ANNEXURE 18B02

V.V. VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)

An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai

Re-accredited with 'A' Grade (3rd Cycle) by NAAC

VIRUDHUNAGAR - 626 001

CHOICE BASED CREDIT SYSTEM
REGULATIONS AND SYLLABUS
(with effect from Academic Year 2018 - 2019)

V.V. Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 19 UG Programmes, 14 PG Programmes, 6 M.Phil. Programmes and 3 Ph.D. Programmes. All these programmes, except Ph.D. Programmes, have been framed as per the guidelines given by UGC under Choice Based Credit System (CBCS).

The Departments of Commerce, English and History upgraded as Research Centres offer Ph.D. Programmes as per the norms and regulations of Madurai Kamaraj University, Madurai and do not come under the purview of CBCS.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed Courses. The CBCS is followed as per the guidelines formulated by the UGC. The students' performance will be evaluated based on the uniform grading system. Computation of the Cumulative Grade Point Average (CGPA) is made to ensure uniformity in evaluation system.

List of Programmes in which CBCS/Elective Course System is implemented

UG PROGRAMMES

Arts & Humanities	:	History (E.M. & T.M.), English and Tamil
Physical & Life Sciences	:	Mathematics, Zoology, Chemistry, Physics, Biochemistry, Home Science - Nutrition and Dietetics, Costume Design and Fashion, Microbiology, Biotechnology, Computer Science, Information Technology and Computer Applications.
Commerce & Management	:	Commerce, Commerce with Computer Applications, Commerce with Professional Accounting Business Administration

PG PROGRAMMES

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Physics, Biochemistry, Food Processing & Quality Control, Chemistry, Zoology, Computer Science, Information Technology, Computer Applications (MCA*)
Commerce & Management	:	Commerce, Business Administration (MBA*) * AICTE approved Programmes

PRE-DOCTORAL PROGRAMMES (M.Phil.)

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Biochemistry
Commerce & Management	:	Commerce

OUTLINE OF CHOICE BASED CREDIT SYSTEM (PG)

1. Core Courses

2. Discipline Specific Elective Courses (DSEC)

3. Non Major Elective Course (NMEC)

List of Non Major Elective Courses (NMEC) Offered

PG PROGRAMMES

Name of the Course	Semester	Department
History of Freedom Movement in India (A.D. 1885 – 1947)	III	History
Functional and Communicative English	III	English
தமிழும் பிறதுறைகளும்	III	Tamil
Taxation Concepts and Assessment	III	Commerce
Entrepreneurship	III	Business Administration
Mathematics For Competitive Examinations	III	Mathematics
Digital Electronics	III	Physics
Industrial Chemistry	III	Chemistry
Apiculture	III	Zoology
Nutrition and Health	III	Home Science – Nutrition and Dietetics
Clinical biochemistry (Basics)	III	Biochemistry
Introduction to Internet and HTML	III	Computer Science
Fundamentals of Information Technology	III	Information Technology
Principles of Information Technology	III	Computer Applications

ELIGIBILITY FOR ADMISSION

The candidate should have passed in B.Sc. Mathematics or B.Sc. Mathematics with Computer Applications of any recognized University.

DURATION OF THE PROGRAMME

The candidates shall undergo the prescribed Programme of study for a period of two academic years (four semesters).

MEDIUM OF INSTRUCTION

English

EVALUATION SCHEME

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	40	60	100
Practical / Project	40	60	100

Core Courses, Discipline Specific Elective Courses and Non Major Elective Course

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation		Marks
Periodic Test	:	25
Seminar	:	10
Assignment	:	5
Total	**:**	**40**

Three Periodic Tests - Average of the best two will be considered
Two Assignments - Best of the two will be considered.

Question Pattern for Periodic Tests **Duration: 2 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Max. Marks
A Q.No.(1 - 5)	Multiple Choice	5	5	1	5
B Q.No.(6 - 10)	Internal Choice Either or Type	5	5	5	25
C Q.No.(11 - 13)	Open Choice	3	2	10	20
				Total	**50**

Marks obtained to be calculated for 25 Marks

EXTERNAL EXAMINATION

Question Pattern **Duration: 3 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each question	Total Marks
A Q.No.(1 - 5)	Multiple Choice (Atleast one question from each unit)	5	5	1	5
B Q.No.(6 - 10)	Internal Choice Either Or Type	5	5	5	25
C Q.No.(11-15)	Open Choice (one from each unit)	5	3	10	30
Total					**60**

FOR EXTRA CREDIT COURSE- SELF STUDY COURSE

- Assessment by Internal Examiner only

QUESTION PATTERN **Duration: 2 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Max. Marks
A Q.No.(1 - 50)	Multiple Choice Questions	50	50	1	50

ELIGIBILITY FOR THE DEGREE

1. The candidate will not be eligible for degree without completing the prescribed Courses of study with a minimum of 50% Pass marks in all the Courses.
2. Attendance, progress and conduct certification from the Head of the Institution will be required for the students to write the examination.
   - No Pass minimum for Internal Assessment.
   - Pass minimum for External Examination is 27 marks out of 60 for Core Courses, Discipline Specific Elective Courses and Non Major Elective Courses.

