PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

SYLLABUS

FOR

M.Sc. (Part-I) MATHEMATICS
(Semester I and II)
Choice Based Credit System (CBCS)

WITH EFFECT FROM ACADEMIC YEAR 2020-21

(JUNE-2020).

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

SCHOOL OF COMPUTATIONAL SCIENCES

DEPARTMENT OF MATHEMATICS

Revised Syllabi of M.Sc.I in Mathematics (Choice Based Credit System)

1) **Title of the course:** M.Sc. in Mathematics
2) **Pattern:** Semester and Credit system.
3) **Duration of Course**: 2 years
4) **Strength of the Students:** 40
5) **Eligibility:** For M. Sc. in Mathematics following candidates are eligible.
   (i) B.Sc. with Mathematics as principal level.
   (ii) B.Sc. with any subject as principal and Mathematics at subsidiary level.

M. Sc. program in Mathematics consists of 100 credits. Credits of a course are specified against the title of the course.

A Four Semester M.Sc. Mathematics Course

Semester	No. of Papers/ Practical's / Seminar	Marks	Credits
Semester I			
• Theory Papers	05	500	20
• Practical Papers	02	100	04
• Seminar/Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Semester II			
• Theory Papers	05	500	20
• Practical Papers	02	100	04
• Seminar/ Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Semester III			
• Theory papers	05	500	20
• Practical Papers	02	100	04
• Seminar/ Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Semester IV			
• Theory papers	05	500	20
• Practical Papers	02	100	04
• Seminar/ Tutorial/Home Assignment /Field Tour/ Industrial Visit	01	25	01
Total marks and credits for M.Sc. Course		**2500**	**100**

M.Sc. Mathematics Choice Based Credit System (CBCS)

Course Structure M.Sc. Part-I (Mathematics) w.e.f. June 2020

M.Sc. MATHEMATICS SEMESTER-I								
Paper Code	**Title of the Paper**	**Semester Examination**			**L**	**T**	**P**	**Credits**
		Theory	**IA**	**Total**				
	Hard Core Theory							
HCT 1.1	Algebra I	80	20	100	4	--	--	4
HCT 1.2	Real Analysis I	80	20	100	4	--	--	4
HCT 1.3	Differential Equations	80	20	100	4	--	--	4
HCT 1.4	Classical Mechanics	80	20	100	4	--	--	4
	Soft Core-Theory (Any one)							
SCT 1.1	Number Theory	80	20	100	4	--	--	4
SCT 1.2	Object Oriented Programming using C++							
	Practical							
HCP1.1	Practical 1 Latex Introduction	40	10	50	--	--	4	2
HCP1.2	Practical 2 Latex	40	10	50	--	--	4	2
	Seminar/Tutorial/ Industrial Visit/ Field Tour	---	25	25	--	1	--	1
Total for Semester-I		**480**	**145**	**625**	**--**	**--**	**--**	**25**
M.Sc. MATHEMATICS SEMESTER-II								
Code	**Title of the Paper**	**Semester Examination**			**L**	**T**	**P**	**Credits**
		Theory	**IA**	**Total**				
	Hard Core Theory							
HCT 2.1	Algebra II	80	20	100	4	-	--	4
HCT 2.2	Real Analysis II	80	20	100	4	-	--	4
HCT 2.3	General Topology	80	20	100	4	-	--	4
	Soft Core Theory (Any One)							
SCT 2.1	Complex Analysis	80	20	100	4	--	--	4
SCT 2.2	Relativistic Mechanics							
	Open Elective Theory (Any one)							
OET 2.1	Fundamentals in Mathematics	80	20	100	4	--	--	4
OET 2.2	*SWAYAM course							
	Practical (Hard and Soft core)							
HCP 2.1	Practical 3 Latex Beamer	40	10	50	--	--	4	2
	Practical (Open Elective) Any One							
OEP 2.1	Practical 4 (Practical based on OEP 2.1)	40	10	50	--	--	4	2
OEP 2.2	Practical /seminar /viva based on SWAYAM course OET 2.2							
	Seminar/Tutorial/ Industrial Visit/ Field Tour	---	25	25	--	1	--	1
Total for Semester-II		**480**	**145**	**625**	**--**	--	**--**	**25**

*: The credits will be transferred as per university policy and UGC guidelines after submitting the course completion certificate/ mark list from SWAYAM.

