Course Title: ALGEBRA AND TRIGONOMETRY

Course	B.Sc., Mathematics (MPC & MAP)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- **To know about various methods to find the roots of the polynomial equations.**
- **To develop the ability to use binomial, exponential and logarithmic series.**
- **To develop the skills of the students in the area of matrices.**
- **To acquire the basic knowledge of circular and hyperbolic trigonometric functions,**
- **To understand how to separate a complex function into its real and imaginary parts and also various methods for the summation of series**

Course outcomes: At the end of the course, students will be able to

CO1	Evaluate summation of series using binomial, exponential and logarithmic series
CO2	Evaluate the sum of the powers of the given equation and also the relation between the roots and coefficients of an equation
CO3	Solve polynomial equations using Newton's Method and Horner's Method, Compute inverse of the matrix using Cayley Hamilton theorem and also obtain eigen values and eigen vectors of different types of matrices
CO4	Expand $\sin\boldsymbol{\theta}$, $\cos\boldsymbol{\theta}$ and $\tan\boldsymbol{\theta}$ in terms of $\boldsymbol{\theta}$, $\sin n\boldsymbol{\theta}$, $\cos n\boldsymbol{\theta}$ in multiples of $\boldsymbol{\theta}$
CO5	Classify relation between circular and hyperbolic functions and solve problems using hyperbolic & inverse – hyperbolic functions

CONTENTS OF MODULE

Unit 1

Theory of Equations :Polynomial equations with Imaginary and irrational roots- Relation between rootsand coefficients- Symmetric functions of roots in terms of coefficients. Reciprocal equations - Standard form-Increase or Decrease the roots of the given equation -Removal of terms Approximate solutions of roots of polynomials by Newton's method, Horner's method.

Unit 2

Summation of Series : Binomial- Exponential -Logarithmic series (Theorems without proof):

Unit 3

Symmetric- Skew Symmetric- Hermitian- Skew Hermitian- Orthogonal Matrices- Eigen values & EigenVectors- Similar matrices- Cayley - Hamilton Theorem, Diagonalization.

Unit 4

Expansions of powers of sin θ, cos θ - Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$.Expansions of sin nθ, cos nθ, tan nθ - Expansions of tan $(\theta_1+\theta_2+...+\theta_n)$ - Expansions of sin x, Cos x, tan x in terms of x- Sum of roots of trigonometric equations – Formation of equation withtrigonometric roots.

Unit 5

Hyperbolic functions-Relation between circular and hyperbolic functions- Formulas in hyperbolicfunctions – Inverse hyperbolic functions. Inverse function of exponential functions – Values of Log (u+iv) - Complex index. Sums of Trigonometric series – Applications of binomial, exponential, logarithmic and Gregory'sseries - Difference method.

Recommended Text :

1. T.Natarajan,. K.S.Ganapathy,Viswanathan Publication 2007.Unit – 1 and 2.
2. Algebra, Volume II byT. K. ManicavachagomPillay ,T.Natarajan ,K.S.Ganapathy, ViswanathanPublication 2008.Unit – 3, 4 and 5.
3. Trigonometry by P. Duraipandian and KayalalPachaiyappa, Muhil Publishers.

Reference Books:

1. Algebra by S. Arumugam (New Gama publishing house, Palayamkottai).
2. Algebra and Trigonometry, Volume I and II by P.R.Vittal, V.Malini (Margham Publishers).
3. Trigonometry, Calculus , Dr. P.R. Vittal , Margham Publications, Chennai.
4. Trigonometry by T.K. Manickavachagam Pillay.S.Viswanathan (Printers and Publishers) Pvt. Ltd.

Mapping of Course Outcomes to Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	1	3	3	3
CO2	3	3	3	2	3	2	1	3	2	3
CO3	3	3	2	2	3	3	1	2	3	1
CO4	3	3	1	3	2	3	1	3	3	2
CO5	3	3	3	2	2	3	1	3	2	3

3 – High 2 – Medium 1 - Low

Course Title: Differential Calculus

Course	B Sc(Maths)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course Objectives

- **To develop the ability to use Leibnitz Rule**
- **To know about the method to find the maxima and minima**
- **To develop the skills of the students in the area of Curvature**
- **To learn methods and techniques of finding asymptotes.**

Course Outcomes: At the end of the course, the Student will be able to

CO1	Evaluate the nth derivative Using Leibnitz Rule
CO2	Finding the maxima and minima for the functions of two variables
CO3	Calculate the Envelope, Evolute, radius of curvature and circle of curvature
CO4	Finding the angle between radius vector and tangent.
CO5	Calculate the asymptotes of the curve

Program Outcome (PO)

At the end of the program, the student will be able to:

PO	Program Outcome
PO1	**Knowledge:** Apply the knowledge of Mathematics to develop logical thinking.
PO2	**Problem Analysis:** Identify the problems in real life situations and develop Mathematical models which paves the way to obtain solutions.
PO3	**Modern tool usage: S**elect and apply appropriate techniques, resources, computer programming and statistical tools to cope up with recent trends.
PO4	**Individual and team work:** Function effectively as an individual and as a member or leader in team.
PO5	**Communication:** Communicate with society at large, being able to comprehend and write affective reports and design documentation, make effective presentations.
PO6	**Project Management:** Acquire Mathematical and Statistical knowledge necessary to formulate, analyze, design and apply in multidisciplinary environments.
PO7	**Life-long learning:** Recognize the need for preparation and the ability to engage in life-long learning in the context of technological change.

Program Specific Outcomes (PSO)

At the end of the program, the student will be able to:

PSO	Program Specific Outcomes (PSO)
PSO1	**Mathematical Thinking:** Acquire abstract mathematical thinking and the capability of developing ideas based on them.
PSO2	**Career:** Practice mathematical tasks, tools, representation and methods for industry and entrepreneurial pursuit.
PSO3	**Creativity:** Develop quest for mathematics and prepare for higher learning.

CONTENTS OF MODULE
UNIT – I : Successive differentiation - n th derivative- standard results – Trigonometrical transformation – formationof equations using derivatives - Leibnitz's theorem and its applications Chapter 3 section 1.1 to 1.6, 2.1 and 2.2
UNIT-II : Total differential of a function – special cases – implicit functions - partial derivatives of a function of two functions - Maxima and Minima of functions of two variables- Lagrange's method of undeterminedmultipliers. Chapter 8 : Section 1.3 to 1.5 and 1.7, Section 4, 4.1 and 5.
UNIT– III: Envelopes – method of finding envelopes – Curvature- circle, radius and centre of curvature- Cartesian formula for radius of curvature – coordinates of the centre of curvature – evolute-and involute - radius ofcurvature and centre of curvature in polar coordinates – p-r equation Chapter 10 Section 1.1 to 1.4 and Section 2.1 to 2.7
UNIT-IV: Polar coordinates - angle between the radius vector and the tangent – slope of the tangent in the polar coordinates – the angle of intersection of two curves in polar coordinates- polar sub tangent and polarsub normal – the length of arc in polar coordinates. Chapter 9 Section 4.1 to 4.6
UNIT-V: Definition-Asymptotes parallel to the axes – special cases – another method for finding asymptotes -asymptotes by inspection – intersection of a curve with an asymptote. Chapter 11 - Section 1 to 7.

Recommended Text Book :

1. "Calculus", Volume - 1 by S. Narayanan and T.K. Manicavachagompillay -S.Viswanathan publishers – 2006.

