VIVEKANANDHA
COLLEGE OF ARTS AND SCIENCES FOR WOMEN
[AUTONOMOUS]

SPONSORED BY: ANGAMMAL EDUCATIONAL TRUST.
An ISO 9001: 2008 Certified Institution
Affiliated to Periyar University, Approved by AICTE and
Re-Accredited with 'A' Grade by NAAC
Recognized under section 2(f) and 12(B) of UGC Act, 1956
Elayampalayam – 637 205.Tiruchengode,Namakkal Dt., TamilNadu

DEPARTMENT OF MATHEMATICS

Master of Science (Mathematics)

SYLLABUS AND REGULATIONS

For the Candidates admitted from the year 2018-2019 Onwards

UNDER OBE PATTERN

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

[Autonomous]

ELAYAMPALAYAM, TIRUCHENGODE

M.Sc. MATHEMATICS - REGULATIONS

(Candidates admitted from 2018 – 2019 Onwards)

I. SCOPE OF THE COURSE

M.Sc. (Mathematics) is a high profile postgraduate program aimed to create enhanced competence of career positioning tied up with opportunity to become a skilled Mathematician. The program expects a serious commitment of the student to take up challenging study schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of two years and equips a student with knowledge, ability, skills and other qualities required for a professional Mathematician.

The uniqueness of the program is its content and topic coverage, the teaching methodology and the faculty. The syllabus has been designed at a level equal to that of professional courses. The teaching methodologies include classroom lectures, industrial visits, orientation, internship, case study and research work. Focus is also on developing soft skills of the students. For Core subjects, Outsource Guest Lectures by Industrialists and Subject Experts will be arranged to enable the students to get wider exposure.

II. SALIENT FEATURES

- Course is specially designed for a higher level Career Placement.
- Special Guest lectures from Subject Experts will be arranged.
- Special Teaching Oriented Training is part of the Degree Course.
- Course pave the way for enhanced conceptual, analytical & deductive skills to meet the Competitive exams like Banking / TNPSC / IAS / IFS / NET / SET etc.,

III. OBJECTIVES OF THE COURSE

Mathematics to-day is penertrating all fields of human endeavour and therefore it is necessary to prepare the students to scope with the advanced developments in various fields of Mathematics. The objectives of this course are the following:

a) To import knowledge in advanced concepts and applications in various fields of Mathematics.

b) To Provide wide choice of elective subjects with updated and new areas in various branches of Mathematics to meet the needs of all students.

IV. ELIGIBILITY FOR ADMISSION

A candidate who has passed B.Sc., Mathematics / B.Sc., Mathematics (Computer Applications) degree of this University or any other University accepted by the Syndicate equivalent there to, subject to such condition as may be prescribed therefore shall be permitted to appear and qualify for the Master of Science (M.Sc.,) Degree Examination in Mathematics of this University after a two academic years and the successful completion of all the courses prescribed.

V. DURATION OF THE COURSE

- The Programme shall extend over a period of two academic years consisting of four semesters. Each academic year will be divided into two semesters. Each semester consist of 90 working days.
- The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekananda College of Arts And Sciences for Women with the approval of Periyar University.

VI. CONTINUOUS INTERNAL ASSESMENT

The performance of the students will be assessed continuously and the

Internal Assessment Marks will be as under:

1. Average of two Tests - 5 Marks
2. Model - 5 Marks
3. Seminar - 5 Marks

4. Assignment - 5 Marks

5. Attendance - 5 Marks

Total = 25 Marks

ATTENDANCE PARTICULARS

Attendance %	Marks
76-80	1
81-85	2
86-90	3
91-95	4
96-100	5

PASSING MINIMUM IN THE EXTERNAL EXAMINATION

In the University Examinations, the passing minimum shall be 50 % out of 75 Marks (i.e 38 Marks in the External Examinations).

VII. ELIGIBILITY FOR EXAMINATION

A candidate will be permitted to appear for the University Examination only on earning 75 % of attendance and a satisfactory conduct. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed with supporting evidence.

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATE

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.

b) 60% and above but below 75 % shall be declared to have passed the examinations in first class.

c) 50%and above but below 60% shall be declared to have passed the examinations in second class.

d) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of two consecutive academic years from the year of admission only will be eligible for rank.

IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than two academic years comprising of four semesters and passed the examinations prescribed and fulfilled such conditions have been prescribed therefore.

X. PROCEDURE IN THE EVENT OF FAILURE

If a candidate fails in a particular subject, she may reappear for the End of Semester in the concerned subject in subsequent semesters and shall pass the examination.

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2018-2019 (i.e.,) for the students who are to be admitted to the first year of the programme during the academic year 2018-2019 and thereafter.

XII. TRANSITORY PROVISIONS

Candidates who have undergone the PG programme of study before 2018-19 shall be permitted to appear for the examinations under those regulations of the year inwhich the candidates admitted to the programme. Supplementary examination will be conducted within a month. In case of failure she has to complete within 5 years (2+3).

Thereafter, they will be permitted to appear for the examination only under the regulation then in force.

For the deserving candidates, if a student fails in a single subject she can be provided with maximum 5 marks as grace mark subject to the recommendation of the passing board.

ABOUT THE COLLEGE

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'VidhyaRathna' Prof.Dr. M. KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of TiruchengodeNamakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A' for its successful performance.

As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfil the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills to face the society.

OUR VISION

- To evolve into a center of excellence in higher education through creative and innovative practices to social equity for women.

OUR MISSION

- To provide sufficient learning infrastructure to the students to pursue their studies.
- To provide good opportunity for higher education and conducive environment to the students to acquire education.
- To provide quality academic programs training activities and research facilities.
- To facilitate industry-institute interaction.

DEPARTMENT OF MATHEMATICS

VISION

- Empowerment of women through Education.
- To upgrade performance standards in the field of Mathematics in order to be a leading department in academic arena.
- To provide excellence in education for all students. We will assess and design courses and learning experiences that promote the academic achievement and the personal and social growth of students.

MISSION

- To Promote Quality Education to Women at all levels.
- To provide students experiences in Mathematics that will empower them to succeed in an ever changing society.
- To empower young women to face the challenges of life with courage and commitment.
- To equip them with enhanced employable skills.

Bloom's Taxonomy Based Assessment Pattern

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze;

K5- Evaluate;**K6**- Creating.

Theory: 75 Marks

Test- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1,K2	A (Answer all)	20x01=20	MCQ/Define	75
K3, K4	B (Either or pattern)	05x05=25	Short Answers	
K5&K6	C (Answer 3 out of 5)	03x10=30	Descriptive/ Detailed	

Programme Outcomes

PO1: Disciplinary knowledge: The main objective of the syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Mathematics. The ultimate goal of the syllabus is that the students at the end are able to secure a job. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject.

PO2: Communication Skills: To help students think, react, and work in innovative ways stimulated by a higher degree of disciplinary synergies that will promote interdisciplinary innovation and divergent thinking.

PO3: Critical thinking: Capacity to apply analytic thought to a body of knowledge; Analyze and evaluate evidence, arguments, claims, and beliefs on the basis of empirical evidence; Identify relevant assumptions or implications; formulate coherent arguments; critically evaluate Practices, policies and theories by following mathematical approach to knowledge development.

PO4: Problem Solving: Identify, formulate, Reviewing literature, and analyze Mathematical problems to arrive at substantiated conclusions using the principles of mathematics, natural, and mathematical techniques.

PO5: Analytical reasoning: Ability to evaluate the qualitative and relevance of evidence, recognizing logically equivalent statements, analyze and synthesize data from a variety of sources, draw valid conclusions and support them with evidence and examples.

PO6: Research-related skills: Use research-based knowledge including design of Mathematical experiments, define problems, formulate hypotheses, test hypotheses, analysis and interpret draw conclusions from data, synthesis of the information to provide valid conclusions. Ability to plan, execute and report the results of an experiment.

PO7: Cooperation/team work: Ability to work effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO8: Scientific reasoning: Ability to analyze, interpret and draw conclusions from qualitative data and critically evaluate ideas from an open minded and reasoned perspective. It might involve observation or assessment of information to arrive at a generalized conclusion, or may involve defining and then testing

a hypothesis to predict specific results**.** Demonstrate knowledge and understanding of interdisciplinary Problem and mathematical principles and apply these to scientific work.

PO9: Reflective thinking: Critical thinking to found new ideas and relate them with similar attributes to help make remembering concepts.

PO10: Information/ Digital Literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate and use a variety of relevant information sources and use software for analysis of data.

PO11: Self-directed learning: To work independently, identify appropriate resources required for a project, and manage the projects through tocompletion.

PO12: Multicultural competence: To beliefs the multicultural perspective is by highlighting particular achievements from various gendered groups. Usually this strategy is used to diversify the mathematics curriculum that typically elevates the Problem. While this approach has some value in diversifying the curriculum, in the absence of a critical stance to teaching math, the approach can fall short of a more comprehensive understanding of the role of multicultural education in math.

PO13: Moral and Ethical awareness: Ability to identify ethical principles and commit to professional ethics and responsibilities and norms of the mathematical practice. To avoid unethical behavior such as fabrication, misrepresentation of data not adhering intellectual property rights, unbiased and truthful actions in all aspects of work.

PO14: Leadership qualities: Capability for mapping out the tasks of a team and setting direction, formulating an inspiring vision, motivating and inspiring team members to engage with that vision and using management skills to guide people to the right destination ,in a smooth and efficiency way.

PO15: Lifelong learning: Ability to acquire knowledge and skills, including ‘’learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development.

Programe Specific Outcomes:

PS01: Think in a critical manner. Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand. Formulate and develop mathematical arguments in a logical manner.

PS02: Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.

