DEPARTMENT OF MATHEMATICS

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari,

Coimbatore – 641021

Syllabus for

B.Sc Mathematics

2021-2022 Batch on-wards

Vision and Mission of the Institution:

VISION

To emerge as a world-renowned Institution that is integrated with Industry to impart Knowledge, Skills, Research Culture and Values in youngsters who can accelerate the overall development of India.

MISSION

To provide quality education at affordable cost, build academic and research excellence, maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India.

MOTTO

Transform the youth into National Asset.

Vision and Mission of the Department:

VISION

The Department aspires to the highest standards of excellence in teaching and service of humanity, through preparing students for learning Applied and Industrial Mathematics for the challenging growth of science and Technology.

MISSION

- The Mission of the Department is to provide an environment where students can learn and become competent users of Mathematics and Mathematical Application and also to provide quality Education, Research and Consultancy by providing highly skilled mathematical knowledge along with the industrial collaboration.

Program Educational Objectives (PEO)

PEO1	:	**Mathematical knowledge.** Apply the fundamental concepts of Mathematics to think logically and technically.
PEO2	:	**Problem solving skills.** Discover the Mathematical and Computational Techniques to solve the problems.
PEO3	:	**Industry Collaboration.**Discuss the multidisciplinary knowledge through projects and industrial training and providing a sustainable competitive edge in meeting the industry needs.
PEO4	:	**Employability Skill:** Perceive to become a eminent Mathematician with the Excellent Employability and Research Skill

Mapping of Institute Mission to PEO

Institute Mission	PEO's
Imparting Knowledge and Skill	PEO1, PEO2
Research Culture	PEO2
Industry collaboration	PEO3
Emerging young India	PEO4

Mapping of Department Mission to PEO

Department Mission	PEO's
Imparting Critical thinking ability to become more Competency	PEO1, PEO2
Analytical Knowledge with Industry collaboration	PEO3, PEO4
Research Culture	PEO1

Program Outcomes (PO)

PO1	**:**	Demonstrate basic manipulative skills in various areas of Mathematics.
PO2	**:**	Imbibe the skills necessary to effectively translate mathematical aspects to the general public.
PO3	**:**	Develop scientific temper among the Students.
PO4		Investigate and apply mathematical problems and solutions related to business and industry.
PO5		Develop solution oriented approach towards various Social and Environmental issues.
PO6		Compare the different Mathematical Models to produce accurate and precise results.
PO7		Analyze a problem, identify and define the computing requirements, which may be appropriate to its solution.
PO8		Acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematical sciences.
PO9		Create awareness to become an enlightened citizen with commitment.

Program Specific Outcomes (PSO)

PSO1	**:**	Understand and apply mathematical concepts in various contexts related to science, technology, business and industry.
PSO2	**:**	Acquire the knowledge to apply analytical and theoretical skills to model and solve mathematical problems
PSO3	**:**	Formulate and develop mathematical arguments in a logical manner.
PSO4	**:**	Apply the critical thinking ability to carry out extended investigation and innovation of mathematical formulations.

Correlation between the POs and the PEOs

Program Outcomes		**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**
PO1	:	3	2	1		1
PO2	:	2	1		3	2
PO3	:	1	3	1	2	
PO4	:		2	3	1	3
PO5	:	1		2	2	3
PO6	:	3		1	2	1
PO7	:	2	1		3	
PO8	:	3		2	3	1
PO9	:		3	1		2
PSO1	:		2	1	3	1
PSO2	:	1	3	1	2	
PSO3	:	1		2	3	2
PSO4	:		2	1	1	3

Components considered for Course Delivery is listed below:

1. Class room Lecture

2. Laboratory class and demo

3. Assignments

4. Case Study

5. Project

6. Online Course

7. External Participation

8. Seminar

9. Internship

Mapping of POs with Course Delivery:

Program Outcomes	Course Delivery								
	1	2	3	4	5	6	7	8	9
PO1	3	2	2	1	1			2	2
PO2	3	2			2	1	2	1	1
PO3		1	3		2		1	2	
PO4			1	2	3	2		3	3
PO5		1		2		3	1		
PO6	2		1	3		2	3		
PO7	1		3	2			2	3	1
PO8	1	3		1	2	2		1	
PO9	2		1		1	1	3		
PSO1	3	2			1		1		1
PSO2			3	2			1	2	
PSO3		1	2		3	2		1	3
PSO4	3	2		1			2		

Mapping should be done based on the correlation of PO / PSO with Course Delivery Components.

If strongly correlated mention - 3
If moderately correlated mention - 2
If less correlated mention - 1
If no correlation leave blank

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
B. Sc. Mathematics Curriculum Structure - Regulation - 2021
(For the students admitted from 2021 onwards)

S.No	Sem	Part	Sub Type	Sub Code	Subject	Credit	Hours	INT	EXT	Total
1	1	1	L1		Language – I	4	4	50	50	100
2	1	2	L2		English for Communication – I	4	4	50	50	100
3	1	3	Core		Core - Classical Algebra with Geogebra	4	4	50	50	100
4	1	3	Core Practical		Core Practical - Practical Algebra	2	4	20	30	50
5	1	3	DSC		DSC 1C	4	4	50	50	100
6	1	3	DSC Practical		DSC Practical - 1C	2	4	20	30	50
7	1	3	Allied-I		DSA 1A	4	4	50	50	100
8	1	4	AEC		Ability Enhancement Course I	2	2	50		50
9	1	6	VAC		Value Added Course - I	2	-	50		50
						28	**30**			
1	2	1	L1		Language – II	4	4	50	50	100
2	2	2	L2		English for Communication – II	4	4	50	50	100
3	2	3	Core		Core - Trigonometry, Vector Calculus & Fourier Series	4	4	50	50	100
4	2	3	Core Practical		Core Practical – Trig World	2	4	20	30	50
5	2	3	DSC		DSC 2C	4	4	50	50	100
6	2	3	DSC Practical		DSC Practical - 2C	2	4	20	30	50
7	2	3	Allied-II		DSA 2A	4	4	50	50	100
8	2	4	AEC		Ability Enhancement Course II	2	2	50		50
9	2	6	VAC		Value Added Course - II	2	-	50		50
						28	**30**			
1	3	3	Core		Core - Statics	4	5	50	50	100
2	3	3	Core Practical		Core Practical – Experimental Statics	2	4	20	30	50
3	3	3	DSC		DSC 3C	4	5	50	50	100
4	3	3	DSC Practical		DSC Practical - 3C	2	4	20	30	50
5	3	3	Allied-III		DSA 3A	4	5	50	50	100
6	3	4	SEC		Skill Enhancement Courses – I	2	5	20	30	50
7	3	4	AEC		Ability Enhancement Course III	2	2	50		50
8	3	6	VAC		Value Added Course - III	2	-	50		50

9	3	6	ITR		Industrial Training Report-I	2		50		50
10	3	6	IDL		Inter Department Learning – I	2	-	50		50
						26	**30**			
1	4	3	Core		Core – Dynamics	4	5	50	50	100
2	4	3	Core Practical		Core Practical – Experimental Dynamics	2	4	20	30	50
3	4	3	DSC		DSC 4C	4	5	50	50	100
4	4	3	DSC Practical		DSC Practical - 4C	2	4	20	30	50
5	4	3	Allied-IV		DSA 4A	4	5	50	50	100
6	4	4	SEC		Skill Enhancement Courses – II	2	5	20	30	50
7	4	4	AEC		ABE	2	2	50		50
8	4	6	VAC		Value Added Course - IV	2	-	50		50
9	4	6	IDL		Inter Department Learning – II	2	-	50		50
						24	**30**			
1	5	3	Core		Core - Real Analysis – I	4	5	50	50	100
2	5	3	Core Practical		Core Practical – Practical Analysis - I	2	5	20	30	50
3	5	3	DSC		DSC 5C	4	5	50	50	100
4	5	3	DSC Practical		DSC Practical - 5C	2	5	20	30	50
5	5	3	Elective I		Elective - I	4	5	50	50	100
6	5	3	Elective II		Elective - II	4	5	50	50	100
7	5	4	SEC		Skill Enhancement Courses – III Comprehensive Exam	2		50		50
8	3	6	ITR		Industrial Training Report-II	2		50		50
9	5	6	VAC		Value Added Course - V	2	-	50		50
						26	**30**			
1	6	3	Core		Core - Real Analysis – II	4	6	50	50	100
2	6	3	Core Practical		Core Practical – Practical Analysis - II	2	4	20	30	50
3	6	3	Elective III		Elective – III	4	6	50	50	100
4	6	3	Elective IV		Elective – IV	4	6	50	50	100
5	6	3	Core Course - XI		Core Project	8	4	80	120	200
6	6	4	SEC		Skill Enhancement Courses – IV	2	4	20	30	50
7	6	5	EX		Extension Activity- EX %	2	-	50		50
						26	**30**			

Discipline Specific Core

S.No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Calculus		
2			Analytical Geometry with Scilab		
3			Differential Equations		
4			Modern Algebra		
5			Graph Theory		
6			Fuzzy Mathematics		
7			Abstract Algebra		
8			Number Theory		
9			Linear Algebra		
10			Group Theory		

Discipline Specific Core - Practical

S.No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Thinking Calculus		
2			Geometry with 2D and 3D		
3			Applicable Derivatives		
4			Actual Algebra		
5			Practical Graph Theory		
6			Frizzy Logic		
7			Practical Abstract Algebra		
8			Exploring the theory of Numbers		
9			Practical Linear Algebra		
10			Practical Group theory		

Allied

S.No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Foundation of Data Analytics		
2			Advanced Data Analytics		
3			Programming with C++		
4			Research Methodology & IPR for Mathematics		
5			Physics-I		
6			Physics-II		

7			Principles of Accountancy		
8			Financial Mathematics		

Skill Enhancement Courses

S.No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Numerical Methods		
2			Introduction to Big Data Analytics with R		
3			Operations Research I		
4			Operations Research II		
5			Mathematica		
6			Quantitative Aptitude		
7			Actuarial Mathematics		
8			Office Automation		

Elective

S.No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Discrete Mathematics & Combinatorics		
2			Introduction to Entrepreneurship		
3			Real time applications of Mathematics		
4			Complex analysis-I		
5			Vedic Mathematics		
6			Probability Theory		
7			Complex analysis-II		
8			Coding Theory		
9			Automata Theory and Formal Languages		
10			Design Theory		
11			Mathematical Modeling		
12			Astronomy		

Semester I

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core-I-Classical Algebra with GeoGebra	4	0	0	4	Theory

Introduction:

This paper enables the students to learn about solving equations using algebraic operations and develop problem solving skills.

Course Focus on: Employability

Course Outcome:

CO1	:	To develop and understand the nature and purpose of expansion and summation
CO2	:	To determine the concepts about sequences and series, Binomial, Exponential and Logarithmic
CO3	:	To analyze the concept of Matrices with respect to real life applications
CO4	:	To impart skills in the various applications of algebraic methods.
CO5	:	To illustrate the convergence properties of power series.
CO6	:	To discuss the need of being with ethics of science while experimenting Algebraic concepts in society.

Unit I: **[12 Periods]**

Binomial theorem for any rational index – Exponential and Logarithmic Series – Summations and Approximations related to these series-Applications.

Unit II: **[12 Periods]**

Theory of Equations: Fundamental Theorem of Algebra – Relations between roots and Coefficients – Symmetric functions of roots.

Unit III: **[12 Periods]**

Transformation of Equations – Reciprocal Equations – Newton's Method of Divisors - Descartes' rule of signs

Unit IV: **[12 Periods]**

Matrices – special types of matrices – characteristic roots and characteristic vectors diagonalization of a matrix.

Unit V: **[12 Periods]**

Introduction to GeoGebra –Installation process –Basic Tools – Equations –Proving Binomial Theorem by using GeoGebra-Matrix GeoGebra.

Textbooks:

1. T.K. Manikavachagam Pillai, T. Natarajan and K.S. Ganapathi, "Algebra Volume I", S. Viswanathan pvt. Ltd, 2004. [Unit I to Unit III]
2. P.Kandasamy, K.Thilagavathi, " Mathematics for B.Sc Branch –I, Volume I", S. Chand and Company Pvt. Ltd, 2015. [Unit IV]
3. Geogebra Manual – The Offical Manual of Geogebera Research.shu.ac.uk/geogebra/GIF – Guides/official Geogebra manual.pdf (2011) [Unit V]

Contents:

Unit I	Chapter-5	Page Number :124-130, 143-152, 191-207, 224-230,
Unit II	Chapter-6	Page Number: 282-307.
Unit III	Chapter-6	Page Number: 309-327.
Unit IV	Chapter-1	Page Number: 3-8.
	Chapter-4	Page Number: 57-97.
Unit V	Chapter-1	

Reference Books:

1. N.P. Bali, " Algebra", Laxmi Publications pt. Ltd, New Delhi, 2009.
2. Arumugam &Issac, Classical Algebra, New gamma Publishing house, Tirunelveli, 2003.

Mapping of Course Outcomes with Program

Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2		3				2			2		1
CO2	1		2			2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Semester I

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical - Practical Algebra	0	0	4	2	Practical

Introduction: This course enables the students to understand about the applications of algebraic concepts and working with Geogebra.

Course Focus on: Employability

Course Outcome:

CO1	:	To apply the fundamental concept of expansion and summation.
CO2	:	To examine the concept of roots of equations.
CO3	:	To compare the concept of increase or decrease the roots of the equation
CO4	:	To analyze the concept of Matrices with respect to real life applications
CO5	:	To examine the applications of Binomial and Newton theorems

1. Solve the Binomial theorem using Geogebra.
2. Derive the Logarithmic series with the help of Geogebra.
3. Summation of series using Geogebra.
4. Transformation of Equations with Geogebra.
5. Solving Newton's method using Geogebra.
6. Multiplication of two Matrices with Geogebra.
7. Finding characteristic roots and characteristic vectors using Geogebra.
8. Solve Exponential theorem using Geogebra.
9. Diagonalization of a matrix using Geogebra.
10. Row reduction operations using Geogebra.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2		1			3		1		2	3
CO2		3				2			3		2	3	
CO3	3	3			2		3	2		1		2	1
CO4		1		2		3			3	2	3		
CO5	1						3				2		1

Semester-II

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core – III - Trigonometry, Vector Calculus and Fourier series	4	0	0	4	Theory

Introduction:

This paper enables the students to learn expansions of trigonometric functions, hyperbolic functions, inverse hyperbolic functions and it aims to develop computational skills.

Course Focus on: Skill development

Course Outcome:

CO1	:	To develop and understand the nature of trigonometric functions
CO2	:	To demonstrate the concept of several trigonometric identities and use them to verify other identities.
CO3	:	To determine the concepts of differential and integral calculus to solve multiple integrals.
CO4	:	To evaluate trigonometric and inverse trigonometric functions.
CO5	:	To understand the concepts of Fourier analysis to half range series.
CO6	:	To develop conceptual understanding and fluency with trigonometric functions, techniques, vector calculus and manipulations.

Unit I: **[12 Periods]**

Expansions of cosnθ, sinnθ and tan nθ -Expansion of $\cos^n\theta$, $\sin^n\theta$ -hyperbolic functions and inverse Hyperbolic functions.

Unit II: **[12 Periods]**

Logarithm of complex quantities-Summations of trigonometric series -Simple problems.

Unit III: **[12 Periods]**

Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl.

Unit IV: **[12 Periods]**

Line integral-surface integral- volume integrals- Gauss, Green & Stokes theorem (Statement only).

Unit V: **[12 Periods]**

Fourier series- The Cosine and Sine series- Even and Odd functions- Half range series.

Text Books:

1. T.K. Manichavasagam Pillai and S.Narayanan," Trigonometry", Viswanathan Publishers and Printers Pvt. Ltd,2013.[Unit I&II]
2. P.Duraipandian and KayalalPachaiyappa," Vector Calculus", Muhil Publishers, 2009. [Unit III &IV].
3. P.R.Vittal. (2004) Vector Calculus, Fourier series and Fourier Transform. Margham Publications, Chennai. [Unit V]

Contents:

Unit I	Chapter-3	Page Number: 61-66, 77-83,
	Chapter-4	Page Number: 93-105.
Unit II	Chapter-5	Page Number: 122 -141.
Unit III	Chapter-1, 2, 3	Page Number: 1-65
Unit IV	Chapter-5&6	Page Number: 98-204.
	Chapter-4	Page Number: 57-97.
Unit V	Chapter -2	Page Number: 6-43.

Reference Books:

1. Kandasamy. P, Thilagavathi. K, " Mathematics for B.Sc. Branch I", Volume I II and IV - S.Chand and Company Ltd, New Delhi, 2004.
2. P. Duraipandian and LaxmiDuraipandian, " Vector Analysis", Emerald Publishers, 2003.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1		2		1				3		2	1		3
CO2	1		3			2		3			3	2	
CO3		1		2		2	3			3		1	2
CO4			1	3	2	3		3		1	2		2
CO5		2		1			2		3	2		3	
CO6	1		2		3				3		1		2

Semester II

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical - Trig World	0	0	4	2	Practical

Introduction: This paper enables the students to learn its application into wider fields like engineering, physics, surveyors, architects, astronomy using Scilab.

Course Focus on: Employability

Course Outcome:

CO1	:	To examine the concept of trigonometric equations, triangles, and applications.
CO2	:	To demonstrate the concept of several trigonometric identities and use them to verify other identities.
CO3	:	To evaluate trigonometric and inverse trigonometric functions.
CO4	:	To determine gradient vector fields and find potential functions
CO5	:	To apply Fourier series analysis using Scilab.

