1 Credit = 15 Lectures = 25 Marks

S.N.D.T. WOMEN'S UNIVERSITY

Syllabus for B.Sc.

Subject: Mathematics

(Credit Based Semester and Grading System with effect from the academic year 2013–2014)

Class	Semester	Paper	Title	Marks	Credits
F.Y.B.Sc.	I	MT101 MT102 MP101	Calculus-I Algebra-1 Practicals based on MT101 and MT102	50 50 50 (150)	2 2 2 (6)
F.Y.B.Sc.	II	MT201 MT202 MP201	Calculus-II Discrete Mathematics Practicals based on MT201 and MT202	50 50 50 (150)	2 2 2 (6)
				300	**12**
S.Y.B.Sc.	III	MT301 MT302 MP301	Linear Algebra-I Differential Equations Practicals based on MT301 and MT302	75 75 75 (225)	3 3 3 (9)
S.Y.B.Sc.	IV	MT401 MT402 MP401	Linear Algebra-II Numerical Methods Practicals based on MT401 and MT402	75 75 75 (225)	3 3 3 (9)
				450	**18**
T.Y.B.Sc.	V	MT501 MT502 MT503 MT504 MP501 MP502	Algebra-II Analysis-I Calculus-III Real and Complex Analysis Practicals based on MT501 and MT502 Practicals based on MT503 and MT504	75 75 75 75 75 75 (450)	3 3 3 3 3 3 (18)
T.Y.B.Sc.	VI	MT601 MT602 MT603 MT604 MP601 MP602	Algebra-III Analysis-II Differential Geometry Graph Theory Practicals based on MT601 and MT602 Practicals based on MT603 and MT604	75 75 75 75 75 75 (450)	3 3 3 3 3 3 (18)
				900	**36**

To be implemented from the Academic year 2013-2014

Name of the Course	:	**Bachelor of Science (B.Sc.)**
Subject	:	**Mathematics**
Duration	:	**3 years**
Number of Semesters	:	**6**
Syllabus of	:	**Semester I and II**
Number of papers	:	**6**
Credits for each paper	:	**2**
Total credits in Semester I and II	:	**12**

SEMESTER I

Paper Code	PAPER NOMENCLATURE	Lectures	Credits
MT101	Calculus-I	30	02
MT102	Algebra-I	30	02
MP101	Practicals based on MT101 and MT102	30	02

SEMESTER II

Paper Code	PAPER NOMENCLATURE	Lectures	Credits
MT201	Calculus-II	30	02
MT202	Discrete Mathematics	30	02
MP201	Practicals based on MT201 and MT202	30	02

SEMESTER I		
Paper Code	**THEORY**	**Credits:2**
MT101	**Title: Calculus-I**	**30 L**
Unit 1	**Limits of a function in one variable**	**15 L**
	Functions in one variable and its graphs, techniques of building new functions from old, rational functions and the exponential functions. Limits of functions in one variable using ε-δ definition, rules of finding limits, Sandwich theorem. Continuity of functions in one variable. Graphical representation of continuity of a real valued function. Continuity of a real valued function over an interval. Intermediate value property.	
Unit 2	**Derivative of a function in one variable**	**15 L**
	Derivative of a real valued function at a point. Geometric interpretation of a derivative of a real valued function at a point. Chain rule, implicit differentiation. Linear Approximations. Successive Differentiation, Leibnitz Theorem for n-th order derivative. L'Hospital's Rule Mean Value Theorems: Roll's Theorem, Lagrange's Mean Value Theorem, Cauchy Mean Value Theorem. Taylor series of functions such as sin, cosine and the hyperbolic functions. Local extrema, absolute extrema, stationary points. Increasing and decreasing functions.	

Main References:

1. Calculus: Early Transcendentals (Stewart's Calculus Series) – James Stewart.
2. Calculus and Analytic Geometry - G.B. Thomas and R. L. Finney, Addison-Wesley.
3. Tom Apostol, Calculus Volume 1, One variable calculus with an introduction to Linear Algebra, Second Edition, Wiley Publications.

