GURU NANAK COLLEGE
(AUTONOMOUS)

VELACHERY ROAD, CHENNAI – 600042

(Re-accredited at 'A-Grade' by NAAC) Affiliated to University of Madras

B.Sc. Mathematics

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

SYLLABUS

(For the candidates admitted for the Academic year 2022-23 and thereafter)

PREAMBLE

Mathematics has been contemplated as a fundamental to the development of Science and Technology. The extent of Mathematics to real world problems has increased by leaps and bounds. This Mathematics program aims to provide a foundation for pursuing research in Mathematics as well as to provide essential quantitative skills to those who interested in related fields In IT industry, there is a large demand for people with strong analytical skills and logical thinking background in the Mathematical Sciences. The undergraduate curriculum in Mathematics is structured in such a way that the students acquire in depth knowledge to perceive the principles of core and elective papers. The comprehensive curriculum design yields an extra-ordinary career opportunities in various sectors and in every domain of contemporaries.

LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

From the Academic Year (2021-22) and there after

Vision

To create an integrated teaching-learning, research and outreach unit on par with global standards that demonstrates the enhancement achievable in all spheres of life through mathematics education.

Mission

- ⊡ To provide an ambience where students can learn, build on their skills and become competent users of Mathematics.
- ⊡ To develop critical mathematical thinking and utilize it to solve challenging problems in various applications.
- ⊡ To involve students in numerous projects this will expand their core subject interest, and help improve their analytical and logical reasoning skills.
- ⊡ To conduct pedagogical training, workshops and conferences for faculty facilitating self-progression.
- ⊡ To conduct outreach programs for socially excluded financially backward students and special children.
- ⊡ To educate students the importance of moral values and develops self-discipline, self-reliance.
- ⊡ To impart the essence of mathematics and to become frontiers in the field.

PROGRAMME OUTCOME

After completion of the programme, the student will be able to

PO 1: Demonstrate ability to formulate most suitable mathematical problems for real-time occurrences

PO 2: Enhanced critical thinking, analytical and computational skills necessary in today's society

PO 3: Develop the ability to understand, develop the mathematical concepts both numerically and graphically and enhance problem solving skills.

PO 4: Provide for professional cadres in the field of mathematics to support national development programs within public and higher education institutes.

PO 5: Build ability to contemplate latest scientific research techniques in the field

PROGRAMME SPECIFIC OUTCOME

The students at the time of graduation will be able to

PSO 1: Students will possess subject knowledge and skills required for progression in terms of higher education in mathematical/ applied fields or professional cadres.

PSO 2: Students will develop the ability to think independently and be able to cater to the needs of the society in local and global levels.

GURU NANAK COLLEGE (AUTONOMOUS)

VELACHERY, CHENNAI – 42.

B.Sc., DEGREE COURSE IN MATHEMATICS

Course Structure for 2022 – 2025 batch

Sem.	Part	Course Component	Subject Name	Hours	Credits	Internal	External	Total
I	I	Language	Tamil - I / Hindi - I	6	3	50	50	100
	II	English	English - I	6	3	50	50	100
	III	Core Paper 1	Algebra	4	4	50	50	100
		Core Paper 2	Differential Calculus	4	4	50	50	100
		Allied - I	Chemistry - I	5	3	50	50	100
		Allied Practical	Allied Chemistry Practical - I	3	*	*	*	*
	IV	NME	Functional Mathematics - I	2	2	50	50	100
		Soft Skill	Soft Skill - I	*	3	50	50	100
Total Hours = 30					**Total credits = 22**			
II	I	Language	Tamil – II/Hindi - II	6	3	50	50	100
	II	English	English - II	6	3	50	50	100
	III	Core Paper 3	Trigonometry and Number Theory	4	4	50	50	100
		Core Paper 4	Analytical Geometry	4	4	50	50	100
		Allied - II	Chemistry - II	5	3	50	50	100
		Allied Practical	Allied Chemistry Practical - II	3	4	50	50	100
	IV	NME	Functional Mathematics - II	2	2	50	50	100
		Soft Skill	Soft Skill - II	*	3	50	50	100
Total Hours = 30					**Total credits = 26**			
III	I	Language	Tamil – III/Hindi - III	6	3	50	50	100
	II	English	English – III	6	3	50	50	100
	III	Core Paper 5	Differential Equations and Laplace Transforms	4	4	50	50	100
		Core Paper 6	Integral calculus and Vector Analysis.	4	4	50	50	100
		Allied - III	Physics - I	5	3	50	50	100
		Allied Practical	Allied Physics Practical - I	3	*	*	*	*
	IV	EVS	Environmental Studies	2	*	*	*	*
		Soft Skill	Soft Skill - III	*	3	50	50	100
Total Hours = 30					**Total credits = 20**			