1. Determine the length of unknown side in given right triangles.
2. Find the values of all trigonometric functions for different degrees.
3. Find the distance from centre of earth to sun.
4. Summation of trigonometric functions using Scilab.
5. Find the gradient, divergence and curl using Scilab.
6. Find the line integral with Scilab.
7. Determine the surface integral using Scilab.
8. Determine the volume integral using Scilab.
9. To plot the function of sin x and cos x.
10. To find the amplitude and period of a given function.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2		2				1		1		3	
CO2	3		2			3			3		2		1
CO3		3		1		2	2			2	3		1
CO4	3			3	1	1		3		1		2	
CO5		3		2			2	3		3	1		3

Semester-III

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core-V - Statics	5	0	0	4	Theory

Introduction:

This paper enables the students to learn about forces and the effect of forces on a non-deformable, or rigid system when the system is in a state of equilibrium.

Course Focus on: Skill development

Course Outcome:

CO1	:	To understand the basic knowledge of equilibrium of a particle.
CO2	:	To develop a working knowledge to handle practical problems.
CO3	:	To understand the equilibrium conditions and solve the related problems.
CO4	:	To gain knowledge on coplanar forces and its properties.
CO5	:	To develop the friction procedure for solving a real life problems.

Unit I: **[12 Periods]**

Introduction – Forces acting at a point: Triangle of forces – Resolution of force – Condition of equilibrium.

Unit II: **[12 Periods]**

Parallel forces and Moments: Resultant of parallel forces – Theorems on Moments –Moment of a force about an axis.

Unit III: **[12 Periods]**

Couples: Introduction-Equilibrium of two Couples- Resultant of a couple and forces. Equilibrium of three forces acting on a rigid body: Conditions of equilibrium – Trigonometrical theorems and problems.

Unit IV: **[12 Periods]**

Coplanar forces - Reduction of any number of coplanar forces - Equation to the line of action of the resultant – Conditions of equilibrium.

Unit V: **[12 Periods]**

Friction: Introduction – Laws of Friction – Definitions – Equilibrium of a particle on a rough inclined plane – Simple Problems.

Text Book:

1. Dr. M. K.Venkataraman, Statics, Agasthiar Publications, Trichy, 15th edition, 2012.

Contents:

Unit-I**:**	Chapter 1 & Sections (2.1 -2.16)
Unit-II:	Chapter 3 Sections (3.1-3.14)
Unit-III:	Chapter 4 Sections (4.1-4.10), Chapter 5 Sections (5.1-5.8)
Unit -IV:	Chapter 6 (Section 1-12).
Unit-V:	Chapter 7 (Section 1-13) Pages: 206 – 238.

Reference Book:

1. Mechanics, P. Duraipandian, LaxmiDuraipandian and Muthamizh Jayapragasam, S. Chand and Company Ltd, New Delhi (1997)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**									**Program Specific Outcomes**			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		1		2		2			3	2		1	
CO2		2	2				3	3			2		1
CO3	1		3	2		3			2	1		3	
CO4		3			3	2	2				2		3
CO5	2		1		2	3		1	3	2		3	

Semester: III

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical - Experimental Statics	0	0	4	2	Practical

Introduction: This paper is to develop the ability to visualize problem formulation and the construction of a meaningful mathematical model to experience the concepts in real life.

Course Focus on: Skill development

Course Outcome:

CO1	:	To apply the concept of forces and its related applications.
CO2	:	To demonstrate the method to resolve forces and to find the resultant of forces.
CO3	:	To experiment the fundamental concepts of statics with respect to real life mechanism.
CO4	:	To analyze the concept of resultant of coplanar forces in different planes.
CO5	:	To examine the concept of couples and parallel forces in different systems.

1. Create a model to establish the concept of couples in parallel planes?
2. Create a chart to demonstrate the application of Lami's theorem?
3. A 15 kg mass is supported by a thin cord attached to a hook in the ceiling. Another cord is attached to the ring of the mass and pulled horizontally until the supporting cord makes an angle of 30° with the vertical. Find the tensions in both strings.
4. A small block of weight 150 N is placed on an inclined plane which makes an angle, $\Theta = 30°$ with the horizontal. What is the component of this weight parallel to inclined plane and perpendicular to inclined plane?
5. A computer base unit of mass 6 kg is dragged along a smooth desk. If the tension in each arm of the person dragging it is 20 N and it acts at 25◦ above the horizontal, what is the acceleration of the base unit and what is its normal reaction?
6. A uniform rod is of length 4 m and mass 8kg and from its extremities are suspended masses of 4kg and 12kg respectively from what point must the rod be suspended so that it may remain in a horizontal position.
7. Find the application of parallelogram law and make it as a model?
8. Demonstrate how Varignon's theorem is used to find the moment. Make it as a model?
9. The four coplanar forces are acting at a point. Determine the resultant in magnitude and direction analytically and graphically?
10. Determine the resultant couple moment acting on the beam.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	

Semester - IV

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core-VII-Dynamics	5	0	0	4	Theory

Introduction:

This paper enables the students to analyze the motion and the dynamical forces acting on mechanical systems describing motion and explaining its causes.

Course Focus on: Skill development

Course Outcome:

CO1	:	To understand the basic concepts of the description of the motion of particles.
CO2	:	To gain knowledge about the vector functions and the fundamental laws of Mechanics.
CO3	:	To understand the concept of speed, velocity and use it in solving mechanics problems.
CO4	:	To solve one dimensional problem involving the forces of gravity.
CO5	:	To solve problems relating to the motion of a particle.

Unit- I **[12 Periods]**

Introduction-Kinematics: Velocity-Relative Velocity-Angular Velocity-Acceleration Relative Acceleration- Motion in a straight line under uniform acceleration.

Unit -II **[12 Periods]**

Projectile: Projectile-Path of a Projectile-Characteristics-Horizontal Projection-Projectile up/down an inclined plane – Motion on the surface of a smooth inclined plane.

Unit -III **[12 Periods]**

Collision of Elastic Bodies: Introduction-Definitions-Fundamental Laws of impact - Impact of a smooth sphere on a fixed smooth plane-Direct impact of two smooth spheres-Oblique impact of two smooth spheres- Loss of Kinetic energy due to oblique impact of two smooth spheres.

Unit -IV **[12 Periods]**

Simple Harmonic Motion: Introduction-S.H.M. in straight line-Compositions of simple harmonic motions of the same period.

Unit-V **[12 Periods]**

Motion Under The action Of Central Forces: Velocity and acceleration in polar coordinates-Equiangular spiral- Differential Equation of central orbits-Pedal Equation of the central orbit- Velocities in a central orbit.

Text Book:

M.K. Venkataraman, Dynamics, 14th Edition, Agasthiar Publications, Trichy, 2011.

Contents:

Unit I:	Chapter 3,	Section 3.1-3.22
Unit II:	Chapter 6,	Sections 6.1-6.16
Unit III:	Chapter 8,	Section 8.1 – 8.8
Unit IV:	Chapter 10,	Sections 10.1-10.13
Unit V:	Chapter 11,	Sections 11.1-11.10

Reference Book:

Mechanics, P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, S. Chand and Company Ltd, New Delhi (1997)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2		3	1	2	2			3		2		1
CO2	1		2		1		1	3		3	2		2
CO3		2	2	1		3	2	2				2	
CO4	1		2		3		3		3		1		3
CO5	2		2		1		3	3		2		3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical - Experimental Dynamics	0	0	4	2	Practical

Introduction: This paper enables the students to gain fundamental knowledge by using concepts of dynamics in real life problems.

Course Focus on: Skill development

Course Outcome:

CO1	:	To analyze the basic concept of Kinematics.
CO2	:	To determine the concept of Acceleration.
CO3	:	To demonstrate the concept of heat transfer.
CO4	:	To demonstrate the concept of projectile and its characteristics.
CO5	:	To apply the concept of impulsive forces to derive conclusions.

1. Determine the moment of inertia of a flywheel.
2. State park design how the skating relies to motion the slope how it will affect the ride?
3. Working model of Hand water pump.
4. Working model of Magnetic levitation.
5. Working model of cricket wicket knockdown challenges gaming model.
6. Make a model for diffusion of liquids .
7. Chart work on swimsuit design it was helpful for competitors? why? what are the materials provide the optimal flow?
8. How the wild wire modeling advanced mathematics fluid dynamics used to find predict the progress of the fire for firefighters.
9. Glacier melting climate change will be one the greatest challenges faced by humanity this century at same time how the thermodynamics can help scientist to understand the interaction of wind sea ice ocean currents and heat transfer.
10. Chart work for motion of a shot & gun.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2		1		2			2		2	1	
CO2		1		2			3	2		1		2	3
CO3		1	3			3			3		3	1	
CO4	2		2	3		2		3		2			3
CO5	1		2		3	1	1				1		2

Semester –V

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core-IX-Real Analysis-I	5	0	0	4	Theory

Introduction:

This paper enables the students to learn the concept of real numbers and to analyze the properties of real numbers with its applications.

Course Focus on: Research

Course Outcome:

CO1	:	To determine the basic topological properties of subsets of the real numbers.
CO2	:	To use the definitions of convergence as they apply to sequences, series, and functions.
CO3	:	To determine the continuity, differentiability, and integrability of functions defined on subsets of the real line.
CO4	:	To produce rigorous proofs of results that arise in the context of real analysis.
CO5	:	To evaluate the concept of Limits and Continuity to solve the problems.
CO6	:	To discuss the fundamental properties of the real numbers that lead to the formal development of real analysis.

Unit – I: **[12 Periods]**

Functions – Real Valued functions – Equivalence, countability – Real numbers – Least upper bound Sequence of real numbers – definition of sequence and subsequence – Limit of a sequence - Convergent sequences – divergent sequences.

Unit – II: **[12 Periods]**

Bounded sequences – Monotone sequences – operations on convergent sequences – operations on divergent sequences – Limit superior and limit inferior – Cauchy sequences.

Unit – III: **[12 Periods]**

Convergent and divergent series of real numbers – series with non–negative terms – Alternating series – conditional convergence and absolute convergence – Rearrangements of series – Test for absolute convergence – series whose terms form a non - increasing sequence.

Unit – IV: **[12 Periods]**

The Class l^2 – Limit of a function on the real line – metric spaces – Limit in metric spaces.

Unit - V: **[12 Periods]**

Functions continuous at a point on the real line – Reformulation – Functions continuous on a metric space – open sets – closed sets – Discontinuous functions on R1.

Text Book:

1. Richard R. Goldberg, Methods of Real Analysis – Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Contents:

Unit – I :	Chapter 1:	Sections 1.3 - 1.7
	Chapter 2:	Sections 2.1 – 2.4
Unit – II:	Chapter 2:	Sections 2.5 – 2.10
Unit – III:	Chapter 3:	Sections 3.1 – 3.7
Unit – IV:	Chapter 3:	Section 3.10
	Chapter 4:	Sections 4.1 – 4.3
Unit – V:	Chapter 5:	Sections 5.1 – 5.6

Reference Books:

1. D. Somasundaram and B.Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, Third Reprint, 2007.
2. Tom. M. Apostol, Mathematical Analysis, Narosa Publications, New Delhi, 2002.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	1				3		2			3		2
CO2		1		2		2			3	2		1	
CO3		2	2				3	3			2		1
CO4	1		3	2		3			2	1		3	
CO5		3			3	2	2				2		3
CO6	2		1		2	3		1	3	2		3	

Semester-V

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical – Practical analysis- I	0	0	5	2	Practical

Introduction: This paper enables the students to learn about the real life application of derivatives continuity Riemann integral – Discovered theorems – integral calculus.

Course Focus on: Research

Course Outcome:

CO1	:	Compare the Properties of Derivatives and Continuity.
CO2	:	Analyze the concept of bounded variations and its properties.
CO3	:	Examine the concept of functions and continuous functions.
CO4	:	Apply the concept of Riemamm- Stieltjes integral and derive conclusions.
CO5	:	Determine the theorems by using the properties of Riemann integral.

1. Chart work on why its inconvenient to use Riemann integral in practical life.
2. Chart work on topology and real analysis to analyze complex networks. E.g. Social networks, biological networks, Internet.
3. Deduce how real analysis is used in neuroscience for finding how neurons are interacting?
4. Make a model for Brouwer's fixed point theorem can be used that if you swirl around your coffee in your coffee mug, then after you have done swirling, there is one drop of coffee that ended up back where it was before you moved anything around?
5. Demonstrate the same cup model for intermediate mean value theorem
6. Chart work on different types of continuity and give me a real life examples
7. Construct a model for convergence sequence
8. Chart work on Riemann integrals applications
9. Demonstrate the concept to Chart work on to show the upper and lower Riemann integrals of a function.

10. Make a model to compare the first and second fundamental theorem of integral calculus.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	3		2				3			3		1
CO2		1				2	3			1	2		3
CO3		2		2		3			3	2		1	
CO4	1	1				2			3		3	2	
CO5	1			2	3	2			3		1		3

Semester-VI

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core-XII-Real Analysis-II	6	0	0	4	Theory

Introduction:

This paper enables the students to understand the concept of metric spaces, concept of metric spaces and Riemann Integral spaces.

Course Focus on: Research

Course Outcome:

CO1	:	To Acquire knowledge on open sets and metric spaces.
CO2	:	To determine the limit point of a series of functions.
CO3	:	To develop knowledge about Riemann Integration and apply into problems.
CO4	:	To understand various theorems associated with Riemann Integration.
CO5	:	To develop skill in checking the uniform and pointwise convergence of series.
CO6	:	To illustrate the convergence properties of power series.

Unit – I: **[12 Periods]**

More about open sets – connected sets – bounded sets and totally bounded sets – complete metric spaces.

Unit – II: **[12 Periods]**

Compact metric spaces – continuous functions on compact metric spaces – continuity of the inverse function – uniform continuity.

Unit – III: **[12 Periods]**

Sets of measure zero – Definition of the Riemann integral – Existence of the Riemann integral – Properties of the Riemann integral.

Unit- IV: **[12 Periods]**

Derivatives – Rolle's theorem – The law of the mean – Fundamental theorem of calculus.

Unit – V: **[12 Periods]**

Pointwise convergence of sequences of functions – uniforms convergence of sequences of functions –

consequences of uniform convergence – convergence and uniform convergence of series of functions.

Text book:

1.Richard R. Goldberg, Methods of Real Analysis – Oxford and IBH Publishing co, Pvt. Ltd., New Delhi.

Contents:

Unit – I :	Chapter 6:	Sections 6.1 – 6.4
Unit – II:	Chapter 6:	Sections 6.5 – 6.8
Unit – III:	Chapter 7:	Sections 7.1 – 7.4
Unit – IV:	Chapter 7:	Section 7.5 – 7.8
Unit – V:	Chapter 9:	Sections 9.1 – 9.4

Reference Books:

1. D. Somasundaram and B.Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, Third Reprint, 2007.
2. Tom. M. Apostol, Mathematical Analysis, Narosa Publications, New Delhi, 2002.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	
CO6	1			3	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical – Practical analysis - II	0	0	5	2	Practical

Introduction: The main aim of this paper is intended to explore the basic ideas of Real Analysis so as to understand the concepts deeper which supports further research.

Course Focus on: Research

Course Outcome:

CO1	:	To analyze the basic concepts of Real and Complex number Systems.
CO2	:	To examine the concept of Set theory, Relations and Functions.
CO3	:	To apply the concept of intersection theorem and covering theorems.
CO4	:	To compare the concept of continuity, convergent sequences and metric space.
CO5	:	To evaluate the concept of Limits and Continuity to solve the problems

1. Make a model Upper bounds and lower bounds used in big data analytics for analyzing algorithms.
2. Construct a model for using Mean value theorem automatic number plate recognition.
3. Chart work on the above optical character recognition used for speed trap prohibition.
4. Make a model how you cut a square pizza into equal triangles among each one for odd number persons using Sperner's lemma and the 2-adic valuation.
5. Chart work for the Bolzano's theorem application for if you get up 7.24 Am you miss the buss. If you get up 6.56 Am then you have too wait along using the above theorem solved this one as chart work?
6. Create a model to distinguish countable and uncountability of real numbers?
7. Construct a model to visualize the concept of open ball, interior point, adherent point and accumulation points?
8. Demonstrate the applications of sequences and series as a model?
9. Prepare a model Lindelof covering theorem with real life examples?
10. Prepare a chart to show the characteristics of Heine Borel theorem?

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1				3		2			3		2
CO2		1		2		2			3	2		1	
CO3		2	2				3	3			2		1
CO4	1		3	2		3			2	1		3	
CO5		3			3	2	2				2		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core- Calculus	4	0	0	4	Theory

Introduction:

This paper enables the students to gain knowledge on fundamental principles, concepts and knowledge in the area of Differential and Integral Calculus.

Course Focus on: Skill development

Course Outcome:

CO1	:	To develop and understand the nature of differentiation and its applications.
CO2	:	To use derivatives to solve authentic real-life application problems.
CO3	:	To use the concepts of differential and integral calculus to solve multiple integrals.
CO4	:	To evaluate beta and gamma functions with respect to change in double integrals.
CO5	:	To examine the properties of Integrals and types of Integrals.
CO6	:	To discuss the Mathematical idea to communicate effectively to the needy with the help of Scientific method of analysis.

Unit I: **[12 Periods]**

Differential Calculus: Successive Differentiation - Leibnitz theorem and its applications – Curvature –Radius of Curvature and Centre of Curvature

Unit II: **[12 Periods]**

Integral Calculus: Properties of definite integrals - Integration by parts - Reduction Formulae - Bernoulli's formula.

Unit III: **[12 Periods]**

Multiple Integrals: Definition of double integral - Evaluation of double integral - double integral in polar Coordinates - Triple integrals.

Unit IV: **[12 Periods]**

Improper Integrals: Beta and Gamma integrals - properties – problems -relation between Beta and Gamma functions.