Evaluation Scheme:

Each theory paper will have 100 marks out of which 80 marks will be for Term End examination and 20 marks for Internal Assessment. The candidate has to appear for internal evaluation of 20 marks and external evaluation (University Examination) of 80 marks for each theory paper.

Each practical paper will have 50 marks out of which 40 marks will be for Term End examination and 10 marks for Internal Assessment. The candidate has to appear for internal evaluation of 10 marks and external evaluation (University Examination) of 40 marks for each practical paper.

Internal Evaluation:

- In case of theory papers internal examinations will be conducted by department / school.
- In case of practical papers 10 marks shall be for internal test, which will be conducted by the department / school.

External Evaluation (End of Term University Examination):

I) Nature of Theory question paper:

1) Each Theory paper is of 80 marks.
2) Each Theory paper will be of 3 hours duration
3) There shall be 7 questions each carrying 16 marks.
4) Students have to attempt **five questions**.
5) Q.No.1 is **compulsory** and shall contain 16 objective type sub-questions each carrying 1 mark.
6) Q.No.2 is **compulsory** and shall contain 4 short answer type sub-questions each carrying 4 marks.
7) Students have to attempt **any three** questions from Q. N0. 3 to Q. No. 7.
8) Q. N0. 3 to Q. No. 7 shall contain 2 long answer type sub-questions (10+6 or 8+8 marks)

II) Nature of Practical question paper: (End of Term Examination)

For Sem-I and II: Practical examination will be conducted for 30 marks and is of two hours duration. There shall be 05 questions each of 10 marks, of which student has to attempt any 03 questions. VIVA will be for 5 marks and 5 marks shall be for day-to-day journal.

Paper no. I

Paper Code: HCT1.1

Algebra - I

UNIT I: Groups (20 L)

Normal and subnormal series, Jordan -Holder Theorem, Composition series, Commutator subgroups, Solvable groups, Nilpotent groups.

UNIT II: (15 L)

Zassenhaus lemma, G- sets, Conjugate classes, P- Subgroups, Sylow theorems, class equation.

UNIT III: (10 L)

UFD, PID, Euclidean domain, arithmetic in Euclidean domains

UNIT IV: Polynomial ring (15 L)

Polynomial ring over the rational field, Division algorithm, irreducible polynomials, The Eisenstein criteria, ideal structure in F[X], Uniqueness of factorization in F[x], UFD in Polynomial rings, Modules, Sub modules.

Recommended Books:

1. J. B. Fraleigh, Basic Algebra, Narosa pub.

2 I. N. Herstein . Topics in Algebra. Wiley Eastern Ltd. New Delhi 1975.

3. Joseph A. Gallian, Contemporary Abstract Algebra, Narosa Pub.

Books for Reference:

1. P.B.Bhattacharya, S.K.Jain and S.R. Nagpaul. Basic Abstract Algebra (2nd Edition) Cambridge University, Press Indian Edition 1997.

2. M. Artin Algebra, Prentice-Hall of India 1991

3. N.Jacobson, Basic Algebra Vols I and II Freeman 1988 (Kalse Published by Firncustan Publishing Company.)

4. S.Lang Algebra 3rd edition. Addison-Westely 1993

5. O.S. Luther and I.B.S. Passi, Algebra Vol. I-Groups. Vol. II-Rings, Narosa Publishing House (Vol 1-1996 Vol. II 1- 1999)

6. D.S.Malik & N.Mordeson and M.K.Sen Fundametnals of Abstract Algebra, Mc. Graw Hill International Edition, 1997.

Paper No. II

Paper Code: HCT 1.2

Real Analysis – I

UNIT I: Riemann Integration :- (15 L)

Definition and existence of the integral, Refinement of partitions, Darboux's theorem, Conditions of integrability, Integrability of the Sum and difference of integrable functions, The integral as a limit of sums, Some integrable functions, Integration and differentiation, the fundamental theorem of Calculus, Mean Value theorem of integral Calculus, Second Mean Value theorem.