ATTENDANCE

The following rules are applicable to the students of all UG, PG and M.Phil. Programmes with effect from 2018-2019.

a) The students with an attendance of 85% and above are permitted to appear for the Summative Examinations without any condition.

b) The students with 78% - 84 % of attendance are permitted to appear for the Summative Examinations by paying a fine of ₹ 500/-

c) The students with 66% - 77% of attendance can appear for the Summative Examinations only after getting special permission from the Principal. Special permission shall be granted by the Principal only on medical grounds and those students should also pay a fine of ₹1000/- along with the application form for exemption. If permission is not granted, they have to appear for the Summative Examinations in the next Semester by paying a fine of ₹ 1000/-

d) The students who have less than 65% of attendance cannot appear for the Summative Examinations and have to repeat the whole semester .

e) For Part V Courses, the students require 75% of attendance to get the required credit.

f) For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

MASTER OF MATHEMATICS

Programme Code – 7013

PROGRAMME OUTCOMES

- Empower self-disciplined, self-monitored and self-esteemed thinking.
- Practice intellectual conception of information, analytical observation, intelligent perception, systematic evaluation and active execution.
- Enhance virtual and non-virtual communication, technical and technological bondage with the society.
- Spread scientific temperament to the Nation, while dealing with the various issues of the society.
- Volunteer in the civic life with values, morality, responsibility and justice.
- Preserve nature in its original form amidst all the natural and artificial calamities.
- Develop the self-sustained and infinite learning to meet the challenges of the contemporary socio-technological scenario.

PROGRAMME SPECIFIC OUTCOMES

- In-depth and detailed functional knowledge of the fundamental theoretical concepts of Mathematics.
- Contribution to the betterment of society through knowledge in Mathematics.
- Insight into the interface between the history of Mathematics and modern technology.
- Experimental skills required to solve scientific and technological problems.

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MASTER OF MATHEMATICS (7013)

Programme Structure - Allotment of Hours and Credits
For those who join in the Academic Year 2018-2019

COURSE STRUCTURE

Components	Semester				Total Number of Hours/ Credits
	I	II	III	IV	
Core Course	6(4)	6(4)	6(5)	6(5)	24(18)
Core Course	6(4)	6(4)	6(5)	6(5)	24(18)
Core Course	6(4)	6(4)	6(5)	6(5)	24(18)
Core Course	6(4)	6(4)	6(5)		18(13)
DSEC	6(4)	6(4)	-	6(5)	18(13)
Non Major Elective	-	-	5(4)	-	5(4)
Online Assessment (SET/NET Preparation - General Paper)	-	-	1(1)	-	1(1)
Project	-	-	-	6(5)	6(5)
Total	**30(20)**	**30(20)**	**30(25)**	**30(25)**	**120(90)**

DSEC – Discipline Specific Elective Course

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MASTER OF MATHEMATICS

Programme Code – 7013

PROGRAMME CONTENT

M.Sc. Mathematics - SEMESTER - I

COURSE CODE	TITLE OF THE COURSE		Hrs/ Wk	CREDITS	MAX. MKS.	
					INT.	EXT.
18PMTC11	Core Course –1 Groups and Rings		6	4	40	60
18PMTC12	Core Course – 2 Analysis		6	4	40	60
18PMTC13	Core Course – 3 Differential Geometry		6	4	40	60
18PMTC14	Core Course – 4 Mechanics		6	4	40	60
18PMTE11	DSE Course – 1	Numerical Analysis	6	4	40	60
18PMTE12		Modern Applied Algebra				
TOTAL			**30**	**20**	**500**	

M.Sc. Mathematics - SEMESTER – II

COURSE CODE	TITLE OF THE COURSE		Hrs/ Wk	CREDITS	MAX. MKS.	
					INT.	EXT.
18PMTC21	Core Course – 5 Linear Algebra		6	4	40	60
18PMTC22	Core Course – 6 Advanced Analysis		6	4	40	60
18PMTC23	Core Course – 7 Differential Equations		6	4	40	60
18PMTC24	Core Course – 8 Mathematical Statistics		6	4	40	60
18PMTE21	DSE Course – 2	Fuzzy Algebra	6	4	40	60
18PMTE22		Advanced Calculus				
TOTAL			**30**	**20**	**500**	

