cardinality.

(Chapter 2: 2 - 4.1, 2 - 4.2, 2 – 4.3, 2 – 4.4,2 – 4.5, 2 – 4.6, 2 – 5.1, 2 – 5.2)

Unit III: Algebraic Structures:

Groups: Definition and Examples – Subgroups and homomorphism – Co-sets and Lagrange's Theorem – Normal subgroups – Algebraic systems with Two Binary Operations.

(Chapter 3 : Sections 3 – 5.1, 3 – 5.2, 3 – 5.3, 3 – 5.4, 3 – 5.5)

Unit IV: Lattices and Boolean algebra:

Lattices as Algebraic Systems – Sub lattices, direct product and homomorphism – Boolean Algebra Definition and examples – Sub Algebra. Direct Product and homomorphism – Boolean functions, Boolean forms and free Boolean Algebras – Values of Boolean expression and Boolean functions.

(Chapter 4: Sections 4 – 1.3, 4 – 1.4, 4 – 2.2, 4 – 3.4, 4 – 3.2)

Unit V: Graph Theory:

Basic definitions – Paths – Rechability and Connectedness – Matrix representation of Graphs – Trees – Finite state machine: Introductory special circuits – Equivalence of finite state machines.

(Chapter 5: 5 – 1.1, 5 - 1.2, 5 – 1.3, 5 – 1.4) and

(Chapter 4: Sections 4 – 6.1, 4 – 6.2)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Discrete Mathematical Structures applications to Computer Science	J.P. Trembley and R.Manohar	Tata McGraw Hills, New Delhi	1997

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Sets, Lattices and Boolean algebra	James C.Abbott	Allya and Bacon Boston	1969
2	Boolean Algebra and its applications	H.G.Flegg	John Wiley and Sons, Inc, NewYork	1974

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	M
CO5	S	M	S	M	S

S- Strong; **M**-Medium.

SEMESTER-I

Elective – I	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE02	NUMBER THEORY	
Credits: 4		

Objectives:

This course introduces fundamental concepts in number theory. It covers concepts such as divisibility and prime numbers, congruence's and congruence's with a prime power modulus, Euler's function and the group of units, quadratic residues and arithmetic function. It provides technical skills to understand and develop various ideas about number analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the divisibility and prime numbers and related problems.	K1
CO2	Analyze congruence's and congruence's with a prime power modulus and its characterization.	K3
CO3	Understand the concepts of Euler's function and the group of units and its problems.	K3
CO4	Develop the quadratic residues and its problem.	K4
CO5	Apply the concepts arithmetic function and its characterization	K3

UNIT I DIVISIBILITY AND PRIME NUMBERS:

Divisors – Bezouts identity – Least common multiples – Linear Diophantine equations – Prime numbers & Prime – Power Factorizations – Distribution of primes – Fermat and Mersenne primes – Primality – Testing and Factorization.Chapter 1: Sec: 1.1-1.4 & Chapter 2: Sec: 2.1-2.4.

UNIT II CONGRUENCES AND CONGRUENCES WITH A PRIME POWER MODULUS:

Modular arithmetic - Linear congruences – Simultaneous Linear congruences – Simultaneous non- linear congruences- An extension of the Chinese remainder theorem – The arithmetic of Z_p – Pseudoprimes & Carmichael numbers - Solving Congruences mod (P^e) .Chapter 3: Sec: 3.1-3.5 & Chapter 4: Sec: 4.1-4.3

UNIT III EULERS FUNCTION AND THE GROUP OF UNITS :

Units – Euler's function – Applications of Eulers function – The group U_n – Primitive roots – The group U_2^e - The existence of primitive roots – The algebraic structure of U_n - The universal exponent. Chapter 5: Sec: 5.1-5.3 & Chapter 6: Sec: 6.1-6.8.

UNIT IV QUADRATIC RESIDUES:

Quadratic congruence's – The group of quadratic residues – The Legendre symbol – Quadratic reciprocity – Quadratic residues for prime power moduli – Quadratic residues for arbitrary moduli. Chapter 7: Sec: 7.1-7.6.

UNIT V ARITHMETIC FUNCTION:

Definition & Examples – Perfect numbers –The mobius inversion formula - Properties of the mobius function – The Dirichlet product . Chapter 8: Sec: 8.1-8.6.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1.	Elementary Number Theory	Gaveth A. Jones & J.Mary Jones	Springer India Pvt Ltd	1998

REFERENCE BOOKS :

S.No	Title of the Book	Author	Publisher	Year of Publication
1.	Beginning Number Theory	Neville Robbins	Springer India Pvt Ltd	1998
2.	Number Theory	Burton		

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	M	M	S	M	S
CO3	S	M	M	S	M
CO4	S	S	S	M	S
CO5	S	S	M	M	S

S- Strong; **M**-Medium.

SEMESTER-I

Elective - I	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE03	Programming in C++	
Credits: 4		

Objectives:

The course provides an introduction to object-oriented programming using C++ language. It provides the concepts such as data abstractions, classes, inheritance, method overloading and overriding, generic programming and standard template library. It enables the students to apply these features in program design and implementation.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define structure and object oriented problem solving approaches.	K1
CO2	Infer classes and objects for a given problem.	K2
CO3	Describe the constructors, destructors and type conversions for the problems .	K2
CO4	Illustrate the code reusability and extensibility by means of Inheritance and Polymorphism.	K3
CO5	Apply the concepts in file operations.	K3

Unit I:

Software Evolution – Procedure oriented Programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of oops – Object oriented Languages – Application of OOP – Beginning with C++ - what is C++ - Application of C++ - A simple C++ Program – More C++ Statements – An Example with class – Structure of C++ Program.

Unit II:

Token, Expressions and control structures: Tokens – Keywords – Identifiers and Constants – Basic Data types – User defined Data types – Derived data types – Symbolic Constants in C++ - Scope resolution operator – Manipulators – Type cost operator – Expressions and their types – Special assignment expressions – Implicit Conversions – Operator Overloading – Operator precedence – Control Structure.

Unit – III: Function in C++:

Main Function – function prototyping – Call by reference – Return by reference – Inline functions – default arguments – Const arguments – Function overloading – Friend and Virtual functions – Math library function.

Class and Objects:

Specifying a class – Defining member functions – A C++ program with class – Making an outside function inline – Nesting of member functions – Private member functions – Arrays within a class – Memory allocations for objects – Static data member – Static member functions – Array of the object – Object as function arguments – Friendly functions – Returning objects – Const member functions – Pointer to members – Local classes.

Unit IV: Constructors and Destructors:

Constructors – Parameterized Constructors in a Constructor – Multiple constructors in a class – Constructors with default arguments – Dynamic Initialization of objects – Copy constructors – Dynamic Constructors – Constructing Two-dimensional arrays – Const objects -– Destructors. Operator overloading and type conversions: Defining operator overloading – overloading unary operators – overloading binary operators - overloading binary operators using friends – Manipulation of strings using operators – Rules for overloading operators – Type conversions.

Unit V: Files:

Introduction – Class for file stream operations – opening and closing a file – detecting End-of file – More about open () File modes – File pointer and their manipulations – Sequential input and output operations. Exception Handling: Introduction – Basics of Exception Handling – Exception Handling Mechanism – Throwing Mechanism – Catching Mechanism – Rethrowing an Exception.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Object-Oriented Programming with C++ 2nd Edition	E.Balagrurusamy	Tata McGraw Hill Pub.	1999

REFERENCES BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	The Waite Group's Object Oriented Programming In Turbo C++	Robert Lafore	Galgotia Publication Pvt. Ltd	1998

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	M	S	S	M	S
CO3	S	M	S	S	S
CO4	S	S	M	S	S
CO5	M	S	S	M	M

S- Strong; **M**-Medium.