Reference Books:

1.Calculus , Dr. P.R. Vittal&Dr. V. Malini, Margham Publications, Chennai.
2.Calculus by Thomas and Fenny, Pearson Publication. Calculus by Stewart

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	2	2	3	2	1
CO2	3	3	2	2	1	2	2	2	3	2
CO3	2	2	3	2	3	2	2	1	2	2
CO4	3	2	1	2	2	2	1	3	2	2
CO5	3	2	3	2	2	2	1	3	2	2

1 - Low 2 – Medium 3 – High

Course Title: ANALYTICAL GEOMETRY

Course	B.Sc., Mathematics (MPC & MAP)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- **To gain knowledge in evaluating chord of contact, polar equation .**
- **To develop the concept of system of planes, angle between the line and plane .**
- **To develop the idea of the equation of sphere and cone.**

Course outcomes: At the end of the course, students will be able to

CO1	**Understand the concept of equation of straight line, circle , conic, chord and tangent , normal equations of hyperbola**
CO2	**Solve the problems in System of Planes - Length of the perpendicular – Orthogonal projection**
CO3	**Estimate the angle between the line and plane, coplanar lines and shortest distance to skewness.**
CO4	**Understand the concept of equation of sphere and its applications**
CO5	**Understand the concept of equation of cone and its types**

CONTENTS OF MODULE
Unit 1 Chord of contact – polar and pole,- conjugate points and conjugate lines. Polar coordinates: General polar equation of straight line – Polar equation of a circle on A_1A_2 as diameter, Equation of a straight line, circle, conic – Equation of chord, tangent, normal.Equations of the asymptotes of a hyperbola.
Unit 2 Introduction – System of Planes - Length of the perpendicular – Orthogonal projection.
Unit 3 Representation of line – angle between a line and a plane- co-planar lines- shortest distance to skewlines- Length of the perpendicular- intersection of three planes
Unit 4 Equation of a sphere - general equation - section of a sphere by a plane - equation of the circle -tangent plane - angle of intersection of two spheres- condition for the orthogonality - radical plane.

Unit -5

Equation of a cone with vertex as origin, Equation of a quadric cone given the vertex and the guiding curve, Condition for a general equation of second degree to represent a cone, equation of right circular cone given the vertex, axis and semi vertical angle, equation of the enveloping cone of a sphere with centre at origin.

Recommended Text :

1. Analytical Geometry of 2D by P.Durai Pandian- Muhil publishers for Unit – 1
2. Analytical Solid Geometry of 3D by Shanthi Narayan and Dr.P.K. Mittal-S.Chand& Co.Pvt.Ltd.- for Unit – 2 to 5

Reference Books:

1. Analytical Geometry of Two Dimension by T.K.Manikavachakam Pillai and S.Narayanan. S.Viswanathan (Printers and Publishers) Pvt. Ltd.
2. Analytical Geometry of Three Dimension by T.K.Manikavachakam Pillai and S.Narayanan

Mapping of Course Outcomes to Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	3	3	2	2
CO2	3	3	3	1	3	3	3	1	3	3
CO3	3	3	2	3	3	3	1	3	2	1
CO4	3	2	3	3	3	1	3	3	3	2
CO5	3	3	1	3	2	3	3	3	1	3

3 – High 2 – Medium 1 - Low

Course Title: Integral Calculus and Vector Analysis

Course	B Sc(Maths)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course Objectives **To develop the ability to use Reduction formula**

- **To know about the method to find the Volume**
- **To develop the skills of the students in the Indefinite Integral.**
- **To learn methods and techniques of solving line and surface Integral.**

Course Outcomes: **At the end of the course, the Student will be able to**

CO1	Evaluate the Integral using Reduction formula
CO2	Calculate Area and Volume using double and triple Integral
CO3	Evaluate the Indefinite Integral using the properties of Beta and Gamma function.
CO4	Calculate directional derivatives, Curl, divergence.
CO5	Solve Line and Surface Integral using Greens, stokes and Gauss theorem

Program Outcome (PO)

At the end of the program, the student will be able to:

PO	Program Outcome
PO1	**Knowledge:** Apply the knowledge of Mathematics to develop logical thinking.
PO2	**Problem Analysis:** Identify the problems in real life situations and develop Mathematical models which paves the way to obtain solutions.
PO3	**Modern tool usage: S**elect and apply appropriate techniques, resources, computer programming and statistical tools to cope up with recent trends.
PO4	**Individual and team work:** Function effectively as an individual and as a member or leader in team.
PO5	**Communication:** Communicate with society at large, being able to comprehend and write affective reports and design documentation, make effective presentations.

PO6	**Project Management:** Acquire Mathematical and Statistical knowledge necessary to formulate, analyze, design and apply in multidisciplinary environments.
PO7	**Life-long learning:** Recognize the need for preparation and the ability to engage in life-long learning in the context of technological change.

Program Specific Outcomes (PSO)

At the end of the program, the student will be able to:

PSO	Program Specific Outcomes (PSO)
PSO1	**Mathematical Thinking:** Acquire abstract mathematical thinking and the capability of developing ideas based on them.
PSO2	**Career:** Practice mathematical tasks, tools, representation and methods for industry and entrepreneurial pursuit.
PSO3	**Creativity:** Develop quest for mathematics and prepare for higher learning.

CONTENTS OF MODULE
UNIT – I: Reduction formulae– Types, $\int x^n e^{ax} dx$, $\int x^n \cos ax dx$, $\int x^n \sin ax dx$, $\int \cos^n x dx$, $\int \sin^n x dx$,$\int \sin^m x \cos^n x dx$, $\int \tan^n x dx$,$\int \cot^n x dx$, $\int \sec^n x dx$, $\int \operatorname{cosec}^n x dx$,$\int x^n (\log x)^m dx$ -Bernoulli'sformula. Chapter 1 Section 13, 13.1 to 13.10,14,15.1.
UNIT-II : Multiple Integrals- definition of the double integrals- evaluation of the double integrals- double integrals in polar coordinates – triple integrals – applications of multiple integrals – volumes of solids of revolution – areas of curved surfaces – change of variables – Jacobians. Chapter 5 Section 1, 2.1, 2.2, 3.1, 4, 6.1, 6.2, 6.3, 7 Chapter 6 Section 1.1, 1.2, 2.1 to 2.4
UNIT– III: Beta and Gamma functions - infinite integral – definitions – recurrence formula of Gamma functions -properties of Gamma-functions - relation between Beta and Gamma functions. Evaluation of double and triple integrals using Beta gamma functions.
UNIT-IV: Introduction - directional derivative- Gradient- divergence- curl- Laplacian Differential Operator. Chapter 2 Sections 2.1 - 2.13.
UNIT-V: Line, surface and volume integrals - Integral Theorems - Gauss, Greens and Stokes (Without proof) –Problems. Chapter 3 Sections 3.1 to 3.6 and Chapter 4 Sections 4.1 to 4.5.

Recommended Text Book :

1. "Calculus",Vol-II by S.Narayanan and T.K.Manicavachagampillay
   S. Viswanathanpublishers– 2007 for Unit 1 , Unit 2 , Unit 3.

2. "Vector Analysis" by P.Duraipandian and KayalalPachaiyappa, S.ChandFor Unit 4,Unit 5.

Reference Books:

1.Integral Calculus and differential equations : Dipak Chatterjee (TATA McGrawHill Publishing companyLtd.).
2.Vector Algebra and Analysis by Narayanan and T.K.Manickvachagam PillayS .Viswanathan Publishers.
Vector Analysis: Murray Spiegel (Schaum Publishing Company, NewYork).