M.Sc. Mathematics - SEMESTER – III

COURSE CODE	TITLE OF THE COURSE	Hrs/ Wk	CREDITS	MAX. MKS.	
				INT.	EXT.
18PMTC31	Core Course – 9 Measure Theory	6	5	40	60
18PMTC32	Core Course – 10 Complex Analysis	6	5	40	60
18PMTC33	Core Course – 11 Operations Research	6	5	40	60
18PMTC34	Core Course – 12 Topology	6	5	40	60
18PMTN31	NME - Mathematics for Competitive Examinations	5	4	40	60
18POLS31	Online Assessment- (SET/NET Preparation – General Paper)	1	1		100
	TOTAL	**30**	**25**	**600**	

M.Sc. Mathematics - SEMESTER – IV

COURSE CODE	TITLE OF THE COURSE		Hrs/ Wk	CREDITS	MAX. MKS.	
					INT.	EXT.
18PMTC41	Core Course – 13 Field Theory & Lattices		6	5	40	60
18PMTC42	Core Course – 14 Functional Analysis		6	5	40	60
18PMTC43	Core Course – 15 Number Theory and Cryptography		6	5	40	60
18PMTE41	DSE – 3	Graph Theory	6	5	40	60
18PMTE42		Combinatorial Mathematics				
18PMTC41PR	Project		6	5	40	60
	TOTAL		**30**	**25**	**500**	

EXTRA CREDIT COURSE

Self Study Course

COURSE CODE	TITLE OF THE COURSE	MAX. MKS.	
		INT.	EXT.
18PMT061	SET/NET Preparation for Algebra & Analysis	100	-

NMEC – Non Major Elective Course

DSEC – Discipline Specific Elective Course

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M.Sc. Mathematics
(2018 -19 onwards)

Semester I	**GROUPS AND RINGS**	Hours/Week: 6	
Core Course-1		Credits: 4	
Course Code **18PMTC11**		Internal 40	External 60

COURSE OUTCOMES

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

- understand the fundamental concepts of abstract algebra such as Cayley's Theorem, Sylow's Theorem, Ideals and Quotient Rings.
- know to apply Sylow's Theorem to check commutativeness of a group.
- differentiate Rings and Quotient Rings.
- characterize Integral Domain and Field in terms of Ideals.
- use a combination of theoretical knowledge and independent mathematical thinking to investigate questions in ring theory and to construct proofs.
- apply the theory in the course to solve a variety of problems at an appropriate level of difficulty.

Group Theory

UNIT I

Cayley 's Theorem, Another Counting Principle, Sylow's Theorem. (18 Hours)

UNIT II

Direct Products, Finite Abelian Groups. (18 Hours)

Ring Theory

UNIT III

Ideals and Quotient Rings, More Ideals and Quotient Rings, The Field of Quotients of an Integral Domain. (18 Hours)

UNIT IV

Euclidean Rings, A particular Euclidean Ring. (18 Hours)

UNIT V

Polynomial Rings, Polynomials over the Rational Field, Polynomial Rings over Commutative Rings. (18 Hours)

TEXT BOOK

Herstein. I.N. (2016), *Topics in Algebra*, Second Edition, John Wiley and Sons.

Unit	Chapter	Section
I	**2**	**2.9, 2.11, 2.12**
II	**2**	**2.13, 2.14**
III	**3**	**3.4, 3.5, 3.6**
IV	**3**	**3.7, 3.8**
V	**3**	**3.9, 3.10, 3.11**

REFERENCE BOOKS

1. John B. Fraleigh (1982), *A First Course in Abstract Algebra*, Third Edition, Narosa Publications, Eighth Reprint, 1996.

2. Joseph A. Gallian (2013), *Contemporary Abstract Algebra*, 8th Edition, BROOKS/COLE, Cengage Learning.

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M.Sc. Mathematics
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Semester I	**ANALYSIS**	Hours/Week: 6	
Core Course-2		Credits: 4	
Course Code **18PMTC12**		Internal 40	External 60

COURSE OUTCOMES

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

- describe fundamental properties of real numbers.
- define countable and uncountable sets.
- calculate the upper limit and lower limit of a sequence.
- recognize alternating convergent, conditionally convergent and absolutely convergent series.
- apply the ratio test, root test and comparison test to determine the convergence of series.
- determine the continuity of real valued functions.
- determine the differentiability of real valued functions.

UNIT I

The real and complex number systems

Ordered sets, The real field (Statements only).

Basic Topology

Finite, Countable and Uncountable Sets, Metric Spaces. (10 Hours)

UNIT II

Basic Topology

Compact Sets, Perfect Sets, Connected Sets.

Numerical Sequences and Series

Convergent sequences, Subsequences, Cauchy sequences, Upper and Lower Limits, Some Special sequences. (20 Hours)

UNIT III

Numerical Sequences and Series

Series ,Series of Non-negative Terms, The Number e, The Root and Ratio Tests, Power Series, Summation by Parts, Absolute Convergence, Addition and multiplication of Series. (20 Hours)

UNIT IV

Continuity

Limits of Function, Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic Functions, Infinite Limits and Limits at Infinity. (20 Hours)

UNIT V

Differentiation

The Derivative of a Real function, Mean Value Theorems, The Continuity of Derivatives, L'Hospital's Rule, Derivatives of Higher Order, Taylor's theorem, Differentiation of Vector-valued Functions. (20 Hours)

TEXT BOOK

Walter Rudin (2016), *Principles of Mathematical Analysis*, Third Edition, McGraw - Hill, International Editions.