PS03: Understand, formulate and use quantitative models arising in social science, business and other contexts.

Programe Educational Objectives:

PEO 1: To provide students with an awareness of skills in life long learning and self education.

PEO 2: To cultivate team work, technical writing, and oral communication skills.

PEO 3: To provide students with an appreciation of mathematical impact on society and the Professional responsibilities of mathematician.

Bloom's Taxonomy

K1: Remembering: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

K2:Understanding: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

K3: Applying: Carrying out or using a procedure for executing, or implementing.

K4: Analyzing: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.

K5: Evaluating: Making judgments based on criteria and standards through critique and checking.

K6: Creating: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
[AUTONOMOUS]
ELAYAMPALAYAM, TIRUCHENGODE -637 205.
DEPARTMENT OF MATHEMATICS
M.Sc. – MATHEMATICS
COURSE PATTERN AND SCHEME OF EXAMINATIONS UNDER OBE
For the Candidates admitted from the year 2018-2019

SEM	SUBJECT CODE	COURSE	SUBJECT TITLE	Hrs/ Week	CREDIT	INT. MARK	EXT. MARK	TOT. MARK
I	**18P1MA01**	Core Course-I	Linear Algebra	6	5	25	75	100
	18P1MA02	Core Course-II	Real Analysis-I	6	5	25	75	100
	18P1MA03	Core Course-III	Number Theory	6	5	25	75	100
	18P1MA04	Core Course-IV	Ordinary Differential Equations	6	5	25	75	100
	18P1MAE01	Core Based Elective-I	Elective from Group-A	6	4	25	75	100
TOTAL				**30**	**24**	**125**	**375**	**500**
II	**18P2MA05**	Core Course-V	Abstract Algebra	6	5	25	75	100
	18P2MA06	Core Course-VI	Complex Analysis	6	5	25	75	100
	18P2MA07	Core Course-VII	Real Analysis-II	6	5	25	75	100
	18P2MA08	Core Course-VIII	Partial Differential Equations	6	5	25	75	100
	18P2MAE03	Core Based Elective-II	Elective from Group-B	6	4	25	75	100
TOTAL				**30**	**24**	**125**	**375**	**500**

III	**18P3MA09**	Core Course-IX	Measure Theory and Integration	6	4	25	75	100
	18P3MA10	Core Course-X	Topology	5	4	25	75	100
	18P3MA11	Core Course-XI	Numerical Analysis	5	4	25	75	100
	18P3MA12	Core Course-XII	Graph Theory	4	4	25	75	100
	18P3MAE05	Core Based Elective-III	Elective From Group-C	5	4	25	75	100
	18P3CSED01	EDC	Introduction to Information Technology	3	2	25	75	100
	18P3HR04	Value based education	Human Rights	2	1	25	75	100
TOTAL				**30**	**23**	**150**	**450**	**600**

IV	**18P4MA13**	Core Course-XIII	Functional Analysis	6	4	25	75	100
	18P4MA14	Core Course-XIV	Probability Theory	6	4	25	75	100
	18P4MA15	Core Course-XV	Fluid Dynamics	6	4	25	75	100
	18P4MAE07	Core Based Elective-IV	Elective from Group-D	6	4	25	75	100
	18P4CSSK01	Soft Skill	Mat Lab	2	1	25	75	100
	18P4MAPR01	PROJECT	Project	4	3	25	75	100
TOTAL				**30**	**20**	**125**	**375**	**600**
GRAND TOTAL				**120**	**91**	**550**	**1650**	**2200**

ELECTIVE PAPERS:

GROUP-A

18P1MAE01 DISCRETE MATHEMATICS*

18P1MAE02 MECHANICS

GROUP-B

18P2MAE03 MATHEMATICAL METHODS*

18P2MAE04 COMBINATORICS

GROUP-C

18P3MAE05 OPTIMIZATION TECHNIQUES*

18P3MAE06 FUZZY SETS AND THEIR APPLICATIONS

GROUP-D

18P4MAE07 DIFFERENTIAL GEOMETRY*

18P4MAE08 DIFFERENCE EQUATIONS

SEMESTER I

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P1MA01	**Title**	**Batch**	2018-2020
		CORE I: LINEAR ALGEBRA	**Semester**	I
Hrs/Week	6		**Credits**	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts of linear transformations and its representation by matrices.	K1, K2
CO2	Discuss the concepts of polynomials and prime factorization of a polynomial	K1,K2,K3
CO3	Demonstrate the properties of determinants and characteristics values.	K4,K5
CO4	Analyze the concept of triangulation, diagonalization and decomposition	K4
CO5	Evaluate the concept of bilinear Transformation.	K5

Unit I : Linear transformations (18 Hrs)

Linear transformations- the algebra of Linear transformations- Isomorphism- Representation of Transformation by matrices

Unit II : Polynomials (18 Hrs)

Algebra- the algebra of polynomials- lagrange interpolation- polynomial ideals- the prime factorization of a polynomial.

Unit III : Determinants (18 Hrs)

Commutative rings- determinant functions – permutations & the uniqueness of determinants- additional properties of determinants.

Unit IV: Elementary canonical forms (18Hrs)

Elementary canonical forms- introduction- characteristic values- annihilatery polynomials- invariant subspaces- simultaneous triangulation, simultaneous diagonalization.

Unit V: The rational & Jordan forms (18 Hrs)

Cyclic subspaces & annihilaters – cyclic decompositions & the rational form- the Jordan form.

TOTAL : **(90 Hours)**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

Kenneth Hoffman & Ray Kunze, ***Linear algebra ,*** 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2015.

REFERENCE BOOKS:

1. Jim Defranza and Daniel Gagliardi, ***Introduction to Linear Algebra with application***, Indian Edition, 2011.

2. V. Krishnamurthy, ***An Introduction to Linear Algebra***, West press Pvt. Ltd., New Delhi, 1938.

3. H. Friedberg, A.J.Insel & L.E.Spence, ***Linear Algebra,*** PHI learning Pvt. Ltd., New Delhi, 2009.

4. L.A. Geza. Schay, ***Introduction to Linear Algebra***, Narosa publishing House, New Delhi, 1998.

ONLINE SOURCES:

1. www.ejournal.com
2. www.ebook.com
3. www.freebookcentre.net
4. www.webnotes.com

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	S	S	S	S	M	S	L	S	L	L	L	S
CO2	S	M	L	S	M	M	S	M	M	M	M	M	L	L	S
CO3	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S
CO4	S	M	M	M	M	S	S	S	M	M	S	L	M	M	S
CO5	S	M	M	M	M	S	S	S	M	L	S	M	M	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	Programme Title	Master of Science (Mathematics)	
Course Code	18P1MA02	Title	Batch	2018-2020
		CORE II: REAL ANALYSIS-I	Semester	I
Hrs/Week	6		Credits	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To remember countable and uncountable sets	K1, K2
CO2	To apply the Convergence in Sequences and Series	K3
CO3	To demonstrate Power series	K4
CO4	To analyze Continuity and Connectedness.	K4, K5
CO5	To Understand the concepts of Differentiation.	K1,K2

UNIT I: Basic Topology **(18 Hrs)**

Finite, Countable and Uncountable Sets – Metric Spaces – Compact Sets – Connected Sets – Problems (Perfect sets - Omitted)

Unit II: Numerical Sequences and Series **(18 Hrs)**

Convergent sequences – Subsequences – Cauchy sequences - Upper and lower limits - Some special sequences – Series – Series of nonnegative terms - The number e - The root and ratio tests – Problems

Unit III: **(18 Hrs)**

Power series - Summation by parts - Absolute convergence - Addition and multiplication of series – Rearrangements – Problems

Unit IV: Continuity: **(18 Hrs)**

Limit of Functions – Continuous functions - Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic functions – Infinite limits and Limits at infinity - Problems

UNIT V: Differentiation **(18 Hrs)**

The derivative of a real function – Mean value theorems – The continuity of the Derivative – L' Hospital's Rule – Derivatives of Higher order – Taylor's theorem – Differentiation ofVector–valued functions – Problems

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

Walter Rudin, ***Principles of Mathematical Analysis***, Third Edition, Mc Graw Hill Book Co.., New Delhi, 2013.

REFERENCE BOOKS:

1.**Tom M .Apostol,** ***Mathematical Analysis***, Second Edition,Narosa Publishing House,2002.

2. **H.L.Royden,** ***Real Analysis***, Third Edition,Prentice-Hall of India,New Delhi,2009

3. **W.J. Kaczor and M.T. Nowak, "Problems in Mathematical Analysis I – Real Numbers , Sequences and Series", American Mathematical Society, 2000.**

4. W.J. Kaczor and M.T. Nowak, "Problems in Mathematical Analysis II – Continuity and Differentiation", American Mathematical Society, 2000.

ONLINE SOURCES :

1. www.analysiswebnotes.com
2. www.freebookcentre.net
3. http://nptl.ac.in

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	M	S	S	S	S	M	M	M	L	S	L	M	M	S
CO3	S	M	S	S	S	S	M	M	M	M	M	M	L	L	S
CO4	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S
CO5	S	M	M	S	S	M	L	M	L	L	M	L	L	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	Programme Title	Master of Science (Mathematics)	
Course Code	18P1MA03	Title	Batch	2018-2020
		CORE III: NUMBER THEORY	Semester	I
Hrs/Week	6		Credits	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To remember the basic ideas about Integers, Primes, Quadratic Residues.	K1, K2
CO2	Discuss the concepts of Congruence's and Solutions of congruence's	K3, K4
CO3	To demonstrate and understanding of Quadratic residues	K4,K5
CO4	To analyze the Mobius inversion formula.	K4
CO5	To Evaluate Diaphantine equations and farey fractions	K5

UNIT I: Divisibility **(18 Hrs)**

Introduction - Divisibility-Primes – The Binomial theorem.