Semester-II

Core - V	M.Sc. Mathematics	2019 - 2020
Code:M19PMA05	ADVANCED ALGEBRA	
Credits: 4		

Objectives:

This course introduces fundamental and advanced level concepts of Algebra. It covers concepts such as Field theory, Galois Theory, Finite fields, Rings and Ring Homomorphism's, Noethorian rings and Artin rings . It provides technical skills to understand and develop various ideas about algebra.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Understand the concepts of Field theory and its related results.	K2
CO2	Identify the logic behind the execution of Galois Theory and its results.	K2
CO3	Analyze the Finite fields an its theorems.	K4
CO4	Develop Rings and Ring Homomorphism's .	K3
CO5	Apply the concepts to Noethorian rings and Artin rings.	K3

Unit I: Field theory:

Extension field – roots of polynomials.

(Chapter5 Sections 5.1, 5.3)

Unit II: Galois Theory:

More about roots-Elements of Galois theory.

(Chapter 5 Section 5.5, 5.6)

Unit III

Finite fields-Wedderburn's theorem on finite division rings-A Theorem of Fresenius. (Chapter 7 Section 7.1, 7.2&7.3)

Unit IV

Rings and Ring Homomorphism's –Extension and Contraction. (Chapter I- Except Operation on Ideals)

Unit V

Primary decomposition in Noethorian rings & Artin rings

(Chapter VII & VIII)

TEXT BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Topics in Algebra 2nd Edition	I.N Herstein	John Wiley and Sons, Newyork	2003
2	Introduction to Commutative Algebra	M.F.Atiyah and I.G.Macdonald	Addison – Wesley Publication Company, Inc	1969

REFERENCES BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Algebra	S.Lang	3rd Edition, Addison Wesley	1993
2	A first course in abstract Algebra	John B.Fraleigh	Addison Wesley	1982
3	Algebra	M.Artin	Prentice Hall of India, NewDelhi	1991
4	Commutative Algebra	N.S. Gopalakrishnan	Oxonian Press Pvt. Ltd, New Delhi	1988

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	M	M	S	S
CO3	M	S	M	M	S
CO4	S	S	S	M	S
CO5	S	M	S	S	S

S- Strong; **M**-Medium;.

Semester-II

Core- VI	M.Sc. Mathematics	2019 - 2020
Code:M19PMA06	ADVANCED REAL ANALYSIS	
Credits: 4		

Objectives:

This course introduces fundamental and advanced level concepts in Real Analysis. It covers concepts such as The Riemann – steiltjes integral, Existence of the integral, properties of integral, Sequences and series of functions, Uniform Convergence, Linear transformations, the contraction principle and the implicit function theorem. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of The Riemann steiltjes integral, Existence of the integral, properties of integral.	K1
CO2	Understand the concepts of Integration & Differentiation, Integration of vector valued functions ,Rectifiable curves.	K3
CO3	Analyze the field of Sequences and series of functions, Uniform Convergence	K3
CO4	Develop the Uniform convergence & differentiation , Equicontinuous families of functions and the Stone Weierstrass Theorem.	K4
CO5	Apply the concepts to Linear transformations, the contraction principle, the implicit function theorem.	K3

Unit - I

The Riemann – Stieltjes Integral-Definition & Existence of the Integral – Properties of the integral.

Unit - II

Integration & Differentiation - Integration of vector valued functions – Rectifiable curves.

Unit – III

Sequences & Series of functions – Discussion of main problems – Uniform convergence – Uniform convergence & continuity – Uniform convergence & integration.

Unit – IV

Uniform convergence & differentiation – Equicontinuous families of functions – The Stone Weierstrass Theorem.

Unit – V

Linear transformations – Differentiations – The contraction principle – The inverse function theorem – The implicit function theorem.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Principles of Mathematical Analysis, 3rd edition	Walter Rudin	MC Graw Hill Book Co., Kogaskusha	1976

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Mathematical Analysis	T.M. Apostol	Narosa Publ. House, New Delhi	1985
2	Real Analysis	H.L. Royden	Macmillan Publ. Co. Inc. 4th edition, New York	1993
3	Mathematical Analysis	V. Ganapathy Iyer	Tata McGraw Hill, New Delhi	1970

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	S	S	S	M
CO3	M	S	M	M	S
CO4	S	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

Semester-II

Core-VII	M.Sc. Mathematics	2019 – 2020
Code:M19PMA07	GRAPH THEORY **	
Credits: 4		

**** - Open Book Examination**

Objectives:

This course focuses on graph theory concepts and to develop a graph theory application. It implements the concepts such as Graphs and Sub graphs, Trees and Connectivity, Euler Tours and Matchings, Edge Colouring and Independent sets, Vertex Colorings and planar graphs . In addition, it also covers the methods to process the graph construction.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define the Graphs and Sub graphs and tree concepts for building theory based applications.	K1
CO2	Illustrate the Connectivity and Euler Tours.	K2
CO3	Demonstrate the Matchings and Edge Colouring.	K4
CO4	Implement method for Independent sets and Vertex Colorings.	K3
CO5	Apply planar graphs and its theorem.	K3

Unit I: Graphs and Trees:

Graphs and simple graphs – Graph isomorphism – Incidence and Adjacency Matrices – Subgraphs – Vertex degrees – Paths and connection – Cycles – The shortest path problem. Trees – Cut edges and bonds – Cut vertices – Cayley's formula .

(Chapter 1 : Sections 1.1 to 1.7 and Chapter 2: Sections 2.1 to 2.4)

Unit II: Connectivity and Euler Tours:

Connectivity – Blocks - Euler Tours – Hamilton cycles

(Chapter 3: Sections 3.1 to 3.2 and Chapter 4: Sections 4.1 to 4.2)

Unit III: Matchings and Edge Colouring:

Matchings – Matching and coverings in Bipartite Graphs – Perfect Matchings - Edge Coloring – Edge Chromatic Number – Vizings Theorem .

(Chapter 5: Sections 5.1 to 5.3 and Chapter 6: Sections 6.1 to 6.2)

Unit IV: Independent sets and Vertex Colorings:

Ramsey's Theorem – Turan's Theorem- Vertex Colorings – Chromatic Number – Brook Theorem – Hajos conjecture – Chromatic Polynomials – Girth and Chromatic Number .

(Chapter 7: Sections 7.1 to 7.3 and Chapter 8 : Sections 8.1 to 8.5)

Unit V: Planar Graphs:

Plane and Planar Graphs –Dual graphs –Euler's graphs –bridges

(Chapter 9: Sections 9.1 to 9.4)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Graph Theory with Applications	J.A.Bondy and U.S.R. Murty	North Holland, New York	1982

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Graph Theory with Application to Engineering and Computer Science	Narasing Deo	Prentice Hall of India, New Delhi	2003
2	Graph Theory	F. Harary	Addison – Wesely Pub. Co. The Mass	1969
3	Graph Theory Application	L. R.. Foulds	Narosa Publ. House, Chennai	1933

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	M	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	M
CO5	S	M	S	S	S

S- Strong; **M**-Medium.

SEMESTER-II

Elective-II	M.Sc. Mathematics	2019 – 2020
Code:M19PMAE04	NUMERICAL ANALYSIS	
Credits: 4		

Objectives:

This course introduces fundamental concepts in numerical analysis. It covers concepts such as Solving Numerical Differentiation and Integration ,Numerical Solution of Ordinary Differential Equations ,Partial-Differential Equations . It provides technical skills to understand and develop various ideas about Applied Mathematics.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of solving non linear equations.	K1
CO2	Analyze Numerical Differentiation and Integration and its problems.	K3
CO3	Understand the concepts of Numerical Solution in Ordinary Differential Equations and its problems.	K3
CO4	Develop the Numerical solutions to Ordinary differential equations and its problem.	K4
CO5	Apply the concepts of Numerical solutions to partial differential equations and its characterization	K3

Unit I: Solving Nonlinear Equations:

Linear Interpolation Methods - Newton's Method - Muller's Method - Fixed-Point Iteration: **x** = g(x) Method - Multiple Roots.

(Chapter –1:Section 1.2 to 1.6) .(Problems only)

Unit II : Numerical Differentiation and Integration:

Differentiation with a Computer -Numerical Integration-The Trapezoidal Rule -Simpson's Rules.

(Chapter –5:Section 5.1 to 5.3) .(Problems only)

Unit III: Numerical Solution of Ordinary Differential Equations:

The Taylor-Series Method -The Euler Method and Its Modifications - Runge - Kutta Methods.