Unit V: **[12 Periods]**

Change of Variables: Jacobian - Change of variable in the case of two variables and three variables – Transformation from Cartesian to polar coordinates – Spherical polar co-ordinates

Textbooks:

1. Narayanan S. and Manicavasagam Pillay T. K, Calculus Volume - I, S. Viswanathan Pvt. Ltd, 2010
2. Narayanan S. and Manicavasagam Pillay T. K, Calculus Volume - II, S. Viswanathan Pvt. Ltd, 2010.

Contents:

Unit I:	Chapter 3:	Sections 10.2.1-10.3.1. (Textbook 1)
Unit II:	Chapter 1:	Sections 1.1.1-1.15.1. (Textbook 2)
Unit III:	Chapter 1:	Sections 1.15.2 (Textbook 2)
	Chapter 5:	Sections 5.1-5.3.2 (Textbook 2)
Unit IV:	Chapter 5:	Sections 5.4-5.5.4 (Textbook 2)
	Chapter 7:	Sections 7.1.1-7.5, (Textbook 2)
Unit V:	Chapter 6	Sections 1.1,1.2,2.1-2.4 (Textbook 2)

Reference Books:

1. George B. Thomas, JR &Ross L. Finney, Calculus and Analytic Geometry, Sixth edition, Narosa Publishing House, New Delhi, 1986.
2. Arumugam & Isaac, Calculus, Vol.1&2, New Gamma Publishing House, 1999.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	
CO6	1			3	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Thinking Calculus-Practical	0	0	4	2	Practical

Introduction:
This paper enables the students to apply the concept of differential equations, integration of different types of functions, its geometrical applications, double, triple integrals and improper integrals.

Course Focus on: Skill development

Course Outcome:

CO1	:	To analyze the fundamental concepts and principles of calculus
CO2	:	To apply the concept of PDE to solve first order equation
CO3	:	To compare the concepts of differential and integral calculus to solve multiple integrals
CO4	:	To create beta and gamma functions with respect to change in double integrals
CO5	:	To examine the properties of Laplace transformation with applications

1. Find the derivative of a function using Geogebra.

2. Deriving Fundamental theorem of Calculus.

3. Find the radius and center of curvature using Geogebra.

4. Integration by parts using Geogebra.

5. Reduction formula using Geogebra.

6. Solving double integrals with Geogebra.

7. Solving triple integrals with Geogebra.

8. Finding Jacobian of a Matrix using Geogebra.

9. Transformation of co-ordinates using Geogebra.

10. Solving improper integrals using Geogebra.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2		2				1		1		3	
CO2	3		2			3			3		2		1
CO3		3		1		2	2			2	3		1
CO4	3			3	1	1		3		1		2	
CO5		3		2			2	3		3	1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core- Analytical Geometry with Scilab	4	0	0	4	Theory

Introduction:

This paper enables the students to learn the various properties of geometrical figures in two dimension and three dimensions.

Course Focus on: Skill development

Course Outcome:

CO1	:	To develop and understand the nature and purpose of two dimension and three dimensions.
CO2	:	To understand the differences of 2D and 3D geometrical shapes.
CO3	:	To acquire knowledge of representing conics in polar co-ordinates.
CO4	:	To construct the models based on Sphere, Cone and Cylinder.
CO5	:	To apply the concepts of Sphere, Cone and Cylinder in real world.
CO6	:	To develop problem solving techniques using analytical geometry to diverse situations in mathematical contexts.

Unit I: **[12 Periods]**

Analytical geometry of 2D-Polar Equations -directrix- chord tangent- normal- Problems.

Unit II: **[12 Periods]**

Analytical Geometry 3D-straight lines-co planarity of straight-line-shortest distance (S.D) And equation of S.D between two lines.

Unit III: **[12 Periods]**

Sphere: Equation of a sphere – Tangent line - Tangent plane – Sections of the sphere- equation of a circle.

Unit IV: **[12 Periods]**

Cone and cylinder: Equation of a Cone -right circular cone- Equation of a cylinder- right circular Cylinder**.**

Unit V: **[12 Periods]**

Introduction to Scilab- Installation process -Scilab functions-Features of Scilab- plotting -plotting Vectors 2D&3D.

Textbooks:

1. P. DuraiPandian &Kayalal Pachaiyappa, "Analytical Geometry 2D", Emerald Publishers, Chennai. 2009.[Unit I].
2. P. DuraiPandian & Kayalal Pachaiyappa, "Analytical Geometry 3D", Emerald Publishers, Chennai. 2009. [Unit II to Unit IV].
3. Er. Hema Ramachandran and Achuthsankar S Nair "Scilab (A free Software to Matlab)" 1 st edition S.Chand and Company 2015
4. Lecture notes/Lab manual/Tutorials on Sci Lab.

Contents:

Unit I	Chapter-10	Section 10.1 – 10.8
Unit II	Chapter-4	Section 4.1-4.2, 4.6, 4.8, 4.9, 4.12
Unit III	Chapter-5	Section 5.1-5.2, 5.4
Unit IV	Chapter-6	Section 6.1, 6.2, 6.3, 6.5, 6.6, 6.7
Unit V	Chapter-3	

Reference Books:

1. T.K. M. Pillai and Others "Analytical Geometry of 2D "– Viswanathan Publications- 2010
2. T.K. M. Pillai and Others "Analytical Geometry of 3D" – Viswanathan Publications- 2009
3. Johnny Heikell Scilab for real Dummies http://www.heikell.fi/download /scilab pdf.pdf

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2			3		3		1			3
CO2	1	1		1		2			3		2	2	
CO3	1	2			2		3	2		3			2
CO4		1		2		3			3		3	1	
CO5		1		2		3		3		2			3
CO6	1		2		3	2					3		

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Geometry with 2D and 3D	0	0	4	2	Practical

Introduction: This paper gives emphasis to enhance student knowledge in two dimensional andthree Dimensional geometry with practical exposures like architectures and design.

Course Focus on: Skill development

Course Outcome:

CO1	:	To analyze the basic concept of Geometry in a practical way.
CO2	:	To compare the differences of 2D and 3D geometrical shapes.
CO3	:	To examine the relationship between Cone and Cylinder.
CO4	:	To construct the models based on Sphere, Cone and Cylinder
CO5	:	To apply the concepts of Sphere, Cone and Cylinder in real world.

1. Solving equations using Scilab.

2.Exponential and rounding functions with Scilab.

3.Polar plotting of a function using Scilab.

4.Find the standard parametric curves using Scilab.

5.Find the standard Cartesian curves using Scilab.

6. Find the equation of a circle using Scilab.

7.Find the volume of a cone using Scilab.

8.Find the volume of a Cylinder using Scilab.

9. Find the volume of a sphere using Scilab.

10. Experiment conic sections and rotation of conics.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1	2			3		3		1			3
CO2	1	1		1		2			3		2	2	
CO3	1	2			2		3	2		3			2
CO4		1		2		3			3		3	1	
CO5		1		2		3		3		2			3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core- Differential Equations	5	0	0	4	Theory

Introduction:

This paper enables the students to develop the knowledge of standard concepts of Ordinary differential equations and apply analytical techniques to compute solutions to various differential equations.

Course Focus on: Skill development

Course Outcome:

CO1	:	To develop ability to solve exact differential equations.
CO2	:	To gain knowledge to solve first-order ordinary differential equations.
CO3	:	To compare the effectiveness of Ordinary and Partial differential equations
CO4	:	To develop problem solving techniques using differential equations
CO5	:	To learn the essentials and methods of solving differential equations and PDE

Unit I: **[12 Periods]**

Ordinary Differential Equations- Differential Equations their formation and solutions: order-degree-linear and nonlinear - implicit and explicit form of solution - general solutions - particular solution - singular solution. Exactness, non-exact equations reduce to exact form. Equations of first order but of higher degree: Equations solvable for y, x- simple problems.

Unit II: **[12 Periods]**

Equations of Second order: Linear homogeneous differential equations with constant coefficients, Euler-Cauchy equation, Linear Nonhomogeneous Differential Equations: Wronskian, linear independence, Method of undetermined coefficients- simple problems.

Unit III: **[12 Periods]**

Systems of first order linear equations: Conversion of nth order differential equation to n first order differential equations, homogeneous linear system with constant coefficients, simultaneous linear differential equations with constant coefficients, simultaneous linear differential equations with variable coefficients- simple problems.

Unit IV: **[12 Periods]**

Partial Differential Equations: Origin of partial differential equations - order - degree - linear- nonlinear

Formation of equations by eliminating arbitrary constants and arbitrary functions. Solutions of partial differential equations: General, particular and complete integrals. Lagrange's linear equation- simple problems.

Unit V: **[12 Periods]**

Classification of partial differential equations of second order. Homogeneous linear partial differential equations with constant coefficient of higher order- simple problems.

Text book:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand, 18th edition, 2016.

Contents:

Unit I : Part I: 1.1-1.9, 2.12-2.22 and Part I: 4.1-4.7

Unit II : Part I: 5.1-5.5, 6.1-6.3, 1.12,1.13, 5.26-5.27

Unit III : Part I: 8.1-8.3, 2.1- 2.7

Unit IV: Part III: 1.1 – 1.5, 2.3-2.12, 3.1-3.2

Unit V: Part III: 8.1, 4.1-4.12

Reference Books:

1. William E. Boyce and Richard C. DiPrima, Elementary differential equations and boundary value problems, Wiley india, 9th edition, 2012.
2. Nita H, Shah, Ordinary and Partial Differential Equations: Theory and Applications, PHI learning, 2nd edition, 2015.
3. Dennis Zill, A First Course in Differential Equations, Cengage Learning, 9th edition, 2009

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1		1		3	
CO2	3		2			3			3		2		1
CO3		3		1		2	2			2	3		1
CO4	3			3	1	1		3		1		2	
CO5		3		2			2	3		3	1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Applicable Derivatives - Practical	0	0	4	2	Practical

Introduction: This paper presents the method of solving ordinary differential Equations of First Order and Second Order, Partial Differential equations.

Course Focus on: Skill development

Course Outcome:

CO1	:	To analyze the fundamental concepts of differential equation.
CO2	:	To design first and second order higher degree equations.
CO3	:	To compare the concepts of ODE, PDE and Homogeneous linear equation.
CO4	:	To examine the real-life applications of ODE & PDE.
CO5	:	To apply the fundamental concepts of Homogeneous linear equation.

1. Application of Differential equation in Exponential Growth – Population
2. Application of Differential equation in Exponential Decay - Radioactive Material
3. Whatistheapplicationoflineardifferentialequationsinsoftwareengineering
4. Application of Differential equation in Newton's Law of Cooling
5. Application of Differential equation in RL circuit
6. Create the model for application of Differential equation in AI
7. Make a model for application of Differential equation in engineering field
8. Modeling of any real-world problem using ordinary differential equations.
9. How Might differential Equations have used in Economic growth
10. What is modern, non- academic example differential equation application?

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			2		1		2	3		2		3	
CO2	1		3	2			2			3	2		1
CO3		1		3		3	3				1	2	
CO4	2			2			2	2	3	1		3	
CO5	1		2			3		3			2		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core - Modern Algebra	5	0	0	4	Theory

Introduction:

This paper enables the students to gain knowledge about Groups, different types of groups , Rings and Ideals.

Course Focus on: Research

Course Outcome:

CO1	:	To acquire the concepts of advanced algebra such as groups, rings and their role in modern mathematics.
CO2	:	To analyze the cyclic subgroups of a group.
CO3	:	To think critically by recognizing patterns and principle of algebra and relating them to the number system.
CO4	:	To acquire knowledge about the ideals and quotient rings.
CO5		To deal with the concept of integral domain and Euclidean domain.
CO6	:	To gain knowledge about the basic concepts of vector spaces.

Unit I:

Groups: Definition and Properties-Permutation groups-Subgroups-Cyclic groups.

Unit II:

Groups: Order of an element-Cosets and Lagrange's theorem-Normal and Quotient groups-Isomorphism-Homomorphism.

Unit III:

Rings: Definition and Examples of Rings - Types of Rings –Subrings and Ideals.

Unit IV:

Rings: Quotient rings- Maximal and prime Ideals –Homomorphism of rings-Ordered integral domain-Euclidean domain.

Unit V:

Vector Spaces: Introduction-Definition-Subspaces-Linear transformation-Rank and nullity-Matrix of a linear transformation.

Text Book:

Arumugam.S and Isaac. A.T, Modern Algebra, Scitech Publications Pvt. Ltd(India), Reprint 2017.

Contents:

Unit-I :Chapter 3 Sections : 3.0 – 3.6.
Unit-II : Chapter 3 Sections : 3.7 – 3.11.
Unit-III : Chapter 4 Sections : 4.1 – 4.7.
Unit-IV : Chapter 4 Sections : 4.8 – 4.15.
Unit-V: Chapter 5 Sections: 5.0 - 5.8

Reference Books:

1.I.N. Herstein, Topics in Algebra, second edition, John Wiley & Sons, New York, 2005.
2. Surjeet Singh and QaziZameeruddin, Modern Algebra, Vikas Publishing house, 8 thedition 2006.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		2		1				3		2	1		3
CO2	1		3			2		3			3	2	
CO3		1		2		2	3			3		1	2
CO4	1		1	3	2	3		3		1	2		2
CO5		2		1			2		3	2		3	

Semester IV

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical – Actual Algebra	0	0	4	2	Practical

Introduction: This paper provides the real-life application about symmetric groups , permutations , ring theory, Quadratic function , vector spaces.

Course Focus on: Research

Course Outcome:

CO1	:	To compare the concept of sets, groups and its properties.
CO2	:	To analyze the basic concepts of Groups.
CO3	:	To examine the types of Rings by their properties.
CO4	:	To determine the concept of Matrices and its types.
CO5	:	To apply the concept of vector space in Transformation.

1. Chart work on types of algebraic structures.
2. Chart work on Applications of symmetric group in molecular system.
3. Chart work on history of Ring Theory.
4. Make a model for cancellation law.
5. Demonstrate the application of Matrices and their inverse matrices in coding or encrypting a message.
6. Make a model for application of vector space in Nature(Fractals)
7. Chart work on application of vector space in search engines.
8. Make a model for linear transformation.
9. Chart work on linear transformation in Image processing.
10. Model work on quadratic function applied in real life application on Banana.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core– Graph Theory	5	0	0	4	Theory

Introduction:

This paper enables the students to gain knowledge about graphs, trees, blocks, connectivity, reversibility, planarity and their properties.

Course Focus on: Skill development

Course Outcome:

CO1	:	To recall the fundamental concepts of graph and its types.
CO2	:	To understand the characteristics of operation on graphs, trees and Fundamental circuits.
CO3	:	To apply the Concepts of Spanning Trees in graphs.
CO4	:	To analyze the concept of characterization in graphs.
CO5	:	To build the Matrix Representation of Graphs and Fundamental Circuit.
CO6	:	To discuss about the application of Graph theory in computer science and other fields.

Unit -I: **[12 Periods]**

Graph – Applications of graphs- Finite and Infinite graphs – Incidence and Degree – Isolated vertex, Pendant vertex and Null graphs. Paths and Circuits: Isomorphism – Subgraphs – Walks, Paths and Circuits – Connected and disconnected graphs – Euler graphs.

Unit -II: **[12 Periods]**

Operations on Graphs – More on Euler graphs – Hamiltonian Paths and Circuits – Travelling Salesman Problem. Trees and Fundamental Circuits: Trees – Properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree.

Unit - III: **[12 Periods]**

Spanning Trees – Fundamental Circuits – Finding all spanning trees of a graph - Spanning trees in a weighted graph .Cut sets and Cut vertices: Cut sets –Properties of a cut set – All cut sets in a graph.

Unit IV: **[12 Periods]**

Planar and Dual Graphs: Planar graphs – Kuratowski's two graphs – Representation of a planar graph. Matrix Representation of Graphs: Incidence Matrix – Circuit Matrix – Fundamental Circuit Matrix and Rank of circuit matrix – Cut set matrix – Relationship among A_f, B_f and C_f – Path matrix.

Unit V: **[12 Periods]**

Introduction – Installation - Basics on NetworkX - Creating a graph- Examining elements of a graph - Adding attributes to graphs, nodes, and edges - Graph generators and graph operations - Analyzing graphs.

Text Book:

1. Narsingh Deo, "Graph theory with Application to Engineering and Computer Science", Prentice Hall of India Pvt. Ltd. (2011).

Contents:

Unit I:	Chapter 1:	Sections: 1.1- 1.5
	Chapter 2:	Sections: 2.1,2.2, 2.4- 2.6.
Unit II:	Chapter 2:	Sections: 2.7-2.10
	Chapter 3:	Sections: 3.1-3.4.
Unit III:	Chapter 3:	Sections: 3.7-3.10
	Chapter 4:	Sections: 4.1 -4.3.
Unit IV:	Chapter 5:	Sections: 5.2-5.4.
	Chapter 7:	Sections: 7.1-7.4, 7.6-7.8.

Reference books:

1. R. Balakrishnan and K. Ranganathan, "A Text Book on Graph Theory", Springer Verlog, New York, 2000.
2. R.Gould, "Graph Theory", The Benjamin/ Cummings Publishing Company, Inc., California, 1988.
3. N. Hartsfield and G. Ringel, "Pearls in Graph Theory", Academic Press, 1990.
4. J.A. Bondy and U.S.R. Murty, "Graph Theory with Applications", Macmillan Company, 1976.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2			3		3		1			3
CO2	1	1		1		2			3		2	2	
CO3	1	2			2		3	2		3			2
CO4		1		2		3			3		3	1	
CO5		1		2		3		3		2			3
CO6	1		2		3	2					3		

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical -Graph Theory with Python	0	0	5	2	Practical

Introduction:

This paper enables the students to gain knowledge about graphs, its properties and types with the help of Python language.