Additional References:

1. Sudhir. R. Ghorpade and Balmohan V. Limaye, A Course in Calculus and Real Analysis, Springer International Edition.
2. Schaum's outline of Theory and Problems of Differential and Integral Calculus.

Paper Code	THEORY	Credits:2
MT102	**Title: Algebra-I**	**30 L**
Unit 1	**Matrices and System of linear equations**	**15 L**
	Matrices: addition and multiplication, transpose and inverse. Reduction to echelon form by elementary row operations, Elementary matrices. Finding inverse of a matrix. Solving system of linear equations. Determinants: expansions about a row or column, Elementary row and column operations on determinants, Properties of determinants. Cofactor expansion of determinant.	
Unit 2	**Properties of Integers and Polynomials**	**15 L**
	Properties of Integers, relation, equivalence relation, equivalence classes. Divisibility of integers, division algorithm, g.c.d of integers. Primes, prime factorization, congruence, solve linear congruence, Chinese Remainder Theorem, Euler's φ-function. Add, multiply and divide polynomials, roots of a polynomial, g.c.d of polynomials.	

References:

1. Linear Algebra, Kenneth Hoffman, Ray Kunze, Prentice-Hall.
2. Elementary Number Theory, David M. Burton, Second Edition, UBS, New Delhi.

Additional References:

1. Concrete Mathematics, Graham, Knuth and Patashnik, Pearson Education Asia Low Price Edition.
2. Introduction to the theory of numbers, I. Niven and S. Zuckerman, Third Edition, Wiley Eastern, New Delhi, 1972.
3. Shaum's outline of Theory and Problems of Matrix Operations.

Paper Code	Practical	Credits:2
MP101	**Title: Practicals based on MT101 and MT102**	**30 L**
	Group A: Calculus-I	
	1. Graphs and functions. 2. Limits of functions, calculating limits using rules of limits and Sandwich theorem	

	3. Differentiability, chain rule, implicit differentiation. 4. Higher order derivatives and Leibnitz theorem. 5. Mean Value Theorems, Taylor's Theorem. 6. Extrema.	
	Group B: Algebra – I	
	1. Matrix operations, echelon form of matrices. 2. Solving system of linear equations. 3. Determinant, cofactor, inverse of a matrix. 4. Division Algorithm in Z, gcd of integers. 5. Primes and the Fundamental Theorem of Arithmetic, Congruence and Euler φ-function. 6. Polynomials, gcd of polynomials.	

SEMESTER II		
Paper Code	**THEORY**	**Credits:2**
MT201	**Title: Calculus-II**	**30 L**
Unit 1	**Vectors in R^2 and R^3 and Derivatives**	**15 L**
	Vectors in two and three dimensional space, vector addition and scalar multiplication, dot product, length, and distance. Parametric equations, polar coordinates, lines and planes. Cylindrical and spherical coordinates. Functions in two/three variables, Limits, Continuity, Directional derivatives, partial derivatives, gradient.	
Unit 2	**Differentiability of Scalar valued functions**	**15 L**
	Higher order partial derivatives. Euler's theorem for homogeneous function, Mean Value Theorem and Taylor's theorem of functions of two variables Extreme values of functions of two variables.	

References:

1. Vector Calculus: Marsden and Tromba, Freeman 2004
2. Calculus: Early Transcendentals (Stewart's Calculus Series) – James Stewart.
3. Calculus and Analytic Geometry - G.B. Thomas and R. L. Finney, Addison-Wesley.

Additional References:

1. Tom Apostol, Calculus Volume 1, One variable calculus with an introduction to Linear Algebra, Second Edition, Wiley Publications.
2. Sudhir. R. Ghorpade and Balmohan V. Limaye, A Course in Calculus and Real Analysis, Springer International Edition.
3. Introduction to vector analysis, H.F. Davis and A. D. Snider, Universal Book stall, New Delhi.
4. Schaum's outline of Theory and Problems of Differential and Integral Calculus.