(Chapter –6:Section 6.1 to 6.3) .(Problems only)

Unit IV:

Higher-Order Equations and Systems -Stiff Equations -Boundary-Value Problems.

(Chapter –6:Section 6.5 to 6.7) .(Problems only)

Unit V:Partial-Differential Equations:

Elliptic Equations - Parabolic Equations - Hyperbolic Equations.

(Chapter –8:Section 8.1 to 8.3) .(Problems only)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Applied Numerical Analysis	C.F. Gerald, and P.O. Wheathy	Seventh Edition, Addison Wesley	2004

REFERENCES BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introductory methods of Numerical Analysis	S.S. Sastry	Printice of India	1995
2	Numerical Methods	V.N.Vedamurthy and Ch. S.N.Iyengar	Vikas Publishing House Pvt Ltd	1998
3	Numerical methods in Science and technology	M.K. Venkatraman	National Publichers Company	1992
4	Numerical Methods	P. Kandasamy, K. Thilagavathy, K. Gunavathy	S. Chand & Company	2003

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	S
CO2	S	M	S	M	S
CO3	M	S	M	S	S
CO4	S	M	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

Semester-II

Elective-II	M.Sc. Mathematics	2019 – 2020
Code:M19PMAE05	FLUID DYNAMICS	
Credits: 4		

Objectives:

This course introduces fundamental concepts in fluid dynamics. It covers concepts such as Streamlines and path lines, Equation of continuity, Pressure at a point in a moving fluid, Some special two dimensional flows , Impulsive motion, Stokes stream function, Some special forms of the stream function for Axis symmetric rotational motions, Stream function, Complex velocity potential for standard two-dimensional flows, Milne-Thomson circle theorem, Some hydro dynamical aspects of conformal transformation. It provides technical skills to understand and develop various ideas about mechanics.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of Streamlines and path lines, Equation of continuity.	K1
CO2	Analyze the Pressure at a point in a moving fluid, Some special two dimensional flows.	K3
CO3	Understand the concepts of Impulsive motion, Stokes stream function.	K2
CO4	Develop the Some special forms of the stream function for Axis symmetric rotational motions, Stream function.	K4
CO5	Apply the Complex velocity potential for standard two-dimensional flows, Milne-Thomson circle theorem, Some hydro dynamical aspects of conformal transformation.	K3

UNIT I :

Real fluids and ideal fluids - Velocity of a fluid at a point - Streamlines and path lines - Steady and unsteady flows. Velocity potential - Vorticity vector - Local and particle rates of change - Equation of continuity - Worked examples - Acceleration of a point of a fluid.

UNIT II:

Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Conditions at a boundary of two inviscid Immissible fluids - Euler's equations of motion - Bernoulli's equation – Worked examples - Some flows involving axial symmetry - Some special two dimensional flows – Impulsive motion.

UNIT III:

Some three dimensional flows - Sources, sinks and doublets - Images in a rigid infinite plane -Axis-symmetric flows - Stokes stream function - Some special forms of the stream function for Axissymmetric irrotational motions.

UNIT IV:

Two dimensional flow - Use of cylindrical polar coordinates - Stream function. Complex potential for two-dimensional irrotational - Incompressible flow - Complex velocity potential for standard two-dimensional flows - Uniform stream, line sources and line sinks, line doublets, line vortices - Worked examples.

UNIT V :

Two dimensional image systems – Milne-Thomson circle theorem - Some applications of the circle theorem - Extension of the circle theorem - Theorem of Blasius - Use of conformal transformation– Some hydro dynamical aspects of conformal transformation - Worked example.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Textbook of Fluid Dynamics	F. Chorlton	CBS Publication and Distribution	2004

UNIT I Chapter 2 Sections 2.1 to 2.9

UNIT II Chapter 3 Sections 3.1 to 3.6, 3.9 to 3.11

UNIT III Chapter 4 Sections 4.1 to 4.3, 4.5, 4.5.1

UNIT IV Chapter 5 Sections 5.1 to 5.6

UNIT V Chapter 5 Sections 5.7 to 5.10.2

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Fluid Dynamics	M.D. Raisinghania	S. Chand	1982
2	An Introduction to Fluid Mechanics	G.K. Batchelor	Foundation Books	1984

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	M	S	S	M	S
CO3	M	S	M	M	S
CO4	S	M	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

Semester-II

Elective-II	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE06	Practical- C++ Lab	
Credits: 4		

Objectives:

This course focuses on object oriented concepts and to develop an application. It implements the concepts such as inheritance, polymorphism, dynamic binding and generic structures to build reusable code. It enables the students to write programs using C++ features such as composition of objects, operator overloads, dynamic memory allocation, file I/O and exception handling. In addition, it also covers the methods to process the biological database.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define the object oriented concepts for building object based applications.	K1
CO2	Illustrate the different logic with suitable validation using control structures, classes and objects.	K2
CO3	Demonstrate the Constructor, Destructor and Inheritance.	K3
CO4	Implement method overloading and method overriding for different user specification.	K3
CO5	Apply programming skills to experiment Protein sequence.	K3

Practical Problems:

1. Create two classes DM and DB, which store the value of distances. DM stores distances in meters and centimeters in DB in feet and inches. Write a program that can create the values for the class objects and add object DM with another object DB.
2. Create a class FLOAT that contains on float data member overload all the four arithmetic operators so that operates on the objects of FLOAT.
3. Design a class polar, which describes a part in a plane using polar coordinates radius and angle. A point in polar coordinates is as shown below. Use the overloads +operator to add two objects of polar. Note that we cannot add polar values of two points directly. The requires first the conversion points into rectangular coordinates and finally creating the result into polar coordinates. [Where rectangle co-ordinates: x = r* cos(a); y = r* sin(a) Polar co-ordinates: a = atan (x/y) r = Sqrt (x*x + y*y)]
4. Create a class MAT of size m*m. Define all possible matrix operations for MAT type objects verify the identity. (A-B)^2+B^2-2*A*B.
5. Area computation using derived class.
6. Define a class for vector containing scalar values. Apply overloading concepts for vector additions, multiplication of a vector by a scalar quantity, replace the values in a position vector.
7. Integrate a function using Simson's 1/3 rule.
8. Solve the system of equations using Guass Sedel method.
9. Solve differential equations using Runge Kutta forth order method.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Object-Oriented Programming with C++ 2nd Edition	E.Balagrurusamy	Tata McGraw Hill Pub.	1999

REFERENCE BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	The Waite Group's Object Oriented Programming In Turbo C++	Robert Lafore	Galgotia Publication Pvt. Ltd	1998

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	M	S	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S

S- Strong; **M**-Medium.

SEMESTER-II

ECC	M.Sc Mathematics	2019 - 2020
Code :M19PHR01	HUMAN RIGHTS	
Credits: 2		

Objective:

To impart the basic ideas about human rights at post graduation level. This paper provides different aspects of human rights which includes children and women. students can learn not only their basic rights but also can understand the duties to be carried out in the days to come.

UNIT I: Introduction to Human Rights:

Human rigths: Meaning- Definitions – Original and growth of Human rights in the world – Need and Types of Human rights – UNHRC (United Nations Human Rights Commission) – Human rights in india.

UNIT II: Classification of Human Rights:

Right to Liberty – Right to Life – Right to Equality – Right to Dignity – Right Against Exploitation – Educational Rights – Cultural Rights – Educational Rights – Economic Rights – Political Rights – Social Rights.

UNIT III: Rights of Women and Children:

Rights of Women– Female Feticide and infanticide and Selective abortion– Physical assault and Sexual Harassment– Domestic Violence-violence at work place – Remedial Measures.Rights Of Children-Protection Rights ,Survival Rights – Participation Rights – Development Rights – Role of UN on convention on Rights of Children.

UNIT IV: Multi-Dimensional aspects of Human Rights:

Labour Rights –Bodent Labour – Child Labour – Contract Labour – Mirgrant Labour – Domestic Woman Labour – Gender Equity – Rights of Ethnic Refugees – Problems and Remedies – Roles of Trade Union in Protecting the unorganized Labourers.