UNIT II Riemann – Stieltijes integral :- (10 L)

Definition and existence of the integral, a condition of integrability

UNIT III Multivariable differential calculus : (20 L)

Introduction, the directional derivative, Directional derivatives and continuity, total derivative, the total derivative expressed in terms of partial derivatives, the Jacobian matrix, the chain rule, the mean value theorem, for differentiable functions, Taylors formula for functions from R^n to R^1

UNIT IV Implicit functions and Extremum problems. [2,3] (15 L)

Functions with nonzero Jacobian determinant, The inverse function theorem, The Implicit function theorem, Extrema of real valued functions of one variable.

Recommended Books :-

1) Mathematical Analysis, 2nd ed., S. C. Malik and Savita Arora, New Age international ltd.
2) Apostol T. M. Mathematical Analysis , (2nd edition) 12.1 – 12.5 , 12.8, 12.9, 12.11, 12.12, 12.14, 13.1, to 13.5 Narosa Pub.

Reference: Books :-

1]Burkill and Burkill A second course Mathematical Analysis, Cambridge University Press (1970)

2]Walter Rudin,Principles of Mathematical Analysis(3rd Ed)MC Graw Hill

3] A Basic Course in Real Analysis , Ajit Kumar & S.Kumaresan, CRC press

4]Introduction to Real Analysis.Robert G.Bartle,Donald R,Sherbert, Wiley India Pvt ltd.

Paper No. III

Paper Code: HCT 1.3

Differential Equations

Unit I: Linear Equations with constant coefficients: (20 L)

The second order homogeneous equation, initial value problems for second order equations, Linear dependence and independence. A formula for the Wronskian, the non-homogeneous equations of order two, the homogeneous equations of order n, initial value problems for the nth order equations, Equations with real constants, The non-homogeneous equation of order n

Unit II: Linear Equations with variable coefficients: (15 L)

Initial value problems for the homogeneous equations, solutions of the homogeneous equations, The Wronskian and linear independence, reduction of the order of a homogeneous equation, Homogeneous equations with analytic coefficients.

Unit III: Linear Equations with regular singular points: (15 L)

The Euler equations, second order equations with regular singular points, The Bessels equation.

Unit IV: Existence and uniqueness of solutions: (10 L)

The method of successive approximations, The Lipschitz condition.

Recommended Books :

1. An introduction to ordinary differential equations. by E.A. Coddington (1974) Prentice Hall of India Pvt.Ltd. New Delhi.

Reference Books :

1. Theory of ordinary differential equations by E.A. Coddington and Levinson (1955) Mc Graw Hill, New York

2. Elementary differential equations by E.D. Rainvills (1964) The Macmillan company, New York.

3. Ordinary Differential equations by G. Birkoff and G.G.Rota John Willey and Sons.

4. Differential Equations with Applications and Historical note by G.F. Simmons (1972) MacGraw Hill, Inc. New York.

5. Ordinary Differential Equations by Somasundaram, Narosa pub.

Paper No. IV

Paper Code: HCT 1.4

Classical Mechanics

Unit-I : (15 L)

Mechanics of a particle, Mechanics of a system of particles, constraints, Generalized coordinates, D'Alembert's principle, Lagrange's equations of motion, the forms of Lagrange's equation for velocity dependent potential, and dissipative forces, applications of Lagrangian formulation, cyclic co-ordinates and generalized momentum, conservation theorems.[1]

Unit –II (15L)

Functionals, basic lemma in calculus of variations, Euler- Lagrange's equations, the case of several dependent variables, the minimum surface of revolutions, the problem of Brachistochrone, Isoperimetric problems, Problem of the maximum enclosed area, shape of a hanging rope [2] [1].