B.Sc., DEGREE COURSE IN MATHEMATICS

Course Structure for 2022 – 2025 batch

Sem.	Part	Course Component	Subject Name	Hours	Credits	Internal	External	Total
IV	I	Language	Tamil – IV/Hindi - IV	6	3	50	50	100
	II	English	English – IV	6	3	50	50	100
	III	Core Paper 7	Mathematical Statistics	4	4	50	50	100
		Core Paper 8	Statics	4	4	50	50	100
		Allied - IV	Physics – II	5	3	50	50	100
		Allied Practical	Allied Physics Practical - II	3	4	50	50	100
	IV	EVS	Environmental Studies	2	2	50	50	100
		Soft Skill	Soft Skill - IV	*	3	50	50	100
Total Hours = 30 Total credits = 26								
V	III	Core Paper 9	Algebraic Structures	6	4	50	50	100
		Core Paper 10	Real Analysis - I	6	4	50	50	100
		Core Paper 11	Dynamics	6	4	50	50	100
		Core Paper 12	Programming Language C with Practical's	6	4	50	50	100
		Elective I (IDE)	Numerical Analysis	6	5	50	50	100
			Value Education	*	2	50	50	100
		Internship		*	2	*	*	*
Total Hours = 30 Total credits = 25								
VI	III	Core Paper 13	Linear Algebra	6	4	50	50	100
		Core Paper 14	Real Analysis - II	6	4	50	50	100
		Core Paper 15	Complex Analysis	6	4	50	50	100
		Elective – II	Operations Research	6	5	50	50	100
		Elective - III	Graph Theory	6	5	50	50	100
	V		Extension Activities	*	1	*	*	*
	Total Hours = 30 Total credits = 23							
	OVERALL CREDITS TOTAL = 142							

SEMESTER - I

CORE THEORY - 1: ALGEBRA

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - I	CREDITS: 4	TOTAL HOURS: 60

COURSE FRAMEWORK:

To develop the knowledge on linear, polynomial, exponential, and logarithmic functions, matrices and systems of equations with an emphasis on problem solving and multiple representations.

COURSE OUTCOME:

After learning the concepts of this subject the student will be able to

1. Concept of matrix and determinant over real or complex numbers, in particular, symmetric and skew-symmetric matrices, Orthogonal, Unitary & Hermitian matrices. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations.
2. Application of Cayley - Hamilton theorem, find the characteristic equation, eigen values and corresponding eigenvectors of a given matrix.
3. Know the application of relations between the roots and coefficients of an equation, analyze the method of solving reciprocal equations and diminishing the roots of an equation.
4. Examine the nature of roots of an equation and determine the roots by using Newton's and Horner's methods.
5. Gain knowledge about binomial, exponential, logarithmic series and solve the problems based on this series.

UNIT I

Matrices: Symmetric; Skew Symmetric; Hermitian; Skew Hermitian; Orthogonal and Unitary Matrices; Rank of a matrix; Consistency and solutions of Linear Equations.

Chapter 2 : Sections 6.1, 6.2, 6.3, 9.1, 11, 16. **(12 hrs)**

UNIT II

Matrices: Cayley-Hamilton theorem; Eigen values; Eigen Vectors; Similar matrices; Diagonalization of a matrix.

Chapter 2: Sections 16, 16.1, 16.2, 16.3. **(12 hrs)**

UNIT III

Theory of Equations: Polynomial equations; Imaginary and irrational roots; Symmetric functions of roots in terms of coefficients; Reciprocal equations, Transformations of equations, Increasing and Decreasing of a roots of the equation.

Chapter 6: Sections 9 to 12, 15, 15.1, 15.2, 15.3, 16, 16.1, 16.2. **(12 hrs)**

UNIT IV

Theory of Equations: Descartes' rule of signs: Approximate solutions of roots of polynomials by Newton-Raphson method- Hornet's method; Cardan's method of solution of a cubic polynomial

Chapter 6: Sections 24, 24.1, 24.2, 24.3, 29.4, 30, 34.1. **(12 hrs)**

UNIT V

Summation of series: Binomial, Exponential and Logarithmic series (theorems without proof); Summation of finite series using method of differences.
Chapter 3: Section 10; Chapter 4: Sections 3, 5, 6, 7. **(12 hrs)**

Content and treatment as in Algebra- Volume I (2018) and II (2015) by T.K. Manikavachagom Pillai and others (Viswanathan publishers).