Unit	Chapter	Section
I	1	1.5- 1.11; 1.19, 1.20, 1.21(Statements only)
	2	2.1 - 2.30
II	2	2.31 - 2.47
	3	3.1 – 3.20
III	3	3.21 – 3.51
IV	4	4.1 – 4.34
V	5	5.1 – 5.19

REFERENCE BOOKS

1. Binmore. K. G. (1982), *Mathematical Analysis*, Second Edition, Cambridge University Press, Reprint 1987.

2. Royden. H.L. (1988), *Real Analysis*, Third Edition, MacMillan, New York.

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Semester I	**DIFFERENTIAL GEOMETRY**	Hours/Week: 6	
Core Course-3		Credits: 4	
Course Code **18PMTC13**		Internal 40	External 60

COURSE OUTCOMES

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

- understand a space curve as the intersection of two surfaces
- find the length of arc, normal and binormal of the curve.
- find the curvature and torsion of different curves in space.
- understand the local intrinsic properties and can derive some more intrinsic properties of a surface.
- know the notion of geodesic structure, properties of geodesics and its differential equation.
- Understand the local non intrinsic properties of different surfaces and different types of curvatures.

UNIT I

The Theory of Space Curves - Introductory remarks about space curves, Definitions, Arc length, Tangent, normal and binomial, Curvature and torsion of a curve given as the intersection of two surfaces, Contact between Curves and Surfaces, Tangent surface, involutes and evolutes**.** (19 Hours)

UNIT II

Intrinsic equations, fundamental existence theorem for space curves – Helices.

The Metric: Local Intrinsic Properties of a surface - Definition of a surface, Curves on surface, Surfaces of revolution, Helicoids. (16 Hours)

UNIT III

Metric, Direction Coefficients, Family of curves, Intrinsic Properties, Geodesics, Canonical geodesic equations, Normal property of geodesics. (18 Hours)

UNIT IV

Existence theorems, Geodesic parallels, Geodesic curvature, Gauss-Bonnet theorem, **The Second fundamental Form: Local Non-Intrinsic Properties of a Surface** The second fundamental form. (19 Hours)

UNIT V

Principal curvatures, Lines of curvature, Developables, Developables associated with space curves, Developables associated with curves on surfaces, Minimal surfaces, Ruled surfaces**.** (18 Hours)

TEXT BOOK

Willmore. T.J (2004), An *introduction to Differential Geometry*, Oxford University Press.

Unit	Chapter	Section
I	1	1 - 7. (Omitting appendix)
II	1	8, 9
	2	1 - 4. (Omitting appendix)
III	2	5 – 7, 9 – 12.
IV	2	13 - 16.
	3	1
V	5	2 - 8

REFERENCE BOOKS

1. Mittal and Agarwal (1998), *Differential Geometry*, Krishna Prakasam Publishers.

2. Somasundaram. D. (2005), *Differential Geometry: A First Course*, Narosa Publishing House.

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Semester I	**MECHANICS**	Hours/Week: 6	
Core Course-4		Credits: 4	
Course Code **18PMTC14**		Internal 40	External 60

COURSE OUTCOMES

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

- get a clear knowledge on degrees of freedom and holonomic and nonholonomic constraints.
- understand the principle of virtual work and Lagrange's equation.
- apply Lagrangian formulation to Atwood's machine and Time dependent Constraint.
- find the shortest distance between two points in a plane by using variational principle.
- understand the canonical momentum and conjugate momentum.
- solve central force problems.
- derive an orbit equation for the Kepler Problem by using the Laplace-Runge – Lenz vector.

UNIT I

Survey of the Elementary Principles - Mechanics of a particle, Mechanics of a system of particles, Constraints. (15 Hours)

UNIT II

D'Alembert's principle and Lagrange's equations, Velocity dependent potentials and the dissipation function – simple applications of the Lagrangian formulation. **Variational Principles and Lagrange's Equations -** Hamilton's principle, Some techniques of the calculus of variations. (20 Hours)

UNIT III

Derivation of Lagrange's equations from Hamilton's principle, Extension of Hamilton's principle to nonholonomic systems, Advantages of a variational principle formulation, Conservation theorems and symmetry properties. (18 Hours)

UNIT IV

The Two -Body Central Force Problem - Reduction to the equivalent one -body problem, The equations of motion and first integrals, The equivalent one – dimensional problem and classification of orbits, The Virial theorem. (18 Hours)

UNIT V

The differential equation for the orbit and integrable power-law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem: Inverse square law of force, The motion in time in the Kepler problem, The Laplace - Runge-Lenz vector. (19 Hours)

TEXT BOOK

Goldstein.H. (1980), *Classical Mechanics*, Second edition , Addison Wesley, New York.