UNIT II: Congruence's **(18 Hrs)**

Congruence's-Solutions of congruence's – The Chinese remainder theorem – Prime power moduli –Prime modulus.

UNIT III: Quadratic reciprocity **(18 Hrs)**

Quadratic residues - Quadratic reciprocity -The Jacobi symbol – Binary Quadratic forms.

UNIT IV: Some functions of Number theory **(18 Hrs)**

Greatest integer function - Arithmetic functions - The Mobius inversion formula- The Recurrence functions.

UNIT V: Some Diaphantine equations and farey fractions **(18 Hrs)**

The equation ax+by= c – farey sequences – Rational approximations – Irrational numbers.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOKS :

Ivan Niven and H.S. Zuckerman,*An Introduction to the Theory of Numbers*, 3rd edition, Wiley Eastern Ltd, New Delhi, 1989.

REFERENCE BOOKS:

1. D.M. Burton, ***Elementary Number theory***, Universal Book Stall, New Delhi 2001
2. K. Ireland and M.Rosen, ***A Classical Introduction to Modern Number Theory***, Springer Verlag, New York, 1972.
3. T.M. Apostol, ***Introduction to Analytic Number Theory***, Narosa Publication, House, Chennai, 1980.
4.*Elementary Number Theory*, Seventh Edition, MC Graw-Hill Companies, 2015.

ONLINE SOURCES:

1. www.mheeducation.co.in

2. www.wiley.com/go/permissions

3. http://www.powershow.com

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	M	L	M	L	L	M	L	L	M	S
CO2	M	M	S	S	S	S	S	L	M	L	L	S	M	L	S
CO3	M	M	S	S	S	S	M	L	L	L	S	M	S	S	S
CO4	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S
CO5	S	M	M	S	S	M	L	M	L	L	M	L	L	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	Programme Title	Master of Science (Mathematics)	
Course Code	18P1MA04	Title	Batch	2018-2020
		CORE IV: ORDINARY DIFFERENTIAL EQUATIONS	Semester	I
Hrs/Week	6		Credits	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Remember the Linear Equations with constant coefficients	K1
CO2	To gain Knowledge about Non homogeneous equations of orders two.	K1,K2
CO3	To Solve the Legendre's Equations.	K5
CO4	To analyze linear equations with regular singular points	K3, K4
CO5	To Evaluate Method of successive approximations	K5

UNIT I: Linear Equations with Constant Coefficients (18 Hrs)

Introduction -Second order homogeneous equations –Initial value problem- Linear dependence and independence- A formula for the Wornskian.

UNIT II: Linear Equations with Constant Coefficients (18 Hrs)

Non –homogeneous equations of order two – Homogeneous and non –homogeneous equations of order n –Initial value problem- A special method to solve a non-homogeneous equation –Algebra of constant coefficient.

UNIT III: Linear Equations with Variable Coefficients (18 Hrs)

Initial value problems for homogeneous equations –Solutions of homogeneous equations - Wronskian and linear independence – Reduction of the order of homogeneous equation **–** The Legendre equation.

UNIT IV: Linear Equations with Regular Singular points (18 Hrs)

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

UNIT V: First Order Equation – Existence and Uniqueness (18 Hrs)

Introduction – Existence and uniqueness of solutions of first order equations – Equations with variable separable –Exact equations – Method of successive approximations – Lipschitz Condition – Convergence of the successive approximations.

TOTAL : **(90 Hours)**

Power point Presentations, Seminar & Assignment

TEXT BOOK :

Earl A. Coddington, ***An Introduction to Ordinary Differential Equation***, Prentice Hall of India, New Delhi, 2011.

REFERENCE BOOKS :

1. **R.P.Agarwal** and **Ramesh C.Gupta**, ***Essentials of Ordinary Differential Equation***, Mc Graw Hill, New York, 1991.
2. **D.Somasundram**, ***Ordinary Differential Equations***, Narosa Publishing House, Chennai – 2002.
3. **D.Raj, D.P.Choudhury** and **H.I.Freedman**, ***A Course in Ordinary Differential Equations***, Narosa Publishing House, Chennai – 2004.

ONLINE SOURCES:

1. http://users.math.msu.edu/users/gnagy/teaching/ode.pdf
2. https://www.cs.bgu.ac.il/~leonid/ode_bio_files/lonascu_lectnotes.pdf

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	M	M	M	L	M	L	L	L	S
CO2	S	M	M	S	S	M	L	M	L	L	M	L	L	M	S
CO3	S	M	M	S	S	M	L	M	L	L	M	L	L	M	S
CO4	M	M	S	S	S	S	S	L	L	L	M	M	M	L	S
CO5	S	M	S	S	S	M	S	M	M	L	S	L	L	L	M

S - Strong; M - Medium; L – Low

Programme code	M.Sc	Programme Title	Master of Science (Mathematics)	
Course Code	18P1MAE01	Title	Batch	2018-2020
		ELECTIVE I: DISCRETE MATHEMATICS	Semester	I
Hrs/Week	6		Credits	04

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Remember the basic ideas of foundations and logic.	K1, K2
CO2	To Gain knowledge about Permutations and Combinations	K4
CO3	Demonstrate the concept of Generating functions.	K2
CO4	To analyze the Boolean Functions and Logic gates.	K1,K2, K5
CO5	To Evaluate the theory of Modeling Computation .	K3,K6

UNIT-I: The Foundations - Logic and proofs (18Hrs)

Propositional – Applications of Propositional – Propositional Equivalences – Predicates and Quantifiers. **Algorithms :** The Growth of functions.

UNIT-II: Counting (18 Hrs)

The Basics of Counting – The Pigeonhole principle – Permutations and Combinations – Generalized Permutations and Combinations – Generating Permutations and Combinations.

UNIT-III: Advanced Counting Techniques (18Hrs)

Applications of Recurrence Relations – Solving Linear Recurrence Relations – Generating Functions.

UNIT-IV: Boolean Algebra : (18 Hrs)

Boolean Functions – Representing Boolean Functions – Logic Gates – Minimization of Circuits.

UNIT-V: Modeling Computation (18 Hrs)

Finite – State machines with Output – Finite – State machines with no Output – Turing Machines.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK :

Kenneth H.Rosen, ***Discrete Mathematics and its Applications***,7th Edition, WCB/McGraw Hill Education, New York, 2008.

REFERENCE BOOKS :

1. J.P.Trembley and R.Manohar, ***Discrete Mathematical Structures applications to Computer Science,***Tata McGraw Hills,New Delhi, 2013.

2.T.Veerarajan, ***Discrete Mathematics with Graph Theory and Combinatorics,*** Tata McGraw Hills Publishing Company Limited, 7th Reprint, 2008.

3. Prof. V.Sundaresan, K.S. Ganapathy Subramaniyan, K.Ganesan, ***Discrete Matheamtics***, Tata Mc Graw Hill, New Delhi, 2000.

ONLINE SOURCES:

1. www.freebook centre.net/

2. www.maths for college.com/nm/topics/text book

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO3	S	M	L	S	S	L	M	L	S	L	S	L	L	L	S
CO4	S	M	S	S	S	M	S	M	S	L	S	M	M	L	S
CO5	L	L	S	M	S	M	L	S	M	M	L	L	L	L	S

S - Strong; M - Medium; L – Low

SEMESTER II

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P2MA05	**Title**	**Batch**	2018-2020
		CORE V: ABSTRACT ALGEBRA	**Semester**	II
Hrs/Week	6		**Credits**	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	Remember the concepts of Group theory.	K1, K2
CO2	Understand the concept of a particular Euclidean ring and other forms of Polynomial rings.	K2
CO3	Analyze Extension Fields .	K4
CO4	Apply the concept of fields in Galois theory.	K3, K4
CO5	To gain knowledge about Linear transformation.	K2, K3

UNIT-I: Group Theory **(18 Hrs)**

Another counting principle – Sylow's theorem – Direct products

UNIT-II: Ring Theory **(18 Hrs)**

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

UNIT-III: Fields **(18 Hrs)**

Extension Fields – Roots of polynomials – More about Roots.

UNIT-IV: Fields **(18 Hrs)**

Elements of Galois Theory – Finite Fields.

UNIT-V: Linear Transformations (**18 Hrs)**

Canonical forms: Triangular form – Trace and Transpose – Hermitian,

Unitary and Normal Transformations.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

N.Herstein (II Edition), ***Topics in Algebra,*** Wiley India Pvt. Ltd., New Delhi, 2016.

REFERENCE BOOKS:

1. **J.B.Fraleigh,** ***A First Course in Abstract Algebra***, 7th Edition, Narosa Publishing House, New Delhi, 2011.

2. **M.Artin,** ***Algebra***, Prentice-Hall, Englewood Cliff, 1991.

3. **I.S.Luthar and I.B.S.Passi,** ***Algebra***, Narosa Publishing House,New Delhi, 2007.

4. **P.N. Arora,** ***Topics in Algebra***, Sultan Chand &sons, Educational Publishers, New Delhi, 2009.

ONLINE SOURCES:

1. www.ejournal.com

2. www.bookcentre.net

3. www.webnotes.com

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	M	L	S	S	L	M	L	S	L	S	L	L	L	S
CO3	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO4	S	S	M	M	S	M	L	S	M	L	S	M	M	S	M
CO5	S	M	L	S	S	L	S	S	S	M	S	L	S	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P2MA06	**Title**	**Batch**	2018-2020
		CORE VI: COMPLEX ANALYSIS	**Semester**	II
Hrs/Week	6		**Credits**	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts of Limits and continuity.	K1, K2
CO2	Apply Cauchy's theorem for a Rectangle and Cauchy's theorem in a Disk.	K3
CO3	Analyze the Calculus of Residues and Harmonic Functions.	K4, K5
CO4	Determine Series and Product Development, Partial Fractions and Factorization.	K5
CO5	Evaluate the Riemann Mapping Theorem, Conformal Mapping of Polygons and Mapping on Rectangle.	K5,K6

Unit I: **(18 Hrs)**

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

Unit II: **(18 Hrs)**

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

Unit III: **(18 Hrs)**

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

Unit IV: **(18 Hrs)**

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

Unit V: **(18 Hrs)**

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

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

L.V. Ahlfors, *Complex Analysis,* Mc Graw Hill, New York, 2016.