REFERENCE BOOKS:

1. Algebra: S.Arumugam (New Gama Publishing house, Palayamkottai)
2. Higher Algebra: H.S Hall and S.R.Knight (HM Publications-1994)
3. Algebra, Analytical Geometry (2D) and Trigonometry: Dr.S.Sudha (Emerald Publishers)
4. Algebra and Trigonometry (I&II): P.R.Vittal (Margham Publishers)

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY – 2: DIFFERENTIAL CALCULUS

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - I	CREDITS: 4	TOTAL HOURS: 60

COURSE FRAMEWORK:

Introduction to fundamental concepts of Calculus.

COURSE OUTCOMES:

On completion of the course, students would be able to

1. Find the derivative of mathematical functions using appropriate methods including algebraic and graphical approach.
2. Identify the difference between average rates of change and instantaneous rates of change and solve problems in successive differentiation, total derivatives, partial derivatives, Jacobians.
3. Construct a mathematical model describing real life situation in which an output value depends on two or more input values and to assess the optimal values of such functions.
4. Estimate the radius and centre of curvature, envelope, evolute and pedal equation of a given curve.
5. Evaluate asymptotes of a function applying derivatives.

UNIT I

Differential Calculus: n^{th} Derivative; Leibnitz's theorem (without proof) and its applications; Partial differentiations, Total differentials; Jacobians. **(12 hrs)**
Chapter 3: Sections 1.1 to 1.6, 2.1, 2.2.

UNIT II

Differential Calculus: Maxima and Minima of functions of two independent variables, Necessary and sufficient conditions (without proof); Lagrange's method (without proof)
Chapter 8: Sections 4, 5. **(12 hrs)**

UNIT III

Curvature: Curvature; radius of curvature in Cartesian and polar coordinates; p-r equations;
Chapter 10: Sections 2.1, 2.3, 2.6, 2.7. **(12 hrs)**

UNIT IV

Centre of curvature, circle of curvature, envelopes, evolutes. **(12 hrs)**
Chapter 10: Sections 1.1 to 1.4, 2.2, 2.4.

UNIT V

Asymptotes: Methods (without proof) of finding asymptotes of rational algebraic curves with special cases, Intersections of a curve with its asymptotes. **(12 hrs)**
Chapter 11: Sections 1 to 4, 5.1 to 5.3, 6, 7.

Content and Treatment as in Calculus by S.Narayanan, T.K.Manickavachagom Pillai Volume I (2018) (Viswanathan Publishers).

REFERENCE BOOKS:

1. Calculus: Dr. S. Sudha (Emerald Publishers)
2. Calculus (I&II): P.R.Vittal (Margham Publishers)
3. Calculus (I & II): Tom M Apostol
4. Differential Calculus by Shanthi Narayan, Dr. K. Mittal
5. Differential Calculus and its Applications by Michael J Field.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

NON - MAJOR ELECTIVE: FUNCTIONAL MATHEMATICS - I

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - I	CREDITS: 2	TOTAL HOURS: 30

COURSE OUTCOMES:
On completion of the course, students would be able to

1. Explain and apply the concepts of Ratio & Proportion
2. Evaluate Percentages
3. Estimate Profit & loss, discounts.
4. Determine Simple and compound interest.
5. Formulate simultaneous system of equations and Solve problems on ages and numbers.

UNIT I **(6 hrs)**
Ratio and Proportion
Chapter 12

UNIT II **(6 hrs)**
Percentages
Chapter 10

UNIT III **(6 hrs)**
Profit and Loss, Discounts.
Chapter 11

UNIT IV **(6 hrs)**
Simple Interest and Compound Interest
Chapters 21, 22.

UNIT V **(6 hrs)**
Solutions of Simultaneous equations and problems on ages and two digit numbers.
Chapters 7,8.

Book for Reference: Quantitative Aptitude R. S. Agarwal.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

Distribution of Questions:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

SEMESTER - II

CORE THEORY– 3: TRIGONOMETRY AND NUMBER THEORY

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - II	CREDITS: 4	TOTAL HOURS: 60

COURSE FRAMEWORK:

The student will have developed the ability to recognize and correctly manipulate trigonometric expressions, identities, equations, prime numbers, congruence's, Euler-Fermat's and Wilson's theorems to prove relations involving prime numbers.