Paper Code	**THEORY**	**Credits:2**
MT202	**Title: Discrete Mathematics**	**30 L**
Unit 1	**Set theory and Logic**	**15 L**
	Introduction to set notation, Manipulation of sets, inclusion, intersection, union, complements, Inclusion-exclusion. Relation, equivalence relation, equivalence classes. Mathematical Logic, the use of truth tables, express mathematical statements symbolically, using quantifiers and connectives, and to negate them, the three main methods of proof (direct, contraposition and contradiction). Mathematical Induction.	
Unit 2	**Functions and Countability**	**15 L**
	Functions and composition, domain and range, injectivity, surjectivity and bijectivity of functions, invertibility of functions. Selecting and counting elements from finite sets. The pigeonhole principle. Recursively Defined Sequences, Solving Recurrence Relations: The Characteristic Polynomial, Solving Recurrence Relations: Generating Functions.	

References:

1. Kenneth H. Rosen, Discrete Mathematics and its applications, Mc-Graw Hill International Edition, Mathematics Series.
2. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.

Additional References:

1. G. Birkoff and S. Maclane, A Survey of Modern Algebra, Third Edition, Mac Millan,New York, 1965.
2. K.D. Joshi, Foundations in Discrete Mathematics, New Age Publishers, New Delhi, 1989.

Paper Code	Practical	Credits:2
MP201	**Title: Practicals based on MT201 and MT202**	**30 L**
	Group A: Calculus-II	
	1. Vector addition and scalar multiplication, dot product, length, and distance, Parametric equations, polar coordinates, lines and planes, Cylindrical and spherical coordinates. 2. Functions in two/three variables, Limits, Continuity, Directional derivatives, partial derivatives, gradient, 3. Taylor's theorem, Extrema and saddle points 4. The double integral over a rectangle, The double integral over more general regions. 5. Changing the order of integration, The triple integral. 6. Parametric curves and surfaces, Length of curves, area of a region, volumes.	
	Group B: Discrete Mathematics	
	1. Express mathematical statements symbolically, using quantifiers and connectives, and to negate them, 2. Three methods of proof (direct, contraposition and contradiction). 3. Equivalence relation, Mathematical Induction. 4. Finding domain and range of function, checking injectivity, surjectivity and bijectivity of functions, finding the inverse a function. 5. Counting elements from finite sets. The pigeonhole principle. 6. Solving Recurrence Relations using the Characteristic Polynomial and Generating Function.	

Workload

1. **Theory** 2 lectures per week per paper. 1 lecture is equivalent to 1 hour.
2. **Practical:** 1 practical of 2 lectures per week per batch. 1 lecture is equivalent to 1 hour.

Scheme of Examination

Theory examination for MT101, MT102, MT201 and MT202:

Duration - 2 Hours duration for each paper.

Theory Question Paper Pattern (For Paper I, and II):

1. There shall be three questions. On each unit there will be one question of 15 marks and the third one will be based on entire syllabus of 20 marks.

2. All questions shall be compulsory with internal choice within the questions. (Each question on each unit will be of 20 to 23 marks with options and a question on entire syllabus will be of 25 to 27 marks with options)
3. Question may be subdivided into sub-questions a, b, c … and the allocation of marks depend on the weightage of the topic.

Practical examination:

Duration - 3 Hours duration for each practical.

(a) Duration - 3 Hours duration.

(b) Practical examination is conducted out of 50 marks.

(c) Students must complete all the practicals to the satisfaction of the teacher concerned.

(d) Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

(e) Question Paper Pattern:

1) There will be four questions of 20 marks each.

2) First two questions will be on group A and attempt any one of them. Remaining two will be on group B and attempt any one of them.

3) 5 marks for record book and 5 marks for viva.

Second Year: Semester III and IV

To be implemented from the Academic year 2014-2015

Name of the Course : Bachelor of Science (B.Sc.)