UNIT V: Grievance and Rederssal Mechanism:

Rederssal Mechanisms at national and international levels – Structure and Functions of national and State level Human rights commission - Constitutional Remedies and Directive principles of state p[olicy.

REFERENCE BOOKS:

1) Baradat sergio and Swaronjali ghosh**.** Teaching of Human Rights: Dominant Publishers and distributers, New Delhi ,2009.
2) Roy A. N Human Rights acchivements and Challengers : Vista International publishing house , Delhi, 2005.
3) Asish Kumar Das and Prasanth kumar Mohanty. Human Rights in India: Sarup and Sons . New Delhi,2007.
4) Bani borgohain. Human Rights social Justiece and political challenge. Kanishka publishers and distributers, new delhi,2007
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6) Meena, P K Human Rights Theory and practice: Murali Lal and sons, New Delhi, 2008.
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Semester-III

Core-VIII	M.Sc. Mathematics	2019 – 2020
Code:M19PMA08	PARTIAL DIFFERENTIAL EQUATIONS	
Credits: 4		

Objectives:

This course introduces fundamental concepts in partial differential equation. It covers concepts such as Second order Partial Differential Equations, Elliptic Differential Equations, Parabolic Differential Equations, Hyperbolic Differential Equations and Integral Transform. It provides technical skills to understand and develop various ideas about partial differential equations.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the Second order Partial Differential Equations and related problems.	K1
CO2	Analyze Elliptic Differential Equations and its characterization.	K3
CO3	Understand the concepts of Parabolic Differential Equations and its problems.	K4
CO4	Develop the Hyperbolic Differential Equations and its problem.	K4
CO5	Apply the Integral Transform and its characterization	K3

Unit I: Second order Partial Differential Equations:

Origin of second order partial differential equations – Linear differential equations with constant coefficients – Method of solving partial (linear) differential equation – Classification of second order partial differential equations – Canonical forms – Adjoint operators – Riemann method. (Chapter 2 : Sections 2.1 to 2.5)

Unit II: Elliptic Differential Equations:

Elliptic differential equations – Occurrence of Laplace and Poisson equations – Boundary value problems – Separation of variables method – Laplace equation in cylindrical – Spherical co-ordinates, Dirichlet and Neumann problems for circle – Sphere. (Chapter 3 : Sections 3.1 to 3.9)

Unit III: Parabolic Differential Equations:

Parabolic differential equations – Occurrence of the diffusion equation – Boundary condition – Separation of variable method – Diffusion equation in cylindrical – Spherical co-ordinates .(Chapter 4: Sections 4.1 to 4.5)

Unit IV: Hyperbolic Differential Equations:

Hyperbolic differential equations – Occurrence of wave equation – One dimensional wave equation – Reduction to canonical form – D'Alembertz solution – Separation of variable method – Periodic solutions – Cylindrical – Spherical co-ordinates – Duhamel principle for wave equations. (Chapter 5 : Sections 5.1 to 5.6 and 5.9)

Unit V: Integral Transform:

Laplace transforms – Solution of partial differential equation – Diffusion equation – Wave equation – Fourier transform – Application to partial differential equation – Diffusion equation – Wave equation – Laplace equation. (Chapter 6 : Sections 6.2 to 6.4)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Partial Differential Equation for Engineers and Scientist	J.N. Sharma and K.Singh	Narosa publ. House, Chennai	2001

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Ordinary and Partial differential Equations	M. D. Raisinghania	S Chand & Co. New Delhi	2012
2	Elemetns of Partial Differeential Equations	I.N.Snedden	McGraw Hill, New York	1964
3	Introduction to partial Differential Equations	K.Sankar Rao	Prentice Hall of India, New Delhi	1995

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	S	M	M	S
CO3	S	M	M	S	M
CO4	S	M	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

Semester-III

Core-IX	M.Sc. Mathematics	2019 - 2020
Code:M19PMA09	TOPOLOGY	
Credits: 5		

Objectives:

This course introduces fundamental and advanced level concepts in Analysis. It covers concepts such as Topological spaces, product of spaces, Identification and Quotient spaces, Homotopy and Isotopy, Separation axioms, Compactness, Connectedness, Pathwise connectedness, Impedding theorems, Extension theorems , Compactifications, Hereditary Properties. It provides technical skills to understand and develop various ideas about topology.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of Topological spaces, product of spaces.	K1
CO2	Understand the concepts of Identification and Quotient spaces, Homotopy and Isotopy.	K2
CO3	Analyze the Separation axioms, Compactness.	K3
CO4	Develop the Connectedness, Pathwise connectedness, Impedding theorems.	K4
CO5	Apply the concepts to Extension theorems , Compactifications, Hereditary Properties.	K3

UNIT I:

Topological spaces – Sets in a space – Maps – Subspaces - Sum and product of spaces.

UNIT II:

Identification and Quotient spaces – Homotopy and Isotopy.

UNIT III:

Separation axioms and Compactness.

UNIT IV:

Connectedness – Pathwise connectedness –Imbedding theorems.

UNIT V:

Extension theorems – Compactifications – Hereditary Properties.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introduction to topology	S.T.Hu	McGraw- Hill, New Delhi	1979

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Topology	J. Dugundji	Prentice Hall of India, New Delhi	1975
2	Introduction to Topology and Modern Analysis	G.F.Simmons	McGraw Hill Book Co, New York	1963
3	Elements of General Topology	S.T. Hu	Holden Day, Inc. New York	1965

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	S	S	M	S	S
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

Semester-III

Core- X	M.Sc. Mathematics	2019 – 2020
Code:M19PMA10	MEASURE THEORY AND INTEGRATION	
Credits: 5		

Objectives:

This course introduces fundamental and advanced level concepts in Analysis. It covers concepts such as Lebesgue Measure, Lebesgue integral, Differentiation and Integration, General Measure and Integration, Measure and Outer Measure. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Find the logic behind the execution of Lebesgue Measure.	K1
CO2	Understand the concepts of Lebesgue integral and related problems.	K4
CO3	Analyze Differentiation and Integration.	K3
CO4	Develop the concept of General Measure and Integration.	K3
CO5	Apply the concepts to Measure and Outer Measure.	K3

Unit I: Lebesgue Measure:

Lebesgue Measure – Introduction – Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Little Woods' Three Principle.

(Chapter 3: Sections 1 to 3, 5 and 6)

Unit II: Lebesgue integral :

Lebesgue integral – The Riemann integral – Lebesgue integral of bounded functions over a set of finite measure – The integral of a nonnegative function – The general Lebesgue integral.

(Chapter 4: Sections 1 to 4)

Unit III: Differentiation and Integration :

Differentiation and Integration – Differentiation of monotone functions – Functions of bounded variation – Differentiation of an integral – Absolute continuity.

(Chapter 5: Sections 1 to 4)

Unit IV : General Measure and Integration :

General Measure and Integration – Measure spaces – Measurable functions – integration – Signed Measure – The Radon – Nikodym theorem.

(Chapter 11: Sections 1 to 3, 5 and 6)

Unit V: Measure and Outer Measure

Measure and outer measure – outer measure and measurability – The Extension theorem – Product measures.

(Chapter 12: Sections 1, 2 and 4)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Real Analysis	H.L.Royden	Mc Millian Publ. Co, New York	1993

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Measure Theory and Integration	G. de Barra	Wiley Eastern Ltd	1981
2	Lebesgue Measure and Integration	P.K. Jain and V.P. Gupta	New Age Int. (P) Ltd., NewDelhi	2000
3	Real and Complex Analysis	Walter Rudin	Tata McGraw Hill Publ. Co. Ltd., New Delhi	1966

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	M	S	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Semester-III

Core – XI	M.Sc. Mathematics	2019 – 2020
Code:M19PMA11	COMPLEX ANALYSIS	
Credits: 5		

Objectives:

This course introduces fundamental and advanced level concepts in complex Analysis. It covers concepts such as Complex Functions, Analytical Functions as Mappings, Complex Integration, Fundamental Theorems, Harmonic functions and Power series expansions. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Find the logic behind the execution of Complex Functions and its properties.	K1
CO2	Understand the concepts of Analytical Functions as Mappings and related problems.	K4
CO3	Analyze Complex Integration, Fundamental Theorems.	K3
CO4	Develop the concept of complex integration.	K3
CO5	Apply the concepts to Harmonic functions and Power series expansions.	K3

Unit I : Complex Functions:

Limits and continuity – Analytic Functions – Polynomials – Rational functions . Elementary theory of Power series : Sequences – Series – Uniform Convergence – Power series – Abel's limit Theorem.