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	2	3	2	1
CO2	3	3	2	2	1	2	2	2	3	2
CO3	2	2	3	2	1	2	2	2	2	2
CO4	3	2	2	2	2	2	1	3	2	2
CO5	3	2	3	2	1	2	2	2	2	2

1 - Low 2 – Medium 3 – High

Differential Equations

Course	B.Sc. Maths
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- **To solve first order Ordinary differential equations**
- **To evaluate particular integrals of special forms**
- **To solve non homogeneous simultaneous linear differential equations**
- **To compute complete, singular and general integrals of partial differential equations**
- **To apply Charpits method**

Course Outcomes: At the end of the course, students will be able to

CO1	Solve linear differential equation and Demonstrate Bernoulli's equation and exactness of first order differential equations
CO2	Exhibit Clairauts form and solve linear differential equations with constant coefficients
CO3	Apply variation of parameter method to solve second order differential equations
CO4	Demonstrate Partial differential equations and its solutions
CO5	Implement Charpit's method

Course Outline	**Unit I: Ordinary Differential Equations:** Concept of existence and uniqueness . Variable separable-Homogeneous Equation-Non-Homogeneous Equations of first degree in x and y-Linear Equation-Bernoulli's Equation-Exact differential equations. Chapter 2: Section 1 to 6.
	Unit II: Equation of first order but not of higher degree: Equation solvable for dy/dx- Equation solvable for y- Equation solvable for x- Clairauts form- Linear Equations with constant coefficients-Particular integrals $e^{ax}, \sin ax, \cos ax, x^m, Ve^{ax}$ $where\ V\ is \sin ax\ \ or \cos ax\ \ or\ x^m$. Chapter 4: Section 1, 2.1, 2.2, 3.1, Chapter 5: Section 4.
	Unit III: Simultaneous linear differential equations- Linear Equations of the Second Order -Complete solution in terms of a known integrals- Reduction to the Normal form- Change of the Independent Variable -

	Method of Variation of Parameters. Chapter 6: Section- 6 ,Chapter 8:Section- 1,2,3,4.
	Unit IV: Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions-complete integral-singular integral-General integral-Lagrange's Linear Equations Pp+Qq=R. Chapter 12: Section- 1, 2, 3.1, 3.2, 4.
	Unit V: Special methods - Standard forms - Charpit's Methods - Related problems Chapter 12: Section-5.1, 5.2, 5.3, 5.4, 6.

Text Book:

1. "Differential Equations and its applications", by S.Narayanan, T.K.Manikavachagam Pillay –- S.Viswanathan (Printers and Publishers) Pvt. Ltd(2006).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2			2	2	2	2	2
CO2	2	3	2			1	2	1	2	2
CO3	2	2	1			2	2	2	3	2
CO4	1	2	2			2	3	3	2	3
CO5	3	2	3			2	2	2	2	2

Course Title: : Elementary Number Theory

Course	B.Sc Maths
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- **To explain the application of divisibility, congruences and its applications in number theory from an algebraic view point.**
- **To demonstrate quadratic residues, describe mobius inversion formula and solving simultaneous linear equations.**

Course outcomes: At the end of the course, students will be able to

CO1	Illustrate divisibility, primes and the binomial theorem
CO2	Judge the solution of congruences using Chinese remainder theorem and explain primitive roots and residues.
CO3	Develop the importance of quadratic residues and reciprocity to apply in quadratic residues and reciprocity.
CO4	Compare greatest integer function and arithmetic function and develop it to mobius inversion formula.
CO5	Examine simultaneous linear equations and formulate it to pythogorean triangles.

CONTENTS OF MODULE
Unit I : Introduction-Divisibility-Primes-The Binomial theorem
Unit II: Congruences, Solution of Congruences,Chinese Remainder Theorem-Primitive roots and Power residue-Number Theory from an Algebric view point-Groups,Rings and Fields
Unit III: Quadratic Residue,Quadratic reciprocity,The Jacobi Symbol
Unit IV: Greatest Integer Function,Arithmetic function,The Mobius Inversion formula Combinational Number Theory
Unit V: The equation ax+by=c,Simultaneous Linear Equation,Pythagorean Triangle,Assorted examples

Contents and treatment as in : "An Introduction to the Theory of Numbers (Vth edition)",by Ivan Niven, Herbert S.Zuckarman and Hugh L.Montgometry John Wiley&Sons , Inc.2001.

Chapter 1	**Sections 1.1 to 1.4**
Chapter 2	**Sections 2.1-2.3,2.8(cor 2.42,th 2.43 and cor 2.44 are omitted)-2.10-2.11**
Chapter 3	**Sections 3.1 to 3.3**

Chapter 4	**Sections 4.1, 4.3 and 4.5**
Chapter 5	**Sections 5.1 to 5.4**

Reference Books:

1.Elementary theory of numbers,cy.Hsiung, Allied publishers,1995

2.Elementary Number Theory,Allyn and Bacon Inc.,Boston,1980

3.Intoduction to Analytic Number Theory,Tom.M.Apostol,Narosa Publishing Houses, New Delhi,1989

e-Resources:

1.https://nptel.ac.in

2.https://mathonline.wikidot.com

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	2	2	3	3	3	2	3
CO2	3	3	3	2	1	2	3	2	2	3
CO3	3	3	2	1	2	3	3	1	3	3
CO4	3	2	3	1	2	3	3	3	2	3
CO5	2	2	3	3	2	3	3	2	3	3

Correlation level : 3 – High 2 – Medium 1 - Low

Integral Transforms

Course	B.Sc Maths
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- **To understand Laplace Transform**
- **To apply Laplace transform to solve differential equations**
- **To analyse Fourier series and its applicability**
- **To compute Fourier Transform**
- **To apply Z Transforms to difference equations**

Course Outcomes: At the end of the course, students will be able to

CO1	Analyse Laplace transform and the conditions of existence of Laplace transform
CO2	Implement the Laplace transform technique to solve differential equations
CO3	Study the expansion of periodic functions using Fourier Series
CO4	Demonstrate the Fourier transform and its properties
CO5	Apply Z transform for difference equations

Course Outline	**Unit I:** The Laplace Transforms-Definitions-Sufficient conditions for the existence of the Laplace transform(without proof)-Laplace transform of periodic functions-some general theorems-evaluation of integrals using Laplace transform-Problems. Chapter 5: Section-1 to 5.
	Unit II: The inverse Laplace Transforms- Applications of Laplace Transforms to ordinary differential equations with constant co-efficients and variable co-efficients, simultaneous equations and equations involving integrals-Problems. Chapter 5: Section-6 to 12.
	Unit III: Fourier series- Expansion of periodic functions of period 2π-

	Expansion of even and odd functions, Half range Fourier series- Change of intervals –Problems. Chapter 6: Section-1 to 6
	Unit IV: Fourier Transform- Infinite Fourier Transform(Complex form) – Properties of Fourier Transform – Fourier cosine and Fourier sine Transform – Properties – Parseval's identity – Convolution theorem - Problems. Chapter 6: Section-8 to 15.
	Unit V: Z Transforms: Definition of Z-Transform and its properties - Z-Transforms of some basic functions- Formation of difference equations – Solution of difference equations using Z – transform- Examples and simple problems

Text Book:

2. "Calculus-Volume III" – S.Narayanan and T.K.ManicavachagamPillai. (Ananda Book Depot)
3. "Engineering Mathematics for Semester III- Third Edition – T.Veerarajan (Tata McGraw-Hill Publishing Company Ltd, New Delhi) (for Unit-V)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2			2	2	2	2	2
CO2	2	3	1			1	2	1	2	2
CO3	2	2	2			2	2	2	3	2
CO4	2	3	2			2	3	2	2	2
CO5	3	2	2			2	2	2	2	2

Title of the Course	DISCRETE MATHEMATICS						
Paper Number	VIII						
Category	Core	Year / Semester	II / IV	Credits	4	Course Code	

Course	B.Sc. Maths	Credits	04
Exam Hours	03	CIA Marks	50
		ESE Marks	50

Learning outcomes:

Students will acquire knowledge

- To apply tools and ideas in Mathematics for solving Applied Problems.
- To Evaluate Boolean functions and to express a logic sentence in terms of predicates, quantifiers, and logical connectives.