REFERENCE BOOKS:

1. **Walter Rudin,*Real and Complex Analysis*,**McGraw. HiII Book Company.
2. **Tristan neetham, *Visual complex analysis,***clarentan press, Oxford.
3. **S.Arumugam, A.Thangapandi Issac, A.Somasundaram, *Complex Analysis***, Scitech Publications(India), Pvt.Ltd., Chennai, 2014.
4. **A.R.Vasishtha, Vipin Vasishtha, *Complex Analysis,*** Krishna Prakashan Media, Ltd, 2002.

ONLINE SOURCES:

1.www.freebookcentre.net
2. www.nptel.ac.in/courses/complex
3. https://www.math.upenn.edu

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	M	L	M	L	L	M	L	L	M	S
CO2	M	M	S	S	S	M	S	L	L	L	M	L	M	M	S
CO3	M	M	S	S	S	S	M	L	L	L	S	M	S	S	S
CO4	M	M	S	S	S	S	S	L	L	L	M	M	M	L	S
CO5	S	M	S	S	S	S	M	M	M	L	M	M	M	L	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P2MA07	**Title**	**Batch**	2018-2020
		CORE VII: REAL ANALYSIS-II	**Semester**	II
Hrs/Week	6		**Credits**	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Remember the concept of Integration and Differentiation.	K1, K2
CO2	To Classify integrals of a bounded function on a closed bounded interval.	K4, k5
CO3	To understand sequences and series of functions and its convergence.	K2, k3
CO4	To gainknowledge about Some special functions**.**	K3, K4
CO5	To Evaluate Functions of several variables.	K5,K6

UNIT I: Riemann – Stieltjes Integral (18 Hrs)

Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector–valued functions – Rectifiable curves - Problems

UNIT II: Sequences and Series of Functions (18 Hrs)

Discussion of main problem – Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration – Uniform Convergence and Differentiation – Problems

Unit III: Sequences and Series of Functions (contd…) (18 Hrs)

Equicontinuous families of functions – Stone-Weierstrass Theorems – Algebra of complex valued functions – Problems

Unit IV: Some special functions (18 Hrs)

Power series – The Exponential and Logarithmic functions – Trigonometric Functions – Fourier series - The Gamma functions – Problems (Algebraic completeness of the complex field -

omitted)

Unit V: Functions of several variables **(18 Hrs)**

Linear transformations – Differentiation – The contraction principle - The inverse function theorem – The implicit function theorem – Problems

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

Walter Rudin, "Principles of Mathematical Analysis", 3 rd Edition, McGraw Hill Book Co., Kogaskusha, 1976.

REFERENCE BOOKS:

1. T.M. Apostol, "Mathematical Analysis", Narosa Publishers, New Delhi,1985.

2. W.J.Kaczor and M.T.Nowak, "Problems in Mathematical Analysis III - Integration", American Mathematical Society, 2000.

3. A. Browder, "Mathematical Analysis, An Introduction", Springer-Verlag, New York, 1996.

4. K.A. Ross, "Elementary Analysis: The Theory of Calculus", 2 nd Edition, Springer, New York, 2013.

5. M. Stoll, "Introduction to Real Analysis", 2 nd Edition, Addison-Wesley Longman Inc, 2001..

ONLINE SOURCES:

1. www.analysiswebnotes.com
2. www.freebookcentre.net
3. http://nptl.ac.in

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S
CO3	S	M	S	S	S	M	S	S	L	M	L	S	M	S	S
CO4	S	M	S	S	S	S	M	M	M	L	S	S	M	L	S
CO5	S	M	L	S	S	S	S	M	S	M	L	S	M	M	M

S - Strong; M - Medium; L – Low

Programme code	M.Sc	Programme Title	Master of Science (Mathematics)	
Course Code	18P2MA08	Title	Batch	2018-2020
		CORE VIII: PARTIAL DIFFERENTIAL EQUATONS	Semester	II
Hrs/Week	6		Credits	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Remember Second order partial differential equations.	K1, K2
CO2	Understand the concept of Cauchy problem.	K2
CO3	To Gain knowledge about separation of variables.	K3, K4
CO4	Analyze the boundary value problems.	K4,K5
CO5	Evaluate the Green's function.	K5

Unit I **(18 Hrs)**

Mathematical Models: The Classical equation – The vibrating string – The vibrating membrane – Conduction of Heat in solids. Classification of second order equations: Second order equations in two independent variables – Cannonical forms – equations with constant coefficients – general solution.

Unit II **(18 Hrs)**

The Cauchy problem: The Cauchy problem – Cauchy – Kowlalewsky theorem – Homogeneous wave equation – Initial – Boundary value problems – Non-homogeneous boundary conditions – Non-homogeneous wave equation, Riemann Method.

Unit III **(18 Hrs)**

Methods of separation of variables: Seperation of variables – The vibrating string problem – Existence and Uniqueness of solution of the vibrating string problem. The heat conduction problem – existence and uniqueness of solution of the heat conduction problem – The laplace and beam equations.

Unit IV **(18 Hrs)**

Boundary value problems: Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorems – Dirichlet problems for a circle – Dirichlet problems for a circular annulus – Neumann problem for a circle Drirchlet problem for a rectangle – Neumann problem for a rectangle.

Unit V **(18 Hrs)**

Green's function: The delta function – Green's function – method of Green's function – Dirichlet problem for the Laplace operator – method of images – method of eigen functions.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

Tyn Myint. U with Lokenath Debnath, ***Partial Differential Equations for Scientists and Engineers***, 3rd Edition ,2004.

REFERENCE BOOKS:

1. **I.N.Sneddon,** ***Elements of Partial Differential Equations,*** McGraw Hill, London, 1957.

2. **L.C.Evans,** ***Partial Differential Equations***, AMS, Providence, R I, 2003.

3. **Stanley j. Farlow,** ***Partial Differential Equations***, Scientist and Engineers, 1982.

4. **E. C. Zachmanoglou,** ***Introduction to Partial Differential Equation***, 1976.

ONLINE SOURCES:

1. https://en.m.wikipedia.org>wiki>partaildifferentialequations

2. Homepage.univ.ac.at>pdeintro

3. https://www.math.upenn.edu

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	L	M	S	S	S	S	L	M	M	S
CO2	S	M	L	S	S	L	M	L	S	L	S	L	L	L	S
CO3	M	M	S	S	S	S	S	L	L	L	M	M	M	L	S

CO4	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S
CO5	S	M	S	S	S	S	M	M	M	M	S	L	L	L	M

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	**18P2MAE03**	**Title**	**Batch**	2018-2020
		ELECTIVE III: MATHEMATICAL METHODS	**Semester**	II
Hrs/Week	6		**Credits**	04

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To understand the concepts ofVariational problems.	K2
CO2	To gain knowledge about Variational Problem.	K3, K4
CO3	To understand various types of integral equation.	K1,K2
CO4	To analyze the Fredholm integral equations.	K4
CO5	To Evaluate Gram Schmit orthogonlization process and Solution of Fredholm integral equation of first kind.	K5,K6

UNIT – I: Variational problems with fixed boundaries (18 Hrs)

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 – Some applications to problems of Mechanics.

UNIT – II : Variational problems with moving boundaries (18 Hrs)

Movable boundary for a functional dependent on two functions – one-side variations – Reflection and Refraction of extermals – Diffraction of light rays.

UNIT – III :Integral Equation (18 Hrs)

Introduction – Types of Kernels – Eigen Values and Eigen Functions – Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems.

UNIT – IV : Solution of Fredholm integral equation (18 Hrs)

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 of successive substitution .

UNIT – V : Hilbert – Schmidt Theory **(18 Hrs)**

Complex Hilbert Space – Orthogonal system of functions – Gram Schmit orthogonlization process - Hilbert – Schmidt Theorem - Solution of Fredholm integral equation of first kind.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOKS:

1. **A.S. Gupta,** ***Calculus of Variations with Application,*** Prentice Hall of India, New Delhi, 2005.

2. **Sudir K.Pundir and Rimple Pundir**, ***Integral Equations and Boundary Value Problems,*** Pragati Prakasam, Meerut, 2005.

REFERENCE BOOKS:

1. F.B.Hildebrand, ***Methods of Applied Mathematics***, Prentice Hall of India Pvt. New Delhi, 1968.

2. R.P.Kanwal, ***Linear Integral Equations-Theory and Techniques***, Academic Press, New York, 1971.

3. L.Elsgolts, ***Differential Equations and Calculus of Variations***, Mir Publishers, Moscow, 1973.

Sadri Hassani, ***Mathematical Methods***, pub 2009.