Subject : Mathematics

Duration : 3 years

Number of Semesters : 6

Syllabus of : Semester III and IV

Number of papers : 6

Credits for each paper : 3

Total credits in

Semester III and IV : 18

SEMESTER III

Paper Code	PAPER NOMENCLATURE	Lectures	Credits
MT301	Linear Algebra-I	45	03
MT302	Differential Equations	45	03
MP301	Practicals based on MT301 and MT302	45	03

SEMESTER IV

Paper Code	PAPER NOMENCLATURE	Lectures	Credits
MT401	Linear Algebra – II	45	03
MT402	Numerical Methods	45	03
MP401	Practicals based on MT401 and MT402	45	03

SEMESTER III		
Paper Code	**THEORY**	**Credits:3**
MT301	**Title: Linear Algebra-I**	**45 L**
Unit 1	**Vector space**	**15 L**
	Vector space – definition and example, generating set, basis and dimension, subspaces of a vector space, row rank and column rank of a matrix	
Unit 2	**Linear Transformations**	**15 L**
	Linear transformation – definition and example including rotation and reflection, matrix form of a linear transformation, kernel and image of a linear transformation, rank-nullity theorem, linear isomorphism.	
Unit 3	**Quotient space**	**15 L**
	Quotient space – definition and example, basis and dimension of quotient space, fundamental theorem of isomorphism.	
References:		
1. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall of India, New Delhi. **2.** Linear Algebra, Kenneth Hoffman, Ray Kunze, Prentice-Hall.		
Additional References:		
1. S. Lang, Introduction to Linear Algebra, Springer-Verlag **2.** A. Ramachandra Rao, P. Bhimashankaran, Linear Algebra, Tata McGraw Hill, New Delhi **3.** H. Anton, C. Rorres, Elementary Linear Algebra with Applications, Wiley		
Paper Code	**THEORY**	**Credits:3**
MT302	**Title: Differential Equations**	**45 L**
Unit 1	**Differential Equations of first order first degree**	**15 L**
	Variable separable form, homogeneous differential equations, Exact Equations and Integrating Factors, rules of finding integrating factors, linear differential equations, Bernoulli's equation	
Unit 2	**Second and higher Order Linear Differential Equations**	**15 L**
	Auxiliary equation, real and distinct roots, equal roots, complex roots of auxiliary equation. Particular solution, Undetermined Coefficient method, variation of parameters method.	
Unit 3	**Partial Differential Equations**	**15 L**
	Surfaces and Curves in three dimensions, solution of equation of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$. Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's	

	method.	

References:

1. A.H.Siddiqi & P. Manchanda – A First Course in Differential Equation with Applications (Macmillian)
2. George. F. Simmons – Differential equation with applications and historical notes (Tata McGraw Hill)
3. Sankara Rao - Introduction to Partial Differential Equation,2nd edition, PHI.

Additional References:

1. E.A. Coddington - An Introduction to Ordinary Differential Equation, PHI.
2. W.E. Boyce & R.C. Diprima - Elementary Differential Equations and boundary value Problems, (Wiley India)
3. B. K. Dutta – Introduction to Partial Differential Equations (New Central Books)
4. Zafar Ahsan - Differential Equations and their Applications , 2nd edition, PHI

Paper Code	Practical	Credits:3
MP301	**Title: Practicals based on MT301 and MT302**	**45 L**
	Group A: Linear Algebra-I	
	1. Vector space and subspaces – examples 2. Finding the basis and dimension of a vector space. 3. Linear transformation – examples 4. Rank-Nullity theorem 5. Quotient space – examples 6. Finding basis and dimension of a quotient space.	
	Group B: Differential Equations	
	1. Solving first order linear equation using variation of parameters, integrating factors. 2. Solving linear differential equations, Bernoulli's equation. 3. Solving non-homogeneous differential equation with UDC method. 4. Solving non-homogeneous differential equation with variation of parameters method. 5. Surfaces and curves in three dimensions. 6. Solving linear first order partial differential equation.	

SEMESTER IV		
Paper Code	**THEORY**	**Credits:3**
MT401	**Title: Linear Algebra-II**	**45 L**
Unit 1	**Inner product space**	**15 L**
	Euclidean space, dot product, general inner product space, orthogonality, orthogonal basis, Gram-Schmidt orthogonalization process, orthogonal transformations.	
Unit 2	**Eigenvalues and Eigenvectors**	**15 L**
	Characteristic polynomial, Cayley-Hamilton Theorem, Eigenvalues and	

	eigenvectors – definition and examples,	
Unit 3	**Quadratic forms**	**15 L**
	Diagonalization, orthogonal diagonalization, quadratic form.	

References:

1. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall of India, New Delhi.
2. Linear Algebra, Kenneth Hoffman, Ray Kunze, Prentice-Hall.