CO1	Analyse the divisibility of integer and also representation of
CO2	Apply Boolean algebra concepts in disjunctive and conjunctive normal form
CO3	Identifying, designing and analyzing circuits, logical gates and combinatorial circuits
CO4	Demonstrate recursive function and classify homogeneous and non-homogeneous linear recurrence relations
CO5	Demonstrate Proportional logic and Predicate logic

Course Outcomes: At the end of the Course, the Student will be able to

COs	CONTENTS OF MODULE
CO1	**UNIT-I:** Integers: Set, some basic properties of integers, Mathematical induction, divisibility of integers, representation of positive integers Chapter 1 - Sections 1.1 to 1.5
CO2	**UNIT- II:** Boolean algebra &Applications: Boolean algebra, two element Boolean algebra, Disjunctive normal form, Conjunctive normal form Chapter 5 - Sections 5.1 to 5.4

CO3	**UNIT–III:** Application, Simplification of circuits, Designing of switching circuits, Logical Gates and Combinatorial circuits. Chapter 5 - Section 5.5, 5.6
CO4	**UNIT-IV:** Recurrence relations and Generating functions: Sequence and recurrence relation, Solving recurrence relations by iteration method, Modeling of counting problems by recurrence relations, Linear (difference equations) recurrence relations with constant coefficients, Generating functions, Sum and product of two generating functions, Useful generating functions, Combinatorial problems. Chapter 6 - Section 6.1 to 6.6
CO5	**UNIT-V:** Proportional logic and Predicate logic: Proportional logic, Adequate system of connectivies, Translation of sentences in a Natural Language into Statement Formula, Logical validity of arguments, Predicate Logic, Negation of a statement obtained by qualification of a predicate, Logical operations on predicates or quantified predicates, Symbolization of sentences by using predicates, Quantifiers and connectives, Logical validity of arguments. Chapter 8 - Sections 8.1, 8.5 to 8.8 (Omit Section 8.2 to 8.4)

Contents and treatment as in	"Introduction to Discrete Mathematics", 2nd edition, 2002 by M. K. Sen and B. C.Chakraborty, Books and Allied Private Ltd., Kolkata.
Reference Books	1. Discrete mathematics for computer scientists and mathematicians by J. L.Mertt,AbrahamKendel and T. P. Baker prentice-hall, India. 2. Discrete mathematics for computer scientists by John Truss-Addison Wesley. 3. Elements of Discrete Mathematics, C. L. Liu, New York Mcgraw-Hill, 1977.
e-Resources:	1. https://brilliant.org/wiki/discrete-mathematics/. 2. https://www.tutorialspoint.com/discrete_mathematics/.

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	2	2
CO2	3	2	1	1	1	2	1	2	2	2
CO3	2	3	2	1	1	1	1	1	2	2
CO4	2	2	1	1	1	2	1	1	2	2
CO5	2	3	2	1	1	1	1	1	3	3

3-High **2-Medium** **1-Low**

Title Of The Course		PROBABILITY AND STATISTICS – I			
Paper Number		III			
Category	Allied	Year	II	Credits	5
		Semester	III		

Course	B.Sc. Maths
Exam Hours	03

Credits	05
CIA Marks	50
ESE Marks	50

Course Objectives

Students will acquire knowledge of

- The laws of Probability and Baye's theorem.
- Measures of Location, Dispersion, Correlation and Regression
- The Discrete and Continuous Probability Distribution

Course Outcomes: At the end of the Course, the Student will be able to

COs	CONTENTS OF MODULE
CO1	**UNIT-I:** Concept of sample space – Events – Definition of Probability (classical, Statistical & Axiomatic) – Addition and Multiplication laws of Probability for 2 events – Extension of Addition and Multiplication laws of events (Statement only) – Independence – Conditional Probability – Baye's theorem - Simple Problems
CO2	**UNIT- II:** Random Variables (Discrete and Continuous) Distribution function- Expected values and Moments- Moment generating function – Probability generating function- Examples
CO3	**UNIT–III:** Characteristic function- Uniqueness and Inversion theorems (Statements and applications only)- Cumulants - Chebychev's Inequality – Simple Problems. Convergence in probability, Weak Law of large numbers with numerical examples, Central Limit Theorem
CO4	**UNIT-IV:** Concepts of bivariate distributions- Correlation and Regression- Linear Prediction- Rank Correlation coefficient, Intra class correlation coefficient, Concepts of partial and multiple correlation coefficients- Simple problems.

CO5	**UNIT-V:** Standard Distributions – Bernoulli Distribution, Binomial- Poisson- Normal- Uniform distributions- Geometric- Exponential- Gamma -Beta distributions- Inter relationship between distributions.

Contents and treatment as in	Elements of Mathematical Statistics, by S.C.Gupta &V.K.Kapoor, Sultan Chand & Sons, New Delhi.
Reference Books	1. Hogg R.V. & Craig A.T. (1988) : Introduction to Mathematical Statistics, McMillan. 2. Mood A.M. &Graybill F.A. &Boes D.G. (1974): Introduction to theory of Statistics,McGraw Hill. 3. Snedecor G.W. & Cochran W.G(1967) : Statistical Methods, Oxford and IBH.
e-Resources:	1. https://nptel.ac.in 2. https://www.wikipedia.org. 3. http://ebooks.lpude.in.statistics.

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**
CO3	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**

3-High 2-Medium 1-Low

Title Of The Course		PROBABILITY AND STATISTICS – II			
Paper Number		IV			
Category	Allied	Year	II	Credits	5
		Semester	IV		

Course	B.Sc. Maths
Exam Hours	03

Credits	05
CIA Marks	50
ESE Marks	50

Learning outcomes: Students will acquire knowledge

CO1	Identify a statistic and point out its importance in application and summarize the theoretical aspect of normal and non-normal populations.
CO2	Explain the bound for defining most efficient estimates derived from Rao Cramer inequality and compare the process of finding interval estimation with the process of finding point estimation.
CO3	Fit best approximation for a given set of data and also compare and analyze whether two sets of data are coming from same population or different population
CO4	Analyze the variability of samples under the given distributions and also obtain its confidence intervals
CO5	Point out the existence of most powerful test by summarizing the theoretical aspects of Neymann Pearson result.

- To provide the foundation of statistical analysis used in varied application
- Of Sampling methods, Tests of significance and testing of hypothesis.