Course Focus on: Skill development

Course Outcome:

CO1	:	To examine the graph elements and its properties.
CO2	:	To understand the characteristics of operation on graphs, trees and Fundamental circuits.
CO3	:	To apply the Concepts of Spanning Trees in graphs.
CO4	:	To analyze the concept of characterization in graphs.
CO5	:	To build the Matrix Representation of Graphs and Fundamental Circuit.

1. Examining elements of a graph
2. Accessing edges and neighbors
3. Adding attributes to graphs, nodes, and edges
4. Analyzing graphs
5. Algorithm for Decomposition .
6. Read and write graphs.
7. Compute some network properties for the lollipop graph
8. Draw a Circular Tree
9. Draw a Random Geometric Graph
10. Labels and Colors

References : https://networkx.org/documentation

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core- Fuzzy Mathematics	5	0	0	4	Theory

Introduction:

This paper enables the students to gain knowledge about fuzzy set theory, algebraic concepts and properties of fuzzy invariance subspaces.

Course Focus on: Skill development

Course Outcome:

CO1	:	To understand the basic concepts of fuzzy set and its properties.
CO2	:	To compare the differences and similarities between fuzzy sets and classical sets theories.
CO3	:	To examine the concept of relations and logic connectives.
CO4	:	To understand the concept of fuzzy subgroup.
CO5	:	To understand the concept of fuzzy invariant subspaces.
CO6	:	To discuss and develop new technologies so as to improve computing facility to maintain environment sustainability.

Unit I : [12 Periods]

Introduction- Fuzzy subsets-Lattices and Boolean Algebras- L fuzzy sets-operations on fuzzy subsets – α level sets – properties of fuzzy subsets of a set.

Unit II : [12 Periods]

Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and product-cartesian product of fuzzy subsets.

Unit III: [12 Periods]

Introduction- Algebra of fuzzy relations-logic-connectives.

Unit IV : [12 Periods]

Connectives- Introduction-fuzzy subgroup – homomorphic image and Pre-image of subgroupoid.

Unit V : [12 Periods]

Fuzzy invariant subgroups-fuzzy subrings.

Text book:

1. S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi,2012.

Contents:

Unit I	Chapter 1	Sections: 1.1,1.2, 1.4,1.5,1.7,1.9,1.10.
Unit II	Chapter 1	Sections: 1.11-1.13.
Unit III	Chapter 2	Sections: 2.1-2.4.
Unit IV	Chapter 2	Sections: 2.5.
	Chapter 3	Sections: 3.1-3.
Unit V	Chapter 3	Sections: 3.4,3.5.

Reference Books:

1.George J.Klir and Tina A. Folger, Fuzzy sets, "Uncertainty and Information", Prentice –Hall of India Private Ltd-Fourth printing –June 1995.

2. H.J.Zimbermann, "Fuzzy Set Theory and its Applications", Allied Publishers Ltd, 1991.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1		1		3	
CO2	3		2			3			3		2		1
CO3		3		1		2	2			2	3		1
CO4	3			3	1	1		3		1		2	
CO5		3		2			2	3		3	1		3
CO6	3		2		3				1			2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core Practical - Frizzy Logic	0	0	5	2	Practical

Introduction:

This course provides the knowledge about applying concepts such as fuzzy set theory, algebraic concepts and various properties of fuzzy invariance subspaces in practical problems and real world phenomena.

Course Focus on: Skill development

Course Outcome:

CO1	:	To analyze the role of fuzzy set and its properties in real life phenomena.
CO2	:	To experiment with algebraic concept and Cartesian product of fuzzy subsets.
CO3	:	To examine the concept of relations and logic connectives.
CO4	:	To construct a mathematical model with the concept fuzzy subgroup.
CO5	:	To apply the concept of fuzzy invariant subspaces in real life phenomena.

1. Find out the cylindrical extension of $R^{(2)}$.
2. Give an example for a reflexive transitive relation and verify whether it is perfect fuzzy order relation.
3. Construct a fuzzy inventory model using fuzzy techniques
4. Identify application of fuzzy logic in facial pattern recognition.
5. Construct a model for new product pricing using fuzzy sets.
6. List out application of fuzzy ideals in medical diagnosis system.
7. List out application of fuzzy techniques in home appliances.
8. Identify application of fuzzy logic in traffic signal.
9. Construct a economic model using fuzzy logic.
10. List out application of fuzzy logic in forensics and computer security.

Text book:

1. S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi,2012.

Reference Books:

1.George J.Klir and Tina A. Folger, Fuzzy sets, "Uncertainty and Information", Prentice –Hall of India Private Ltd-Fourth printing –June 1995.

2. H.J.Zimbermann, "Fuzzy Set Theory and its Applications", Allied Publishers Ltd, 1991.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core - Abstract Algebra	5	0	0	4	Theory

Introduction: This paper enables the students to learn about groups, subgroups, Rings and Maximal and Prime Ideals.

Course Focus on: Research

Course Outcome:

CO1	:	To recall fundamental concept of sets and groups
CO2	:	To examine the concept of cyclic groups and langrage's theorem
CO3	:	To estimate the properties of isomorphism and homomorphism
CO4	:	To discuss the concept of rings and properties of rings by some definition and examples
CO5	:	To describe the facts of Maximal and Prime Ideals
CO6	:	To discuss the use of Mathematical concepts and to develop further the ability to understand and produce proofs in an algebraic context.

Unit I:

Groups : Definition and Examples – Elementary Properties of a Group – Equivalent Definitions of a Group.- Permutation Groups

Unit II:

Subgroups - Cyclic Groups-Order of an Element – Cosets and Lagrange's Theorem .

Unit III:

Normal Subgroups and Quotient Groups - Isomorphism –Homomorphism

Unit IV:

Rings: Definitions and Examples - Elementary properties of rings –Isomorphism - Types of rings.-Characteristic of a ring – subrings – Ideals - Quotient rings

Unit V:

Maximal and Prime Ideals.-Homomorphism of rings – Field of quotient of an integral domain – unique factorization domain-Euclidean domain

Textbook:

1. S Arumugam and AThangapandi Isaac, Modern Algebra, SciTech Publications, Chennai, 2003.

Contents:

Unit I : Chapter 3 Sections 3.1-3.4
Unit II : Chapter 3 Sections3.5-3.8
Unit III : Chapter 3 Sections 3.9-3.11
Unit IV : Chapter 4 Sections 4.1-4.8
Unit V : Chapter 4 Sections 4.9- 4.11, 4.13-14

Reference Books:

1. N. Herstein, Topics in Algebra, John Wiley & Sons, Student 2nd edition, 1975.
2. Vijay, K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt. Ltd.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2		1			3		1		2	3
CO2		3				2			3		2	3	
CO3	3	3			2		3	2		1		2	1
CO4		1		2		3			3	2	3		
CO5	1						3				2		1
CO6	3			1	2	2			1	3		1	2

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Practical Abstract Algebra	0	0	4	2	Practical

Introduction: This paper enables the students to learn about groups, subgroups, Rings and Maximal and Prime Ideals.

Course Focus on: Skill development

Course Outcome:

CO1	:	To apply the fundamental concept of sets and groups
CO2	:	To examine the concept of cyclic groups and langrage's theorem
CO3	:	To analyze the properties of isomorphism and homomorphism
CO4	:	To estimate the concept of rings and properties of rings by some definition and examples
CO5	:	To discover the factsof Maximal and Prime Ideals

1) How Rubik's Cube forms a group?

2) Applications of Group Theory in Western Music**.**

3) What are direct and practical application of Infinite-dimensional vector spaces?

4) How Ring used in Cryptography?

5) What are the examples of semiring structures in real-life situation?

6) What are some interesting applications of the concept of homomorphism?

7) How do you show that something is a maximal ideal with real life Example?

8) Identify application of group theory in Computer Science.

9) Make a Model for Real world applications of Rings, fields and groups.

10) List out Applications of ring theory in chemistry.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core - Number Theory	5	0	0	4	Theory

Introduction:

This course enables the students to understand the concept of Permutation and Combinations, Congruences, Primitive roots and their basic properties.

Course Focus on: Skill development

Course Outcome:

CO1	:	To recall the concept of divisibility and linear Diophantine equations.
CO2	:	To apply the concept of permutations and combinations in deriving theorems.
CO3	:	To make use of properties of congruence in theorems.
CO4	:	To examine the concept of multiplicative functions.
CO5	:	To develop new methods to solve unsolved problems about primes.
CO6	:	To explain the need of number theoretic concepts and encryption methods used for a large variety of security measures.

Unit –I: **[12 Periods]**

Basic Representation: Principles of Mathematical induction – The Basis Representation Theorem. The Fundamental Theorem of Arithmetic: Euclid's Division Lemma – Divisibility – The linear Diophantine Equation – The Fundamental Theorem of Arithmetic.

Unit –II: **[12 Periods]**

Combinational and Computational Number Theory: Permutations and Combinations- Fermat's Little Theorem (Statement only) - Wilson's Theorem – Generating Functions

Unit –III: **[12 Periods]**

Solving Congruences: Linear congruences – the theorems of Fermat and Wilson Revisited – The Chinese Remainder theorem – Polynomial congruences.

Unit –IV: **[12 Periods]**

Arithmetic Functions: Combinatorial study of $\emptyset(n)$ – Formulae for d(n) and $\emptyset(n)$ – Multiplicative arithmetic functions – The Mobius Inversion Formula.

Unit –V: **[12 Periods]**

Primitive Roots: Properties of Reduced Residue Systems – Primitive Roots Modulo P. Prime Numbers: Elementary properties of $\emptyset(x)$ – Tchebyshev's theorem – Some unsolved problems about primes.

Text Book:

1. George E. Andrews, "Number Theory", HPS (India), 1992.

Contents:

Unit 1 : Chapter 1 and 2.
Unit II : Chapter 3: Sections: 3.1 – 3.3,
: Chapter 4 : Sections: 4.1, 4.2.
Unit III : Chapter 5.
Unit IV : Chapter 6.
Unit V : Chapter 7 and 8.

Reference Books:

1. David M. Burten, "Elementary Number Theory", McGraw- Hill, 1997.
2. Kumaravelu et al., "Elements of Number Theory", Nagerkovil, SKV, 2002.
3. Telang, "Number theory", Tata McGraw-Hill publishing Company Ltd, 1984.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	
CO6	1			3	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Exploring the theory of numbers	0	0	4	2	Practical

Introduction: This course enables the students to understand the concepts of fundamental theorems, Permutation and Combinations, Congruence, Primitive roots and their basic properties.

Course Focus on: Skill development

Course Outcome:

CO1	:	Apply the concepts of divisibility algorithms.
CO2	:	Evaluate the concept of permutations and combinations in security sectors
CO3	:	Examine the properties of congruence in theorems.
CO4	:	Apply the concept of number theory in practical world
CO5	:	Analyzing the number theory makes an important role in E- commerce

1. Make model for how the number theory work out for security.
2. Chart work on Pseudorandom numbers.
3. Chart work for Chinese Remainder Theorem and applications of the Chinese Remainder Theorem.
4. Make a model for Cryptography is the study of secure communication via encryption. One of the earliest uses was in ancient Rome and involved what is now known as a Caesar cipher.
5. Chart work on without number theory our money will not be safe in bank why?
6. Chart work on divisibility algorithms used in computer and data science?
7. Make a model for using Fibonacci Numbers.
8. Chart work on number theory used in Barcodes.
9. Take a survey E- commerce peoples using number theory concepts why?
10. Chart work on Making of modular designs using number theory.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core - Linear Algebra	5	0	0	4	Theory

Introduction: This course enables the students to understand the concept of Vector spaces, linear equations and linear transformations.

Course Focus on: Research

Course Outcome:

CO1	:	To explain the basic concepts of Vector spaces.
CO2	:	To examine the concept of linear transformations and its characteristics.
CO3	:	To understand the concept of Inner product space.
CO4	:	To demonstrate the concept of determinants.
CO5	:	To make use of the concept of determinants and developing knowledge about diagonalization.
CO6	:	To develop the concept of linear algebra to develop ethical and legal environment.

Unit I: **[12 Periods]**

Vector Spaces: Definitions and Examples- Vector Subspaces-Basics and dimension of a vector spaces-Quotient spaces

Unit II: **[12 Periods]**

Linear Transformations: Linear Transformations-Representatives of a linear maps and matrices-Kernal and image transformations-Some special linear transformations

Unit III: **[12 Periods]**

Inner product space: Orthogonality- Orthonormal basis-Orthogonal complements and projections- Orthogonal transformation.

Unit IV: **[12 Periods]**

Determinants: 2 X 2 determinants as area of a parallelogram- Determinants and properties-Computation of determinants- Basics results on determinants.

Unit V: **[12 Periods]**

Determinants: Orientations and vector product.

Diagnolization: Eigen values and Eigen Vectors- Diagonalization of symmetric matrices

Text Book:

1. S.Kumaresan, "Linear Algebra", Second Edition, PHI Learning Pvt. Ltd, New Delhi, 2017.

Contents:

Unit I : Chapter 2 and 3.
Unit II : Chapter 4.
Unit III: Chapter 5: Sections: 5.2,5.5,5.6,5.8.
Unit IV: Chapter 6: Sections:6.1,6.2,6.3,6.4.
Unit V: Chapter 6: Sections: 6.5, Chapter 7: 7.2, 7.3.

Reference Books:

1. B. S. Vatssa," Theory of matrices", Willey Eastern Limited,1995.
2. I.N. Herstein," Topics in algebra", John Wiley Son (ASIA) Pvt Ltd,Second Edition,2004.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1		1		2			3		1	2		3	
CO2	2		3	1	2	2			3		2		1
CO3	1		2		1		1	3		3	2		2
CO4		1		2		3	2	2	1		1	2	
CO5	2	3	1	3		2	1			2		1	3
CO6		2		1	3		2	3	2		1	3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Practical Linear Algebra	0	0	4	2	Practical

Introduction: This course enables the students to apply the concept of Vector spaces, linear equations, linear transformations and determinants.

Course Focus on: Research

Course Outcome:

CO1	:	To apply basic properties of Vector spaces.
CO2	:	To examine the characteristics of linear transformation in real life phenomena
CO3	:	To compare the applications of matrix and determinants.
CO4	:	To determine the properties of inner product space.
CO5	:	To analyze the properties of diagonalization to construct a mathematical model.

1. How are linear transformations used in science&technology?
2. Identify application of linear transformation in computer graphics
3. Demonstrate basis and dimension of a Vector Space with example.
4. List out application of inner product space in boundary value problem.
5. Identify the role of linear transformation in the rotation of rigid body in two dimensions.
6. Write (0, −26, −9) as a linear combination of (5, 3, 7) and (2, −4, 1). Show that (1, 3, 5) cannot be written as a linear combination of these two vectors.
7. If {u, v} is a basis for the subspace U, then show that {u + 2v, −3v} is also a basis for U
8. For each of the following transformations, determine the kernel and the range and whether the transformation is one-to-one and/or onto.
    a. T : R2 → R2 , T(x, y) = (2x − 3y, 5x + y).
    b. T : R2 → R2 , T(x, y) = (8x + 4y, 2x + y).
    c. T : R3 → R2 , T(x, y, z) = (x − y, y − z).
    d. T : R2 → R3 , T(x, y) = (2x − 3y, 5x + y, y
9. Make a Model for Applications of Vector Space in Physics.
10. Let $= \begin{pmatrix} 2 & 1 \\ 0 & 2 \end{pmatrix}$. Find all eigenvalues of M. Does M have two linearly independent eigenvectors? Is there a basis in which the matrix?

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Core - Group theory	5	0	0	4	Theory

Introduction: This course provides knowledge about groups, subgroups, cyclic groups, normal subgroups, homeomorphisms and isomorphism.

Course Focus on: Research

Course Outcome:

CO1	:	To recall the basic concepts of Set theory.
CO2	:	To understand the concepts of groups and its types.
CO3	:	To examine the concepts of permutation and its properties.
CO4	:	To apply the concept of normal subgroups and factor groups.
CO5	:	To compare the theorems on Homomorphism.
CO6	:	To develop the knowledge about group theory and its problem solving technique.

Unit I: **[12 Periods]**

Groups: Definition and Examples of Groups – Elementary Properties of Groups - Finite Groups- Order of a Group, order of an Element with examples

Unit II: **[12 Periods]**

Subgroup, Subgroup Tests and Examples - Center of a Group – Centralizer of a in G – Cyclic Groups -Definition and Examples, Fundamental Theorem of Cyclic Groups- Problems related to cyclic groups.

Unit III: **[12 Periods]**

Permutation Groups: Definition and Examples – Cycle Notation – Properties of Permutations –Isomorphism : Definition and Examples – Cayley's Theorem - Properties of Isomorphisms (statements only)- Automorphisms, Inner Automorphism with some examples

Unit IV: **[12 Periods]**

Cosets and Lagrange's Theorem - Normal Subgroups and Factor Groups -Applications of Factor Groups (theorems with proof only)

Unit V: **[12 Periods]**

Group Homomorphisms - Properties of Homomorphisms - The First Isomorphism Theorem – sylows theorems (statements only) with related problems (maximum five only).

Text Book:

1. Joseph A. Gallian, "Contemporary Abstract Algebra", eighth edition.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2					3		2		3	
CO2	1	3		2				3			3		1
CO3		1				2	3			1	2		3
CO4		2		2		3			3	2		1	
CO5	1	1				2	1		3		3	2	
CO6	1			2	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Practical Group theory	0	0	4	2	Practical

Introduction: This course provides knowledge about groups, subgroups, cyclic groups, normal subgroups, homeomorphisms and isomorphism.