ONLINE SOURCES:

1. http://physics.bgu.ac.il/~gedalin/Teaching/Master/mmp.pdf

2. http://home.iitk.ac.in/~dasgupta/Mathbook/Imastertrans.pdf

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	S	S	L	M	L	S	L	S	L	L	L	S
CO2	S	S	M	M	S	M	L	S	M	L	S	M	M	S	M
CO3	S	L	S	S	M	L	S	M	S	M	S	M	M	M	S

CO4	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO5	S	M	L	S	S	S	S	M	S	M	L	S	M	M	M

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P2MAE04	**Title**	**Batch**	2018-2020
		ELECTIVE PAPER IV: COMBINATORICS	**Semester**	I
Hrs/Week	6		**Credits**	05

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Understand the concepts of Permutations and Combinations.	K1, K2
CO2	To analyze the concepts of Generating functions	K4
CO3	To solve the problems of recurrence relations with two indices.	K5, K6
CO4	To gain knowledge in rook polynomials	K2, K3
CO5	To analyze the concept of Polya's theory of counting	K4,K5

UNIT-I: **(18 Hrs)**

Permutations and combinations – distributions of distinct objects – distributions of non distinct objects – Stirlings formula.

UNIT-II: **(18 Hrs)**

Generating functions – generating function for combinations – enumerators for permutations – distributions of distinct objects into non – distinct cells – paetitions of integers – the Ferrwr's graphs – elementary relations.

UNIT-III: **(18 Hrs)**

Recurrence relation – linear recurrence relations with constant coefficients solutions by the technique of generating functions – a special class of non linear difference equations – recurrence relations with two indices.

UNIT-IV: **(18 Hrs)**

The principle of inclusion and exclusion – general formula – permutations with restriction on relative positions – derangements – the rook polynomials – permutations with forbidden positions.

UNIT-V: **(18 Hrs)**

Polya's theory of counting – equivalence classes under a permutation group Burnside theorem – equivalence classes of functions – weights and inventories of functions – Polya's fundamental theorem – generation of Polya's theorem.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

C.L.Liu, ***Introduction of Combinatorial Mathematics,*** McGraw Hill, 1968.

REFERENCE BOOKS:

1. **Marshall Hall Jr,** ***Combinatorial Theory,*** John Wiley & sons, second edition.

2. **H.J. Rayser,** ***Combinatorial Mathematics,*** Carus Mathematical Monograph.

ONLINE SOURCES:

1. www.ejournal.com

2. www.ebook.com

3. www.freebookcentre.net

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO3	S	M	L	S	S	S	S	M	S	M	L	S	M	M	M
CO4	S	M	S	S	S	M	L	M	L	L	M	L	L	L	S

CO5	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S

S - Strong; M - Medium; L – Low

SEMESTER- III

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	**18P3MA09**	**Title**	**Batch**	2018-2020
		CORE IX :MEASURE THEORY AND INTEGRATION	**Semester**	III
Hrs/Week	6		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Know about the Measurable functions and its Properties	K1
CO2	To understand the Riemann integral.	K1, K2
CO3	To gain knowledge about Monotone functions.	K3, K4
CO4	To analyze the Radon-Nikodym Theroem.	K4, K5
CO5	To evaluate Measure and outer measure.	K5,K6

UNIT – I: Lebesgue Measure (18Hrs)

Introduction-Outer Measure-Measurable Sets and Lebesgue Measure-Measurable Functions-Littlewood's Three Principles.

UNIT - II : Lebesgue Integral (18 Hrs)

The Riemann Integral-the Lebesgue Integral of a Bounded Function over a Set of Finite Measure-the integral of a Nonnegative Function –the General Lebesgue Integral.

UNIT – III : Differentiation and Integration (18 Hrs)

Differentiation of Monotone Functions- Functions of Bounded Variation-Differentiation of an Integral- Absolute continuity.

Unit – IV :General Measure and Integration **(18 Hrs)**

Measure and Integration- Measure Spaces- Measurable Functions- Integration-Signed measures- the Radon-Nikodym Theroem.

UNIT - V : Measure and Outer Measure **(18 Hrs)**

Outer Measure and Measurability-the Extension Theorem-Product Measures.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK :

H. L. Royden, "**Real Analysis"**, 3rd Edition, Prentice Hall of India Private Ltd., New Delhi-110001, 2009.

REFERENCE BOOKS:

1. G.de.Barra, "*Measure Theory and Integration"*, WILEY Eastern Ltd,1981.
2. P.K.Jain and V.P.Gupta, "*Lebesgue Measure and integration"*, New Age INT(P)Ltd., 2000.
3. Walter Rudin,"*Real and Complex Analysi"s*, Tata Mc Graw Hill Publ.Co.Ltd.,1966.
Simmons G.F, "*Topology and Modern Analysis"*, Mc Graw Hill Book Company, 1963.

ONLINE SOURCES:

1. https://ocw.mit.edu.
2. https://nptel.ac.in
3. https://swayam.gov.in

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	M	M	L	M	M	S	S	M	L	M	S
CO2	S	M	L	S	S	M	M	M	M	L	S	M	L	L	S
CO3	S	L	S	S	S	S	S	S	M	L	S	L	S	M	S

CO4	S	M	S	S	M	S	L	S	M	L	S	L	S	S	S
CO5	S	M	S	S	S	S	M	S	M	L	S	M	M	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P3MA10	**Title**	**Batch**	2018-2020
		CORE X: TOPOLOGY	**Semester**	III
Hrs/Week	5		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To recall the basic ideas about Topology, Open set, Closed set.	K1
CO2	Discuss the concepts Topological spaces, order topology and product topology.	K2, K3
CO3	To analyze the Connectedness	K4
CO4	To Gain knowledgein Compactness.	K3, K4
CO5	To Evaluate Countability axioms and Separation axioms.	K5

Unit-I: Topological spaces **(15 hrs)**

Topological spaces - Basis for a Topology - The order topology - Product topology on XxY-The subspace topology - Closed sets and Limit points.

Unit-II: Continuous Functions **(15 hrs)**

Continuous functions - The product topology - The metric topology.

Unit-III: Connectedness **(15 hrs)**

Connected spaces - Connected subspaces of the real line - Components and local connectedness.

Unit-IV: Compactness **(15 hrs)**

Compact spaces - Compact subspaces of the real line - limit point compactness - local compactness.

Unit-V: Countability and separation axioms **(15 hrs)**

The Countability axioms - The separation axioms - Normal spaces - The Urysohn lemma - The Urysohn metrization theorem - The Tietze extension theorem.

TOTAL : **75 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

James R. Munkres, "***Topology"***, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2014.

REFERENCE BOOKS:

1. **J. Dugundji, "*Topology"***, Allyn and Bacon, 1975.

2**. George F.Simmons**, "***Introduction to Topology and Modern Analysis"***, McGraw Hill 2006.

3. S.**T.Hu**, "***Elements of general topology"***, Holden day,Inc,New York, 1988.

4. **K. Chandrasekara Rao**, "***Topology"***, Narosa Publishing House, Pvt., Ltd., 2009.

ONLINE SOURCES:

1. https://nptel.ac.in/downloads/111106054/

2. https://ocw.mit.edu.

3. https://swayam.gov.in

4. www.freebookcentre.net

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S

CO2	S	M	L	S	S	L	S	S	S	M	S	L	S	M	S
CO3	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO4	S	S	M	M	S	M	L	S	M	L	S	M	M	S	M
CO5	S	M	S	S	S	S	M	M	M	M	S	L	L	L	M

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P3MA11	**Title**	**Batch**	2018-2020
		CORE PAPER XI: NUMERICAL ANALYSIS	**Semester**	III
Hrs/Week	5		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To recall the basic concepts of Newton's method, Trapezoidal rule and Simpson's rules	K1, K2
CO2	To understand various types of methods to solve the Differential Equations.	K2
CO3	To solve the problems of ODE.	K5, K6
CO4	To gain knowledge in Boundary Value Problems And Characteristic Value Problems	K3, K4
CO5	To Analyze the concept of Numerical Solution Of Partial Differential Equations	K4, K5

Unit I:Solution Of Nonlinear Equations (15 Hrs)

Newton's method – Convergence of Newton's method – Bairstow"s Method for quadratic factors. **Numerical Differentiation And Integration:** Derivatives from Differences tables – Higher order derivatives – Divided difference, Central-Difference formulas – Composite formula of Trapezoidal rule – Romberg integration – Simpson's rules.

Unit II : Solution Of System Of Equations (15 Hrs)

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

Unit III: Solution Of Ordinary Differential Equations **(15 Hrs)**

Taylor series method – Euler and Modified Euler methods – Rungekutta methods – Multistep methods – Milne's method – Adams Moulton method.

Unit IV: **Boundary Value Problems And Characteristic Value Problems** **(15 Hrs)**

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

Unit V:Numerical Solution Of Partial Differential Equations **(15 Hrs)**

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

TOTAL : **75 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

C.F.Gerald and P.O.Wheatley, "*Applied Numerical Analysis"*, Fifth Edition, Addison Wesley, (1998).

REFERENCE BOOKS :

1. **M.K. Venkatraman, "*Numerical Methods in Science and Technology",*** National Publishers Company, 2nd Edition,(1992).

2. **S.C. Chapra and P.C. Raymond, "*Numerical Methods for Engineers",*** tata McGraw Hill, (2000)

3. **P. Kandasamy et al., "*Numerical Methods",***S.Chand & Company Ltd.(2003).

ONLINE SOURCES:

1. https://nptel.ac.in/downloads/111106054/
2. https://ocw.mit.edu.
3. https://swayam.gov.in
4. www.freebookcentre.net

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	S	S	M	M	M	M	L	S	M	L	L	S
CO2	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO3	S	M	S	S	S	S	M	S	M	L	S	M	M	M	S
CO4	S	M	S	S	S	S	L	S	L	L	S	L	M	M	S
CO5	M	M	S	S	S	S	M	L	L	L	S	M	S	S	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P3MA12	**Title**	**Batch**	2018-2020
		CORE XII: GRAPH THEORY	**Semester**	III
Hrs/Week	4		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To Understand the concepts of related to Graphs and Trees.	K1, K2
CO2	To gain knowledge about connectivity and trees.	K3, K4
CO3	To apply the Concept in Matchings and colorings	K3
CO4	To analyze Graph Colorings.	K4
CO5	To Evaluate Planarity.	K5, K6

Unit I: **(12 Hrs)**

Basic Results: Introduction-Basic Concepts-Subgraphs-Degrees of Vertices - Paths and Connectedness - Automorphism of a Simple Graph. Directed Graphs: Introduction-Basic Concepts-Tournaments.