Course Outcomes: At the end of the Course, the Student will be able to

COs	CONTENTS OF MODULE
CO1	**UNIT-I:** Sampling Distributions – Concept of Standard error – Sampling distribution based on normal distribution- t, z, Chi Square and F distributions.
CO2	**UNIT- II** Point estimation – Concepts of unbiasedness – consistency – efficiency and sufficiency- Cramer Rao inequality – Methods of estimation- Maximum likelihood- moments - minimum square and their properties (Statement only).
CO3	**UNIT–III:** Test of significance – Standard error- Large sample test, Exact test based on normal, t, chi-square and F idistribution with respect to population mean/means, proportion/proportions, variance and correlation coefficient. Test of independence of attributes based on contingency tables- Goodness of fit based on chi-square.
CO4	**UNIT-IV:** Analysis of Variance: One way, two way classification concepts &Problems. Interval estimation – Confidence intervals for population mean/means- Proportion/proportions and variances based on t, Chi-Square and F.
CO5	**UNIT-V:** Test of hypothesis- Type I and II errors- Power of test – Neymann Pearson lemma- Likelihood ratio test-concepts of most powerful test- statements and results only-simple problems, Concept of p-value, Power of test.

Contents and treatment as in	Elements of Mathematical Statistics, by S.C.Gupta &V.K.Kapoor, Sultan Chand & Sons,New Delhi.
Reference Books	1. Hogg R.V. & Craig A.T. (1988): Introduction to Mathematical Statistics, McMillan. 2. Mood A.M. &Graybill F.A. &Boes D.G. (1974): Introduction to theory of Statistics,McGraw Hill. 3. Snedecor G.W. & Cochran W.G(1967) : Statistical Methods, Oxford and IBH. 4. Hoel P.G. (1971) : Introduction to Mathematical Statistics, Wiley. 5. Wilks S.S. Elementary Statistical Analysis, Oxford and IBH.
e-Resources:	1. https://nptel.ac.in 2. https://www.wikipedia.org. 3. http://ebooks.lpude.in.statistics.

Mapping of Course Outcomes to Program Outcome & Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**	**1**	**1**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**1**	**1**	**1**	**3**	**3**	**2**	**2**
CO3	**2**	**3**	**3**	1	1	2	**1**	**2**	**2**	**2**
CO4	**3**	**3**	**2**	1	1	2	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	1	1	2	**1**	**2**	**2**	**2**

3-High **2-Medium** **1-Low**

Course Title: ALGEBRAIC STRUCTURES

Course	B Sc (Maths)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course Objectives:

Students will acquire knowledge about the concepts of Sets, Groups and Rings.

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Summarize the structure of Group, Subgroups and Demonstrate operations satisfying various properties in group structure.
CO2	Explain normal subgroups, quotient groups, homomorphism, automorphism and demonstrate with an example.
CO3	Explain Cayley's theorem, the permutations groups with an example.
CO4	Define Rings, some special classes of rings with an example and Explain ideals and quotient Rings
CO5	Illustrate Imbedding of Integral domain over Field and demonstrate the Euclidean Rings.

COs	CONTENTS OF MODULE
CO1	**Unit 1:** Introduction to groups- Subgroups- cyclic groups and properties of cyclic groups- Lagrange'sTheorem- A counting principle. Chapter 2 Section 2.4 and 2.5.
CO2	**Unit 2:** Normal subgroups and Quotient group- Homomorphism- Automorphism. Chapter 2 Section 2.6 to 2.8.
CO3	**Unit 3:** Cayley's Theorem- Permutation groups. Chapter 2 Section 2.9 and 2.10.
CO4	**Unit 4:** Definition and examples of ring- Some special classes of rings- homomorphism of rings- Ideals and quotient rings- More ideals and quotient rings. Chapter 3 Section 3.1 to 3.5.
CO5	**Unit 5:**The field of quotients of an integral domain- Euclidean Rings- The particular Euclidean ring. Section 3.6to 3.8.

Contents and treatment as in

"Topics in Algebra" – I. N. Herstein, Wiley Eastern Ltd.

Reference Books

1. Modern Algebra by M.L.Santiago, McGraw Hill Education India pvt Ltd.
2. Modern Algebra by S. Arumugam and others, New Gamma publishing House, Palayamkottai.
3. Modern Algebra by Visvanathan Nayak, Emerald Publishers, Reprint 1992.

1. https://nptel.ac.in
2. http://garsia.math.yorku.ca/~sdenton/algstruct.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02	PS03
CO1	3	3	2	2	1	2	2	3	3	2
CO2	3	3	2	2	1	2	2	3	2	3
CO3	3	3	1	1	1	2	1	3	1	2
CO4	3	3	1	1	1	2	1	2	2	2
CO5	3	2	1	2	1	2	2	3	2	2

Correlation levels: 1- Weak 2-Medium 3-High

Course Title: Real Analysis-I

Course	B.Sc. Maths
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- To make the students capable of analysing any given sequence and series
- To calculate limit superior, limit inferior and the limit of a sequence
- To learn certain proof techniques and write precise proof of theorems
- To recognize alternating, conditionally convergent and absolutely convergent series

Course outcomes: At the end of the course, students will be able to

CO1	Describe the fundamental properties of the real numbers that lead to the formal development of real analysis and recognize the basic properties of the field of real numbers, cardinality of a sets.
CO2	Demonstrate the concepts of limits in sequences and examine the basic principles of convergence and conditions of the convergent, divergent of a sequence.
CO3	Estimate the limit superior, limit inferior, limit of a sequence and explain Cauchy sequence.
CO4	Construct mathematical proofs of convergence test of a sequence and distinguish between conditional convergence and absolute convergence. Explain and demonstrate the basic concepts of absolute convergence of a sequence and derive the 'test for convergence' using summation by parts.
CO5	Explain the Euclidian distance function and the geometric meaning of each of the metric space properties and point out whether a given distance function is a metric.

CONTENTS OF MODULE
Unit I: Sets and Functions: Sets and elements- Operations on sets- functions- real valued functions- equivalence- countability - real numbers- least upper bounds.
Unit II: Sequences of Real Numbers: Definition of a sequence and subsequence- limit of a sequence- convergent sequences- divergent sequences- bounded sequences- monotone sequences
Unit III: Operations on convergent sequences- operations on divergent sequences- limit superior and limit inferior- Cauchy sequences.
Unit IV: Series of Real Numbers: Convergence and divergence- series with non-negative terms- alternating series- conditional convergence and absolute convergence- tests for absolute convergence- series whose terms form a non-increasing sequence- the class l^2 .
Unit V: Limits and Metric Spaces: Limit of a function on a real line-. Metric spaces - Limits in metric spaces. Continuous Functions on Metric Spaces: Function continuous at a point on the real line- Reformulation- Function continuous on a metric space.

Recommended Text: Contents and treatment as in
Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co.

Reference Books:

1. Principles of Mathematical Analysis by Walter Rudin,TataMcGrawHill.
2. Mathematical Analysis Tom M Apostol, Narosa Publishing House

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	1	2	2	2	2	2	2
CO2	3	2	2	1	2	2	2	3	2	2
CO3	2	2	2	1	1	3	2	2	2	2
CO4	3	2	1	1	1	3	1	3	2	3
CO5	3	2	2	1	2	2	2	3	2	3

3 – High 2 – Medium 1 - Low

Course Title: Mechanics

Course	B Sc (Maths)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

Students will acquire knowledge about

Particles or body in rest under the given forces. Forces, equilibrium of a particle and centre of mass of various bodies.

The motion of bodies under the influence of forces. Rectilinear motion of particles, Projectiles, Impact and Moment of Inertia of Particles.