Course Focus on: Research

Course Outcome:

CO1	:	To analyze the basic concepts of Set theory.
CO2	:	To determine the concepts of groups and its types.
CO3	:	To examine the concepts of permutation and its properties.
CO4	:	To apply the concept of normal subgroups and factor groups.
CO5	:	To compare the theorems on Homomorphism.

1. Working model of using an application of dihedral group
2. Chart work on harmonic analysis in image processing
3. Make a model to Calculate group multiplication table for h2 O
4. Chart work on Classification of the symmetry of molecules.
5. Working model of an application of group theory to music theory. the chromatic scale of western music consists of12 notes why?
6. Application of symmetry group work on frequency test of election to elected members
7. Mathematical model work for Cayley Q8 group how it will work?
8. Make a model and Finding the rotation of car wheels using mattress group
9. Model to solving of Rubik's cube puzzle.
10. Pattern generation using graphic design.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied – Foundation of Data Analytics	4	0	0	4	Theory

Introduction:

This paper enables the students to learn fundamental concepts of Statistics with application to SPSS.

Course Focus on: Employability

Course Outcome:

CO1	:	To describe the key terminology, concepts, tools and techniques used in statistical analysis.
CO2	:	To develop a concise and clear description of a statistical problem.
CO3	:	To analyze statistical data using measures of central tendency, dispersion and location.
CO4	:	To use probability distributions to describe the behavior of discrete and continuous random variables.
CO5	:	To investigate relationships between variables using regression models.
CO6	:	To construct and interpret graphical display of distributions of data.

Unit I: **[12 Periods]**

Data Definitions and Analysis Techniques:

Concept of Data, Variables and Attributes, Elements, - Levels of Measurement - Primary data – Methods of collecting primary data - Secondary data - Sources of secondary data – Classification and Tabulation - Diagrammatic and graphic presentation of data.

Unit II: **[12 Periods]**

Descriptive Statistics:

Measures of central tendency – Mean, Median and Mode - Measures of Dispersions – Range, Quartile Deviation, Standard Deviation, Variance

Unit III: **[12 Periods]**

Data analysis techniques:

Pearson's correlation co-efficient - Spearman's Rank correlation co-**e**fficient, Regression – concepts – Regression lines

Unit IV: **[12 Periods]**

Probability:

Random experiments, trial, sample space, events. Approaches to probability-Classical, Empirical, subjective and axiomatic, Addition rules of probability, Conditional probability, Independence of Events

and multiplication rule of probability-Bayes theorem and its applications

Unit V: **[12 Periods]**

Perform test using SPSS – Diagrams and Graph - Descriptive Statistics – Regression – Correlation.

Text Books:

1. S.P.Gupta, Statistical Methods, Sultan Chand &Sons, Educational Publishers, New Delhi, 2015.
2. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical statistics , Sultan Chand &Sons, Educational Publishers, New Delhi, 2011.

Contents:

Unit I	Chapter-3	Page Number: 40-58.
	Chapter-5	Page Number: 91-114.
	Chapter-6	Page Number: 127 -160.
Unit II	Chapter-7	Page Number: 177-221.
	Chapter-8	Page Number: 271-304.
Unit III	Chapter-10	Page Number: 390-420.
	Chapter-11	Page Number: 451-465.
Unit IV	Chapter-1(Vol-II)	Page Number: 751-770.

Reference Books:

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Applied Statistics, Educational Publishers, New Delhi, 2012.
2. G.V. Shenoy, V.K. Srivastava and S.C.Sharma, New Age International (Pvt.Ltd) Publishers, New Delhi,2014.
3. R.S. Bhardwaj, Business Statistics, Published by Anurag Jain for Excel books, Second Edition, New Delhi, 2008.
4. N.P. Bali, Statistics (Maths Series), Laxmi Publications pvt.Ltd, New Delhi.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1		1		3	
CO2	3		2			3			3		2		1
CO3		3		1		2	2			2	3		1
CO4	3			3	1	1		3		1		2	
CO5		3		2			2	3		3	1		3
CO6	3		2		3				1			2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied – Advanced Data Analytics	4	0	0	4	Theory

Introduction:

This paper enables the students to learn fundamental concepts of Statistics with application to SPSS.

Course Focus on: Employability

Course Outcome:

CO1	:	To identify and demonstrate appropriate sampling and data collection processes.
CO2	:	To understand the basic principles underlying statistical inference.
CO3	:	To learn about the concept of hypothesis testing and distributions.
CO4	:	To define and demonstrate the concepts of estimation and properties of estimators.
CO5	:	To identify the type of statistical situation to which different distributions can be applied.
CO6	:	To analyze Statistical data using SPSS and derive conclusions.

Unit I: **[12 Periods]**

Testing of Hypothesis: Statistical hypothesis - simple and composite hypothesis, Null and Alternative Hypothesis – Sample and Parameter Space – Two Types of errors – Critical Region - Power Test(Concept only). Test of significance - exact tests based on t, chi-square and F distributions.

Unit II: **[12 Periods]**

Multi variate Data analysis techniques: Analysis of variance; one way, two way classifications, Total sum of squares, between sum of squares and within sum of squares – Assumptions - ANOVA Table.

Unit III: **[12 Periods]**

Non Parametric Test: Non-parametric methods, Basic distribution, Wold-Wolfowitz run test, Test for randomness, Median Test, Sign test, Mann-Whitney-Wilcoxon U-test.

Unit IV: **[12 Periods]**

Census and Sampling: Principal steps in a sample survey, different types of sampling, Organization and execution of large scale sample surveys, errors in sampling (Sampling and non sampling errors) simple random sampling, Systematic, Stratified sampling (Theory only).

Unit V: **[12 Periods]**

Perform test using SPSS – Test of Hypothesis - ANOVA – Non parametric test.

Text Books:

1. S.P.Gupta, Statistical Methods, Sultan Chand &Sons, Educational Publishers, New Delhi, 2015.
2. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical statistics , Sultan Chand &Sons, Educational Publishers, New Delhi, 2011.

Contents:

Unit I	Chapter-3	Page Number: 881-913.
	Chapter-4	Page Number: 954-1000.
Unit II	Chapter-5	Page Number: 1004 -1006.
Unit III	Chapter-5	Page Number: 1009-1038.
Unit IV	Chapter-11	Page Number: 1160-1171.

Reference Books:

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Applied Statistics, Educational Publishers, New Delhi, 2012.
2. G.V. Shenoy, V.K. Srivastava and S.C.Sharma, New Age International (Pvt.Ltd) Publishers, New Delhi,2014.
3. R.S. Bhardwaj, Business Statistics, Published by Anurag Jain for Excel books, Second Edition, New Delhi, 2008.
4. N.P. Bali, Statistics (Maths Series), Laxmi Publications pvt.Ltd, New Delhi.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	
CO6	1			3	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied - Programming with C++	5	0	0	4	Theory

Introduction:

This paper enables the students to learn about the applicability of OOPs concept with the help of C++.

Course Focus on: Employability

Course Outcome:

CO1	:	To understand dynamic memory management techniques using pointers, constructors and destructors.
CO2	:	To describe the concept of function overloading, operator overloading and virtual functions
CO3	:	To apply inheritance, usage of exception handling, generic programming.
CO4	:	To describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
CO5	:	To demonstrate the use of various OOPs concepts with the help of programs.
CO6	:	To solve numerical problems using C++.

UnitI: **[12 Periods]**

OOPS: A New Paradigm – Evaluation of Programming Paradigm – Objects – Classes — OOPs Languages – Application of OOPs.

UnitII: **[12 Periods]**

Application of C++ - Structure of C++ Program – Tokens, Expression -Basic Data Types –Symbolic Constants – Operator in C++ - Function.

UnitIII: **[12 Periods]**

Array of Objects – Friend Function -Pointer to Members — Operator Overloading and Type Conversions – Overloading – Function Overloading – Special Features of Function Overloading.

Unit IV: **[12 Periods]**

Inheritance – Single Inheritance –public - Private – Protected Inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Polymorphism – Virtual Functions

Unit V: **[12 Periods]**

C++ Streams – Stream Classes -Unformatted I/O Operation – Managing Console I/O Operations - Classes for File Stream Operations – Opening and Closing a file.

Text Book:

1. E.Balagurusamy - 'Object Oriented programming with C++', 4th edition, McGraw Hill Publishing Company Limited, 2006.

Contents:

Unit – I : Chapter 1: Sections 1.1 – 1.8

Unit – II : Chapter 2: Sections 2.1 – 2.6
Chapter 3: Sections 3.1 – 3.24
Chapter 4: Sections 4.1 – 4.11
Unit – III: Chapter 5: Sections 5.4 – 5.19
Chapter 7: Sections 7.1 – 7.8
Unit – IV : Chapter 8: Sections 8.1 – 8.12
Unit – V: Chapter 10: Sections 10.1 – 10.6
Chapter 11: Sections 11.1 – 11.3

Reference Books:

1. Ashok N.Kamthane – 'Object Oriented Programming with ANSI and Turbo C++', Pearson

2. D.Ravichandran, "Programming with C++", Tata McGraw-Hill Publishing CompanyLimited, New Delhi, 2002.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1	2			3		3		1			3
CO2	1	1		1		2			3		2	2	
CO3	1	2			2		3	2		3			2
CO4		1		2		3			3		3	1	
CO5		1		2		3		3		2			3
CO6	1		2		3	2					3		

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied- Research Methodology & IPR for Mathematics	5	0	0	4	Theory

Introduction:

This paper enables the students to understand the concept of research and report writing and to discuss about the mathematical software.

Course Focus on: Employability

Course Outcome:

CO1	:	To give an overview of the research methodology and explain the technique of defining a research problem.
CO2	:	To explain the functions of the literature review in research.
CO3	:	To explain the art of interpretation and the art of writing research reports.
CO4	:	To discuss about Various Mathematical and Statistical software's and its applications.
CO5	:	To explain various forms of the intellectual property.

Unit I: **[12 Periods]**

Introduction Research: Objectives – importance - characteristics and utility of research - Defining research problems - sources of research ideas - developing good research questions - Ethical consideration in Mathematical research.

Unit II: **[12 Periods]**

History of Mathematics and Literature survey: Scientific research and literature survey - History of mathematics - finding and solving research problems - role of a supervisor - survey of a research topic - publishing a paper - reviewing a paper - ethics and plagiarism.

Unit III: **[12 Periods]**

Latex - Text and Maths – words – sentences – paragraphs - Command and environment. Document structure - Article class - Comments and footnotes - Change font characters. List environment - Style and size environment.

Unit IV: **[12 Periods]**

Report Preparation: Steps involved in report writing, APA writing style - Bibliography using Latex, Research paper writing. Thesis writing. Presentation using beamer class.

Unit V: **[12 Periods]**

Introduction and the need for intellectual property right (IPR) -Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design –

Genetic Resources and Traditional Knowledge –Trade Secret -IPR in India : Genesis and development – IPR in abroad.

Text Books:

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018
2. (E-resource) World Intellectual Property Organisation. (2004). WIPO Intellectual Property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf
3. Intellectual Property Rights: Protection and Management. India, Nithyananda K V. (2019). IN: Cengage Learning India Private Limited.

Reference Books:

1. Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005
2. Law relating to Intellectual Property Rights. India, Ahuja, V K. (2017). IN: Lexis Nexis.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2		1		2			2		2	1	
CO2		1		2			3	2		1		2	3
CO3		1	3			3			3		3	1	
CO4	2		2	3		2		3		2			3
CO5	1		2		3	1	1				1		2

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied - Physics - I	5	0	0	4	Theory

Introduction:

This paper enables the students to learn about solving equations using algebraic operations and develop problem solving skills.

Course Focus on: Skill development

Course Outcome:

CO1	:	To recall the basic concept of Mechanics
CO2	:	To understand the properties of elasticity.
CO3	:	To analyze the condition for interference.
CO4	:	To apply the concept of thermal physics.
CO5	:	To explain the Laws of electricity .
CO6	:	To discuss the concepts of physics and its applications.

Unit I: **[12 Periods]**

Mechanics: Composition of two simple harmonic motions along a line and at right angles –Lissajou's figures, uniform circular motion - Acceleration of a particle in a circle - Centripetal and centrifugal forces - Banking on curved tracks. Projectile - Motion in horizontal plane - Maximum height – Time of flight – Range – to prove the path of the Projectile is a parabola – Range and time of flight in a horizontal plane.

Unit II: **[12 Periods]**

Properties of matter and sound

Elasticity: Elastic constants – Bending of beams – Young's modulus by uniform and non-uniform bending – Energy stored in a stretched wire – Torsion in a wire – Determination of rigidify modulus – Torsional oscillation – Static torsion.

Sound: interference of sound waves – Beats – Doppler Effect –Applications – Ultrasonic – Piezoelectric method – Applications.

Unit III: **[12 Periods]**

Condition for interference – Young's double slit experiment – Interference due to transmitted light – Air wedge – Newton's rings – Determination ofrefractiveindex of a liquid – Diffraction - Diffraction at a single slit – Transmission grating – Polarization – Production and analysis of circularly and elliptically polarized light – Optical activity – Specific rotation – Half shade polarimeter

Unit IV: **[12 Periods]**

Thermal physics : Specific heat of solids and liquids – Dulong and Petit law – Newton's law of cooling – Thermal conductivity – Lee's disc method – Variation of specific heat with temperature – Vanderwaal's equation of state – derivation of critical constants – Black body radiation – Stefan's law – Laws of thermodynamics – Change of entropy in reversible and irreversible processes.

Unit V: [12 Periods]

Current Electricity and Electromagnetism: Kirchhoff's laws – Wheatstone's network – Condition for balance – Carey –Foster's bridge – measurement of resistance – Capacitor – Energy of charged capacitors – Loss of energy due to sharing of charges. Electromagnetic induction - Faraday's laws – AC circuits – Mean – rms – Peak values – LCR in series and in parallel – Sharpness of resonance – Ballistic Galvanometer – Theory – Measurement of capacitance – Transformer and its applications.

Text books:

1. R. Murugeshan, "Properties of matter"S.Chand& Company, 2015. (unit 1&2)
2. Brijlal&N.Subramaniam, "Heat and thermodynamics"S.Chand& Company (2006).(unit 3)
3. Brijlal, M.N. Avadhanalu& N. Subramaniam, "A text book of Optics" S.Chand& Company (2015) (unit 4)
4. Brijlal&Subramaniam, "Electricity and magnetism", S.Chand& Company publishers, New Delhi (2004). (unit 5)

References Books:

1. D.S.Mathur, "Properties of Matter" Shyamlal Charitable Trust, New Delhi (2010).
2. Singhal, "Heat, Thermodynamics and Statistical mechanics" Agarwal Prakash Pragati Prakashan publisher Meerut (1992).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied - Physics - II	5	0	0	4	Theory

Introduction: This paper provides the knowledge about up gradation in the field of quantum Mechanics, Atomic and Nuclear Physics and LASER

Course Focus on: Skill development

Course Outcome:

CO1	:	To acquire the knowledge of Light and applications through Quantum concepts.	
CO2	:	To gain knowledge about nucleus, its properties and detection of particles.	
CO3	:	To acquire knowledge about atom models.	
CO4	:	To understand concept of LASER and its applications.	
CO5	:	To gain knowledge about number systems and logic gates.	

Unit I: **[12 Periods]**

Quantum Physics: Photoelectric effect - Laws of photoelectric effect – Millikan's experiment – Photoconductive and photovoltaic cells – Photomultiplier – Applications of photo cells – Production and properties of X-rays – X – ray spectrum – Mosley's law – Compton effect – Relation for change in wavelength – X- ray diffraction – Bragg's law – Miller indices – Determination of h,k,l values of cubic crystals.

Unit II: **[12 Periods]**

Nuclear Physics : Classification of nuclei – General properties of nuclei – Characteristics of nuclear forces – Nuclear structure – Liquid drop model – Shell model – Particle accelerators – Betatron – Electron synchrotron – Artificial Transmutations by α -particles – Photon particles Nuclear fission and fusion (Quantitative) -Elementary particles – Mesons – Baryons – Leptons.

Unit III: **[12 Periods]**

Atomic Physics and Elements of Relativity: Atom model – Sommerfeld – Vector atom models –Periodic table – Pauli's exclusion principle – excitation and ionization potentials – Frank and Hertz method – Postulates of theory of relativity – Lorentz transformation equations – derivations – Length contraction – Time dilation – Mass- energy equivalence.

Unit IV: **[12 Periods]**

Laser Physics : Purity of spectral lines – Coherence length and time – Spontaneous and induced emissions – population inversion – Meta stable state – Conditions for laser action – Ruby laser – He-Ne lasers – Applications of lasers – Raman effect – Raman shift – Stokes and antistokes lines – LASER Raman spectrometer.

[12 Periods]

Unit V:

Electronics and Communication Physics : V – I Characteristics of p-n junction diode – Zenar diode – Uses of Zenar diode – Characteristics of FET – UJT- **Principles of LED**,LCD - Number systems – Conversion of Binary into Decimal – Decimal into Binary – Binary addition – Subtraction – Basic logic gates – Boolean algebra – Demorgan's theorem – Modulation – AM –FM – Basic principles of antenna and RADAR.

Text book:

1.R.Murugeshan and KiruthigaSivaprasath , "Modern Physics", S.Chand& Company (2008) (Unit I to V)

Reference Books:

1. Theraja.B.L, "Basic electronics" S.Chand& Company (2004).
2. V.K.Metha, "Principles of electronics" S.Chand& Company (2005).
3. Thiagarajan, "LASER physics" Mcmillan, New Delhi (1992).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied - Principles of Accountancy	5	0	0	4	Theory

Introduction: The paper aims to provide a knowledge about Concepts and conventions of Accounting &Basic Accounting framework.