Unit	Chapter	Section
I	1	1.1 – 1.3
II	1	1.4 -1.6
	2	2.1 – 2.2
III	2	2.3 – 2.6
IV	3	3.1 - 3.4
V	3	3.5 - 3.9

REFERENCE BOOKS

1. Gupta, Kumar, Sharma (2012), *Classical Mechanics*, Pragati Prakashan.

2. Bhatia. V.B. (2001), *Classical Mechanics*, Narosa Publishing House.

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Semester I	**NUMERICAL ANALYSIS**	Hours/Week: 6	
DSEC-1		Credits: 4	
Course Code **18PMTE11**		Internal 40	External 60

COURSE OUTCOMES

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

- understand the basic principles of Numerical Methods.
- apply Numerical Methods in solving algebraic equations and ordinary differential equations.
- find the Eigen values and Eigen vectors by using iteration method.
- know the significance of difference operators in interpolation.
- evaluate the definite integral of complicated functions approximately.
- solve the initial value problems in ordinary differential equations.

UNIT I

TRANSCENDENTAL AND POLYNOMIAL EQUATIONS - Introduction, Bisection method, Iteration methods based on first degree equation, Iteration methods based on second degree equation, Rate of convergence, General iteration methods, Methods for complex roots, Polynomial equations. (20 Hours)

UNIT II

SYSTEM OF LINEAR ALGEBRAIC EQUATIONS AND EIGEN VALUE PROBLEMS - Introduction, Direct methods, Error analysis for direct methods, Iteration methods, Eigen values and Eigen vectors, Jacobi method for symmetric matrices.

(16 Hours)

UNIT III

INTERPOLATION AND APPROXIMATION - Introduction, Lagrange and Newton interpolations, Finite difference Operators, Interpolating polynomials using finite differences, Hermite interpolation, Piecewise and spline interpolation. (20 Hours)

UNIT IV

DIFFERENTIATION AND INTEGRATION - Introduction, Numerical Differentiation, Extrapolation methods, Partial Differentiation, Numerical integration, Methods based on interpolation, Composite integration methods, Romberg Integration**.**

(18 Hours)

UNIT V

ORDINARY DIFFERENTIAL EQUATIONS: INITIAL VALUE PROBLEMS - Introduction, Difference equations, Numerical methods, Single step methods**.** (16 Hours)

TEXT BOOK

Jain. M.K, Iyengar. S. R. K. and Jain. R. K(2012), *Numerical Methods for Scientific and Engineering Computation*, Sixth Edition, New Age International Publishers.

Unit	Chapter	Section
I	2	2.1 - 2.6, 2.8, 2.9.
II	3	3.1 - 3.4 (Omitting SOR method, convergence Analysis of Iterative methods, Optimal Relaxation parameter for the SOR method, Iterative method to determine A^{-1}), 3.5, 3.7
III	4	4.1 - 4.6.
IV	5	5.1, 5.2, 5.4 - 5.7, 5.9, 5.10
V	6	6.1 - 6.4

(Note: Section B of the Question paper will contain only numerical problems. Scientific calculator is allowed).

REFERENCE BOOKS

1. Kandasamy. P, Thilagavathy. K, Gunavathi. K. (2006), *Numerical Methods*, Sultan chand.
2. Sastry. S.S. (2009), *Introductory Methods of Numerical Analysis*, Fourth Edition, PHI Learning Private Ltd.

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Semester I	**MODERN APPLIED ALGEBRA**	Hours/Week: 6	
DSEC-1		Credits: 4	
Course Code **18PMTE12**		Internal 40	External 60

COURSE OUTCOMES

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

- introduce the ideas and techniques of modern algebra.
- use modern algebra in applied mathematics.
- introduce the digital computer programming language ALGOL.
- construct the Boolean expression in minimized form.

UNIT I

Finite State Machines - Introduction, Binary devices and States, Finite - State machines, Covering and equivalence, Equivalence states, A minimization procedure, Turing machines, Incompletely specified machines – Relations between states – a minimization procedure. (18 Hours)

UNIT II

Programming Languages-Introduction, Arithmetic expressions, Identifiers: assignment statements, Arrays, FOR statements, Block structure in ALGOL, The ALGOL grammar, Evaluating arithmetic statements, Compiling arithmetic expressions. **(**18 Hours)

UNIT III

Boolean Algebras - Introduction, Order, Boolean polynomials, Block diagrams for gating networks, Connections with logic, Logical capabilities of ALGOL, Boolean applications, Boolean sub algebras, Disjunctive normal form, direct products; morphisms.