Course outcomes: At the end of the course, the student will be able to

CO1	Recall the basic definitions of forces, Newtons laws of motion, Distinguish problems under moments, parallel forces and couples.
CO2	Explain Equilibrium of a rigid body under three coplanar forces, Centre of mass, hanging body in equilibrium and demonstrate problems under hanging strings.
CO3	Recall the basic definitions of work, conservative field of force, power, simple harmonic motion and demonstrate problems under work, Simple harmonic motion
CO4	Recall concepts of projectiles, differentiate time of flight, horizontal range in an inclined plane and evaluate problems under Impact.
CO5	Define circular motion, central orbits, Explain moment of Inertia of simple bodies and theorems of parallel and perpendicular axes and evaluate various problems under moments of Inertia

COs	CONTENTS OF MODULE
CO1	**Unit 1** Force- Newtons laws of motion - resultant of two forces on a particle- Equilibrium of a particle.Forces on a rigid body – moment of a force – general motion of a rigid body- equivalent systems offorces – parallel forces – forces along the sides of a triangle – couples. Chapter 2 - Section 2 .1 , 2.2 , Chapter 3 - Section 3.1. Chapter 4 - Section 4 .1 to 4.6.
CO2	**Unit 2** Resultant of several coplanar forces- equation of the line of action of the resultant- Equilibrium of arigid body under three coplanar forces . Centre of mass – finding mass centre – a hanging body in equilibrium,Hanging strings- equilibrium of a uniform homogeneous string – suspension bridge Chapter 4 - Section 4.7 to 4.9

	Chapter 6 - Section 6.1 to 6.3. Chapter 9 - Section 9.1, 9.2.
CO3	**Unit 3** Kinematics -Basic units – velocity – acceleration- coplanar motion . Work, Energy and power – work – conservative field of force – power – Rectilinear motion under varying Force: Simple harmonic motion (S.H.M.) – S.H.M. along a horizontal line- S.H.M. along a vertical line Chapter 1 - Section 1.1 to 1.4 Chapter 11 - Section 11.1to 11.3 ,Chapter 12 - Section 12.1 to 12.3
CO4	**Unit 4** Projectiles -Forces on a projectile- projectile projected on an inclined plane. Impact: Impulsive force - impact of sphere - impact of two smooth spheres – impact of a smooth sphereon a plane – oblique impact of two smooth spheres Chapter 13 - Section 13.1,13.2 Chapter 14 - Section 14.1, 14.5
CO5	**Unit 5** Circular motion – Conical pendulum – simple pendulum – central orbits -general orbits - central orbits-conic as centered orbit. Moment of inertia, Perpendicular and parallel axes theorem Chapter 15 - Section 15.1, 15.2, 15.6 Chapter 16 - Section 16.1 to 16.3 Chapter 17 -Section 17.1, 17.1.1

Contents and treatment as in

"Mechanics" by P. Duraipandian ,LaxmiDuraipandian , MuthamizhJayapragasham, S. Chandand Co limited 2008 .

Reference Books

1. Dynamics – K. ViswanathaNaik and M. S. Kasi, Emerald Publishers.
2. Dynamics – A. V. Dharmapadam, S. Viswanathan Publishers.
3. Mechanics – Walter Grenier.

e-Resources:

1. https://www.wikipedia.org/
2. https://physics.info

3. Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02	PS03
CO1	3	3	2	1	1	2	2	3	3	2
CO2	3	3	2	1	1	2	2	3	2	3
CO3	3	3	1	1	1	2	1	3	1	2
CO4	3	3	1	1	1	2	1	2	2	2
CO5	3	2	1	2	1	2	2	3	2	2

Correlation levels: 1- Weak 2-Medium 3-High

Course Title: Operations Research

Course	B Sc (Maths) MPC & MAN
Exam Hours	03

Credits	05
CIA Marks	50
ESE Marks	50

Course objectives

- **To formulate and analyzing the Linear Programming Problem from the real-world problems.**
- **Develop mathematical skills to analyze and solve network models arising from a wide range of applications.**
- **The student get knowledge about the scope and application of operations research in business and industry.**

Course outcomes: At the end of the course, students will be able to

CO1	Able to formulate linear programming problems and solve using Graphical, Simplex method.
CO2	Able to analyze and solve Transportation using appropriate method.
CO3	Able to analyze and solve Assignment problems and Game theory.
CO4	Able to design and solve Networks Models using CPM, PERT.
CO5	Estimate optimum solution for sequencing problems.

CONTENTS OF MODULE
Unit -1: Linear programming – Formulation – Graphical solution – Simplex method – Simple applications. Big-M method.
Unit -2: Linear programming - Principle of Duality – Primal – Dual relation -Dual simplex method – Simple applications. **Transportation Problem**: Finding initial solution by North West Corner Rule – Vogel's Approximation method and Matrix minimum method – Procedure for finding optimal solution – Both minimisation and maximisation cases – Unbalanced and degenerate transportation problems.
Unit -3: Assignment Problem: Formulation – Minimisation cases – procedure for getting optimum solution – Unbalanced problem – Maximisation problem – Problems with restrictions. **Game Theory**: Two Person Zero-Sum game with saddle point – without saddle point –dominance rule – Solving 2 x n or m x 2 game by graphical method.
Unit -4: Networks: Rules for network construction – Critical Path Method - Time calculation sin PERT – PERT algorithm (Crashing excluded) – Related problems.
Unit -5: Sequencing Problem – n jobs through 2 machines – n jobs through 3 machines – n jobs through m machines. Graphical method.

Recommended Text :

P.K. Gupta and D. S. Hira, Operations Research, S. Chand & Co.

Reference Books:

1. *KanthiSwaroop, P.K. Gupta,Manmohan*,Operations Research –Sultan Chand & sons.
2. *H.A. Taha*, Operations Research Prentice Hall of India, New Delhi
3. *Sundaresan, Ganapathy Subramanian, Ganesan.,*Resource Management Technique – Meenakshi Agency.

Mapping of Course Outcomes to Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**3**
CO2	**2**	**3**	**2**	**1**	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**1**	**2**	**1**	**3**	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**2**

3 – High 2 – Medium 1 - Low

Course Title: PROGRAMMING IN PYTHON WITH PRACTICALS (THEORY)

Course	B. Sc Maths
Exam Hours	03

Credits	05
CIA Marks	50
ESE Marks	50

Course objectives

- To learn and understand Python programming basics and paradigm.
- To learn and understand control statements, Looping, functions and string manipulations.
- To learn and know the concepts of file handling and exception handling.

Course outcomes: At the end of the course, students will be able to

CO1	Understand the concept of operators, data types in python programming.
CO2	Understand control statements and Looping
CO3	Apply the concept of functions in python programming.
CO4	Understand the concept of formatting operator and strings
CO5	Analyze the structures of list, tuples and maintaining dictionaries

CONTENTS OF MODULE
UNIT-I : Basics of Python Programming: Features – History – Future – Python Interpreter and Interactive Mode – Writing and Executing First Python Programme – Values and Types – Data Types – Operators and Expressions – Operations on Strings – Type Conversion – Comments – Functions and Modules. Chapter 2: Section 2.1 – 2.22
UNIT-II: Control Flow Statements: Introduction to Decision Control Statements –Conditional Branching –Loops Structures – Nested Loops – Break – Continue – Pass – Else Statement Used with Loops. Chapter 3: Section 3.1 – 3.8
UNIT-III: Functions: Introduction – Defining a function– Function Call – Variable Scope and Lifetime – Fruitful Function –Lambda – Function Composition – Documentation Strings – Recursive Functions Chapter 4: Section 4.1 – 4.8, 4.10 (Omit 4.9)
UNIT-IV: Strings: Concatenating, Appending, and Multiplying Strings – Immutable – Formatting Operator – Built-in String Methods and Functions – Slice Operation – Comparing Strings – Iterating String. Lists, Tuples and Dictionaries: Sequence – Lists. Chapter 5: Section 5.1 – 5.5, 5.8, 5.9 (Omit 5.6, 5.7) Chapter 6: Section 6.1 to 6.2
UNIT-V: Lists, Tuples and Dictionaries: Tuple – Dictionaries File Handling: Opening and Closing Files – Reading and Writing Files. Error and Exception Handling: Introduction – Handling Exceptions. Chapter 6: Section 6.4 to 6.5 (Omit 6.3) Chapter 7: Section 7.4, 7.5 Chapter 8: Section 8.1, 8.2

Recommended Text:

"Problem Solving and Programming with Python", by ReemaThareja (Second Edition, 2019,OXFORD University Press)

Reference Books:

1. "Problem Solving and Python Programming" by Mr. Ashok NamdevKamthane and Mr.Amit Ashok Kamthane (McGraw Hill Education (India) Private Limited).