Course Focus on: Employability

Course Outcome:

CO1	:	To recall the fundamental concept of accounting.
CO2	:	To understand the concept of accounting information to solve Errors and rectification.
CO3	:	To apply the Bills of exchange and Account current in data.
CO4	:	To analyze the Accounting for consignments and Joint ventures.
CO5	:	To apply the Bank Reconciliation statement and Accounts of professionals.
CO6	:	To develop knowledge on application of accountancy in real life business.

Unit I: **[12 Periods]**

Fundamentals of Book Keeping – Accounting Concepts and Conventions – Journal – Ledger – Subsidiary books – Trial balance.

Unit II: **[12 Periods]**

Final accounts of a sole trader with adjustments – Errors and rectification.

Unit III: **[12 Periods]**

Bills of exchange - Accommodation bills – Average due date – Account current.

Unit IV: **[12 Periods]**

Accounting for consignments and Joint ventures.

Unit V: **[12 Periods]**

Bank Reconciliation statement – Receipts and Payments and income and expenditure account and Balance sheet – Accounts of professionals.

Text Book:

1.1. N.Vinayakam, P.L.Mani, K.L.Nagarajan – Principles of Accountancy – S.Chand& Company Ltd.
2. T.S.Grewal – Introduction to Accountancy- S.Chand& Company Ltd.
3. R.L.Gupta, V.K.Gupta, M.C.Shukla – Financial Accounting – Sultanchand& sons.

Reference Books:

1. T.S.Grewal, S.C.Gupta, S.P.Jain – Advanced Accountancy- Sultanchand& sons.

2. K.L.Narang, S.N.Maheswari - Advanced Accountancy-Kalyani publishers.
3. S.K.Maheswari, T.S.Reddy - Advanced Accountancy-Vikas publishers.
4. A.Murthy -Financial Accounting – Margham Publishers.
5. P.C.Tulsian - Advanced Accountancy – Tata McGraw Hill Companies.
6. A.Mukherjee, M.Hanif – Modern Accountancy. Vol.1- Tata McGraw Hill Companies.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1		1	3	2		1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	3				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		3			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Allied - Financial Mathematics	5	0	0	4	Theory

Introduction: This course is intended to prepare students to use fundamental ideas about mathematics in solving monetary problems related to learn financial ethics.

Course Focus on: Employability

Course Outcome:

CO1	:	To recall the concept of profit and loss, basis of interest.
CO2	:	To explain the suitability of interest and valuations of securities in business situation.
CO3	:	To understand the fundamental concepts of insurance mathematics.
CO4	:	To apply Premium Calculations and Law of Averages and Large numbers.
CO5	:	To examine the concept of various distributions.
CO6	:	To develop the knowledge in students to follow ethics in financial transaction.

Unit I: **[12 Periods]**
Simple Interest-Compound Interest-Nominal and effective rate of interest.

Unit II: **[12 Periods]**
Present Value- Accumulated Value-Future value- Annuities and Perpetuity-Monthly installment (EMI Calculations)-Valuations of Securities-Stocks and shares.

Unit III: **[12 Periods]**
Probability of survival and death- Life contingencies- Mortality table- Life table.

Unit IV: **[12 Periods]**
Assurance- Annuities(life)- Premium Calculations- Law of Averages and Large numbers.

Unit V: **[12 Periods]**
Loss Distribution-Skewed Distribution-Gaussian Distribution- Cauchy distribution-β and γ Distributions.

Text Book:
1. Introduction to Financial Mathematics- Kevin.J. Hashtings-CRC Press-2003.

Reference books:
1. Ales Cerny: "Mathematical techniques in Finance: Tools for incomplete markets", Princeton University Press.
2. S.R. Pliska, "Introduction to Mathematical Finance: Discrete time models".

3. Karatzas and S. Shreve, "Methods of Mathematical Finance", Springer, New York .
4. MarekCapinski and Tomasz Zastawniak, "Mathematics for Finance: An Introduction to Financial Engineering", Springer, London.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course - Numerical Methods	5	0	0	2	Theory

Introduction

This paper enables the students to learn numerical approximation strategies and a basic knowledge on the theory that supports numerical algorithms

Course Focus on: Skill development

Course Outcome:

CO1	:	To demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problem
CO2	:	To apply numerical methods to obtain approximate solutions to mathematical problems
CO3	:	To analyse and evaluate the accuracy of common numerical methods
CO4	:	To analyse error obtained in the numerical solution of the problem
CO5	:	To apply numerical methods in modern scientific computing with finite precision computation.
CO6	:	To relate the subject knowledge with their experiments during their course of study.

Unit I: **[12 Periods]**

Solutions of algebraic and transcendental equations: Introduction -Bisection method- The Iteration method -False position method -Newton-Raphson Method- Ramanujan's method.

Unit II: **[12 Periods]**

Interpolation- Errors in Polynomial interpolation, Finite differences, Differences of a polynomial, Newton's forward and backward interpolation, Central differences, Gauss, Stirling, Bessel's and Everett's Formulae, Lagrange's Interpolation formula.

Unit III: **[12 Periods]**

Linear systems of equations: Consistency of Linear System of equations, Solutions of Linear Systems by direct method: Gaussian elimination, Gauss Jordan, solution of tridiagonal systems, Solutions of linear systems by iterative methods: Jacobi method, Gauss-Seidel method.

Unit IV: **[12 Periods]**

Numerical integration: Trapezoidal rule-Geometrical interpretation and error of Trapezoidal rule -

Simpsons
one third rule and three eighth rule formulae - Romberg integration

Unit V: **[12 Periods]**

Numerical solution for ordinary differential equation-Solution of first order ODE by Taylor series method - Solution of first order ODE by Euler method- Error estimates for the Euler method – Modified Euler method - Runge Kutta method of second, third and fourth order.

Text Book:

1. Introductory Methods Numerical Analysis, S. S. Sastry Fifth Edition, Prentice- Hall Of India

Contents:

Unit I:	Chapter 2	Sections 2.1 -2.6
Unit II:	Chapter 3	Sections 3.2, 3.3 and 3.7, 3.9.1
Unit III:	Chapter 7	Sections 7.5.1, 7.5.3, 7.5.9 and 7.6
Unit IV:	Chapter 6	Sections 6.4.1-6.4.3, 6.4.6
Unit V :	Chapter 8	Sections 8.1, 8.2, 8.4 and 8.5

Reference Books:

1.Venkataraman M.K., "Numerical methods in Science and Engineering", National Publishing Company, Revised Edition, 2005.
2.Kandasamy P., "Numerical Methods", S.Chand and Co, Reprint 2010
3. M.K.Jain., Iyengar. S.R.K., Jain R.K., "Numerical Methods for Scientific and Engineering Computation", (6th Edition), New Age International, 2012.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2		2	3	1			3		1		2	3
CO2		3				2			3		2	3	
CO3	3	3			2		3	2		1		2	1
CO4		1		2		3			3	2	3		
CO5	1						3				2		1
CO6	3			1	2	2			1	3		1	2

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course – Introduction to Big Data Analytics with R	5	0	0	2	Theory

Introduction:

This paper enables the students to learn fundamental concepts of Big Data along with practical exposure to R program.

Course Focus on: Employability

Course Outcome:

CO1	:	To optimize business decisions and create competitive advantage with Big Data analytics.
CO2	:	To explore the fundamental concepts of big data analytics.
CO3	:	To learn to use various techniques for mining data stream.
CO4	:	To understand the various search methods and visualization techniques.
CO5	:	To explore the fundamental concepts of R Programming.
CO6	:	To learn to apply various techniques for Big Data using R program.

Unit I: **[12 Periods]**

Introduction to Big Data: Introduction to Big Data Plat form – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data – Analytic Processes and Tools – Analysis vs reporting.

Unit II: **[12 Periods]**

Mining data streams: Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –Estimating Moments – Counting Oneness in a Window – Decaying Window Real time Analytics Platform (RTAP) Applications.

Unit III: **[12 Periods]**

Hadoop : History of Hadoop – the Hadoop Distributed File System –Components of Hadoop Analyzing the Data with Hadoop – Scaling Out – Hadoop Streaming – Design of HDFS – Map Reduce Features – Hadoop environment.

Unit IV: **[12 Periods]**

Introduction to R programming - Overview of R, R data types and objects, reading and writing data Control structures, functions, scoping rules.

Unit V: **[12 Periods]**

Tools in R: Scientific Calculator – Inspecting Variables – Vectors –Matrices And Arrays - Lists and Data Frames – Functions – Strings and Factors – Flow Control and Loops – Date and Times.

Text Books:

1. "Intelligent Data Analysis", Michael Berthold, David J.Hand, Springer,2007. (Unit I and II)
2. "Hadoop: The Definitive Guide" Tom White Third Edition, O'reilly Media, 2012. (Unit III)
3. "Learning R" Richard Cotton, O'Reilly, 2013 (Unit IV and V)

Contents:

Unit I : Chapter 1 : Page no. 1 – 14.
Unit II : Chapter 2 ; Page no. 16 – 28.
Unit III : Chapters 1, 2 & 3 : Page no. 1 – 50.
Unit IV : Chapters 8 : Page no. 111-122.
Unit V: Chapters 9, 10 & 11 : Page no. 126 – 160.

Reference Books:

1. "Mining of Massive Data sets", Anand Raja ramanand Jeffrey David Ullman, CUP, 2012.
2. "Data Mining Concepts and Techniques" Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, Reprinted 2008.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1		1		2			3		1	2		3	
CO2	2		3	1	2	2			3		2		1
CO3	1		2		1		1	3		3	2		2
CO4		1		2		3	2	2	1		1	2	
CO5	2	3	1	3		2	1			2		1	3
CO6		2		1	3		2	3	2		1	3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course-Operations Research-I	4	0	0	2	Theory

Introduction:

This paper enables the students to learn the basic skills of solving very common problems which we come across in various fields like transportation, sequencing and industries with machines.

Course Focus on: Employability

Course Outcome:

CO1	:	To identify the goals and objectives of LPP and describe the procedure of solving LPP.
CO2	:	To develop the ability to handle the LPP equation to analyze the effect of objective function.
CO3	:	To understand the various methods of solving the Transportation Problem.
CO4	:	To understand how to reduce the cost value of the Assignment Problems.
CO5	:	To develop the sequence procedure for solving a real life problems.

Unit I: **[12 Periods]**

LPP: Introduction- Linear Programming Problem – Formulation of L.P.P – Graphical solutions of L.P.P –Canonical & standard form of LPP- Simplex Method- Big-M Method.

Unit II: **[12 Periods]**

Duality in LPP: - Duality in Linear Programming - General primal-dual pair - Formulating a Dual problem - Primal-dual pair in matrix form -Dual simplex method.

Unit III: **[12 Periods]**

Transportation problem: Introduction- LP formulation of the TP - Solution of a TP - Finding an initial basic feasible solution (NWCM - LCM -VAM) – Degeneracy in TP – Transportation Algorithm (MODI Method).

Unit IV: **[12 Periods]**

Assignment problem: Introduction- Solution methods of assignment problem – special cases in assignment problem.

[12 Periods]

Unit-V:

Sequencing Problem: Introduction- Problem of sequencing-processing n jobs through Two

machines- processing n jobs through k machines- processing 2 jobs through k machines.

Text Book:

1.Operations Research by Kanti Swarup , P.K.Gupta and Man Mohan, S. Chand & Sons Education Publications, New Delhi (2008).

Contents:

Unit I:	Chapter 2:	Sections 2.1 – 2.4,
	Chapter 3:	Sections 3.1 – 3.5, Sections 4.1-4.4
Unit 2:	Chapter 5 :	Sections 5.1 – 5.7, 5.9
Unit 3:	Chapter 10:	Sections 10.1 – 10.13
Unit 4:	Chapter 11:	Sections 11.1 – 11.7
Unit 5:	Chapter 12:	Sections 12.1-12.6

Reference Books:

1. Sundaresan.V, Ganapathy Subramanian. K.S. and Ganesan.K, Resource Management Techniques, A.R. Publications, 2002.
2. Prem Kumar Gupta D. S. Hira, "Operations Research", S. Chand & Company Ltd, Ram Nagar, New Delhi.
3. S. Dharani Venkata Krishnan, "Operations Research Principles and Problems", Keerthi publishing house PVT Ltd.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	3		2				3			3		1
CO2		1				2	3			1	2		3
CO3		2		2		3			3	2		1	
CO4	1	1				2			3		3	2	
CO5	1			2	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course-Operations Research-II	4	0	0	2	Theory

Introduction:

This paper enables the students to develop basic skills for solving problems like Queuing, Network analysis and solving the game and inventory problems.

Course Focus on: Employability

Course Outcome:

CO1	:	To apply and extend the game theory problems to analyze real world systems.
CO2	:	To find solutions to network flow problems using standard algorithms.
CO3	:	To analyze a project with deterministic as well as probabilistic activity times.
CO4	:	To understand and develop the inventory models and setting safety stocks.
CO5	:	To deal the problems with simulation to determining how to manage the resources efficiently under various types of simulation.

Unit -I **[12 Periods]**

Game Theory: Introduction- Two person zero sum game – MAXIMIN – MINIMAX Principle – Saddle Point – Games without Saddle Point – Graphical solutions of 2 x n and m x 2 games – Dominance Property – General solution of m x n games by LPP.

Unit-II **[12 Periods]**

PERT and CPM – Basic components – logical sequencing - Rules of network construction- Critical path analysis - Probability considerations in PERT-Distinction between PERT and CPM.

Unit-III **[12 Periods]**

Inventory control – Types of inventories – Inventory costs – EOQ Problem with no shortages – Production problem with no shortages – EOQ with shortages – Production problem with shortages – EOQ with price breaks.

Unit IV: **[12 Periods]**

Queueing Theory – Introduction – Queueing system – Characteristics of Queueing system – symbols and Notation – Classifications of queues – Problems in (M/M/1) : (∞/FIFO)(Derivation also); (M/M/1) : (N/FIFO); (M/M/C) : (∞/FIFO); (M/M/C) : (N/FIFO) Models- Simple Problems.

Unit V: **[12 Periods]**

Simulation – Introduction – simulation models – Event – Types of simulation – Generation of Random Numbers – Mante - carlo simulation – simulation of queueing system.

Text Book:

Operations Research by Kanti Swarup , P.K.Gupta and Man Mohan, S. Chand & Sons Education Publications, New Delhi (2008).

Contents:

Unit I:	Chapter 17:	Sections 17.1 – 17.9
Unit II:	Chapter 25	Sections 25.1 to 25.4, 25.6-25.8
Unit III :	Chapter 19:	Sections: 19.1-19.6, 19.10 - 19.12.
Unit-IV:	Chapter 21:	Sections:21.1-21.9.
Unit-V:	Chapter 22:	Sections: 22.1,22.4-22.8

Reference Books:

1. Sundaresan.V, Ganapathy Subramanian. K.S. and Ganesan.K, Resource Management Techniques, A.R. Publications, 2002.
2.Prem Kumar Gupta D. S. Hira, "Operations Research", S. Chand & Company Ltd, Ram Nagar, New Delhi.
3. S. Dharani Venkata Krishnan, "Operations Research Principles and Problems", Keerthi publishing house PVT Ltd.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		2				3	2		2		1	3
CO2	1	1	2					3		2	1		
CO3		1		2		2	3					2	3
CO4		2		1		3	2		3	1		3	
CO5	1		2		2			3			2		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course - Mathematica	5	0	0	2	Theory

Introduction: This course provides knowledge about numerical calculations, algebraic equations, math functions and various operations on functions and matrices.

Course Focus on: Skill development

Course Outcome:

CO1	:	To gain knowledge on the basic concepts of Mathematica.
CO2	:	To understand the concept of functions and programs.
CO3	:	To apply advanced mathematics in Mathematica.
CO4	:	To classify the concepts of series, limits and residues.
CO5	:	To explain the numerical operations on data & functions.
C06	:	To discuss the problem solving techniques using mathematics.

Unit I: **[12 Periods]**
Introduction to Mathematica: Running Mathematica - Numerical calculations – Building up calculations – Using the Mathematica system – Algebraic calculations – Symbolic mathematics - Numerical mathematics.

Unit II: **[12 Periods]**
Functions and programs – Lists – Graphics – Input and output in notebooks – The structure of graphics.

Unit III: **[12 Periods]**
Advanced Mathematics in Mathematica: Numbers - Mathematical functions – Algebraic manipulation – Manipulating equations.

Unit IV: **[12 Periods]**
Series, limits and residues - Linear algebra.

Unit V: **[12 Periods]**
Numerical operations on data and functions.

Text Book:
1. S. Wolfram, Mathematica, Fifth Edition, Cambridge University Press, Cambridge, 2003.

Contents:

Unit I : Chapter 1: Sections 1.0-1.6
Unit II : Chapter 1: Sections 1.7-1.10
Unit III : Chapter 3: Sections 3.1-3.4
Unit IV : Chapter 3: Sections 3.6-3.7
Unit V : Chapter 3: Sections 3.8-3.9

References Books:

1. David McMahon, Daniel M.Topa, A Beginners guide to Mathematica, Taylor and Francis Publications,1st edition, 2002.
2. Paul Wellin, Programming with Mathematica-An Introduction, Cambridge University Press, 1st edition, 2013.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course - Quantitative Aptitude	5	0	0	2	Theory

Introduction: To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of competitive examinations.