(Chapter 2 : Sections 1 to 2)

Unit II : Analytical Functions as Mappings:

Conformality: Arcs and closed curves – Analytic functions in Regions – Conformal mapping – Length and area . Linear transformations : Linear group – Cross ratio – Symmetry –Oriented Circles –Families of circles . (Chapter 3 : Sections 2 to 3)

Unit III : Complex Integration Fundamental Theorems:

Line integrals –Rectifiable Arcs-Line Integrals as Arcs – Cauchy's Theorem for a Rectangle and in a disk. Cauchy's Integral Formula: Index of point with respect to a closed curve- The Integral formula – Higher order derivatives .Local properties of analytic functions: Taylor's Theorem – Zeros and Poles – Local mapping - Maximum Principle. (Chapter 4 : Sections 1 to 3)

Unit IV : Complex Integration (Contd.):

The general form of Cauchy's Theorem: Chains and Cycles – Simple connectivity – Homology – General statement of cauchy's theorem – Proof of Cauchy's theorem – Locally exact differentials – Multiply connected regions – Calculus of residues – Residue Theorem – Argument Principle-Evaluation of Definite Integrals. (Chapter 4 : Sections 4 and 5)

Unit V : Harmonic functions and Power series expansions:

Harmonic Functions: Definition and basic properties- Mean-Value Property-Poisson's formula's –Schwarz's Theorem . Reflection Principle : Weierstrass's theorem- Taylor's series –Laurent series. (Chapter 4 : Sections 6 and Chapter 5 : Sections 1)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Complex Analysis, 3rd edition	L.V Ahlfors	Mc Graw Hill Inter., Edition, New Delhi	1979

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Functions of one Complex variable	J.B Conway	Narosa Publ. House, New Delhi	1980
2	Foundations of Complex Analysis	S.Ponnusamy	Narosa Publ. House, New Delhi	2004
3	Complex-Analysis	S.Lang	Addison – Wesley Mass	1977

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	M	S	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Semester-III

Soft Skills-II	M.Sc. Mathematics	2019 – 2020
Code:M19PMASS02	SCILAB	
Credits: 2		

Objectives:

This course introduces fundamental concepts in Scilab theory. It covers concepts such as Learning Scilab, Starting Scilab, Typing Commands, Basic Arithmetic, Complex Numbers, Help in Scilab, The Help Command, The Help Window , Help on the Web, Adding a Line, Hints for Good Graphs, Plot data as points, Choose a good scale, Solving Equations, Matrices and Vectors, Creating Matrices, Systems of Equations, Polynomials, Graphs Function Plotting, Printing Graphs, Component Arithmetic, Graphs in Reports, and Advanced Graphics. It provides technical skills to understand and develop various ideas about document preparation.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind Learning Scilab, Starting Scilab, Typing Commands	K1
CO2	Analyze basic Arithmetic, Complex Numbers, Help in Scilab, The Help Command, The Help Window , Help on the Web and its characterization.	K3
CO3	Understand the concepts of Adding a Line, Hints for Good Graphs, Plot data as points, Choose a good scale.	K3
CO4	Develop the Solving Equations, Matrices and Vectors, Creating Matrices, Systems of Equations, Polynomials.	K4
CO5	Apply the concepts Graphs Function Plotting, Printing Graphs, Component Arithmetic, Graphs in Reports, and Advanced Graphics.	K3

Unit I:

Introduction – Learning Scilab – Further References – Starting Scilab – Typing Commands.

Unit II:

Simple calculations : Basic Arithmetic – Complex Numbers.
Help in Scilab : The Help Command – The Help Window – Help on the Web.

Unit III:

Adding a Line – Hints for Good Graphs – Plot data as points – Choose a good scale.

Unit IV:

Solving Equations - Matrices and Vectors – Creating Matrices – Systems of Equations – Polynomials.

Unit V:

Graphs – Function Plotting – Component Arithmetic – Printing Graphs – Graphs in Reports – Advanced Graphics.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introduction to Scilab	Graeme Chandler	Stephen Roberts	2002

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	M	S	S	M
CO3	S	S	M	S	M
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Semester-III

Elective -III	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE07	CALCULUS OF VARIATION AND INTEGRAL EQUATIONS	
Credits: 4		

Objectives:

This course focuses on integral equations concepts and to develop an application of integration. It implements the concepts such as Variational problems with fixed boundaries, Variational problems with moving boundaries, Integral Equation, Solution of Fredholm integral equation, Hilbert – Schmidt Theory. In addition, it also covers the methods to process the calculus of variation and integral equations.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define Variational problems with fixed boundaries.	K1
CO2	Illustrate the Variational problems with moving boundaries.	K2
CO3	Demonstrate Integral Equation.	K3
CO4	Implement method for Solution of Fredholm integral equation.	K3
CO5	Apply Hilbert – Schmidt Theory.	K3

Unit I: Variational problems with fixed boundaries:

The concept of variation and its properties – Euler's equation- Variational problems for Functionals – Functionals dependent on higher order derivatives – Functions of several independent variables . (Chapter 1: Sections 1.1 to 1.5) of [1]

Unit II: Variational problems with moving boundaries:

Movable boundary for a functional dependent on two functions – one-side variations – Reflectionand Refraction of extermals – Diffraction of light rays. (Chapter 2: Sections 2.1 to 2.5) of [1]

Unit III: Integral Equation:

Introduction – Types of Kernels – Eigen Values and Eigen functions – Differentiation the Sign Integration - Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems. (Chapter 1: Section 1.1 to 1.8) of [2]

Unit IV: Solution of Fredholm integral equation:

Second kind with separable kernel – Orthogonality and reality eigen function – Fredholm Integral equation with separable kernel – Solution of Fredholm integral equation by successive substitution – Successive approximation – Volterra Integral equation – Solution by successive substitution. (Chapter 2: Sections 2.1 to 2.3 and Chapter 4 Sections 4.1 to 4.5) of [2]

Unit V: Hilbert – Schmidt Theory:

Complex Hilbert space – Orthogonal system of functions- Gram Schmit orthogonlization process – Hilbert – Schmit theorems – Solutions of Fredholm integral equation of first kind. (Chapter 3: Section 3.1 to 3.4 and 3.8 to 3.9) of [2]

TEXT BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Calculus of Variations with Application	A.S Gupta	Prentice Hall of India, New Delhi	2005
2	Integral Equations and Boundary Value Problems	Sudir K.Pundir and Rimple Pundir	Pragati Prakasam, Meerut	2005

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Methods of Applied Mathematics, Prentice	F.B. Hildebrand	Hall of India Pvt. New Delhi	1968
2	Linear Integral Equations Theory and Techniques	R. P. Kanwal	Academic Press, New York	1971
3	Differential Equations and Calculus of Variations	L. Elsgolts	Mir Publishers, Moscow	1973

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	M
CO3	M	S	M	M	S
CO4	S	S	S	M	M
CO5	S	M	S	S	S

S- Strong; **M**-Medium.