COURSE OUTCOMES:

After learning the concepts of this subject the student will be able to

1. Understand the concepts of circular, hyperbolic, inverse hyperbolic functions and solving problems.
2. Evaluate the sum of different types of trigonometrical series and understand its applications.
3. Understand and apply the concepts of logarithm of complex numbers.
4. Understand the basic concepts of number theory and gain the ability to solve the problems related to them.
5. Understand the concept of Fermat's theorem, Wilson's theorem and gain the ability to solve the problems related to them.

UNIT I

Trigonometry: Expansions of $sinx, cosx, tanx$ in terms of x; Expansion of $sinnx,\ cosnx,\ tannx,\ sin^n x, cos^n x, sin^m x cos^n x$, hyperbolic and inverse hyperbolic functions.
Chapter 3: Sections 1, 2, 3, 4, 4.1, 5, 5.1.; Chapter 4: 1, 2, 2.1, 2.2, 2.3. **(12 hrs)**

UNIT II

Summation of series: Sums of sines and cosines of n angles which are in A.P.; Summation of trigonometric series using telescopic method, C+iS method. **(12 hrs)**
Chapter 6: Sections 1, 2, 3.

UNIT III

Logarithms of Complex numbers. (**12 hrs)**
Chapter 5: Sections 5, 5.1, 5.2.

UNIT IV

Number Theory: Prime number; Composite Number; decomposition of a composite number as a product of primes uniquely (without proof); divisors of a positive integer n; congruence modulo n.
Chapter 5: Sections 1 to 11. **(12 hrs**)

UNIT V

Number Theory: Euler function (without proof); highest power of a prime number p contained in $n!$; Fermat's and Wilson's theorems. **(12 hrs)**
Chapter 5: Sections 12 to 17.

Content and treatment as in

1. Trigonometry by T.K.Manikavachagom Pillai and others (Viswanathan publishers) (2018) for units I, II, III.
2. Algebra- Volume I (2018) and II (2015) by T.K.Manikavachagom Pillai and others (Viswanathan publishers) for units IV, V.

REFERENCE BOOKS:

1. Trigonometry: P.Duraipandian (Emerald Publishers)
2. Plane Trigonometry Part 2: S.L.Loney
3. Algebra and Trigonometry (I&II): P.R.Vittal (Margham Publishers)

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY– 4: ANALYTICAL GEOMETRY

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - II	CREDITS: 4	TOTAL HOURS: 60

COURSE FRAMEWORK:

To enable vivid description of 2D & 3D geometry graphically and correlate the same algebraically.

COURSE OUTCOMES:

On completion of the course, students would be able to

1. Interpret a general second-degree equation into corresponding conic section and formulate equations of conics in 2D space.
2. Compute the pole, polar, co normal and concyclic points of the different types of conics.
3. Illustrate the properties and solve problems on conjugate diameters and asymptotes of certain types of conics.
4. Derive the various forms of equations of a plane, apply them in problem solving and also evaluate interplanar angle/ distance.
5. Describe a sphere in 3D, discuss its equation, explain and apply the concepts of tangent plane, plane section of a sphere, orthogonal spheres.

UNIT I

Parabola: pole, polar, co-normal points, concyclic points.
Ellipse: pole, polar, conormal points, conjugate lines, conjugate diameters. **(12 hrs)**
Chapter 6: Sections 4, 5, 6, 6.1, 8, 8.1, 8.2, 10, 11, 12; Chapter 7: Sections 5, 6, 7, 7.1, 7.2, 10, 10.1, 12, 12.1, 16, 16.3 (1) to (5).

UNIT II

Hyperbola: asymptotes, conjugate diameters.
Rectangular Hyperbola: conormal points, concyclic points. **(12 hrs)**
Chapter 6: Sections 8, 9, 10, 12, 13.

UNIT III

Planes: Planes; General equation of a plane; normal form; intercept form; intersection of planes; angle between planes. **(12 hrs)**
Chapter 2: Sections 1 to 7, 9.

UNIT IV

Straight Lines: Straight Lines; symmetric form; coplanar lines; shortest distance; image of a point and a line on a plane. **(12 hrs)**
Chapter 3: Sections 1 to 4, 7, 8.