Unit –III (15L)

Hamilton's principle, Lagrange's equations from Hamilton's principle, (holonomic system) Hamilton's equations of motion from a variational principle. The principle of least action cyclic coordinates and Routh's procedure, conservation theorems and physical significance of Hamiltonian [1]

Unit –IV (15 L)

The kinematics of rigid body motion, The independent co-ordinates of a rigid body, orthogonal transformations, properties of transformation matrix, infinitesimal rotations, the Eulerian angles, the Cayley-Klein parameters, Euler's theorem on motion of rigid body. Angular momentum and kinetic energy of motion of a rigid body about a point, [1].

Recommended Books :

1. Classical Mechanics by H.Goldstein (1980) Narosa Publishing House, New Delhi
2. Calculus of variations with applications to Physics and Engineering (International series in Pure and Applied Mathematics) by Robert Weinstock (1952) McGraw-Hill book comp. New York.
3. Classical Mechanics by N.C.Rana and P.S. Joag (1991) Tata McGraw Hill, New Delhi.

Reference Books :

1. A treatise on the Analytical Dynamics of Particles and rigid bodies. by E.T.Whittaker (1965) Cambridge University Press.
2. Classical Mechanics by E.A.Desolge, Vol. I and II (1982) John-Wiley and sons, New York.
3. Classical Mechanics A Modern Perspective by V.Barger and Martin Olsson(1995) McGraw Hill, Inc.New York.
4. Classical Machanics with introduction to Non-linear oscillation and chaos by V.B.Bhatia (1997) Narosa Pub.House
5. Classical Mechanics by J. C. Upadhyay, Himalaya Pub.

Paper No.V

Paper Code: SCT1.1

Number Theory

Unit- I

Review of divisibility, The division algorithm, Greatest common divisor, Euclidean algorithm, Diophantine equation ax + by = C, Primes and their distribution, Fundamental Theorem of Arithmetic, The Goldback Conjecture. (15 L)

Unit- II

Congruences, Properties of Congruences, Linear congruences, Special divisibility tests, Fermat's theorem, Fermat's factorization method, Little theorem, Wilsons theorem. (15 L)

Unit-III

Number theoretic functions, The functions τ and σ, The Mobius Inversion formula, The greatest integer function, Eulers Generalization of Fermats theorem, Euler's phi function, Euler's theorem, properties of phi function. (15 L)

Unit-IV

Primitive roots, The order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, The theory of Indices. (15 L)

Recommended book:

1. D.M.Barton : Elementary Number Theory, Universal book stall, New Delhi.

Reference Books :

2. S.B.Malik : Basic Number theory Vikas publishing House.
3. George E.Andrews : Number theory, Hindusthan Pub. Corp.(1972)
4. Nisen Zuckerman : An Introduction to theory of numbers.
5. Hari Kishan : Number Theory , Pragati edition.
6. Pundir : Number Theory, Pragati edition.

Paper No. V
Paper Code: SCT:1.2
OBJECT ORIENTED PROGRAMMING USING C++

Unit :1

(A)Algorithm Development : Problem definition, Writing step by step procedure, representation in terms of Flow chart,, Tracing, Testing

(B)Overview Of C++ : Object Oriented Programming, Introducing C++ Classes, Concepts of Object Oriented Programming, C++ as a superset of C, New style comments, main function in C++, meaning of empty argument list, function prototyping, default arguments and argument matching, User defined data types: enumerated types, use of tag names, anonymous unions, scope of tag names.

(C)Classes & Objects :Classes, Structure & Classes, Union & Classes, Inline Function, Scope Resolution operator, Static Class Members: Static Data Member, Static Member Function, Passing Objects to Function, Returning Objects, Object Assignment. Friend Function, Friend Classes. **(15Lectures)**

Unit:2

(A)Array, Pointers References & The Dynamic Allocation Operators: Array of Objects, Pointers to Object, Type Checking C++ Pointers, The This Pointer, Pointer to Derived Types, Pointer to Class Members, References: Reference Parameter, call by reference and return by reference Passing References to Objects, Returning Reference, Independent Reference, C++'s Dynamic Allocation Operators, Initializing Allocated Memory, Allocating Array, Allocating Objects.