2. “Python Programming” by Ch.Sathyanarayana, M.Radhika

e-Resources:

https://www.pythonforbeginners.com/

https://www.w3schools.com/

Mapping of Course Outcomes to Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	3	2	3	1	2
CO2	1	2	2	-	-	2	1	2	3	3
CO3	3	1	2	-	-	1	2	3	2	2
CO4	2	3	1	-	-	2	2	1	2	1
CO5	3	2	2	-	-	1	1	2	1	3

3 – High 2 – Medium 1- Low

Course Title: Linear Algebra

Course	B Sc (Maths)
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course Objectives

Students will acquire knowledge about the Vector Spaces, Dual spaces, Inner product spaces and linear transformations**.**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Define vector space, Linear span, linearly independent and dependent with illustrations, explain the existence theorem for basis of finitely generated vector space and evaluate dimension of vector space.
CO2	Explain linear transformation, dual spaces, demonstrate Rank – Nullity theorem with an illustration.
CO3	Demonstrate and evaluate minimal polynomial, matrix of a linear transformation, Eigen values and Eigen vectors of linear transformation.
CO4	Define Norm, Inner Product Space, Discuss orthogonal and orthonormal basis, Explain the Gram-Schmidt Orthogonalizations process, and construct orthogonal and orthonormal basis for a given basis.
CO5	Discuss adjoint operators and their properties with an illustration.

COs	CONTENTS OF MODULE
CO1	**Unit – I: Vector spaces** Vector spaces, subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vector space, Dimensions, Quotient space and its dimension.
CO2	**Unit- II**: **Homomorphism and Isomorphism of Vector Spaces** Homomorphism and isomorphism of vector spaces,Linear transformations and linear forms on vector spaces, Dual Spaces, Null Space, Range space of a linear transformation, Rank - Nullity Theorem.
CO3	**Unit–III: Algebra of Linear Transformation** Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.
CO4	**Unit – IV: Inner Product Spaces** Inner product spaces and norms, Cauchy-Schwarz inequality, Orthogonal sets and Basis, Orthonormal basis, Gram-Schmidt orthogonalization process, Orthogonal complements, Bessel's inequality.
CO5	**Unit – V: Adjoint Operators and their Properties** The adjoint of a linear operator, Least squares approximation, Minimal solutions to systems of linear equations, Normal, Self - adjoint, Unitary and orthogonal operators and their properties.

Contents and treatment as in

Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi.

Reference Books

1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.
3. Andrilli, S., & Hecker, D. (2016). Elementary Linear Algebra (5th ed.). Academic Press, Elsevier India Private Limited.
4. Kolman, Bernard, & Hill, David R. (2001). Introductory Linear Algebra with Applications (7th ed.). Pearson Education, Delhi. First Indian Reprint 2003.
5. Lay, David C., Lay, Steven R., & McDonald, Judi J. (2016). Linear Algebra and its Applications (5th ed.). Pearson Education.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02	PS03
CO1	3	3	2	1	1	2	2	3	3	2
CO2	3	3	2	1	1	2	2	3	2	3
CO3	3	3	1	1	1	2	1	3	1	2
CO4	3	3	1	1	1	2	1	2	2	2
CO5	3	2	1	2	1	2	2	3	2	2

Correlation levels: 1- Weak 2-Medium 3-High

Course Title: Real Analysis II

Course	B.Sc Maths
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- **To write clear and precise proof of theorems.**
- **Introduce the concepts of Riemann integrable and properties of Riemann integrable.**
- **To identify the correct theorems to deal with unknown problems.**

Course outcomes: At the end of the course, students will be able to

CO1	Examine the continuity of a functions via open and closed sets and give the definition of concepts related to metric spaces, such as continuity, compactness, completeness and connectedness
CO2	Describe about bounded, unbounded sets and distinguish between compact and complete metric spaces.
CO3	Determine the Riemann integrability of a bounded function, identify the size of a sets by outer measure and choose the Riemann integral properties to find the value of the integrals.
CO4	Demonstrate the usage of the Mean Value Theorem, Fundamental theorem of Calculus to problems in the context of real analysis and Roll's theorem, Mean value theorem for differentiable functions.
CO5	Distinguish between point wise and uniform convergence of a sequence of functions and illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.

CONTENTS OF MODULE
Unit I: Continuous Functions on Metric Spaces: Open sets- closed sets- Discontinuous function on R^1. Connectedness, Completeness and Compactness: More about open sets- Connected sets.
Unit II: Bounded sets and totally bounded sets -Complete metric spaces- compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.
Unit III: Calculus: Sets of measure zero, definition of the Riemann integral, - properties of Riemann integral.
Unit IV: Derivatives- Rolle's theorem, Law of mean, Fundamental theorems of calculus.
Unit V: Taylor's theorem- Pointwise convergence of sequences of functions, uniform convergence of sequences of functions.

Recommended Text Book:

Richard R. Goldberg. Methods of Real Analysis. Oxford and IBH Publishing Co)

Reference Books:

1. Principles of Mathematical Analysis by Walter Rudin,TataMcGrawHill.
2. Mathematical Analysis Tom M Apostal,Narosa Publishing House.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**2**	**2**
CO2	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**3**	**2**	**3**
CO3	**2**	**3**	**3**	**1**	**2**	**2**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**1**	**1**	**2**	**2**	**3**	**2**	**3**
CO5	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**2**

3 – High 2 – Medium 1 - Low

Course Title: FUNCTIONS OF A COMPLEX VARIABLE

Course	B.Sc Maths
Exam Hours	03

Credits	04
CIA Marks	50
ESE Marks	50

Course objectives

- Explain the fundamental concepts of the functions of a complex variable and their role in modern mathematics and applied contexts**.**
- Demonstrate understanding by analysing, proving and explaining concepts from complex analysis.
- Relate the algebraic and geometric properties of conformal mappings, and apply these to determine the properties of analytic functions.
- Calculate series expansions for analytical complex-valued functions, evaluate contour integrals and definite integrals.

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Derive Cauchy Riemann equation and identify analytic functions.
CO2	Discuss Bilinear transformation and various standard transformations.
CO3	Evaluate value of the function using Cauchy's integral theorem.
CO4	Represent the given function in a series form valid in a domain.
CO5	Evaluate Improper real integrals using residues.