(18 Hours)

UNIT IV

Optimization and Computer Design - Introduction, Optimization, Computerizing Optimization, Logic design, NAND gates and NOR gates, the minimization problem, Procedure for deriving prime implicants, Consensus taking, Flip-flops, Sequential machine design. (18 Hours)

UNIT V

Binary Group Codes

Introduction, Encoding and decoding, Block codes, Matrix encoding techniques, Group codes, Decoding tables, Hamming codes. (18 Hours)

TEXT BOOK

Birkhoff . G. and Bartee . T.C. (1987), *Modern Applied Algebra*, CBS Publishers and Distributors, New Delhi.

Unit	Chapter	Section
I	3	3.1 - 3.9.
II	4	4.1 - 4.9
III	5	5.1 - 5.10
IV	6	6.1 - 6.10
V	8	8.1 - 8.7

REFERENCE BOOK

John E. Hopcroft Jeffery D. Ullman (2002), *Introduction to Automata Theory, Languages, and Computation*, Narosa, 19th Reprint.

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Semester II	**LINEAR ALGEBRA**	Hours/Week: 6	
Core Course-5		Credits: 4	
Course Code **18PMTC21**		Internal 40	External 60

COURSE OUTCOMES

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

- demonstrate vector spaces and understand their properties.
- understand the notion of a linear transformation and its matrix.
- solve systems of linear equations.
- recognize and invert orthogonal matrices and orthogonally diagonalize symmetric matrices.
- find the change-of-basis matrix with respect to two bases of a vector space.
- manipulate and compute determinants.

UNIT I

Vector Spaces & Modules - Dual Spaces, Inner Product Spaces, Modules. (18 Hours)

UNIT II

Linear Transformations : The Algebra of Linear Transformations- Characteristic roots- Matrices. (18 Hours)

UNIT III

Canonical forms: Triangular form- Nilpotent transformations- A Decomposition of V: Jordan form. (18 Hours)

UNIT IV

Canonical forms: Rational Canonical form. Trace and Transpose. (18 Hours)

UNIT V

Determinants- Hermitian,- Unitary and Normal Transformations. (18 Hours)

TEXT BOOK

Herstein. I.N. (2016), *Topics in Algebra*, Second Edition, John Wiley and Sons.

Unit	Chapter	Section
I	4	4.3 - 4.5
II	6	6.1 – 6.3
III	6	6.4 – 6.6
IV	6	6.7 – 6.8
V	6	6.9 – 6.10

REFERENCE BOOKS

1. Joseph A. Gallian(2013), *Contemporary Abstract Algebra*, 8th Edition, BROOKS/COLE, Cengage Learning.

2. David S. Dummit and Richard M. Foote (2004), *Abstract Algebra*, Third Edition, John Wiley and Sons, Inc.

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VIRUDHUNAGAR - 626 001

M.Sc. Mathematics
(2018 -19 onwards)

Semester II	**ADVANCED ANALYSIS**	Hours/Week: 6	
Core Course-6		Credits: 4	
Course Code **18PMTC22**		Internal 40	External 60

COURSE OUTCOMES

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

- determine the Riemann integrability of a bounded function.
- prove some theorems concerning integeration.
- recognize the difference between pointwise and uniform convergence of a sequence of functions.
- illustrate the effect of uniform convergence on the limit function in continuity, differentiability, and integrability.
- integrate or differentiate a series by term by term.
- apply the integral theory to prove results about specific classes of functions.

UNIT I

The Riemann- Stieltjes Integral - Definition and Existence of the Integral- Properties of the Integral- Integration and Differentiation-Integration of Vector valued functions- Rectifiable Curves. (18 Hours)

UNIT II

Sequences and Series of Functions -Discussion of main problem- Uniform convergence- Uniform Convergence and Continuity-Uniform Convergence and Integration- Uniform Convergence and Differentiation- Equicontinuous Families of Functions- The Stone-Weierstrass Theorem. (19 Hours)

UNIT III

Some Special Functions - Power Series- The Exponential and Logarithmic Functions- The Trigonometric Functions- The Algebraic Completeness of the Complex Field- Fourier Series - The Gamma Function. (19 Hours)

UNIT IV

Functions of Several Variables - Linear Transformations- Differentiation- The Contraction Principle- The Inverse Function Theorem. (20 Hours)

UNIT V

The Implicit Function Theorem- Determinants. (14 Hours)

TEXT BOOK

Walter Rudin(2016), *Principles of Mathematical Analysis*, Third Edition, McGraw Hill, International Student Edition.

Unit	Chapter	Section
I	6	6.1 – 6.27
II	7	7.1 – 7.33
III	8	8.1 – 8.22
IV	9	9.1 – 9.25

REFERENCE BOOKS

1. Binmore. K. G. (1982), *Mathematical Analysis*, Second Edition, Cambridge University Press, Reprint 1987.
2. Tom M. Apostal (1974), *Mathematical Analysis – A Modern Approach to Advanced Calculus*, Addison-Wesley Publishing Company.