(B)Constructor & Destructor: Introduction, Constructor, access specifiers for constructors, and instantiation, Parameterized Constructor, Multiple Constructor in A Class, Constructor with Default Argument, Copy Constructor, Destructor.

(C) Overloading as polymorphism : Function & Operator Overloading : Function Overloading, Overloading Constructor Function Finding the Address of an Overloaded Function, Operator Overloading: Creating A Member Operator Function, Creating Prefix & Postfix Forms of the Increment & Decrement Operation, Overloading The Shorthand Operation (I.E. +=,-= Etc), Operator Overloading Restrictions, Operator Overloading Using Friend Function, Overloading New & Delete, Overloading Some Special Operators, Overloading[ ], ( ), -, Comma Operator.

(15 Lectures)

Unit :3

(A) Inheritance : Base Class Access Control, Inheritance & Protected Members, Protected Base Class Inheritance, Inheriting Multiple Base Classes, Constructors, Destructors & Inheritance, When Constructor & Destructor Function are Executed, Passing Parameters to Base Class Constructors, Granting Access, Virtual Base Classes .

(B) Virtual Functions & Polymorphism : Virtual Function, Pure Virtual Functions, Early Vs. Late Binding, Templates and Exception Handling.

(C) Templates: Reason for templates compactness and flexibility, function template examples explicit specialization, class templates, out of class definition of member functions **(15 Lectures)**

Unit:4

(A) The C++ I/O System Basics : C++ Streams, The Basic Stream Classes C++ Predefined Streams, Formatted I/O: Formatting Using The Ios Members, Setting The Formal Flags, Clearing Format Flags, An Overloaded Form Of Setf ( ), Using Width() Precision() and Fill(), Using Manipulators to Format I/O, Creating Your own Manipulators

(B) Working with files : Introduction, Classes for file stream operations, Opening and Closing file, Open(): File Modes, File pointers and their Manipulations, Sequential Input and Output Operations, Updating a File: Random Access , Error Handling During File Operations

(15 Lectures)

Reference books:

1) C++ The Complete Reference By *Herbert Sehildt - Tmh*
2) C++ By *Balguruswami – Tata Mcgraw Hills*
3) C++ By M. Kumar, Tata Mcgraw

Mathematics Practical-I

Paper Code: HCP1.1

LaTeX Introduction

Unit I: Introduction to LaTeX, Installation of LaTeX, Layout Design, LaTeX input files, Understanding Latex compilation Basic Syntax, Input file structure, document classes, packages (Geometry, Hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color), page styles.

Unit II: Typesetting Mathematical formulae: fractions, Integrals, sums, products, Fancy Header, tables, Page Layout – Titles, Abstract Chapters, Sections, References, Equation references, citation, Writing equations, Matrix, Tables, arrays.

Mathematics Practical -II

Paper Code: HCP1.2

LaTeX

Unit I: Inline math formulas and displayed equations, Math symbols and fonts, Delimiters, Producing Mathematical Graphics, Table of contents, generating new commands, Figure handling, Numbering, List of figures, List of tables, Generating index.

Unit II: Document classes for paper writing, thesis, books, etc. Table of contents, index, Bibliography management, hypertext, pdf pages, geometry, fancy header and footer, Verbatim, itemize, enumerate, boxes, equation number.

Paper No. VI

Paper Code: **HCT 2.1**

Algebra - II

Unit –I (20 L)

Introduction to Extension fields, field adjunctions, Algebraic and Transcendental elements, Simple extensions, Finite extensions, Algebraic extensions, Roots of Polynomials, Multiple roots, Splitting field, Uniqueness of Splitting field, Separable elements, Separable extensions, Perfect field.

Unit II

The elements of Galois theory, Automorphism of Fields, Fixed fields, Group of Automorphisms of a field K relative to subfield F of K, Normal extension, Galois group, Fundamental theorem of Galois theory. (20 L)

Unit III

Finite fields and its applications. (10 L)

Unit IV

Constructible real numbers, Solvability by radicals. (10 L)

Recommended Books :

1.Herstein I.N. : Topics in Algebra, Wiley Eastern Ltd.,Second ed. 1993.