Unit II: **(12 Hrs)**

Connectivity and Trees: Connectivity: Introduction-Vertex cut and Edge Cut-Connectivity and Edge Connectivity. Trees: Introduction-Definition, Characterization and Simple Properties-Centers and Centroids- Cutting the Number of Spanning Trees-Cayley's Formula.

Unit III: **(12 Hrs)**

Independent Sets, Matchings and Cycles: Independent Sets and Matchings: Introduction-Vertex-Independent Sets and Vertex Coverings-Edge-Independent sets-Matchings and Factors-Matchings in Bipartite Graphs. Cycles: Introduction-Eulerian GraphsHamiltonian Graphs.

Unit IV: **(12 Hrs)**

Graph Colorings: Introduction-Vertex colorings-Critical Graphs-Edge colorings of Graphs-Kirkman's Schoolgirl- Problem-Chromatic Polynomials.

UNIT V: **(12 Hrs)**

Planarity: Introduction- Planar and Nonplanar Graphs –Euler Formula and its Consequences and $K_{3,3}$ are Nonplanar Graphs – Dual of a Plane Graph- The Four-Color Theorem and the Heawood Five-Color Theorem-Hamiltonian Plane Graphs-Tait Coloring.

TOTAL : **60 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

R.Balakrishnan and K.Ranganathan, "Text Book of Graph Theory", (2nd Edition), Springer, 2012.

REFERENCE BOOKS:

1. **J.A.Bondy and U.S.R. Murty**, "**Graph Theory with Applications"**, 1982.

2. **Narasing Deo,**"**Graph Theory with Application to Engineering and Computer Science"**, Prentice Hall of India, 2003.

3. **F. Harary**, "**Graph Theory"**, Addison – Wesely Pub. Co. The Mass. 1969. 4. L. R.. Foulds, Graph Theory Application, Narosa Publ. House, Chennai, 1933.

4.**K.R.Partha sarathy "Introduction to graph theory",** Prentice Hall of India, 2003.

ONLINE SOURCES :

1. https://nptel.ac.in/downloads/111106054/
2. https://ocw.mit.edu.
3. https://swayam.gov.in

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	S	S	M	M	M	M	L	S	M	L	L	S
CO2	S	L	S	S	S	S	S	S	M	L	S	L	S	M	S
CO3	S	M	S	S	S	S	M	M	M	L	L	L	M	M	M
CO4	M	M	S	S	S	S	S	L	L	L	M	M	M	L	S
CO5	S	M	S	S	S	S	M	S	M	L	S	M	M	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P3MAE05	**Title**	**Batch**	2018-2020
		CORE BASED ELECTIVE III: OPTIMIZATION TECHNIQUES	**Semester**	III
Hrs/Week	5		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To understand the concepts of duality in Linear programming problem.	K1, K2
CO2	To know about decision analysis and games.	K2, K3
CO3	To apply the idea about Simulation modeling through Monte Carlo simulation.	K3, K4
CO4	To analyze Non linear programming problem.	K4
CO5	To Evaluate Quadratic programmingproblem.	K5

Unit I: Duality Linear Programming **(15 Hrs)**

General Primal-Dual – Formulating a Dual problem – Duality and Simplex Method – Dual Simplex Method.

Unit II: Decision analysis and games **(15 Hrs)**

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.

Unit III: Simulation modeling **(15 Hrs)**

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.

Unit IV: Nonlinear Programming Problem **(15 Hrs)**

Formulation – General NLPP – Constrained optimization with equality constraints - Constrained optimization with inequality constraints.

Unit V: Nonlinear programming Methods **(15 Hrs)**

Graphical solution – Khun-Tucker Conditions with non-negative constraints - Quadratic programming – Wolfe's method - Separable convex programming - Geometric programming.

TOTAL: **75 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

TEXT BOOK:

1. H.A. Taha, "*Operation Research an Introduction",* Prentice Hall India**,** 2003.**(Unit I , II , & III)**

2. Kanti swarup, P.K. Gupta and Man Mohan , "*Operations Research",* Sultan Chand & Sons, 2015. **(Unit IV & V)**

REFERENCE BOOKS:

1. **F.S. Hillier and G.J. Lieberman, "*Introduction to Operation Research",***

Mc Graw Hill Book Company, 1989.

2. **Philips D.T.Ravindra A. and J. Solbery,**"***Operations Research", Principles and***

Practice, John Wiley and Sons, New York.

3. **B.E.Gillett,** ***Operations research – A Computer Oriented Algorithmic***

Approach,TMH Edition, New Delhi, 1976.

ONLINE SOURCES:

1. https://nptel.ac.in/downloads/111106054/

2. https://ocw.mit.edu.
3. https://swayam.gov.in

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	M	S	S	S	M	S	S	L	M	L	S	M	S	S
CO3	S	S	M	M	S	M	L	S	M	L	S	M	M	S	M
CO4	S	M	S	S	S	S	M	M	M	L	S	S	M	L	S
CO5	S	M	L	S	S	S	S	M	S	L	S	M	M	M	M

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P3CSED1	**Title**	**Batch**	2018-2020
		EDC: INTRODUCTION TO INFORMATION TECHNOLOGY	**Semester**	III
Hrs/Week	3		**Credits**	1

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To learn about difference between data and information.	K1, K2
CO2	To gain knowledge about the Hardware and Software concepts.	K1,K2
CO3	To understand about Multimedia concepts in a computer.	K2
CO4	To create awareness about computer network and communication systems.	K5, K6
CO5	To develop the internet technologies and WWW ideas.	K6

UNIT I **(9 Hours)**

Introduction To Computer: Introduction- What is Computer?-Types of Computers-Organization of Basic computers- Applications of Computers-Limitations of Computers. Data Representation in Computers: Bits and Bytes-Number systems for Data Representation-Coding Schemes-Conversations of Numbers-Binary Arithmetic.

UNIT II **(9 Hours)**

Hardware Devices: Introduction-Input devices-Output devices-Storage devices. **Software concepts:** Introduction-System software-Utility Software-Application Software.

UNIT III **(9 Hours)**

Multimedia: Introduction- What is Multimedia?-Applications of Multimedia-Components of Multimedia-Hardware for Multimedia-Software Multimedia-Graphics Files.

UNIT IV **(9 Hours)**

Data Communication And Computer Network: Introduction-Data Communication-Transmission Media-Multiplexing-Switching-Computer Network-Network Topologies-Communication Protocols-Network Devices.

UNIT V **(9 Hours)**

Internet Basics:Introduction-Evolution of Internet-Basics Internet Terms-Getting Connected to internet-Internet Applications-E-Mail Introduction-Data Over internet- Internet and viruses.

TOTAL : **45 Hours**

Power point Presentations, Seminar ,Quiz, Assignment, Animation video Class

TEXT BOOKS:

1. "**Computer Fundamentals and Applications**", by Ashok Arora, VIKAS Publishing House PVT LTD, 2015.
2. "**Introduction to Computer Science**" ITL Education Solutions Limited, Second Edition. 2011.

REFERENCE BOOKS:

1. "**Introduction to Information Technology**" Xpress Leaning, ITL Education Solutions Limited, 2012.
2. "**Data Communication and Computer Network**", by Brijendra Singh, Second Edition, Prentice Hall of India PVT LTD, 2006.
3. "**Introduction to Computers**" by Gary B. Shelly, Thomas J Cashman & Misty E. Vermaat, Eighth Edition,2011.

ONLINE SOURCES:

1. https://homepage.cs.uri.edu/faculty/wolfe/book/Readings/Reading03.htm
2. https://www.computerhope.com/issues/ch000039.htm

3. https://www.omicsonline.org/conferences-list/multimedia-tools-and-applications
4. https://www.lucidchart.com/pages/templates/network-diagram/network-topology-diagram-template
5. https://www.sciencedirect.com/topics/computer-science/internet-architecture

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	M	M	M	L	M	S	S	M	L	M	S
CO2	S	L	M	M	M	S	S	S	S	S	S	M	L	M	S
CO3	S	M	M	S	S	S	M	S	M	S	S	M	S	M	S
CO4	S	M	S	S	S	S	M	M	M	L	M	M	M	M	S
CO5	M	M	S	S	S	S	M	M	L	S	S	M	M	S	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P3HR04	**Title**	**Batch**	2018-2020
		VALUE BASED EDUCATION:HUMAN RIGHTS	**Semester**	III
Hrs/Week	2		**Credits**	1

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To create awareness, conviction& commitment to values for improving the quality of life through education.	K6
CO2	Discuss the concepts Characteristics of Human Rights.	K5
CO3	To demonstrate an understanding of Indian Constitutional Guarantee on Human Rights	K4,K5
CO4	To analyze Human Rights for Women .	K3,K4
CO5	To Evaluate Human Rights in Emerging Sectors.	K5,K6

Unit-I: Introduction To Human Rights **(6 Hrs)**

Definitions – Characteristics of Human Rights – Principles of Human Rights – Theories of Human Rights – Theory of Natural Rights, Social welfare Theory, Legal Theory – Classification of

Human Rights- International instruments of Human Rights: Universial Declaration of Human Rights (1948) – International Covenant on Civil, Economic, Social & Cultural and Political Rights.