Semester-III

Elective-III	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE08	OPTIMIZATION TECHNIQUES	
Credits: 4		

Objectives:

This course introduces fundamental and advanced level concepts in operation research. It covers concepts such as Integer linear programming, Deterministic dynamic programming, Decision analysis and games, Simulation modeling, Non-linear programming algorithms. It provides technical skills to understand and develop various ideas about real life problems.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Find the logic behind the execution of Integer linear programming.	K1
CO2	Understand the concepts of Deterministic dynamic programming and related results.	K4
CO3	Analyze Decision analysis and games and its theorems.	K2
CO4	Develop the concept of Simulation modeling.	K3
CO5	Apply the concepts to Non-linear programming algorithms.	K3

Unit I: Integer linear programming:

Introduction – Illustrative applications integer programming solution algorithms: Branch and Bound (B & B) algorithm – zero – One implicit enumeration algorithm – Cutting plane Algorithm. (Sections 9.1,9.2,9.3.1.,9.3.2,9.3.3)

Unit II: Deterministic dynamic programming:

Introduction – Recursive nature of computations in DP – Forward and backward recursion – Selected DP applications cargo – Loading model – Work force size model – Equipment replacement model – Investment model – Inventorymodels. (Sections10.1,10.2,10.3,10.4.1,10.4.2,10.4.3, 10.4.4, 10.4.5)

Unit III: Decision analysis and games:

Decision environment – Decision making under certainty (Analytical Hierarchy approach) Decision making under risk – Expected value criterion – Variations of the expected value criterion – Decision under uncertainty Game theory – optimal solution of two – Person Zero – Sum games – Solution of mixed strategy games.(Sections 14.1,14.2,114.3.1,14.3.2,14.4,14.5.1,14.5.2)

Unit IV: Simulation modeling:

What is simulation – Monte carlo simulation – Types of simulation – Elements of discrete event simulation – Generic definition of events – Sampling from probability distributions. Methods for gathering statistical observations – Sub interval method – Replication method – Regenerative (Cycle) method – Simulation languages. (Sections 18.1,18.2,18.3, 18.4.1,18.4.2,18.5,18.6,18.7.1,18.7.2,18.7.3,18.8)

Unit V: Non-linear programming algorithms:

Unconstrained non- linear algorithms – Direct search method – Gradient method Constrained algorithms: Separable programming – Quadratic programming – Geometric programming – Stochastic programming – Linear combinations method – SUMT algorithm.(Sections : 21.1.1, 21.1.2, 21.2.1, 21.2.2, 21.2.3, 21.2.4, 21.2.5, 21.2.6)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Operations Research an Introduction 6th Edison	Hamdy A. Taha	University of Arkansas Fayetteville	2002

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introduction to Operation Research 4th edition	F.S. Hillier and G.J. Lieberman	Mc Graw Hill Book Company, New York	1989
2	Operations research	B.E.Gillett	A Computer Oriented Algorithmic Approach,TMH Edition, New Delhi	1976

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	M
CO3	S	M	M	S	M
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Semester-III

Elective-III	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE09	DIFFERENCE EQUATIONS	
Credits: 4		

Objectives:

This course focuses on difference equations concepts and to develop an application in differential equation. It implements the concepts such as Difference Calculus, Linear Difference Equations, Initial value problems for linear systems, Stability of linear systems, Asymptotic analysis of sums. In addition, it also covers the methods to process the applications of difference equations.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define the theory of Difference Calculus for building applications.	K1
CO2	Illustrate the theory of Linear Difference Equations and its related results.	K2
CO3	Demonstrate the Linear Difference Equations and properties of difference equation.	K4
CO4	Implement method for Initial value problems for linear systems, Stability of linear systems.	K3
CO5	Apply Asymptotic analysis of sums and its applications.	K3

Unit I: Difference Calculus:

Difference operator – Summation – Generating function – Approximate summation. (Chapter 2 Sections 2.1 to 2.3)

Unit II: Linear Difference Equations:

First order equations – General results for linear equations.
(Chapter 3 Sections 3.1 to 3.2)

Unit III: Linear Difference Equations(Contd.):

Equations with constant coefficients – Equations with variable coefficients – z – transform. (Chapter 3 Sections 3.3,3.5 and 3.7)

Unit IV:

Initial value problems for linear systems – Stability of linear systems. (Chapter 4 Sections 4.1 to 4.3)

Unit V:

Asymptotic analysis of sums – Linear equations (Chapter 5 Sections 5.1 to 5.3)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Difference Equations	W.G.Kelley and A.C.Peterson	Academic press, New York	1991

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	An Introduction to Difference Equations	S.N.Elaydi	Springer – Verleg, NewYork	1990
2	Difference Equations	R.Mickens	Van Nostrand Reinhold, New York	1990
3	Difference Equations and Inequalities	R.P.Agarwal	Marcelm Dekker, New York	1992

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	S	S	M	M
CO3	M	S	M	S	S
CO4	S	M	S	M	S
CO5	S	S	M	S	S

S- Strong; **M**-Medium.

Semester-IV

Core- XII	M.Sc. Mathematics	2019 - 2020
Code:M19PMA12	FUNCTIONAL ANALYSIS	
Credits: 5		

Objectives:

This course introduces fundamental and advanced level concepts in functional Analysis. It covers concepts such as Banach Spaces, Banach Spaces and Hilbert Spaces, Hilbert Spaces, Operations on Hilbert Spaces, Banach Algebras. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Find the logic behind the execution of Banach Spaces and its properties.	K1
CO2	Understand the concepts of Banach Spaces and Hilbert Spaces and related results.	K4
CO3	Analyze Hilbert Spaces and its theorems.	K3
CO4	Develop the concept of Operations on Hilbert Spaces.	K3
CO5	Apply the concepts to Banach Algebras.	K3

Unit I: Banach Spaces:

Banach Spaces – Definition and examples – Continuous linear transformations – Hahn Banach theorem. (Chapter 9 : Sections 46 to 48)

Unit II: Banach Spaces and Hilbert Spaces:

The natural embedding of N in N** - Open mapping theorem – Conjugate of an operator – Hilbert space – Definition and properties. (Chapter 9 : Sections 49 to 51, Chapter 10 : Sections 52)

Unit III: Hilbert Spaces:

Orthogonal complements – Orthonormal sets – Conjugate space H* - Adjust of an operator. (Chapter 10 : Sections 53 to 56)

Unit IV: Operations on Hilbert Spaces:

Self adjoint operator – Normal and Unitary operators – Projections. (Chapter 10: Sections 57 to 59)

Unit V: Banach Algebras:

Banach Algebras – Definition and examples – Regular and simple elements – Topological divisors of zero – Spectrum – The formula for the spectral radius – The radical and semi simplicity. (Chapter 12 : Sections 64 to 69)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introduction to Topology and Modern Analysis	G.F.Simmons	McGraw Hill Inter. Book Co, New York	1963

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Functional Analysis	W. Rudin	Tata McGraw Hill Publ. Co, New Delhi	1973
2	Functional Analysis	D. Somasundaram	S. Viswanathan Pvt.Ltd., Chennai	1994

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Semester-IV

Core-XIII	M.Sc. Mathematics	2019 - 2020
Code:M19PMA13	DIFFERENTIAL GEOMETRY	
Credits: 5		

Objectives:

This course focuses on differential geometry concepts and to develop an application in space science. It implements the concepts such as theory of Space curves, Local Intrinsic properties of surface, Local Intrinsic properties of surface and geodesic on a surface, Geodesic on a surface. In addition, it also covers the methods to process the space science technology.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define the theory of Space curves for building differential calculus based applications.	K1
CO2	Illustrate the theory of Space curves and its related results.	K2
CO3	Demonstrate the Local Intrinsic properties of surface.	K3
CO4	Implement method for Local Intrinsic properties of surface.	K3
CO5	Apply Geodesic on a surface and its applications.	K3

Unit-I Theory of Space Curves:

Theory of space curves – Representation of space curves – Unique parametric representation of a space curve – Arc-length – Tangent and osculating plane – Principle normal and binormal – Curvature and torsion – Behaviour of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces. (Chapter 1 : Sections 1.1 to 1.9)

Unit II: Theory of Space Curves (Contd.):

Contact between curves and surfaces – Osculating circle and osculating sphere – Locus of centre of spherical curvature – Tangent surfaces – Involutes and Evolutes – Intrinsic equations of space curves – Fundamental Existence Theorem – Helices. (Chapter 1 : Sections 1.10 to 1.13 and 1.16 to 1.18)

Unit III: Local Intrinsic properties of surface:

Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – Direction coefficients on a surface. (Chapter 2 : Sections 2.1 to 2.10)

Unit IV: Local Intrinsic properties of surface and geodesic on a surface:

Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Geodesics and their differential equations – Canonical geodesic equations – Geodesics on surface of revolution. (Chapter 2: Sections 2.11 to 2.15 and Chapter 3: Sections 3.1 to 3.4)

Unit V: Geodesic on a surface:

Normal property of Geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic curvature – Gauss Bonnet Theorems – Gaussian curvature – Surface of constant curvature. (Chapter 3: Sections 3.5 to 3.8 and Sections 3.10 to 3.13)

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Differential Geometry	D. Somasundaram	Narosa publ. House, Chennai	2005

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	An Introduction to Differential Geometry	T. Willmore	Clarendan Press, Oxford	1959
2	Lectures on Classical Differential Geometry	D.T Struik	Addison – Wesely- Mass	1950
3	Elementary Topics in Differential Geometry	J.A. Thorpe	Springer – Verlag, New York	1979

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	M	S	S	M
CO3	M	S	M	S	S
CO4	S	M	S	M	S
CO5	S	S	M	S	S

S- Strong; **M**-Medium.