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M.Sc. Mathematics
(2018 -19 onwards)

Semester II	**DIFFERENTIAL EQUATIONS**	Hours/Week: 6	
Core Course-7		Credits: 4	
Course Code **18PMTC23**		Internal 40	External 60

COURSE OUTCOMES

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

- solve Homogeneous Equations.
- reduce the order of a Homogeneous Equation.
- find solutions of second order equations with regular singular points.
- manipulate the Lipschitz Condition and Convergence of the Successive Approximations.
- understand the concept of existence and uniqueness of solutions.
- solve linear partial differential equations and non-linear partial differential equations.

UNIT I

Linear Equations with Variable Coefficients -Introduction- Initial Value Problems for the Homogeneous Equation- Solutions of the Homogeneous Equation- The Wronskian and Linear Independence- Reduction of the Order of a Homogeneous Equation- The Non-Homogeneous Equation- Homogeneous Equations with Analytic Coefficients- The Legendre Equation. (20 Hours)

UNIT II

Linear Equations with Regular Singular Points - Introduction- The Euler Equation- Second Order Equations with regular Singular points-an Example- Second Order Equations with Regular Singular Points-the General Case- The Bessel Equation- The Bessel Equation (continued) (19 Hours)

UNIT III

Existence and Uniqueness of solutions to First Order Equations - Introduction- Equations with Variables Separated- Exact Equations- The Method of Successive Approximations- The Lipschitz Condition- Convergence of the Successive Approximations- Approximations to, and Uniqueness of, Solutions. (19 Hours)

UNIT IV

Partial Differential Equations of the First Order

Partial Differential Equations – Origins of First-Order Partial Differential Equations - Linear Equations of the First Order – Integral Surfaces Passing through a given Curve- Surfaces Orthogonal to a given System of Surfaces. (15 Hours)

UNIT V

Nonlinear Partial Differential Equations of the First Order – Compatible Systems of First-Order Equations – Charpit's Method – Special Types of First-Order Equations.

(17 Hours)

TEXT BOOK

1. Coddington. E.A.(2010), *An Introduction to Ordinary Differential Equations*, Prentice Hall of India.
2. Sneddon. I.N.(1986), *Elements of Partial Differential Equations*, McGraw Hill Book Company.

Unit	Chapter	Section
Text Book - 1		
I	3	1 – 8
II	4	1 – 4, 7 - 8
III	5	1 – 6 & 8
Text Book - 2		
IV	2	2.1 – 2.2 & 2.4 – 2.6
V	2	2.7 & 2.9 – 2.11

REFERENCE BOOKS

1. George F. Simmons *(2008), Differential Equations with Applications and Historical Notes*, 13th reprint, Tata McGraw - Hill Publishing Company Ltd.
2. Deo. S. G and Raghavendra. V. (1980), *Ordinary differential equations and stability theory*, Fifth reprint 1992, Tata McGraw Hill Education Private Limited.

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M.Sc. Mathematics
(2018 -19 onwards)

Semester II	**MATHEMATICAL STATISTICS**	Hours/Week: 6	
Core Course-8		Credits: 4	
Course Code **18PMTC24**		Internal 40	External 60

COURSE OUTCOMES

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

- understand concepts such as probability, conditional probability, cumulative distribution function and Transformations.
- Understand moment generating functions, characteristic functions and correlation functions.
- understand and apply the Jensen's and Chebyshev's inequalities which are often encountered in probability and statistics.
- obtain distribution function of a random variable and multivariate random variables.
- do problems involving Binomial, Geometrical. Trinomial, Poission and Multivariate Normal distributions.
- understand convergence of a sequence of random variables. This include the central limit theorem and Stirling's Formula.

UNIT I

Introduction, Set Theory, The probability set function, Conditional probability and Independence, Random variables of the discrete type, Random variables of the continuous type, Properties of the distribution function, Expectation of a random variable, some special expectations , Chebyshev's inequality. (18 Hours)

UNIT II

Distributions of two random variables, Conditional distributions and expectations, The correlation coefficient, Independent random variables, Extension to several random variables. (18 Hours)

UNIT III

The binomial and related distributions, The Poisson distribution, The Gamma and Chi-square distributions, The normal distribution, The Bivariate normal distribution. (18 Hours)

UNIT IV

Sampling theory, Transformations of variables of the discrete type, Transformations of variables of the continuous type, The Beta, t, F distributions, Extensions of the change-of-variable technique, Distributions of order statistics, the moment generating function technique, The distributions of X and $\frac{nS^2}{\sigma^2}$, Expectations of functions of random variables. (18 Hours)

UNIT V

Convergence in distribution, Convergence in probability, Limiting moment generating functions, The central limit theorem, some theorems on limiting distributions. (18 Hours)

TEXT BOOK

Hogg, Mckean, Craig(2002), *Introduction to Mathematical Statistics*, Fifth Edition, Pearson Education.