2.J.B. Fraleigh : A first course in Abstract Algebra, Narosa Pub.Co.

References :

1. P.B.Bhattacharya, S.K.Jain and S.R. Nagpaul. Basic Abstract Algebra (2nd Edition) Cambridge University, Press Indian Edition 1997.

2. M.Artin Algebra, Prentice-Hall of India 1991

3. N.Jacobson, Basic Algebra Vols I and II Freeman 1988 (Kalse Published by Firncustan Publishing Compay.)

4. S.Lang Algebra 3rd edition. Addison-Westely 1993

5. O.S. Luther and I.B.S. Passi, Algebra Vol. I-Groups. Vol. II-Rings, Narosa Publishing House (Vol 1-1996 Vol. II 1- 1999)

6. D.S.Malik & N.Mordeson and M.K.Sen, Fundametnals of Abstract Algebra, Mc. Graw Hill International Edition, 1997

7.Joseph Galian , Contemporary Abstract Algebra.

Paper No. VII

Paper Code: HCT 2.2

Real Analysis - II

Unit I. Lebesgue Measure: Outer measure, Measurable sets, Lebesgue measure, non-measurable sets.

(15L)

Unit II. Measurable functions: Measurable functions and their properties, Egoroff's theorem

(15L)

Unit III. Lebesgue Integral: Lebesgue integral of a bounded function over a set of finite measure, the Lebesgue integral of a non-negative measurable function, Fatou's Lemma, the general Lebesgue integral, convergence in measure. (15L))

Unit IV. Differentiation and Integration: Differentiation of monotone functions, function of bounded variation, Differentiation of an integral, Absolute continuity, Convex functions.

(15L)

Recommended Books :

1. Royden H.L.: Real Analysis , Printice Hall of India.
2. Simmon G.F : Introduction to topology and Modern Analysis, McGraw Hill Book Company, New York 1963

Reference Books :

1. Berberian, S.K. Measure and Integration, McMillan N.Y.1965
2. Rana : An Introduction to Measure and Integration, Narosa (1997)
3. G. De. Barra, Measure and Integration

Paper No. VIII

Paper Code: HCT 2.3

General Topology

Unit –I (10L)

Definition and examples of topological spaces, closed sets, closure, dense sets, Neighborhood, Interior, Exterior, Boundary, accumulation points, and derived sets, Bases, sub-bases, Relative topology.

Unit –II (20 L)

Continuous functions and homeomorphism, Compact sets and connected sets,

Unit –III (15L)

Separation Axioms: To, T1, T2, T3, T 3½, T4 - Their characterizations and basic properties.

Unit IV: (15 L)

First and Second countable spaces, Lindeloff spaces, separable spaces, second countability and seperablility.

Recommended Books :-

1]Munkres J. R. :- Topology – A first course, prentice Hall of India (200)

Reference Books :

1] Gupta K.P: Topology , Pragati Prakashan.

2] Joshi K. D. : Introduction to General Topology – Wiley Eastern (1983)

3] Willard S : General Topology, Adisson Weseley (1970)

4] Perwin W.J.: Foundations of General Topolgoy,Academic Press (1964)

Paper No. IX
Paper Code: SCT 2.1
Complex Analysis

1] UNIT –I (10 L)

Power Series, Analytic functions, Power series representation of analytic functions, Mobius transformations, Cross Ratio.

2] UNIT –II (20 L)

Zeros of analytic function, Liouville's theorem, Fundamental theorem of algebra, Index of a closed curve, Cauchy's integral formula, Cauchy's theorem, Morera's theorem, counting zeros of analytic functions, open mapping theorem, Goursat's theorem.

3] UNIT –III (20 L)

Isolated singularities, characterization of isolated singularities, Laurent series expansion, Residue theorem, Evaluation of definite integrals, Argument principle, Rouche's theorem.