Additional References:

1. S. Lang, Introduction to Linear Algebra, Springer-Verlag
2. A. Ramachandra Rao, P. Bhimashankaran, Linear Algebra, Tata McGraw Hill, New Delhi
3. H. Anton, C. Rorres, Elementary Linear Algebra with Applications, Wiley

Paper Code	**THEORY**	**Credits:3**
MT402	**Title: Numerical Methods**	**45 L**
Unit 1	**Roots of Non-Linear equations**	**15 L**
	Approximations and errors in computing, significant digits, types of errors, Convergence of an iterative process. Roots of non – Linear equations, Bisection Method, Convergence of bisection method, False position method, its convergence, Newton – Raphson method, its convergence, Secant Method, its convergence.	
Unit 2	**System of linear equations & Eigenvalues**	**15 L**
	Iterative solutions of Linear Equations, Gauss Jocobi Iteration method, Gauss - Seidal iterative method Eigenvalue problem, eigenvalues of symmetric tridiagonal matrix.	
Unit 3	**Numerical Solution of Ordinary Differential equations**	**15 L**
	Numerical Solution of Ordinary Differential equations –Picard's method , Euler's Method, modified Euler's method, Runge –Kutta Methods.	

References:

1. M.K Jain, R.K Iyengar, R.K Jain " Numerical Methods for Scientific and Engineering Computation". Wiley Eastern Ltd, New Delhi-1997.
2. M.K.Venkataraman– Numerical methods in Science and Engineering , National Publishing company 1990 edition

Additional References:

1. V. Rajaraman – Computer Oriented Numerical Methods , PHI Pub.
2. S.S. Sastry – Introductory methods of Numerical Analysis, PHI Pub.

Paper Code	**Practical**	**Credits:3**
MP401	**Title: Practicals based on MT401 and MT402**	**45 L**
	Group A :Linear Algebra-II	
	1. Gram-Schmidt orthogonalization process 2. Orthogonal transformations. 3. Cayley-Hamilton Theorem	

	4. Eigenvalues and eigenvectors 5. Diagonalization 6. Orthogonal diagonalization and quadratic form.	
	Group B: Numerical Methods	
	1. Solving non-linear equation using bisection method and false position method. 2. Solving non-linear equation using Newton-Raphson method and secant method. 3. Solving system of equations using Gauss-Jacobi method, Gauss-Seidel method 4. Finding eigenvalues and eigenvectors. 5. Solving first order linear differential equations using Picards method, Euler method 6. Solving first order linear differential equations using Runge-Kutta Method.	

Workload

1. **Theory** 3 lectures per week per paper.
2. **Practical:** 1 practical each of 3 lecture periods per week per batch. Three lecture periods of the practicals shall be conducted in succession together on a single day.

Scheme of Examination

Theory examination for MT301, MT302, MT401 and MT402:

Duration - 3 Hours duration for each paper.

Theory Question Paper Pattern:

1. There shall be three questions. On each unit there will be one question of 20 marks and the fourth one will be based on entire syllabus of 15 marks.
2. All questions shall be compulsory with internal choice within the questions. (Each question on each unit will be of 25 to 27 marks with options and a question on entire syllabus will be of 20 to 23 marks with options)
3. Question may be subdivided into sub-questions a, b, c … and the allocation of marks depend on the weightage of the topic.

Practical examination for MP301 (MP401):

(a) Duration - 3 Hours duration for each practical.
(b) Practical examination is conducted out of 75 marks.
(c) Students must complete all the practicals to the satisfaction of the teacher concerned.
(d) Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.
(e) Question Paper Pattern:
(1) There will be four questions of 30 marks each.

(2) First two questions will be on group A and attempt any one of them.
Remaining two will be on group B and attempt any one of them.
(3) 5 marks for record book and 10 marks for viva/ presentation/ assignment.

Third Year: Semester V and VI

To be implemented from the Academic year 2015-2016

Name of the Course : Bachelor of Science (B.Sc.)