Unit-II: Indian Constitutional Guarantee on Human Rights (6 Hrs)

Fundamental rights part III of the constitution – Directive principles partIV of the constitution – The Criminal Procedure Code, 1973 – Protection of Civil Rights Act, 1955 as amended in 1976 – The Scheduled Caste and Scheduled Tribe (Prevention of Atrocities) Act, 1989 – Optional Protocol to International Covenant on Civil & Political Rights.

Unit-III: Implementing Agencies of Human Rights in India (6 Hrs)

National Human Rights Commission (N.H.R.C) – State Human Rights Commission (S.H.R.C) – National Commission for Women, 1990 – National Commission for Minorities - National Commission for Scheduled Caste and Scheduled Tribe (S.C & S.T) – Their powers and functions.

Unit-IV: Human Rights for Women (6 Hrs)

Constitutional Provisions : Articles 14, 15, 15(3), 16, 39(a), 39(b), 39(c) & 42 of the constitutions – Legal Provisions : The Employees State Insurance Act, 1948, The Family Courts Act, 1954, The Special Marriage Act, 1954, The Hindu Marriage Act, 1955, The Maternity Benefit Act, 1961 (Amended in 1955), Dowry Prohibition Act, 1961, The Equal Remuneration Act, 1976, The Prohibition of Child Marriage Act, 2006, The Factories (Amendment) Act, 1986, The Protection of Women from Domestic Violence Act, 2005.

Unit-V: Human Rights in Emerging Sectors (6 Hrs)

Instruments on the Rights of Children – Refugees and Human Rights – Certain incidents that pose a threat to Human Rights – Educational Rights – Rights to Employment – Right to Information Act, 2005.

TOTAL : 30 Hours

Power point Presentations, Seminar & Assignment

TEXT BOOK:

Brian Orend,*Human Rights : Concepts and Context* – 2002.

REFERENCE BOOKS:

1. Arun Rai,*National Human Rights Commission f India: Formation, Functioning & Future Prospects,* Atlantic Publishers, Delhi.

2. Brinder Pal Singh Sehgal, *Human Rights in India : Problems and Perspectives*.

ONLINE SOURCES:

1.https://www.tutorialspoint.com

2. https://en.wikipedia.org/wiki/HumanRights

3. http://web.mit.edu/

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	M	M	S	S	S	S	M	M	L	S	S	M	M	S	S
CO2	M	M	S	S	S	M	S	M	M	L	M	M	M	M	S
CO3	S	M	S	S	S	M	M	S	M	L	L	L	M	M	S
CO4	M	M	S	S	S	S	S	L	M	L	L	S	M	L	S
CO5	S	M	S	S	S	S	M	S	M	L	S	M	M	M	S

S - Strong; M - Medium; L – Low

SEMESTER- IV

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P4MA13	**Title**	**Batch**	2018-2020
		CORE XIII: FUNCTIONAL ANALYSIS	**Semester**	IV
Hrs/Week	6		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To understand the concept of Banach spaces.	K1, K2
CO2	To apply the Concept in Hilbert spaces.	K3
CO3	To demonstrate Orthogonal complements.	K4, K5
CO4	To analyzeself adjoint operators.	K4
CO5	To gain knowledge about Finite dimensional spectral theory.	K2, K3

Unit I: **(18 Hrs)**

Banach spaces: The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem.

Unit II: **(18 Hrs)**

The natural imbedding of N in N** - The open mapping theorem- The conjugate of an operator. Hilbert spaces: The definition and some simple properties.

Unit III: **(18 Hrs)**

Orthogonal complements - Orthonormal sets- The Conjugate space H* - The adjoint of an operator.

Unit IV: **(18 Hrs)**

Self-adjoint operators – Normal and unitary operators – Projections.

Unit V: **(18 Hrs)**

Finite dimensional spectral theory: Matrices –The spectral theorem – General preliminaries on Benach's Algebra: The definition and some examples - Regular and singular elements.

TOTAL : **90 Hours**

Power point Presentations, Seminar & Assignment

TEXT BOOK:

G.F. Simmons, ***Introduction to Topology and Modern Analysis****,* TATA McGraw –Hill Book Company, New Delhi, 1963, 5th Reprint 2006.

REFERENCE BOOKS :

1. Dr. D. Somasundaram, ***Functional Analysis,*** S.Viswanathan Pvt.Ltd, 2008.
2. G. Bachman and L. Narici, ***Functional Analysis,*** Academic Press, New York, 2000.
3. H.C. Goffman and G. Fedrick, ***First Course in Functional Analysis,*** Prentice Hall of India, New Delhi, 2000.
4. E. Kreyszig, ***Introductory Functional Analysis with Applications,***John Wiley & Sons, New York, 1978.
5. E.S.Suhubi, ***Functional Analysis,*** Springer International Edition, India, 2009.

ONLINE SOURCES:

1. https://ocw.mit.edu
2. www.sciencedirect.com
3. www.elsevier.com
4. www.khanacademy.org

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	S	S	L	M	L	L	S	M	M	M	S
CO2	M	M	S	S	S	M	S	L	L	L	M	L	M	M	S
CO3	M	M	S	S	S	S	M	L	L	L	S	M	S	S	S
CO4	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO5	S	M	S	S	S	M	S	S	L	M	L	S	M	S	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P4MA14	**Title**	**Batch**	2018-2020
		CORE XIV: PROBABILITY THEORY	**Semester**	IV
Hrs/Week	6		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To given the basic concept of Probability theory.	K1, K2
CO2	To understand the concept of moments.	K2, K3
CO3	To analyze the characteristic functions	K4
CO4	To apply the concepts of discrete and continuous distributions.	K3, K4
CO5	To gain knowledge about Bernoulli Law of Large Numbers.	K4,K5

Unit I: **(18 Hrs)**

Random Events and Random variables – 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 random variables.

Unit II: **(18 Hrs)**

Parameters of the distribution – Expectation – Moments – The Chebyshev inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

Unit III: **(18 Hrs)**

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 – Probability generating functions.

Unit IV: **(18 Hrs)**

Some probability distributions – One point, two point, Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.

Unit V: **(18 Hrs)**

Limit theorems – Stochastic convergence – Bernoulli Law of Large Numbers – Convergence of sequence of distribution functions – Levy-Crammer Theorem – De Moivre Laplace theorem – Borel-Cantelli Lemma – Kolmogorov inequality and Kolmogorov Strong Law of Large numbers.

TOTAL : **90 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

TEXT BOOK:

B.R.BHAT " **Modern Probability theory: an introductory** " 4th edition,new age international publisher ,2007.

REFERENCE BOOKS:

1. M. Fisz, "*Probability theory and Mathematical Statistics"*, John Wiley and Sons, 1963.
2. R.B. Ash, "*Real Analysis and Probability"*, Academic Press, 1972.
3. K. L. Chung, "*A course in Probability"*, Academic press, 1974.
4. Y.S.Chow and H. Teicher, "*Probability Theory"*, Springer Verlag, 1988.
5. V. K. Rohatgi, "*An Introduction to Probability Theory and Mathematical Statistics"*, Wiley Eastern Ltd., 2015.

ONLINE SOURCES:

1. https://nptel.ac.in
2. https://www.britannica.com/topic/probability-theory

3. https://en.m.wikibooks.org
4. http://study.com/academy/lesson/basic-probability-theory-rules-formulas.html

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	M	S	S	S	M	L	M	L	L	M	L	L	L	S
CO3	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO4	S	L	S	S	S	S	S	S	M	L	S	L	S	M	S
CO5	S	M	S	S	M	S	L	S	M	L	S	L	S	S	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P4MA15	**Title**	**Batch**	2018-2020
		CORE XV: FLUID DYNAMICS	**Semester**	IV
Hrs/Week	6		**Credits**	4

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To know about the kinematics of fluid and its terminology.	K1, K2
CO2	To Gain knowledge in Equations of Motion of a Fluid	K3, K4
CO3	To understand the concepts of Some Three –Dimensional Flows	K2
CO4	To analyze Some Two -Dimensional Flows	K4
CO5	To Evaluate Viscous Flow and connected properties	K5 ,K6

Unit -I : Kinematics of Fluids in Motion **(18 Hrs)**

Real Fluids and Ideal Fluids- Velocity of a Fluid at a Point- Stream lines and path lines:Steady and Unsteady Flows- the Velocity Potential-The Vorticity Vector-Local and Particle Rates of change-the equation of Continuity-Worked Examples-Acceleration of a fluid Conditions at a rigid Boundary.

Unit-II : Equations of Motion of a Fluid **(18 Hrs)**

Pressure at a Point in a Fluid at Rest-Pressure at a Point in a Moving Fluid-Conditions at a Boundary of Two inviscid Immiscible Fluids-Euler's Equations of Motion –Bernoulli's Equation – Worked Examples-Discussion of the Case of Steady Motion under Conservative Body Forces.

Unit – III: Some Three –Dimensional Flows **(18 Hrs)**

Introduction-Sources, Sinks and Doublets-Images in a Rigid Infinite Plane-
Axi-Symmetric Flows: Stokes's Stream Function.

Unit IV: Some Two -Dimensional Flows **(18 Hrs)**

Meaning of Two -Dimensional Flow-Use of Cylindrical Polar Co-ordinates-the Stream Function –the Complex Potential for Two –Dimensional, Irrotational, InCompressible Flow –Complex Velocity Potential for Standard Two –Dimensional flows-Some Worked Examples.

Unit V: Viscous Flow **(18Hrs)**

Stress Components in a Real Fluid –Relations between Cartesian Components of Stress-Translational Motion of Fluid Element-the Rate of Strain Quadric and Principal Stresses- Some Further Properties of the Rate of Strain Quadric-Stress Analysis in Fluid Motion- Relations between Stress and Rate of Strain-the co-efficient of Viscosity and Laminar Flow-the Navier –Stokes Equations of Motion of a Viscous Fluid.