Unit	Chapter	Section
I	1	1.1 - 1.10
II	2	2.1 - 2.5
III	3	3.1 - 3.5
IV	4	4.1-4.9
V	5	5.1-5.5

REFERENCE BOOKS

1. 1.Alexander M. Mood, Franklin A. Graybill, Duane C. Boes(1974), *Introduction to the theory of Statistics*, Third Edition, McGraw Hill International Book Company.

2. Kapoor. J.N. and Saxena. H.C. (2009), *Mathematical Statistics*, 25th Edition, S. Chand & Co.

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M.Sc. Mathematics
(2018 -19 onwards)

Semester II	**FUZZY ALGEBRA**	Hours/Week: 6	
DSEC -2		Credits: 4	
Course Code **18PMTE21**		Internal 40	External 60

COURSE OUTCOMES

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

- understand the basic mathematical elements of the fuzzy set theory.
- understand the fuzzy arithmetical concepts.
- decide the differences and similarities between crisp set and fuzzy set theory.
- recognize fuzzy logic membership function.
- fuzzify the classical basic results in Groups, Ideals and Rings.
- recognize fuzzy isomorphism on fuzzy quotient rings.

UNIT I

Fuzzy Sets: Basic Types – Fuzzy Sets: Basic Concepts – Additional Properties of α-Cuts – Representation of Fuzzy Sets – Extension Principle for Fuzzy Sets. (15 Hours)

UNIT II

Types of Operations - Fuzzy Complements. Crisp and Fuzzy Relations – Binary Fuzzy Relations – Binary Relations on a Single Set – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Ordering Relations - Fuzzy Morphisms.

(21 Hours**)**

UNIT III

Definition of Fuzzy Subgroups – Examples and Properties – Union of two Fuzzy subgroups – Fuzzy subgroup generated by a Fuzzy subset– Fuzzy Normal Subgroups.

(18 Hours)

UNIT IV

Fuzzy normal subgroups under homomorphisms – characteristics subgroups – Fuzzy conjugate subgroups – Fuzzy Sylow subgroups. (18 Hours)

UNIT V

Fuzzy Ideals and their Operations. Some Elementary Properties – Union of Fuzzy Subrings(Fuzzy Ideals) – Fuzzy Subring(Fuzzy Ideal) Generated by a Fuzzy Subset – Fuzzy Ideals and Homomorphisms – Fuzzy Cosets. (18 Hours)

TEXT BOOKS

1. George J.Klir and Bo Yuan(2008), *Fuzzy Sets and Fuzzy Logic – Theory and Applications*, Second Edition, Prentice – Hall of India.
2. Rajeshkumar (1993), *Fuzzy Algebra Vol I,* University of Delhi, Publication Division.

Unit	Chapter	Section
Text Book - 1		
I	1	1.3 – 1.4
	2	2.1 – 2.3
II	3	3.1 – 3.2
	5	5.1& 5.3 - 5.8
Text Book - 2		
III	1	1.2.16 - 1.2.21
	2	2.1- 2.3 (up to 2.3.3)
IV	2	2.3.4 - 2.3.14 & 2.4
V	3	3.1 - 3.5

REFERENCE BOOKS

1. Zimmer Mann. H.J.(2006), *Fuzzy set Theory and its applications*, Fourth Edition, Springer International Ltd.
2. John .N Mordeson and Malik. T.S. (1998), *Fuzzy Commutative Algebra*, World Scientific Publishing Com. Pvt. Ltd.

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M.Sc. Mathematics
(2018 -19 onwards)

Semester II	**ADVANCED CALCULUS**	Hours/Week: 6	
DSEC-2		Credits: 4	
Course Code **18PMTE22**		Internal 40	External 60

COURSE OUTCOMES

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

- understand the detailed idea about the principles of Calculus.
- have a deep knowledge about double and triple Integrals.
- know its Applications to Geometry and Analysis.
- understand the significance of Differential Geometry and Vector Calculus.

UNIT I

Integration

The Definite integral – Evaluation of Definite Integrals. (18 Hours)

UNIT II

Differentiation of Transforms

Differentials of Transformations – Inverses of Transformations. (18 Hours)

UNIT III

The Implicit function Theorems – Functional Dependence. (18 Hours)

UNIT IV

Applications to Geometry and Analysis

Transformations of Multiple Integrals – Integrals over curves and surfaces.

(18 Hours)

UNIT V

Differential Geometry and Vector Calculus

Differential forms – Vector Analysis – The theorems of Green, Gauss, and Stoke's – Exact forms and closed forms – Applications. (18 Hours)

TEXT BOOK

Creighton Buck. R. (1978), *Advanced Calculus*, Third Edition, McGraw Hill Kogakusha Ltd.

Unit	Chapter	Section
I	4	4.2- 4.3
II	7	7.4 - 7.5
III	7	7.6 - 7.7
IV	8	8.3 & 8.6
V	9	9.2- 9.6

REFERENCE BOOK

Robert Wrede and Murray R. Spiegel (2005), *Advanced Calculus*, Second Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.