Subject : Mathematics

Duration : 3 years

Number of Semesters : 6

Syllabus of : Semester V and VI

Number of papers : 12

Credits for each paper : 3

Total credits in

Semester V and VI : 36

Semester V

Paper Code	PAPER NOMENCLATURE	Lectures	Credits
MT501	Algebra-II	45	03
MT502	Analysis-I	45	03
MT503	Real and Complex Analysis	45	03
MT504	Calculus-III	45	03
MP501	Practicals based on MT501 and MT502	45	03
MP502	Practicals based on MT501 and MT502	45	03

Semester VI

Paper Code	PAPER NOMENCLATURE	Lectures	Credits
MT601	Algebra-III	45	03
MT602	Analysis-II	45	03
MT603	Differential Geometry	45	03
MT604	Graph Theory	45	03
MP601	Practicals based on MT601 and MT602	45	03
MP602	Practicals based on MT603 and MT604	45	03

SEMESTER V		
Paper Code	**THEORY**	**Credits:3**
MT501	**Title: Algebra-II**	**45 L**
Unit 1	**Group**	**15 L**
	Binary operation, Groups, Definition and elementary properties,finite groups, sub groups, cyclic subgroups, groups of permutations.	
Unit 2	**Group Homomorphism**	**15 L**
	Homomorphism, Definition and Elementary Properties, group isomorphisms, automorphisms.	
Unit 3	**Normal Subgroup**	**15 L**
	Normal subgroups, example, The Fundamental theorem of homomorphism theorem, Applications	
References:		
1. Joseph A Gullian - A Contemporary Abstract Algebra,Narosa Pub.House **2.** I.N Herstein - Topics in Algebra, Wiley publications		
Additional References:		
1. M. Artin, Algebra, PHI Publication, New Delhi 2. J.B. Fraleigh, A first Course in Abstract Algebra, Narosa, New Delhi 3. N.S. Gopalakrishnan, University Algebra, New Age International, New Delhi		
Paper Code	**THEORY**	**Credits:3**
MT502	**Title: Analysis-I**	**45 L**
Unit 1	**Real Numbers**	**15 L**
	Intervals. Bounded and unbounded sets, supremum, infimum. Order completeness in R. Archimedian property of real numbers. completeness property	
Unit 2	**Open sets**	**15 L**
	Neighbourhood of a point. Interior point of a set. Open set. Limit point of a set.	
Unit 3	**Closed sets**	**15 L**
	Bolzano Weierstrass theorem for sets. Closed sets, closure of a set. Dense sets. Countable and uncountable sets	
References:		
1. Robert G Bartle and Donald R Sherbert –Introduction to real analysis 3rd edition.Wiley **2.** Richard R Goldberg – Methods of real analysis 3rd edition , Oxford and IBM Publishing Co (1964)		
Additional References:		
1. Elias Zako – Mathematical analysis Vol1, Overseas Press, New Delhi(2006) 2. J. M .Howie – Real Analysis, Springer 2007 **3.** K.A Ross - Elementary Real Analysis, Springer, Indian Reprint		

Paper Code	THEORY	Credits:3
MT503	**Title: Real and Complex Analysis**	**45 L**
Unit 1	**Sequences and series in R**	**15 L**
	Convergence of sequence in R. Cauchy`s general principle of convergence for a series. Positive term series. A necessary condition for convergence of positive term series. Geometric series. The comparison series $\sum\frac{1}{hP}$ comparison test for positive term series. Cauchy`s root test, Ratio test. Absolute convergence	
Unit 2	**Complex Numbers**	**15 L**
	Sums and products. Basic algebraic properties. Further properties. Vectors and moduli. Different representations. Exponential forms.	
Unit 3	**Analytic functions**	**15 L**
	Functions of a complex variable, derivatives-differentiation formulas-Cauchy-Riemann equations-sufficient condition for differentiability-analytic functions.	

References:

1. Robert G Bartle and Donald R Sherbert –Introduction to real analysis 3rd edition.Wiley
2. Richard R Goldberg – Methods of real analysis 3rd edition , Oxford and IBM Publishing Co (1964)
3. R.V. Churchil and I.W. Brown, complex variables and applications, International student publication.