Course Focus on: Employability

Course Outcome:

CO1	:	To recall the fundamental concepts of mathematics.
CO2	:	To understand the need of critical thinking to improve chance of employ ability.
CO3	:	To apply the concept of measurement and simple interest.
CO4	:	To examine the ability of knowledge in mathematics.
CO5	:	To examine the knowledge in logical reasoning.
CO6	:	To develop problem solving skills and reasoning ability for cracking competitive exams.

Unit I: **[12 Periods]**
Area-Average-Calendar-Chain Rule-Puzzles

Unit II: **[12 Periods]**
Partnership-Percentage-Pipes and Cisterns-Problems on ages

Unit III: **[12 Periods]**
Problems on boat and Stream-Ratio- Simple Interest-Time and work

Unit IV: **[12 Periods]**
Mental Ability and logical reasoning - Analogy Test- Series Test- Same Class (Odd) Test- Logical Venn Diagram - Syllogism.

Unit V: **[12 Periods]**
Analytical Reasoning-Mirror Images-Water Image (Number Letter Figure)-Completion of Incomplete Pattern-Grouping of Identical figures.

Text Book:
1. Dr. R.S.Aggarwal ," Quantitative Aptitude" , S.Chand, company limited,.

Reference Books:

1. Dr.R.S.Aggarwal ,"A Modern Approach to Verbal and Non Verbal Reasoning, Revised Edition, S.Chand.
2. Edgar Thorpe "Mental ability and Quantitative Aptitude", 2 Edition
3. Hand book on "Mental Ability and Logical Reasoning" by Bharathiar University, Coimbatore.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1		1	3	2		1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	3				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		3			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course - Actuarial Mathematics	4	0	0	2	Theory

Introduction: This paper enables the learners to gain basic knowledge of life table statistics and get an idea of interest and force of mortality.

Course Focus on: Employability

Course Outcome:

CO1	:	To remember the basics of probability and theory of interest.
CO2	:	To acquire knowledge about computational illustration in splus.
CO3	:	To analyze the comparison of forces of morality.
CO4	:	To examine the knowledge of binomial variables.
CO5	:	To classify some special integrals and rules for manipulating expectations.
C06	:	To develop the practical knowledge on Real life problems.

Unit I: **[12 Periods]**

Basics of Probability and Interest: Probability. Theory of Interest: Variable Interest Rates, Continuous-time Payment Streams.

Unit II: **[12 Periods]**

Interest and Force of Mortality: More on Theory of Interest, Annuities and Actuarial Notation, Loan Amortization and Mortgage Refinancing, Illustration on Mortgage Refinancing. Interest and Force of Mortality: Computational Illustration in Splus, Coupon and Zero Coupon Bonds.

Unit III: **[12 Periods]**

Interest and Force of Mortality: Force of Mortality and Analytical Models, Comparison of Forces of Mortality. Probability and Life tables: Interpreting Force of Mortality, Interpolation Between Integer Ages.

Unit IV: **[12 Periods]**

Binomial variables and Law of Large Numbers, Exact Probabilities, Bounds and Approximations. Simulation of Life Table Data, Expectation for Discrete Random Variables.

Unit V: **[12 Periods]**

Rules for Manipulating Expectations. Some Special Integrals.

Text Book:

1.Eric V. Slud, "Actuarial Mathematics and Life-Table Statistics", Department of Mathematics, University of Maryland, College Park, 2001.

Contents:

Unit I - Chapter 1: Sections - 1. 1 - 1.4

Unit II - Chapter 2: Sections - 2.1(2.1.1 - 2.1.5)

Unit III - Chapter 2: Sections - 2.2

Chapter 3: Sections - 3.1, 3.2

Unit IV – Chapter 3: Sections - 3.3, 3.3.1,3.4, 3.4.1

Unit V - Chapter 3: Sections - 3.4.2 ,3.5

Reference Books:

1. Charles L. Trowbridge, "Fundamental Concepts of Actuarial Mathematical Science", Actuarial Education and Research Fund, Revised Edition, 1989.

2. Jerry Alan Veeh, "Lecture Notes on Actuarial Mathematics", (e-notes), 2006.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Skill Enhancement Course - Office Automation	4	0	0	2	Theory

Introduction: This subject deals with Microsoft Word, Microsoft Excel and access so that students will gain basic computer knowledge.

Course Focus on: Skill development

Course Outcome:

CO1	:	To recall the basics of computer language.
CO2	:	To develop skills in windows using , WordPad, notepad etc.
CO3	:	To examine the concept of Microsoft office and access the knowledge about working in WordPad.
CO4	:	To analyze the available tools to work with excel.
CO5	:	To describe the usage of computers and the essential components in business and society.
CO6	:	To develop the knowledge to work with Microsoft office.

Unit I: **[12 Periods]**

Windows Operating System: Overview of different version of windows Opening, closing and resizing windows-enlarging-reverting, reducing the windows-basic windows elements-saving, printing file-quitting a program-file and Folder-Working in Explorer-opening and closing a folder in Explore-Entertainment-working in paint-working in WordPad and Notepad-system tools.

Unit II: **[12 Periods]**

Introduction to Microsoft Office 2000-Word Processing & Microsoft Word-Introduction to Word Processing-Some Important Terms of Word Processing Starting Word-Microsoft Word Screen-File Menu-Edit Menu-View Menu-Insert Menu Format Menu Tools Menu-Table Menu-Window Menu-Help Menu-Formatting the Text Alignment of Text-Applying Fonts-Size of Text-Font of the Text-Color of the Text.

Unit III: **[12 Periods]**

Spreadsheets & Microsoft Excel: Understanding Microsoft Excel for Windows-Starting Microsoft Excel 2000-Understanding Spreadsheets-File Menu-Edit Menu-View Menu-Insert Menu-Format Menu-Tools Menu-Data Menu-Window Menu Help Menu.

Unit IV: **[12 Periods]**

Creating a Worksheet in Excel for Windows-Copying Formula-Formulas That Make Decisions-Styles-Functions in Excel-Using Auto Sum-Using auto calculateReferences-Sum Function-Average Function-Creating Charts in Excel-Creating Graphs Modifying Chart-Adding Data to Chart-Add a Data table to a Chart-Add a Trend

LineCreating a Pivot Table Report-Modifying the Chart Type.

Unit V: **[12 Periods]**

Introduction to Tables-Simple Queries-Form.

Text Book:

1. IT Tools and Applications-Vikas Gupta-Dreamtech Press-First edition-2003

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2
CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective I - Discrete Mathematics & Combinatorics	5	0	0	4	Theory

Introduction:

This paper enables the students to gain knowledge on mathematical logic, Relations & Functions, Formal languages and Automata, Lattices and Boolean Algebra and Combinatorics.

Course Focus on: Skill development

Course Outcome:

CO1	:	To construct mathematical arguments using logical connectives and quantifiers.
CO2	:	To solve problems involving recurrence relations and generating functions.
CO3	:	To perform operations on discrete structures such as sets, functions, relations, and sequences.
CO4	:	To compute a generating function and apply them to combinatorial problems.
CO5	:	To use permutations and combinations to solve counting problems with sets and multisets.
CO6	:	To be able to apply basic counting techniques to solve combinatorial problems.

Unit I: **[12 Periods]**

Combinatorics: Introduction - Sum and Product Rules - Permutations - Combinations – Pigeonhole Principle – Binomial Theorem - Multinomial Coefficient – Principle of Inclusion and Exclusion.

Unit II: **[12 Periods]**

Recurrence Relations and Generating functions: Recurrence - An introduction - Polynomials and their Evaluations - Recurrence Relations - Solution of Finite Order Homogeneous (linear) Relations - Solution of Non-homogeneous relations - Generating Functions - Some common recurrence relations.

Unit III: **[12 Periods]**

Logic: Introduction - TF-statements – Connectives - Atomic and Compound Statements - Well Formed (Statement) Formulae -The Truth table of a Formula - Tautology - Tautological Implications

and Equivalence of Formulae - Replacement Process - Functionally Complete Sets of Connectives and Duality Law – Normal Forms - Principal Normal Forms.

Unit IV: **[12 Periods]**

Lattices and Boolean Algebra: Lattices - Some properties of Lattices -New lattices – Modula and Distributive lattices - Boolean Algebras.

Unit V: **[12 Periods]**

Language, Grammar and Automata: Introduction - Language - The Set Theory of Strings – Languages – Regular Expressions and Regular Languages - Grammar - Finite-State Machine- Finite State Automata.

Text Books:

1. Sharma J. K," Discrete Mathematics", Macmillan Publishers India Ltd, 2011.
2. Venkataraman M. K, Sridharan N and Chandrasekaran N, "Discrete Mathematics", The National Publishing Company, 2000.

Contents:

Unit I:	Chapter 6	Sections: 6.1 to 6.7 and 6.9. [Text Book 1]
Unit II:	Chapter 8	Sections : 8.1 to 8.8. [Text Book 1]
Unit III :	Chapter 9	Sections: 9.1 to 9.12. [Text Book 1]
Unit IV:	Chapter 10	Sections: 10.1 to 10.5. [Text Book 1]
Unit V:	Chapter 15	Sections: 15.1 to 15.7. [Text Book 2]

Reference Books:

1.Ralph P. Grimaldi, "Discrete and Combinatoral Mathematics – An applied introduction", Third Edition, Addison Wesley Publishing Company, 1994.

2.Tremblay J. P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2001.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	

CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	
CO6	1			3	3	2			3		1		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective I- Introduction to Entrepreneurship	5	0	0	4	Theory

Introduction:

This paper enables the students to learn importance of various government schemes and opportunities for entrepreneurs and to understand the financial ventures for new business.

Course Focus on: Entrepreneurship

Course Outcome:

CO1	:	To able to become an ethical entrepreneur and to provide job for others.
CO2	:	To analyze the business environment in order to identify business opportunities.
CO3	:	To forecast the market opportunity through surveys.
CO4	:	To interpret their own business plan and support the entrepreneurs by preparing project plan.
CO5	:	To raise capital by submitting project plan to various financial institutes.
CO6	:	To develop the knowledge about Professional ethics and management techniques

Unit I: **[12 Periods]**

Basics of Entrepreneurship- classification of Entrepreneurship- Importance of Entrepreneurship- difference between Entrepreneurship and employment – Entrepreneurial skills- current trends.

Unit II : **[12 Periods]**

Business management skills-Internal skills- Financial management – Operating management – Manpower management – Material and Inventory management.

Unit III: **[12 Periods]**

Business management skills- External skill – Marketing Management- Sales Management – Business opportunities – Market Survey and Strategy- investment and investors relations- Business Outreach and promotions.

Unit IV: **[12 Periods]**

Schemes and Funding- Banking – Lending schemes – Government sponsored schemes- MSME credit – MUDRA loan- PMEGP scheme- CGTMSE Scheme- start-up India.

Unit V: **[12 Periods]**

Business plan preparation: plan format- proposal preparation – business pitching – EDP- Feasibility Report-successful enterprises-case studies.

Reference Books:

1. C.B.Gupta and S.P.Srinivasan, Entrepreneurial Development.
2. S.S. Khanka, Entrepreneurial Development.
3. S. Anil Kumar, Entrepreneurship Development, New Age International, 2008.
4. Website: https://msme.giv.in/all-schemes

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	1				3		3	1	2	1		3
CO2	1	3			3		2	2		1		3	
CO3		1		3			3	2			2		1
CO4		1		2		3			3		3	2	
CO5			1	2		2		3		3			1
CO6	1		2		3	2			3		2		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective I- Real time applications of Mathematics	5	0	0	4	Theory

Introduction:
This paper provides the knowledge about real time applications of mathematics.

Course Focus on: Skill development

Course Outcome:

CO1	:	To understand the concept of Area, Volume, percentage and ratio.
CO2	:	To learn about the concept of foreign business transactions.
CO3	:	To understand about the concept of mathematics sport and games.
CO4	:	To learn about the concept of Numerical reading and Government Budget.
CO5	:	To understand about the concept of probability, time and work.

Unit- I: **[12 Periods]**

Mathematics for Living**:** Approximation, Estimation, the calculator and strategies of checking – Measurement – Linear –Area – Volume, Capacity and weight – Measuring Time – Fractions, Decimals, Percentages and Ratio – House and Home Mathematics – current Affairs.

Unit –II: **[12 Periods]**

Enterprise Mathematics**:** Wages and Salaries – Business Transactions – Keeping Records – Foreign Business Transactions – Planning for Business and Monitoring – Presentation and Analysis – Current Affairs.

Unit-III: **[12 Periods]**

Mathematics for Leisure and Civic Affairs: The mathematics of games and sport – Geometry and Sport – Leisure Time Mathematics –Holiday and Travel Mathematics – Elections – Current Affairs.

Unit- IV: **[12 Periods]**

Mathematics for Working Life: Wages and Salaries – Numerical Reading, Recording and Representation – Money Matters in the world of work – Government Budget – Examination preparation and Personal Reflection – Current Affairs.

Unit –V: **[12 Periods]**

Probablity – Permutation and combination – Pipes and Cisterns –Problems on age- Time and Work.

Text Book:

1. "Mathematical Applications", Government Publications, Postal trade section, Dublin.
2. Dr.R.S. Aggarwal, "Quantitative Aptitude", S.Chand, Company Limited.

Contents:

Unit I- Module 1 Page No: 10-18 [Text Book 1].

Unit II- Module 2 Page No: 22-30 [Text Book 1].

Unit III- Module 3 Page No: 34-41[Text Book 1].

Unit IV- Module 4 Page No: 46-54[Text Book 1].

Unit V – Chapter 8,15,16,30,31 [Text Book 2].

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3		2				3	2		2		1	3
CO2	1	1	2					3		2	1		
CO3		1		2		2	3					2	3
CO4		2		1		3	2		3	1		3	
CO5	1		2		2			3			2		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective II- Complex Analysis – I	5	0	0	4	Theory

Introduction:

This paper enables the students to equip with necessary knowledge and skills for handling mathematical operations, analyses and problems involving complex numbers.

Course Focus on: Research

Course Outcome:

CO1	:	Represent complex numbers algebraically and geometrically.
CO2	:	Define and analyze limits and continuity for complex functions as well as consequences of continuity.
CO3	:	Calculate exponentials and integral powers of complex numbers.
CO4	:	Describe conformal mappings between various plane regions.
CO5	:	Explain and understand the concept of Mapping by elementary transformations.
CO6	:	Explain and apply Cauchy's integral formula and some of its consequences.

Unit-I: **[12 Periods]**

Analytic functions: Limits – Limits involving the point at infinity - Continuity-Derivatives and Differentiation Formula -Cauchy-Riemann equations -Cauchy-Riemann equations in polar form-Properties of Analytic functions -Necessary and sufficient conditions for Analytic functions.

Unit-II: **[12 Periods]**

Conformal Mappings: Harmonic functions -Determination of Harmonic conjugate and Analytic functions-conformal mapping- Isogonal mapping -Further properties and Examples-Transformations of

Harmonic functions.

Unit-III: **[12 Periods]**

Mapping by Elementary transformations: Linear transformations - The transformations w=z+d, w=1/z, $w=z^2$, w= z , w = ez, w=sin z - Bilinear Transformation and special Bilinear Transformation - problems.

Unit-IV: **[12 Periods]**

Integrals: Contours - Line Integrals - Cauchy-Goursat's Theorem (without proof) – Cauchy's Integral Formula – Extension of Cauchy's Integral Formula.

Unit-V: **[12 Periods]**

Elementary Functions: The Exponential function – The Logarithmic functions – Branches and derivative of logarithms – Some identities involving logarithms – Complex Exponents – Trigonometric functions – Hyperbolic functions – Inverse Trigonometric and Hyperbolic functions.

Textbook:

1. R.V.Churchill and J.W.Brown, (1984) *Complex Variables and Applications*. McGraw Hill International Book Co., Singapore. (Third Edition)

Contents:

Unit I:	Chapter 2:	Sections 15-25.
Unit II:	Chapter 2:	Section 26.
	Chapter 9:	Sections 101-106.
Unit III:	Chapter 8:	Sections 90-97.
Unit IV:	Chapter 4:	Sections 39-51.
Unit V:	Chapter 3:	Sections 29-36.

Reference Books:

1. P. Duraipandian and LaxmiDuraipandian (1976) Complex Analysis: Emerald Publishers, Chennai
2. S. Ponnusamy. (2000) Foundations of Complex Analysis, Narosa Publishing House, New Delhi .
3. Murray R. Spiegel. (2005) Theory and Problems of Complex Variable. Tata-Mcgraw Hill Edition, New Delhi.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes	Program Specific Outcomes

	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1			2		1		2	3		2		3	
CO2	1		3	2			2			3	2		1
CO3		1		3		3	3				1	2	
CO4	2			2			2	2	3	1		3	
CO5	1		2			3		3			2		3
CO6		2		3		2			2	1		1	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective II -Vedic Mathematics	5	0	0	4	Theory

Introduction:

This paper enables the students to acquire knowledge about Ancient mathematical techniques.

Course Focus on: Skill development

Course Outcome:

CO1	:	An ability to solve multiplication in speed way.
CO2	:	An ability to solve Multiplications and divisions in various level.
CO3	:	An ability to solve Multiplication in an easy technique.
CO4	:	An ability to solve Division is an easy and speed technique
CO5	:	An ability to solve cubic roots and cube of numbers using short cuts.

Unit –I: **[12 Periods]**

Normal Method- Vedic Method -Multiplication with a series of 9s - Multiplication of a number by same number of 9s- Multiplication of a number by greater number of 9s -Multiplication of a number by lesser number of 9s.

Unit – II: **[12 Periods]**

Operations with 11 – Multiplication - Divisibility test of numbers by 11 - Multiplication with 111.

Unit – III: **[12 Periods]**

Multiplication Nikhilam - Secondary bases of 50 - Secondary base of 250 - Secondary base of 500 - Secondary bases like 40, 60 - Secondary base of 300.