UNIT V

Sphere: Equation of a sphere; general equation; section of a sphere by a plane; tangent plane; orthogonal spheres. **(12 hrs)**
Chapter 4: Sections 1 to 8.

Content and treatment as in Analytical Geometry – Part I & II (2017): T.K.Manikavachagom Pillay, T.Natarajan (Viswanathan Publishers) – Part 1 for units I, II; Part 2 for units III, IV, V.

REFERENCE BOOKS:

1. Analytical Geometry of 2 dimensions: P.Duraipandian
2. Coordinate Geometry: Dr. P. Balasubramanian and Others (McGraw Hill Publishers)
3. Calculus and coordinate geometry of two dimensions: P.R.Vittal (Margham Publishers)
4. Coordinate Geometry of 3 Dimensions and probability: P.R.Vittal (Margham Publishers)

QUESTION PAPER PATTERN:

Section	Question Component	Number	Mark	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

NON - MAJORELECTIVE: FUNCTIONAL MATHEMATICS – II

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - II	CREDITS: 2	TOTAL HOURS: 30

COURSE OUTCOMES:

On completion of the course, students would be able to

1. Relate and interpret the concepts of Time and work, pipes and cisterns.
2. Determine Speed, time and distance, relative speeds; illustrate problems on races.
3. Solve problems on boats and streams, trains.
4. Explain and apply the concepts of Mensuration.
5. Evaluate Stocks and shares.

UNIT I **(6 hrs)**

Time and work – pipes and cisterns – Problem.

Chapters 15, 16.

UNIT II **(6 hrs)**

Time and distance – Relative speeds – Problems on Races.

Chapter 17, 26.

UNIT III **(6 hrs)**

Boats and Streams, Problems on Trains

Chapter 18,19.

UNIT IV **(6 hrs)**

Mensuration

Chapters 24, 25.

UNIT V **(6 hrs)**

Stocks & Shares

Chapter 29

Book for Reference: Quantitative Aptitude R. S. Agarwal.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

SEMESTER - III

CORE THEORY– 5: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

SUBJECT CODE:	**THEORY**	**MARKS: 100**
SEMESTER - III	**CREDITS: 4**	**TOTAL HOURS: 60**

COURSE FRAMEWORK:

To determine how differential equations can be used in solving many applicable oriented problems and Laplace transformation as a tool for solving it.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Analyzing the solution of real-world situation modelby applying differential concept. Solve the differential equations, and interpret the solutions. In particularly finding a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y.
2. Compute all the solutions of second and higher order linear differential equations with constant coefficients.
3. Form partial differential equations. Finding the solution of the Lagrange's form of the First order partial differential equations for some standard types.
4. Finding the solution of the First order partial differential equations for some standard types.
5. Define Laplace transform and Use inverse Laplace transform to return familiar functions. Apply Laplace transform to solve second order linear differential equation and simultaneous linear differential equations

UNIT I

Ordinary Differential Equations: First order but of higher degree equations- solvable for p, solvable for x, solvable for y, Clairaut's form. **(12 hrs)**

Chapter 4: Sections 1 to 4.

UNIT II

Ordinary Differential Equations: Second order differential equations with constant coefficients with particular integrals for e^{ax} x^m, $e^{ax}\sin mx$, $e^{ax}\cos mx$. Second order differential equations with variable coefficients $ax^2\frac{d^2y}{dx^2} + bx\frac{dy}{dx} + cy = q(x)$, Method of variation of parameters. **(12 hrs)**

Chapter 5: Sections 1 to 6, Chapter 8: Section 4.

UNIT III

Partial Differential Equations: Formation of PDE by eliminating arbitrary constants and arbitrary functions; Lagrange's equations Pp+Qq=R. **(12 hrs)**

Chapter 12: Sections 1 to 4.

UNIT IV

Partial Differential Equations: complete integral; singular integral; general integral; Charpit's method and standard types f(p,q)=0, f(x,p,q)=0, f(y,p,q)=0, f(z,p,q)=0, f(x,p)= f(y,q); Clairaut's form. **(12 hrs)**

Chapter 12: Sections 5 and 6.

UNIT V

Laplace transform: Laplace transform; inverse Laplace transform(usual types); applications of Laplace transform to solution of first and second order linear differential equations(constant coefficients) and simultaneous linear differential equations. **(12 hrs)**

Chapter 9.

Content and treatment as in **Differential Equations and Laplace Transforms** by S.Natarajan T.K.Manikavachagom Pillay (2017), (Viswanathan Publishers).