Semester-IV

Core-XIV	M.Sc. Mathematics	2019 - 2020
Code:M19PMA14	MATHEMATICAL PROBABILITY THEORY **	
Credits: 5		

**** - Open Book Examination**

Objectives:

This course introduces fundamental and advanced level concepts in probability theory. It covers concepts such as Random Events and Random Variables, A parameters of the Distribution, Characteristic functions, Some probability distributions, Limit Theorems. It provides technical skills to understand and develop various ideas about probability theory.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Find the logic behind the execution of Random Events and Random Variables.	K1
CO2	Understand the concepts of A parameters of the Distribution and related results.	K4
CO3	Analyze Characteristic functions and its theorems.	K3
CO4	Develop the concept of Some probability distributions.	K3
CO5	Apply the concepts to Limit Theorems.	K3

Unit I: Random Events:

Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events.

Random Variables:

Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of Multi-Dimensionalrandom variables. Chapter 1: Sections 1.1 to 1.7, Chapter 2: Sections 2.1 to 2.9 .

Unit II: arameters of the Distribution:

Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types. Chapter 3: Sections 3.1 to 3.8

Unit III: Characteristic functions:

Properties of characteristic functions – Characteristic functions and moments – Semi-invariants – characteristic function of the sum of the independent random Variables – Determination of distribution function by the Characteristic function.Chapter 4: Sections 4.1 to 4.5

Unit IV: Some probability distributions:

One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal- gamma – Beta – Cauchy and Laplace (continuous) distributions. Chapter 5: Section 5.1 to 5.10

Unit V: Limit Theorems:

Stochastic convergence – Bernoulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindeberg Theorem – Lapunov Theroem. Chapter 6: Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Probability Theory and Mathematical Statistics	M. Fisz	John Wiley and Sons, New York	1963

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Probability Theory and Mathematical Statistics	M. Fisz	John Wiley and Sons, New York	1963
2	Real Analysis and Probability	R.B. Ash	Academic Press, New York	1972
3	A course in Probability	K.L.Chung	Academic Press, New York	1974
4	Probability Theory (2nd Edition)	Y.S.Chow and H.Teicher	Springer Verlag. Berlin	1988
5	Probability (2nd Edition)	R.Durrett	Duxbury Press, New York	1996
6	An Introduction to Probability Theory and Mathematical Statistics(3rd Print)	V.K.Rohatgi	Wiley Eastern Ltd., New Delhi	1988
7	A Probability Path	S.I.Resnick	Birhauser, Berlin	1999
8	Modern Probability Theory (3rd Edition)	B.R.Bhat	New Age International (P)Ltd, New Delhi	1999
9	Counter Examples in Probability and Statistics	J.P. Romano and A.F. Siegel	Wadsworth and Brooks / Cole Advanced Books and Software, California	1968

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	M
CO3	S	S	M	S	S
CO4	S	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Semester-IV

Elective-IV	M.Sc. Mathematics	2019 – 2020
Code:M19PMAE10	DESIGN THEORY	
Credits: 4		

Objectives:

This course focuses on design theory concepts and to develop an graph theory application. It implements the concepts such as Steiner triple system, λ- fold triple system, Quasigroup identities & graph decompositions & Kirkman triple systems, Maximum packings & Minimum coverings, Mutually Orthogonal Latin Squares. In addition, it also covers the methods to process the frame construction.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Define the Steiner triple system concepts for building design based applications.	K1
CO2	Illustrate the λ- fold triple system.	K2
CO3	Demonstrate the Quasigroup identities & graph decompositions & Kirkman triple systems.	K3
CO4	Implement method Maximum packings & Minimum coverings.	K3
CO5	Apply Mutually Orthogonal Latin Squares.	K3

UNIT I: STEINER TRIPLE SYSTEM:

The existence problem- $\gamma \equiv 1 \pmod 6$: The Skolem construction -$\gamma \equiv 5 \pmod 6$: The 6n+5 construction_ Quasi groups with holes and steiner triple systems – The wilson constructium – Cyclic Steiner triple systems.

Chapter: 1 Sec: 1.1 – 1.7.

UNIT II: λ- FOLD TRIPLE SYSTEM:

Triple systems of index $\lambda > 1$ – The existence of idempotent latin squares -2- Fold triple systems – Mendelsohn triple systems – $\lambda = 3$ and 6-λ – Fold Triple systems in general.

Chapter: 2 Sec: 2.1 – 2.6

UNIT III: QUASIGROUP IDENTITIES & GRAPH DECOMPOSITIONS & KIRKMAN TRIPLE SYSTEMS:

Quasi group identities – Mendel sohn triple systems revisited – Steiner triple systems revisited –A recursive construction – Constructing pairwise balanced designs.

Chapter: 3 Sec: 3.1 – 3.3 & Chapter:5:Sec: 5.1 – 5.2.

UNIT IV: MAXIMUM PACKINGS & MINIMUM COVERINGS:

The general problem – Maximum packings – Minimum coverings. Chapter: 4 Sec: 4.1 – 4.3

UNIT V: MUTUALLY ORTHOGONAL LATIN SQUARES:

Introduction – The Euler and MacNeish conjectures – Desproof of the MacNeish conjecture – Desproof of the Euler conjective – Orthogonal latin squares of order $n \equiv 2 \pmod 4$.

Chapter: 6 Sec: 6.1 – 6.5.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Design Theory, second edition	C.A. Rodger and Charles C.Lindner	CRC Press	1997

REFERENCE BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Design Theory	Pascal Le Masson – Benoit Weil Armand Hatchuel	Springer	2017

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	M
CO3	M	S	M	S	S
CO4	S	S	S	M	M
CO5	S	M	S	S	S

S- Strong; **M**-Medium.

Semester-IV

Elective-IV	M.Sc. Mathematics	2019 - 2020
Code:M19PMAE11	STOCHASTIC PROCESS	
Credits: 4		

Objectives:

This course introduces fundamental concepts in stochastic process. It covers concepts such as Stochastic Process, Markov Chains, classification of states and chains, Stability of Markov chain, Poisson process, Markov chain with discrete state space, Renewal process, Renewal process in continuous time , Markov Renewal and semi- markov processes. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of Stochastic Process, Markov Chains, classification of states and chains.	K1
CO2	Understand the concepts of Stability of Markov chain, Poisson process	K2
CO3	Analyze the Markov chain with discrete state space.	K3
CO4	Develop Renewal process, Renewal process in continuous time.	K4
CO5	Apply the concepts to Markov Renewal and semi- markov processes.	K3

Unit I:

Stochastic Process: Introduction – Specification of Stochastic Processes, Stationary processes, Martingales, Markov Chains: Definitions and Examples, Higher transition probabilities, classification of states and chains.

Unit II:

Stability of Markov chain, Markov chains with denumerable number of states, Poisson process.

Unit III:

Poisson process and related distributions – Markov chain with discrete state space.

Unit IV:

Renewal process: Renewal process-Renewal process in continuous time – Renewal equation – Stopping time: Wald's equation – Renewal theorems.