TOTAL : **(90 Hrs)**

Power point Presentations, Seminar & Assignment

TEXT BOOK :

F.Chorlton, ***Text book of Fluid Dynamics***, CBS Publication New Delhi, 2004.

REFERENCE BOOKS:

1. **G.K.Batchaelor**, ***An Introduction to Fluid Mechanics***, Foundation Books,New Delhi,2002.

2. **S.W .Yuan**, ***Foundations of Fluid Mechanics,*** Prentice Hall of India Pvt. LtD., New Delhi,2000.

3. **R.K.Rathy,** ***An Introduction to Fluid Dynamic***, IBH Publ.Comp.New Delhi, 2002.

ONLINE SOURCES:

1. www.efluids.com

2. www.springer.com

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	M	L	M	L	M	L	S	L	L	L	S
CO2	S	S	M	M	S	M	L	S	M	L	S	M	M	S	M
CO3	S	M	L	S	S	L	M	L	S	L	S	L	L	L	S
CO4	S	L	S	M	M	L	L	M	M	L	M	L	L	L	S
CO5	S	M	S	S	S	S	M	S	M	L	S	M	M	M	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P4MAE07	**Title**	**Batch**	2018-2020
		ELECTIVE IV: DIFFERENTIAL GEOMETRY	**Semester**	IV
Hrs/Week	6		**Credits**	4

Course Outcomes (CO)

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To gain the knowledge about space curves	K3, K4
CO2	To understand the concept of theory of surfaces.	K1, K2
CO3	To apply the concepts to global analysis and topology of manifolds.	K2, K3
CO4	To determine the new techniques of differential geometric methods.	K5, K6
CO5	To focus on Geodesic on a surface.	K4, K5

Unit: I **(18 Hrs)**

Theory of Space Curves: Introduction – Representation of space curves –Unique parametric representation of a space curve –Arc length – Tangent and osculating plane –Principle normal and binormal–Curvature and torsion – The curvature and torsion of a curve as the intersection of two surfaces.

Unit :II **(18 Hrs)**

Theory of Space Curves (Contd): Contact between curves and surfaces-Osculating circle and osculating sphere –Locus of centres of spherical curvature – Tangent surfaces – Involutes and Evolutes – Intrinsic equations of space curves – Fundamental Existence theorem for space curves.

Unit :III **(18 Hrs)**

The first fundamental form and Local Intrinsic properties of a surface: Introduction - 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 – The first fundamental form - Direction coefficients on a surface.

Unit :IV **(18 Hrs)**

The first fundamental form and Local Intrinsic properties of a surface (Contd) and geodesic on a surface: Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Introduction - Geodesics and their differential equations – Canonical Geodesic equations.

Unit :V **(18 Hrs)**

Geodesic on a surface: Normal property of Geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesics parallels – Geodesic curvature – Gauss Bonnet Theorems – Gaussian curvature.

TOTAL : **90 Hours**

Power point Presentations, Seminar ,Quiz, Assignment

TEXT BOOK:

1. **D. Somasundaram,** ***Differential Geometry***, Narosa Publ.House, Chennai-2006.

REFERENCE BOOKS :

1. **T.Wilmore,*****An Introduction to Differential Geometry,*** Clarendan Press,Oxford,2015.

2. **D.T. Struik,*****Lectures on classical Differential Geometry,*** Addison-Wesely,Mass 2006

3. **J.A. Thorpe,*****Elementary Topics in Differential Geometry,*** Springer-Verlag, NewYork,1979.

4. **Erwin Kreyszig,*Differential Geometry, Dover publications,*** INC, New York 2000.

ONLINE SOURCES:

1. https://nptel.ac.in/downloads/111106054/
2. https://ocw.mit.edu.
3. https://swayam.gov.in
4. www.freebookcentre.net

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	M	M	S	S	S	S	S	L	L	L	M	M	M	L	S
CO2	S	M	S	S	S	S	L	M	L	L	S	M	M	M	S
CO3	S	M	S	S	S	M	L	M	L	L	M	L	L	L	S
CO4	S	M	S	S	S	S	M	M	M	L	M	M	M	M	S
CO5	S	M	S	S	S	S	M	M	M	L	S	S	M	L	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	18P4CSSK01	**Title**	**Batch**	2018-2020
		ESSENTIALS OF MATLAB	**Semester**	IV
Hrs/Week	2		**Credits**	01

Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To learn about how to approach for solving mathematics problem by using matlab software and simulation tools.	K1, K2
CO2	To understand about creating arrays in MATLAB.	K2
CO3	To create awareness about Mathematical operations with arrays in MATLAB.	K6
CO4	To gain knowledge about 2D and 3D plots.	K1,K2
CO5	To develop the programming for mathematical problems.	K5, K6

Unit-I: Starting With Matlab: **(6 Hrs)**

Starting Matlab, Matlab Windows - Working In The Command Window - Arithmetic Operations With Scalars - Display Formats -Elementary Math Built-In Functions- Defining Scalar Variables- Useful Commands For Managing Variables -Script Files -Examples Of Matlab Applications Problems.

Unit-II: Creating Arrays: (6 Hrs)

Creating A One-Dimensional Array (Vector)-Creating A Two-Dimensional Array (Matrix) - Notes About Variables In Matlab -The Transpose Operator - Array Addressing -Using A Colon : In Addressing Arrays- Adding Elements To Existing Variables -Deleting Elements - Built-In Functions For Handling Arrays -Strings And Strings As Variables.

Unit-III:Mathematical Operations with Arrays: (6 Hrs)

Addition and Subtraction-Array multiplication-Array Division-Element-By-Element Operations - Using Arrays In Matlab Built-In Math Functions- Built-In Functions For Analyzing Arrays-Generation Of Random Numbers.

Unit-IV:Two-Dimensional Plots: (6 Hrs)

The Plot Command - The Fplot Command -Plotting Multiple Graphs In The Same Plot- Plots With Special Graphics –Histograms. **Three-Dimensional Plots** :Line Plots -Mesh And Surface Plots - Plots With Special Graphics-The View Command.

Unit-V:Programming in Matlab: (6 Hrs)

Relational And Logical Operators - Conditional statements-The Switch-Case Statement-Loops - For-End Loops -While-End Loops - Nested Loops And Nested Conditional Statements-The Break And Continue Commands.

TOTAL : 30 Hours

Power point Presentations, Seminar ,Quiz, Assignment, Animation video Class

TEXT BOOKS:

Amos Gilat, ***MATLAB: An introduction with Applications***, 5th Edition, JOHN WILEY & SONS, INC.

REFERENCE BOOKS:

1. **S.Swapna Kumar,** ***MATLAB Easy way of Learning,*** Lenina SVB,PHI Publications.
2. **Rudra Pratap,** ***Getting Started with MATLAB***,OXFORD University Press.

3. Khalid Sayood and Richard C. Dorf, ***Learning Programming Using MATLAB*** (Synthesis Lectures on Electrical Engineering), Morgan & claypool publishers.

4. D. Hanselman and B Littlefield, *Mastering Matlab 7*, Pearson Education.

5. A.Gilat, ***Matlab****: An Introduction with Applications*, John Wiley and Sons, 2004

ONLINE SOURCES:

1. www.mathworks.com
2. https://www.tutorialspoint.com/matlab/
3. https://en.wikipedia.org/wiki/MATLAB

Mapping with Programme Outcomes

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	S	S	S	S	M	S	S	S	S	M	M	M	S
CO2	S	M	S	S	S	S	M	S	S	S	M	M	M	S	S
CO3	S	M	S	S	S	S	S	S	M	S	S	M	M	S	S
CO4	S	M	M	S	S	S	S	S	S	S	M	L	M	M	S
CO5	M	M	S	S	S	S	S	S	S	M	M	M	M	S	S

S - Strong; M - Medium; L – Low

Programme code	M.Sc	**Programme Title**	**Master of Science (Mathematics)**	
Course Code	**18P4MAPR01**	**Title**	**Batch**	2018-2020
		PROJECT	**Semester**	IV
Hrs/Week	4		**Credits**	3

Topic:

The Topic of the dissertation shall be assigned to the candidate before the beginning of third semester and a copy of the same should be submitted to the examination to approval.

No. of Copies Project/Dissertation:

The students should prepare three copies of dissertation and submit the same for the evaluation by examiners.After evaluation one copy is to be retained in the college library and one copy is to be submitted to the COE cell and one copy can be held by the student.

Format to be followed:

The formats/certificates for project/dissertation to be submitted to the students is given below:

Format for the preparation of project work:

a) Title page

b) Bonafide certificate

c) Acknowledgement

d) Table of contents

CONTENTS

Chapter No.	**Title**	**Page No**
1	Introduction	
2	Title of the Chapters	
3	Conclusion	
4	References	

Format of the Title Page:

TITLE OF THE PROJECT/DISSERTATION

Project /Dissertation submitted in partial fulfillment of the requirement for the Degree of Master of Science in

MATHEMATICS

By

Student's Name :

Register Number :

College :

Year :

Format of the Certificate:

This is to certify that the dissertation entitled …….. …submitted in partial fulfillment of the requirement of the degree of Master of Science in MATHEMATICS,is a record of bonafide research work carried out by …… under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree ,diploma,fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

Signature of the Guide

Date:

Place:

QUESTION PAPER PATTERN -PG

Bloom's Taxonomy Based Assessment Pattern

K1-Remembering; **K2**- Understanding; **K3**- Appling;
K4-Analyzing;**K5**-Evaluating;**K6**- Creating;

Theory: 75 Marks

Test- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer all)	20x01=20	MCQ/Define	75
K2& K3	B (Either or pattern)	05x05=25	Short Answers	
K4& K5	C (Answer 3out of5)	03x10=30	Descriptive/ Detailed	