4] Unit – IV (10 L)

Maximum Modulus theorems, Schwarz's lemma, Hurwitz's theorem, Montel theorem, Riemann mapping theorem.

Recommended Books :

J.B. Conway -Function of one complex variable (second edition) Narosa (1980)

Reference Books :

1. L.V. Ahliors : Complex Analysis, McGraw Hall (1979)
2. H.Silverman : Complex Variables, Hanton Mifflin (1975)
3. N.Levinson and R M.Redheffer : Complex Variables, Tata McGraw Hill (1980)
4. Remmert : Complex Function Theory, Springer Verlag
5. S.G.Kvanse : Complex Ananlysis
6. Dennis G.Zill , Patrik D. Shanahan : A first course in Complex Analysis, Jones and Bartlett Publishers.

Paper No.IX

Paper Code: SCT 2.2

Relativistic Mechanics

UNIT I:Relativistic Kinematics : (20 L)

Galilean transformations, Newtonian Relativity, Electromagnetism and Newtonian Relativity, Inertial frames, postulates of special relativity, Derivation of the Lorentz Transformation equations, Consequences of the Lorentz Transformation equations, viz. Lorentz contraction, time dilation, simultaneity and colocality of events. Invariance of electromagnetic wave equation. The relativistic addition of velocities (Einstein's formula) Lorentz velocity and acceleration transformation equations, relativistic aberration formula and Doppler effect [1]

UNIT II:.Relativistic Dynamics : (15 L)

Variation of mass of a moving particle, relativistic momentum, force, work and energy, The equivalence of mass and energy. The transformation properties of momentum, energy, mass and force Minkowski space-time, four velocity vector, four momentum, Relativistic Lagrangian and Hamiltonian. [1]

UNIT III :Electromagnetism : (15 L)

The interdependence of electric and magnetic fields, The transformation for electric and magnetic fields, the field of a uniformly moving point charge, The invariance of Maxwells equations [1]

UNIT IV: Tensor Analysis : (10 L)

Transformation of co-ordinates, Laws of transformation of contravariant, covariant and mixed tensors of different ranks. Cartesian tensor, metric tensor.

Recommended Books :

1. Introduction to special Relativity by R.Resnick [1968]

2. "A text book of Matrix and Tensor by Paria G. Scholan's Publication, Indore.

Reference Books :

1.Relativity and Gravitation by Philippe Tourrence (1972) Cambridge University Press.

2.Relativistic Mechanics by Satyaprakash , Pragati Prakashan.

Paper No.X

Paper Code: OET 2.1

Fundamental in Mathematics

UNIT I: (20 L)

Elementary Matrix Operations and Elementary Matrices, Types of Matrices and Determinants, Rank of Matrix and Matrix inverses.

UNIT II:. (15 L)

Solutions of system of simultaneous Linear homogenous equations and Solutions of system of simultaneous linear non-homogenous equations.

UNIT III : (10 L)

Vector Spaces, Subspaces, Linear Combinations, Linear Dependence and Linear independence, Bases, Dimensions.

UNIT IV: (15 L)

Linear transformations, Null spaces, Range Spaces, Matrix representations of linear transformations.

Recommended Books :

1. Linear Algebra, by Stephen H. Friedberg (Author), Pearson Pub.

Reference Books :

1) Linear Algebra by A.R.Vasistha and J.N.Sharma (Author), Krishna Pub.

2) Linear Algebra by K.P.Gupta(Author), A Pragati Edition.

3) Joseph Gallian , Contemporary Abstract Algebra.

4) Dr. B. S. Grewal , Higher Engineering Mathematics , Khanna Publishers.

Mathematics Practical Paper-3

Paper Code: HCP 2.1

LaTeX Beamer

Beamer class (Classes: article, book, report, beamer, slides), beamer theme, frames, slides, pause, overlay, transparent, handout stands presentation mode. Applications to: Writing Resume, Writing question paper, Writing articles/ research papers, Presentation using beamer.

Mathematics Practical -IV

Paper Code: OEP 2.1

At least five practical should be conducted on open elective theory paper OEP 2.1