Unit V:

Markov Renewal and semi-markov processes: Introduction – Definitions and Preliminaries results – Markov renewal equations – Limiting behaviours.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Stochastic Processes 4th Edition	Prof. J. Medhi	New age International (P) Ltd, New Delhi	2017

Unit I: Chapter2: 2.1 to 2.4; Chapter3: 3.1, 3.2, 3.4 (3.3 is not included)
Unit II: Chapter3: 3.6, 3.8, 4.1 (pages 157-169)
Unit III: Chapter4: 4.2 to 4.5 (pages 170-206)
Unit IV: Chapter6: 6.1 to 6.5 (pages 242 – 272)
Unit V: Chapter7: 7.1 to 7.4 (pages 313 – 331) (example problems only)

REFERENCE BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Stochastic Processes	T.Veerarajan	McGraw Hill	2008

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	M	S	M
CO3	M	S	M	S	S
CO4	S	S	M	M	S
CO5	S	S	M	S	M

S- Strong; **M**-Medium.

Semester-IV

Elective-IV	M.Sc. Mathematics	2019 – 2020
Code:M19PMAE12	Fuzzy sets and Fuzzy logic	
Credits: 4		

Objectives:

This course introduces fundamental concepts in Fuzzy sets and Fuzzy logic. It covers concepts such as Form classical sets to fuzzy sets; Fuzzy sets versus crisp sets, Operations on fuzzy sets, Fuzzy arithmetic, Fuzzy relations and Fuzzy Logic. It provides technical skills to understand and develop various ideas about analysis.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind the execution of the form classical sets to fuzzy sets; Fuzzy sets versus crisp sets	K1
CO2	Understand the concepts of an operation on fuzzy sets.	K2
CO3	Analyze the concept of fuzzy arithmetic	K3
CO4	Develop the idea about the fuzzy relations.	K4
CO5	Apply the concepts to the fuzzy logic and its related theorems.	K3

Unit I: Form classical sets to fuzzy sets, Fuzzy sets versus crisp sets

Introduction – Crisp sets – Fuzzy sets – Characteristics and significance of the paradigm shift – Additional properties of α – cuts – Representation of fuzzy sets – Extension principal for fuzzy sets.

Unit II: Operations on fuzzy sets

Types of operations – Fuzzy complements – Fuzzy intersections: t-norms – fuzzy unions: t – conorms – Combinations of operations – Aggregation operations.

Unit III: Fuzzy arithmetic

Fuzzy numbers – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations on fuzzy numbers – fuzzy equations.

Unit IV: Fuzzy relations

Crisp versus Fuzzy relation - projections and cylindric extensions - binary fuzzy relations - Binary Relations on a single set - Fuzzy compatibility relations - Fuzzy ordering Relations - Furry Morphisms - Sup-I compositions of Fuzzy Relations - Info compositions of Fuzzy Relations

Unit V:Fuzzy Logic

Classical Logic- Multivalued Logic – Fuzzy propositions –Fuzzy propositions – Fuzzy Quantifiers –Linguistic Hedges – Inference form conditional fuzzy propositions – Inference from conditional and qualified propositions – Inference form quantified propositions.

TEXT BOOK:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	**Fuzzy sets and Fuzzy logic Theory and Applications**	George J, Klir Bo Yuvan	PHI learning pvt.ltd	2009

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	M
CO3	S	M	M	S	M
CO4	M	S	S	M	S
CO5	S	M	S	S	M

S- Strong; **M**-Medium.

Extra Disciplinary Course (EDC):

EDC - I	SEMESTER-II	2019 - 2020
Code:M19EMA01	QUANTITATIVE APTITUDE	
Credits: 4		

Objectives:

This course introduces fundamental concepts such as Numbers, system in Quantitative aptitude. It covers concepts such as Numbers, H.C.F. and L.C.M. of numbers, Simplification , Square roots and Cube Roots , Average, Problems on numbers , problems on Ages, Percentage , Profit and Loss, Ratio and Proportion , Partnership. It provides technical skills to understand and develop various department examinations like Group Exams, TNPSC, RRB, SSC & IBPS.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Identify the logic behind Numbers, H.C.F. and L.C.M. of numbers and its problem.	K1
CO2	Understand the concepts of Simplification, Square roots and Cube Roots , Average and its problem.	K2
CO3	Analyze the problems on Problems on numbers , problems on Ages, and its problem.	K2
CO4	Develop the Percentage, Profit and Loss and its problem. .	K2
CO5	Apply the concepts to solve a problem for Ratio and Proportion , Partnership.	K3

Unit I:

Numbers, H.C.F. and L.C.M. of numbers .(Section-I:1,2)

Unit II:

Simplification , Square roots and Cube Roots , Average.

(Section-I:4,5,6)

Unit III:

Problems on numbers , problems on Ages. (Section-I:7,8)

Unit IV:

Percentage , Profit and Loss. (Section-I:10,11)

Unit V:

Ratio and Proportion , Partnership. (Section-I:12,13)

TEXT BOOK:

S.No	Tiltle of the Book	Author	Publishing Company	Year of Publication
1.	Quantitative Aptitude for competitive Examination	R.S.Aggarwal.	S.Chand& company Ltd,152,Anna salai,Chennai.	2014

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	M
CO2	S	M	S	M	S
CO3	M	M	M	S	M
CO4	S	M	S	M	M
CO5	S	M	M	S	S

S- Strong; **M**-Medium.

EDC-II	SEMETER -II	2019 - 2020
Code:M19EMA02	OPERATION RESEARCH	
Credits: 4		

Objectives:

This course introduces fundamental concepts of Operation Research. It covers concepts linear Programming, Simplex Method, Big M method, Transportation Problem, Assignment problem, PERT / CPM. It provides technical skills to understand the concepts in applied mathematics.

Course Outcomes:

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Acquiring knowledge of basic idea of the linear programming.	K1
CO2	Understand the Solution of the Big M method.	K2
CO3	Demonstrate understanding of the importance of the Transportation Problem.	K4
CO4	Develop the idea about the Assignment problem.	K3
CO5	Understanding the concept of PERT / CPM.	K4

Unit I:

Introduction - Definition of O.R. – Scope , phases and Limitations of O.R. – Linear Programming Problem – Definitions – Mathematical Formulation – Characteristic of a LPP – Matrix form of LPP – Graphical Method – Definitions of bounded , unbounded and optimal solutions – procedure of solving LPP by graphical method – problems – Simplex technique - Definitions of Basic , non basic variables – basic solutions – slack variables and optimal solution , simplex procedure of solving LPP – problems.

Unit II:

Introduction – Big – M method – Definitions of Big – M method , surplus variables and artificial variables – Procedure of solving an LPP by Big – M method – Pseudo optimal solution – Problems – Two – Phase Simplex method – Procedure of solving an LPP by two – phase simplex method – problems.

Unit III:

Introduction – Balanced and unbalanced T.P , Feasible solution – Basic feasible solution – Optimum solution – Degeneracy in a T.P. – Mathematical formulation – North – West Corner rule – Vogel's approximation method (unit penalty method) - Method of Matrix minima (Least cost Method) – problems – Algorithm of Optimality test (Modi Method) – Problems .

Unit IV:

Assignment problem – Definition – Mathematical formulation of the Assignment problem – Test for optimality by using Hungarian method - Unbalanced Assignment problem – Degeneracy in Assignment problem - Maximization case in Assignment problem – Restrictions on Assignment problem – Variations in Assignment problem –problems .

Unit V:

Introduction – Definition of network, event, activity, optimistic time, pessimistic time, the most likely time, critical path, total float and free float – Difference between slack and float – Phases of critical path in a PERT network – difference between CPM and PERT – Problems.

TEXT BOOK:

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research, Ninth Edition	P.K.Gupta, Man Mohan and Kanti Swarup	Sultan Chand and Sons, New Delhi	2001

REFERENCE BOOKS:

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research, Second Edition	S.Kalavathy	Vikas Publishing House, New Delhi	2002
2.	Operations Research, Second Edition	P.K.Gupta and D.S.Hira	S.Chand & Co, NewDelhi	2004
3.	Operations Research	Nita Hshah Ravi M. Gor Hardiksoni	PHI, P,Ltd,	2010

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	M
CO3	S	S	S	M	S
CO4	M	M	M	M	S
CO5	S	S	M	M	S

S- Strong; **M**-Medium.