Unit – IV: **[12 Periods]**

Division by a flag of one digit (no remainder) - Division by a flag of one digit (with remainder)- Division with adjustments -Division with a flag of 2 digits - Division with a flag of 3 digits.

Unit – V: **[12 Periods]**

Square Root of a Number -Cubes and Cube Roots -Computing cubes of 2-digit numbers -Cube roots of 2-digit numbers -Computing fourth power of 2-digit numbers.

Text Book:

1. "The Power of Vedic Maths", by Aul Gupta, Published by Jaico Publishing House, 2nd Edition.

Reference Book:

1. Jagadguru Swami Sri Bharati Tirthaji Maharaja, "Vedic Mathematics", Shri Jainendra Press, A – 45, Phase I , Industrial Area, Naraina, New Delhi – 110 028.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3		2				3	2		2		1	3
CO2	1	1	2					3		2	1		
CO3		1		2		2	3					2	3
CO4		2		1		3	2		3	1		3	
CO5	1		2		2			3			2		3

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective II -Probability Theory	5	0	0	4	Theory

Introduction: This paper provides knowledge on the building blocks of probability theory that are necessary to understand statistical inference.

Course Focus on: Skill development

Course Outcome:

CO1	:	To recall the basic concept of Probability and its axioms.
CO2	:	To understand the concept of independence and strong convergence.
CO3	:	To apply Law of large numbers and also random walk.
CO4	:	To classify the conditional expectations and conditional probabilities.
CO5	:	To prove the Central Limit theorem.
CO6	:	To develop the knowledge of Probability Theory in diverse situations.

Unit - I: **[12 Periods]**

Probability - Random Variables and Measurability Results, Expectations and the Lebesgue Theory, Image Measure and the Fundamental Theorem of Probability.

Unit - II: **[12 Periods]**

Independence and strong convergence- independence – convergence concepts, series and inequalities.

Unit - III: **[12 Periods]**

Law of Large Numbers, Applications to Empiric Distributions, Densities, Queuing and Random walk.

Unit - IV: **[12 Periods]**

Conditional Expectation, Conditional Probabilities. Probability Distributions and Characteristic Functions - Distribution Functions and Selection - Principle – Characteristic Functions, Inversion, and Levy's Continuity Theorem

Unit - V: **[12 Periods]**

Weak limit Laws – Classical Central Limit theorems – General limit laws, Including stability.

Text Book:

1. M.M. Rao, "Probability Theory with Applications " Academic Press, 1984.

Contents:

Unit I: Chapter 1: Sections: 1.1-1.4.

Unit II: Chapter 2: Sections: 2.1, 2.2.

Unit III: Chapter 2: Sections: 2.3, 2.4.

Unit IV: Chapter 3: Sections: 3.1, 3.2.

Chapter 4: Sections: 4.1, 4.2.

Unit V: Chapter 5: Sections: 5.1, 5.3.

Reference Books:

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.
3. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York,1996.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1		1		2			3		1	2		3	
CO2	2		3	1	2	2			3		2		1
CO3	1		2		1		1	3		3	2		2
CO4		1		2		3	2	2	1		1	2	
CO5	2	3	1	3		2	1			2		1	3

CO6		2		1	3		2	3	2		1	3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective III- Complex Analysis – II	6	0	0	4	Theory

Introduction:

This paper enables the students to understand the concept of series, sequences and various applications of Residues.

Course Focus on: Research

Course Outcome:

CO1	:	To analyze sequences and series of analytic functions and types of convergence.
CO2	:	To express analytic functions in terms of power series and Laurent series.
CO3	:	To describe basic properties of complex integration and having the ability to compute integrals.
CO4	:	To use power series and line integrals to construct differentiable functions.
CO5	:	To compute the residue of a function and use the residue theory to evaluate a contour integrals.
CO6	:	To apply this knowledge in the context of further applications.

Unit-I: **[12 Periods]**

Series: Convergences of Sequences – Convergences of Series – Taylor series – Proof of Taylor's Theorem – Examples – Laurent series – Proof of Laurent's theorem – Examples.

Unit-II: **[12 Periods]**

Series: Absolute and Uniform convergence of power series – continuity of sums of power series – Integration and differentiation of power series – Uniqueness of series representations – Multiplication and Division of power series.

Unit-III: **[12 Periods]**

Residues and Poles: Singularities and classifications- Types of singularities – Zeros and Poles – Residues –Cauchy's Residue theorem-Residues at poles – Zeros of analytic functions – problems.

Unit-IV: **[12 Periods]**

Application of Residues: Evaluation of Improper Integrals – Examples – Improper Integrals from Fourier Analysis – Jordan's Lemma.

Unit V: **[12 Periods]**

Application of Residues: Indented Paths – An Indentation, around a branch point – Integration Along a Branch cut – Definite Integrals Involving sines and cosines – Argument Principle – Rouche's Theorem.

Text Book:

1.R.V.Churchill and J.W.Brown, (1984) *Complex Variables and Applications*. McGraw Hill International Book Co., Singapore. (Third Edition).

Contents:

Unit I :	Chapter 5:	Sections 55-62.
Unit II:	Chapter 5:	Sections 63-67.
Unit III:	Chapter 6:	Section 68-76.
Unit IV:	Chapter 7:	Sections 78-81.
Unit V:	Chapter 7:	Sections 82-87.

Reference Books:

1. P. Duraipandian and LaxmiDuraipandian (1976) Complex Analysis: Emerald Publishers, Chennai.

2. S. Ponnusamy. (2000) Foundations of Complex Analysis, Narosa Publishing House, New Delhi.

3. Murray R. Spiegel. (2005) Theory and Problems of Complex Variable. Tata-Mcgraw Hill Edition, New Delhi.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2		1			3		1		2	3
CO2		3				2			3		2	3	
CO3	3	3			2		3	2		1		2	1
CO4		1		2		3			3	2	3		
CO5	1						3				2		1
CO6	3			1	2	2			1	3		1	2

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective III- Coding Theory	6	0	0	4	Theory

Introduction: This paper enables the learners to gain basic knowledge of Coding Theory.

Course Focus on: Skill development

Course Outcome:

CO1	:	To remember the basics of effects of error correction and detection.
CO2	:	To acquire knowledge about Linear codes.
CO3	:	To analyze the comparison of Parity check matrices.
CO4	:	To examine the knowledge of Some bounds for codes.
CO5	:	To classify some special Polynomials and words.
C06	:	To develop the practical knowledge on Real life problems.

Unit I: **[12 Periods]**

Basic assumptions – Correcting and detecting error patterns – information rate – effects of error correction and detection – finding the most likely code word transmitted.

Unit II: **[12 Periods]**

Linear codes – two important – subspaces independence – basic, dimension – matrices – Bases for C and C+ -

generating matrices on coding.

Unit III: **[12 Periods]**

Parity check matrices – equivalent codes – distance of a linear code – Linear codes – cosets – MLD for linear codes – Reliability of IMLD for linear codes.

Unit IV: **[12 Periods]**

Some bounds for codes – perfect codes – hamming codes – extended codes – The extended Golay code – decoding the extended Golay code – Golay code.

Unit V: **[12 Periods]**

Polynomials and words – introduction to cyclic codes – introduction to cyclic codes – Polynomial encoding and decoding – finding cyclic codes – Dual cyclic codes.

Text Book:

Coding theory, the essentials – Marcel Dekker, Inc. Madtrison Avenue, New york.

Contents:

Unit I - Chapter 1: Sections - 1. 1 - 1.6

Unit II - Chapter 2: Sections - 2.1 – 2.6

Unit III - Chapter 2: Sections - 2.7 – 2.12

Unit IV – Chapter 3: Sections - 3.1 - 3.7

Unit V - Chapter 4: Sections - 4.1 - 4.5

Reference Books:

1. "Error Control Coding", by Shu Lin and Daniel J. Costello, Jr., second edition, Prentice Hall, 2004.

2. Todd K. Moon, "Error Correction Coding", 1st Edition, Wiley-Interscience, 2006.

3. F. J. MacWilliams, N. J. A. Sloane, "The Theory of Error-Correcting Codes", North-Holland, Amsterdam, 1977

4. R. E. Blahut, "Algebraic Codes for Data Transmission", 1st Edition, Cambridge University Press 2003.

5. Cary W. Huffman, Vera Pless, "Fundamentals of Error-Correcting Codes", 1st Edition, Cambridge University Press, 2003.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3			1	2			2		1
CO2	1		2		1	2		3		3		2	
CO3		1	2				2		3	1		3	2

CO4	2	3			3	1		3		1	3		2
CO5		1		2		2			3	2		1	
CO6	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective III–Automata Theory and Formal Languages	6	0	0	4	Theory

Introduction: This paper provides knowledge Finite automata, regular languages, and pushdown automata which play a crucial role to identify different formal language classes and their relationship.

Course Focus on: Skill development

Course Outcome:

CO1	:	To acquire a fundamental understanding of the core concepts in automata theory and formal languages.
CO2	:	To design grammars and automata for different language classes.
CO3	:	To describe the types of grammar and derivation tree.
CO4	:	To apply context-free languages, push-down automata.
CO5	:	To design automata, regular expressions and context-free grammars accepting or generating a certain language.

Unit - I: **[12 Periods]**

Phrase Structure Languages: Introduction – phrase structure languages.

Unit - II: **[12 Periods]**

Closure Operations: Closure operations.

Unit - III: **[12 Periods]**

Context Free Languages : Context free languages.

Unit - IV: **[12 Periods]**

Finite State Automata: Finite state automata.

Unit - V: **[12 Periods]**

Push Down Automata : Push down automata.

Text Book:

1. Formal Languages and Automata- Rani Siromoney. (Revised edition 1984)(Published by the Christian Literary Society, Madras-3)Chapters 1 to 6.

Reference Books:

1. Formal languages and their relation automata-J.E. Hopcroft and D.Ullman(AddisionWesley1969).
2. Automata theory:Machines and Languages-Richard .Y.Kain(McGraw Hill1972) .

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective IV– Design Theory	6	0	0	4	Theory

Introduction:

This paper enables the students to gain knowledge on Balanced Designs, Difference sets, Finite Geometrics and Block designs, Hadamard matrices and Latin squares.

Course Focus on: Skill development

Course Outcome:

CO1	:	To understand about the basic concept of Balanced Designs.
CO2	:	To analyze Finite algebra, Difference sets and Difference method.
CO3	:	To gain knowledge on Finite Geometrics and Block Designs.
CO4	:	To learn about Hadamard Matrices and its applications.
CO5	:	To understand the concept of Latin Squares.

Unit I: **[12 Periods]**

Combinatorial Designs - Some Examples of Designs - Block Designs - System of Distinct Representatives – Pairwise Balanced Designs - Balanced Incomplete Block Designs.

Unit II: **[12 Periods]**

Finite algebra, Difference sets and Difference method Finite Fields - Quadratic Elements - Sums of Squares - Difference sets - Properties of Difference sets – General Methods.

Unit III: **[12 Periods]**

Finite Geometrics and Block Designs Finite affine planes - Construction of finite affine Geometries - Finite projective Geometries – Residual and derived designs - Existence theorem.

Unit IV: **[12 Periods]**

Hadamard Matrices Hadamard Matrices and Block Designs - Kronecker Product Constructions - Williamson's Method - Regular Hadamard Matrices.

Unit V: **[12 Periods]**

Latin Squares :Latin Square and Subsquares - Orthogonality - Idempotent Latin Squares- Transversal Designs – Spouse – Avoiding Mixed - Double Tournaments - Three Orthogonal Latin Squares.

Text Book :

1.W. D. Wallis, Combinatorial Designs, Marcel Dekker, INC, New York, 1988.

Contents:

Unit I:	Chapters 1 and 2
Unit II:	Chapters 3 and 4
Unit III:	Chapters 5 and 6: Section 5.1 to 5.3, 6.1 and 6.2
Unit IV:	Chapter 8
Unit V:	Chapter 10

Reference Books:

1. M. Hall, Combinatorial Theory, Second Edition, Wiley-Interscience, New York, 1986.
2. D.R. Stinson, Combinatorial Designs: Constructions and Analysis, Springer, 2004.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	1		2			2		3		3		2	
CO2		1	2				2		3	1		3	2
CO3	2	3			3	1		3		1	3		2

CO4		1		2		2			3	2		1	
CO5	2		2		3		3		1		3	2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective IV- Mathematical modeling	6	0	0	4	Theory

Introduction:

This paper enables the students to have brief knowledge about designing the mathematical models in terms of differential equations for given phenomena.

Course Focus on: Skill development

Course Outcome:

CO1	:	To recall the concepts of mathematical modeling in terms of differential equations.
CO2	:	To understand the idea about model design for given problems.
CO3	:	To analyze the procedure for physical phenomena.
CO4	:	To apply the design of models in terms of PDE.
CO5		To examine the various methods for obtain the models.
CO6	:	To apply the Mathematical Modeling through Graphs

Unit I: **[12 Periods]**

Simple Situations Requiring Mathematical Modeling - The Technique of Mathematical Modeling - Mathematical Modeling Through Differential Equations - Linear Growth and Decay Models - Non-Linear Growth and Decay Models - Compartment Models - Mathematical Modeling of Geometrical Problems Through Ordinary Differential Equations of first Order.

Unit II: **[12 Periods]**

Mathematical Modeling In Population Dynamics - Mathematical Modeling of Epidemics Through Systems of Ordinary Differential Equations of first Order - Compartment Models through Systems of Ordinary Differential Equations - Mathematical Modeling In Economics Through Systems of Ordinary Differential Equations of first Order.

Unit III: **[12 Periods]**

Mathematical Models in Medicine, Arms Race, Battles and International Trade In Terms of

Systems

of Ordinary Differential Equations - Mathematical Modeling of Planetary Motions - Mathematical Modeling of Circular Motion and Motion of Satellites - Mathematical Modeling through linear differential equations of second order.

Unit IV: **[12 Periods]**

Mathematical Modelling through Difference Equations : Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

Unit V: **[12 Periods]**

Mathematical Modelling through Graphs : Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs

Text Book:

1. J.N. Kapur, Mathematical Modelling, Wiley Eastern Limited, New Delhi, 1988.

Contents:

Unit 1:	Chapter 2,	Section 2.1 – 2.6
Unit 2:	Chapter 3,	Section 3.1 – 3.6
Unit 3:	Chapter 4,	Section 4.1 – 4.4
Unit 4:	Chapter 5,	Section 5.1 – 5.5
Unit 5:	Chapter 7,	Section 7.1 – 7.5

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				1		1		3	
CO2	3		2			3			3		2		1
CO3		3		1		2	2			2	3		1
CO4	3			3	1	1		3		1		2	
CO5		3		2			2	3		3	1		3
CO6	3		2		3				1			2	

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
	Elective IV- Astronomy	6	0	0	4	Theory

Introduction:

This course enables the students to learn about the Planetary motion in Kepler's law, Zones of earth and conversion of time.

Course Focus on: Employability

Course Outcome:

CO1	:	To apply the trigonometry concepts in astronomy.
CO2	:	To apply the mathematical concepts to explore planets.
CO3	:	To understand the concepts of zones of earth.
CO4	:	To analyze the concept of Kepler's laws of motion.
CO5	:	To develop knowledge about seasons and climate.
CO6	:	To discuss about the astronomical facts in conversion of time.

Unit I: **[12 Periods]**

Spherical Trigonometry – Sphere – Great circles and small circles – Axis and poles of a circle – Distance between two points on a sphere – Angle between two circles – Secondaries – Angular radius or spherical radius- Polar triangle – Relation between the elements of a Spherical triangle and its polar triangle.

Unit II: **[12 Periods]**

Principle of duality – Colunar and antipodal triangles - Relations between the sides and angles of a spherical triangle-Cosine formula -Sine formula -Cotangent formula-Supplemental cosine formula-Five parts formula-functions of half an angle – Functions of half a side Delambre's analogies-Napier's analogies – Napier's rules.

Unit III: **[12 Periods]**

The zones of earth – To trace the variations in the durations of day and night during the year at different stations-To find the duration of perpetual day in a place of latitude $\theta > 90 - w$ – To find analytically the conditions for perpetual day and night.

Unit IV: **[12 Periods]**

Kepler's Laws: Kepler's laws of planetary motion -Longitude of perigee -Forward motion of the apse line –To calculate the eccentricity of the earth's orbit around the sun -verification of Kepler's law - explanation of third law -Newton's deductions from Kepler's law –To derive Kepler's third law from Newton's law of gravitation –To find the mass of the planet – To fix the position of the planet in its elliptic orbit.

Unit V: **[12 Periods]**

Time: Equation of time – Analytical expression for the equation of the time – effect on the equation of time on the lengths of morning and evening -Stationary values of equation of time – Seasons -Causes of seasons -calendar – different kind of years -Julian date – Conversion of time - Relation between sidereal and mean times – standard times

Text Book:

1.Kumaravelu S and Susheela Kumaravelu," Astronomy for degree classes", 7th edition 1986.

Contents:

Unit I:	Chapter 1	Sections: 1 - 16. Pg.No : 1 – 10
Unit II:	Chapter 1	Sections: 18 - 32. Pg.No : 11 – 24
Unit III:	Chapter 3	Sections: 87 – 90 Pg.No : 90 -103
Unit IV:	Chapter 6	Sections: 146 - 165. Pg.No : 172 – 197
Unit V:	Chapter 7	Sections: 166 -188 Pg.No : 198 – 222

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2					3		2		3	
CO2	1	3		2				3			3		1
CO3		1				2	3			1	2		3
CO4		2		2		3			3	2		1	
CO5	1	1				2	1		3		3	2	
CO6	1			2	3	2			3		1		3