COs	CONTENTS OF MODULE
CO1	**Unit 1** Analytic Functions: Functions of a Complex Variable – Limit- Theorems on Limits – Continuous functions- Differentiability – Cauchy – Riemann equations – Analytic functions- Harmonic functions – Conformal mapping. Chapter 1 – sec 2.1 to 2.9.
CO2	**Unit 2** Bilinear Transformations: Elementary transformations – Bilinear transformations – Cross ratio- Fixed Points of Bilinear Transformations – Mapping by Elementary Functions - The Mapping $w = z^2$, z^n, n is a positive integer, $w = e^z$, sin z, cos z. Chapter 3 – sec 3.1 to 3.4 , Chapter 5 – sec 5.1 to 5.5
CO3	**Unit 3** Complex Integration – definite integral – Cauchy's Theorem – Cauchy's integral formula – Higher derivatives. Chapter 6 – sec 6.1 to 6.4
CO4	**Unit 4** Series expansions – Taylor's series – Laurent's Series – Zeroes of analytic functions- Singularities. Chapter 7 – 7.1 to 7.4
CO5	**Unit 5**

	Residues – Cauchy's Residue Theorem – Evaluation of definite integrals. Chapter 8 – 8.1 to 8.3.

Contents and treatment as in

"Complex Analysis" by S.Arumugam, Thangapandi Isaac, A.Somasundaram, SciTech publications (India) Pvt Ltd,2002.

Reference Books:

1. Complex variables and Applications (Sixth Edition) by James Ward Brown and Ruel V.Churchill, Mc.Grawhill Inc.
2. Complex Analysis by P.Duraipandian, Kayalak Pachaiyappa, S.Chand & Co Pvt.Ltd.
3. Complex Analysis,T.K.Manickavachagom Pillay, S.Viswanathan Publishers Pvt. Ltd.

e-Resources:

1. http://ebooks.lpude.in.complexanalysis.
2. https://nptel.ac.in.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	2	2	3	2	3
CO2	3	3	2	-	-	2	2	3	2	3
CO3	3	3	2	-	-	2	2	3	2	3
CO4	3	3	2	-	-	2	2	3	2	3
CO5	3	3	2	-	-	2	2	3	2	3

3 – High 2 – Medium 1 - Low

Course Title: MACHINE LEARNING USING R (THEORY)

Course	B. Sc Maths
Exam Hours	03

Credits	05
CIA Marks	50
ESE Marks	50

Course objectives

- To understand the need for machine learning for various problem solving
- To understand the latest trends in machine learning

To design appropriate machine learning algorithms for problem solving

Course outcomes: At the end of the course, students will be able to

CO1	Differentiate various learning approaches, and to interpret the concepts of supervised learning, unsupervised learning
CO2	Understand Bayesian Decision theory and Multivariate Method
CO3	Apply Clustering & Regression techniques
CO4	Understand Neural Networks and Multilayer Perceptrons
CO5	Understand local models, Assessing and Comparing Classification Algorithms

CONTENTS OF MODULE
UNIT 1: INTRODUCTION TO MACHINE LEARNING Machine learning – examples of machine learning applications – Learning associations – Classification – Regression Unsupervised learning – Supervised learning- Learning class from examples- PAC learning – Noise, model selection and generalization – Dimension of supervised machine learning algorithm.
UNIT-II: DECISION THEORY Bayesian Decision theory – Introduction – Classification – Discriminant function – Bayesian networks -Association rule - Parametric Methods – Introduction – Estimation -Classification - Regression – Multivariate Methods – Data Parameter estimation - Classification – Complexity – Features – Dimensionality Reduction – Analysis – Multidimensional scaling – Linear discriminant analysis.
UNIT-III: CLUSTERING & REGRESSION Clustering – Mixture densities – k- means clustering – Supervised Learning after clustering – Hierarchical clustering – Nonparametric Methods – Density estimation – Generalization of multivariate data – Classification – Regression – Smoothing models – Decision Trees – Univariate trees – Multivariate trees – Learning rules from data – Linear Discrimination.
UNIT-IV: MULTILAYER PERCEPTRONS Structure of brain – Neural networks as a parallel processing - Perceptron – Multilayer perceptron – Back propagation- Training procedures – Tuning the network size – Learning time.
UNIT-V: LOCAL MODELS Competitive learning -Adaptive resonance theory – Self organizing map – Basis functions – Learning vector quantization – Assessing and Comparing Classification Algorithms – Combining Multiple Learners – Reinforcement Learning.

Recommended Text:

1. Ethem alpaydin, “Introduction to Machine Learning”, MIT Press,2004.
2. Tom Mitchell, “Machine Learning”, McGraw Hill, 1997.

e-Resources:

https://nptel.ac.in/

http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=10341&mode=toc.

MACHINE LEARNING USING R (PRACTICALS)

LIST OF EXPERIEMNTS

1. Evaluating the results of machine learning algorithms.
2. Implement Regression and Correlation Techniques.
3. Implement Classification Algorithms.
4. Implement Logistic Regression
5. Implement Reinforcement learning model

Mapping of Course Outcomes to Program Specific Outcomes

3 – High 2 – Medium 1- Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	3	2	1	1	2
CO2	1	2	2	-	-	2	1	2	3	3
CO3	3	1	2	-	-	1	2	3	1	2
CO4	2	1	1	-	-	2	3	1	2	1
CO5	2	3	2	-	-	1	1	2	1	1

Course Title: TROPICAL LINEAR ALGEBRA

Course	**B Sc (MATHEMATICS)**
Exam Hours	**03**

Credits	**05**
CIA Marks	**50**
ESE Marks	**50**

Course Objectives

Tropical linear algebra enables students to efficiently describe and deal with complex sets reveal combinatorial aspects of problems and view a class of problems in a new, unconventional way.

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Analyze the properties of curve counting compactifications.
CO2	Abel to find formulations of the local rigidity theorems for curves and hypersurfaces that are amenable to direct application to problems in control theory
CO3	Investigate eigenvalues and eigenvectors in tropical linear algebra. Able to explain the varieties that are parameterized by monomials in linear forms.
CO4	Understand the concepts of generators, basis, column spaces. Differentiate between solvable systems and unsolvable systems.
CO5	Apply the concepts of principle eigen value and eigen spaces.

CONTENTS OF MODULE
Unit – I: Tropical islands Planes, amoebas and their tentacles, Implicitization, curve counting compactifications
Unit – II: Tropical varieties: Hypersurfaces- the fundamental theorem, the structure theorem.
Unit - III: Tropical varieties: Multiplicities and balancing, connectivity and fans, stable intersection.
Unit -IV: Max – linear systems: Bounded mixed integer solution to dual inequalities, the combinatorial method, the algebraic method, subspaces, generators, external and bases, column spaces, unsolvable systems.
Unit- V: Eigen Values and Eigen Vectors: The eigen problem: basic properties, maximum cycle mean is the principle eigen value, principle eigen space, finite eigen vectors, commuting matrices have a common eigen vector.

Contents and treatment as in

1. Introduction to Tropical Geometry by Diane Maclagan, Bernd Sturmfels.
2. Peter Butkovic – Max – linear Systems: Theory and Algorithms, Springer Monographs in Mathematics

Reference Books

Tropical Algebraic Geometry by Itenberg, Ilia, Mikhalkin, Grigory, Shustin, Eugenii Springer.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PS02**	**PS03**
CO1	3	2	2			2	2	3	3	3
CO2	3	3	2			2	3	3	2	2
CO3	2	3	1			2	1	3	1	2
CO4	3	3	2			2	2	2	1	2
CO5	3	2	1			2	2	3	2	2

Correlation levels: 1- Weak 2-Medium 3-High