Additional References:

1. M.R Spiegel – Complex Variables, Schaum's Series
2. Elias Zako – Mathematical analysis Vol1, Overseas Press, New Delhi(2006)
3. J. M .Howie – Real Analysis, Springer 2007

Paper Code	THEORY	Credits:3
MT504	**Title: Calculus III**	**45 L**
Unit 1	**Integration**	**15 L**
	Integral and review techniques for calculating integrals, The double integral over a rectangle, The double integral over more general regions, Changing the order of integration, The triple integral.	
Unit 2	**Line integral**	**15 L**
	Parameterization of curves and lines, Line integral, example, Green's theorem	
Unit 3	**Surface integral**	**15 L**
	Parameterization of surface, fundamental vector product, Gauss Divergence theorem, stoke's theorem	

References:

1. Vector Calculus: Marsden and Tromba, Freeman 2004
2. Calculus: Early Transcendentals (Stewart's Calculus Series) – James Stewart.
3. Calculus and Analytic Geometry - G.B. Thomas and R. L. Finney, Addison-Wesley.

Additional References:

1. Tom Apostol, Calculus Volume 1, One variable calculus with an introduction to Linear Algebra, Second Edition, Wiley Publications.
2. Sudhir. R. Ghorpade and Balmohan V. Limaye, A Course in Calculus and Real Analysis, Springer International Edition.
3. Introduction to vector analysis, H.F. Davis and A. D. Snider, Universal Book stall, New Delhi.
4. Schaum's outline of Theory and Problems of Differential and Integral Calculus.

Paper Code	**Practical**	**Credits:3**
MP501	**Title: Practicals based on MT501 and MT502**	**45 L**
	Group A: Algebra-II	**45 L**
	1. Groups example 2. Cyclic groups 3. Group homomorphism 4. Group isomorphism 5. Normal Subgroups 6. Fundamental Theorem	
	Group B: Analysis-I	
	1. Supremum, infimum. Order completeness in R. 2. Archimedian property of real numbers. completeness property 3. Open set, interior points 4. Limit points 5. Closed set, closure of a set 6. Countable and uncountable subset of R	
Paper Code	**Practical**	**Credits:3**
MP502	**Title: Practicals based on MT503 and MT504**	**45 L**
	Group A: Real and Complex Analysis	**45 L**
	1. Sequence in R 2. Series in R 3. Complex numbers properties 4. Complex number representation 5. Limit theorems 6. CR equations	
	Group B: Calculus-III	
	1. Differentiability of vector valued function, Jacobian 2. Local and absolute extrema 3. Line integral example 4. Greens theorem 5. Gauss Divergence theorem 6. Stoke's theorem	

SEMESTER VI		
Paper Code	**THEORY**	**Credits:3**
MT601	**Title: Algebra-III**	**45 L**
Unit 1	**Rings**	**15 L**
	Rings, Definition and examples, characteristics of a ring, integral domain, field	
Unit 2	**Ideals**	**15 L**
	Ideals, definition and examples, maximal ideal, prime ideals, quotient rings, fundamental theorem of ring homomorphism	
Unit 3	**Polynomial rings**	**15 L**
	Polynomial rings, definition and example, properties.	
References:		
1. Joseph A Gullian - A Contemporary Abstract Algebra,Narosa Pub.House **2.** I.N Herstein - Topics in Algebra, Wiley publications		
Additional References:		
1. M. Artin, Algebra, PHI Publication, New Delhi 2. J.B. Fraleigh, A first Course in Abstract Algebra, Narosa, New Delhi 3. N.S. Gopalakrishnan, University Algebra, New Age International, New Delhi		
Paper Code	**THEORY**	**Credits:3**
MT602	**Title: Analysis-II**	**45 L**
Unit 1	**Sequence and Series of Functions**	**15 L**
	Pointwise and uniform convergence of functions, consequences, integration and differentiation of series of functions.	
Unit 2	**Fourier Series**	**15 L**
	Fourier series of function, Fourier convergence theorem, Fourier transform	
Unit 3	**Application of Fourier Transform**	**15 L**
	Application to Image processing and Digital Signal Processing	
References:		
1. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH publishing 2. Rihard Beals, Analysis an introduction, Cambridge		
Additional References:		
1. H.L. Royden, Real Analysis, Macmillan		
Paper Code	**THEORY**	**Credits:3**
MT603	**Title: Differential Geometry**	**45 L**
Unit 1	**Curves**	**15 L**
	Curves in a plane and space, global properties of curves	
Unit 2	**Surfaces**	**15 L**

	Surfaces in three dimensions	
Unit 3	**Curvature**	**15 L**
	Curvature of surface, First fundamental Form	
References:		
1. Andrew Pressley, Elementary Differential Geometry, Springer International Edition. 2. John A. Thrope, Differential Geometry, Springer International Edition		
Additional References:		
1. Andrew Pressley, Elementary Differential Geometry, Springer International Edition. 2. John A. Thrope, Differential Geometry, Springer International Edition		
Paper Code	**THEORY**	**Credits:3**
MT604	**Title: Graph Theory**	**45 L**
Unit 1	**Graph and Trees**	**15 L**
	An introduction to graph. Definition of a Graph, Graphs as models, Vertex Degrees, Sub graphs, Paths and cycles The matrix representation of graphs, Tree, spanning tree	
Unit 2	**Hamiltonian Graph**	**15 L**
	Euler Tours and Hamiltonian Cycles. Euler's Tours, Hamiltonian graphs, The travelling salesman problem, Matching and Augmenting paths, Hall`s Marriage Theorem, Matching	
Unit 3	**Coloring of a Graph**	**15 L**
	Vertex Coloring and edge coloring, characterisation	
References:		
1. John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers 2. Douglas B West Peter Grossman - Introduction to Graph Theory		
Additional References:		
1. John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers 2. Douglas B West Peter Grossman - Introduction to Graph Theory 3. W.D.Wallis - A Biginner's Guide to Discrete Mathematics, Springer		
Paper Code	**Practical**	**Credits:3**
MP601	**Title: Practicals based on MT601 and MT602**	**45 L**
	Group A: Algebra-II	**45 L**
	1. Rings and examples 2. Integral domain, characteristics, fields 3. Ideals 4. Type of ideals 5. Polynomial Rings 6. Gauss lemma	
	Group B: Analysis-II	
	1. Pointwise convergence 2. Uniform convergence 3. Fourier Series 4. Fourier Transform 5. Application of Fourier Transform 6. Application of Fourier Transform	

Paper Code	Practical	Credits:3
MP602	**Title: Practicals based on MT603 and MT604**	**45 L**
	Group A: Differential Geometry	**45 L**
	1. Curves in plane 2. Curves in space 3. Surfaces examples 4. Surface properties 5. Curvature of surface 6. First fundamental form	
	Group B: Graph Theory	
	1. Graph, subgraph, path, cycle 2. Tree, spanning tree 3. Hamiltonian cycle 4. System of Distinct Representatives 5. Vertex coloring 6. Edge coloring	

Workload

1. **Theory** 3 lectures per week per paper.
2. **Practical:** 1 practical each of 3 lecture periods per week per batch. Three lecture periods of the practicals shall be conducted in succession together on a single day.

Scheme of Examination

Theory examination for MT501, MT502, MT503, MT504, MT601, MT602, MT603 and MT604:

Duration - 3 Hours duration for each paper.

Theory Question Paper Pattern:

1. There shall be three questions. On each unit there will be one question of 20 marks and the fourth one will be based on entire syllabus of 15 marks.
2. All questions shall be compulsory with internal choice within the questions. (Each question on each unit will be of 25 to 27 marks with options and a question on entire syllabus will be of 20 to 23 marks with options)
3. Question may be subdivided into sub-questions a, b, c … and the allocation of marks depend on the weightage of the topic.

Practical examination for MP501, MP502 (MP601, MP602):

(a) **Duration** - 3 Hours duration for each practical.
(b) Practical examination is conducted out of 75 marks.

(c) Students must complete all the practicals to the satisfaction of the teacher concerned.

(d) Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

(e) Question Paper Pattern:

(1) There will be four questions of 30 marks each.

(2) First two questions will be on group A and attempt any one of them. Remaining two will be on group B and attempt any one of them.

(3) 5 marks for record book and 10 marks for viva/ presentation/ assignment.

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