REFERENCE BOOKS:

1. Integral Calculus and differential equations: Dipak Chatterjee (Tata McGraw Hill Publishing Comp Ltd)
2. Advanced Engineering Mathematics: Erwin Kreyszig (John Wiley and sons New York 1999)
3. Calculus: Narayanan and others (S.Viswanathan Publishers)
4. Differential Equations and Integral Transforms: Dr.S.Sudha (Emerald Publishers)

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

THEORY – 6: INTEGRAL CALCULUS AND VECTOR ANALYSIS

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - III	CREDITS: 4	TOTAL HOURS: 60

COURSE FRAMEWORK:

To expose the students to various techniques of vector calculus, Fourier series and Fourier transforms.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Understand the reduction formula, properties of beta and gamma functions.
2. Demonstrate integrate more complicated functions using standard methods of integration such as integration by change of order to find the area and volume using Cartesian Coordinate.
3. Analyse various periodic functions and trigonometric series.
4. Apply various integral functions to a system , to evaluate various properties.
5. Apply various differential functions to a system and to understand the theorem associated with it.

UNIT I

Integral calculus: Reduction Formula for $\int_0^{\frac{\pi}{2}} sin^m x\, cos^n x\, dx$, $\int_0^{\frac{\pi}{2}} cos^m x cosnx dx$, $\int_0^{\frac{\pi}{2}} cos^m x\, sin\, nx\, dx$, Beta and Gamma functions, properties. **(12 hrs)**

Chapter 1: Sections 1.3, 13.1 to 13.5, 13.10.

UNIT II

Multiple Integrals: Double integrals, Change of order of integration, triple integrals, area and volume using Cartesian coordinates. **(12 hrs)**

Chapter 5: Sections 2.1, 2.2, 6.3.

UNIT III

Fourier series: Introduction, Expansions of periodic function of period 2π; expansion of even and odd functions; half range cosine and sine series. **(12 hrs)**

Chapter 2: Sections 1, 2, 3,3.1,3.2,4,5.1,5.2.

UNIT IV

Vector Differentiation: Gradient, divergence, curl, directional derivative, unit normal vector to a surface. **(12 hrs)**

Chapter 8: Sections 17, 18, 19, 21.

UNIT V

Vector Integration: Line, Surface and volume integrals; theorems of Gauss, Stroke's and Green (without proof) -problems. **(12 hrs)**

Chapter 8: Sections 2, 5, 6, 8.2, 9, 10.

Contents and treatment as in

1. Calculus Volume II (2018), by S.Narayanan, T.K.Manickavachagom Pillai S.Viswanathan Publishers) for units I, II.
2. Vector Calculus by P. Kandalama, Thilagavathi for units III, IV, V.

REFERENCE BOOKS:

1. Vector Analysis: Murray Spiegel (Schaum Publishing Company, New York)
2. Integral calculus and differential equations by Dipak Chatterjee (TATA McGraw Hill Publishing company Ltd.)
3. Integral Calculus by Shanti Narayanan
4. Vector Algebra and Analysis by S.Narayanan, T.K.Manickavachagom Pillai (S. Viswanathan Publishers.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

SEMESTER - IV

CORE THEORY – 7: MATHEMATICAL STATISTICS

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - IV	CREDITS: 4	TOTAL HOURS: 60

COURSE FRAMEWORK:

To understand the fundamental concept of Statistics and to learn the real life application of statistics.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. The difference between qualitative and quantitative data, be able to organize the data and present a meaningful overview of the data through the use of frequency distributions. Compute the measures of central tendency (i.e. the mean, median and mode) and measures of dispersion (i.e. the variance, standard deviation and coefficient of variation
2. Calculate the correlation coefficient for the given data. Compute Rank correlation for the given data. Also compute the lines of regression, Regression coefficients and its properties.
3. Define probability density function, probability distribution, Discuss the moment generating functions and Probability generating functions.
4. Define the cumulants, characteristic function, and proving the Chebyshev's inequality. For the given date we will fit the following curve straight line, parabola, power curve, exponential curves.
5. Set up and work with discrete random variables. In particular, understand the Bernoulli, binomial, geometric and Poisson distributions. Work with continuous random variables. In particular, know the properties of uniform, normal and exponential distributions.

UNIT I

Statistics: Introduction, measures of central tendency- measures of dispersion- skewness-kurtosis. **(12 hrs)**

Chapter 2 - 2.1 to 2.11(omit 2.11.1) Chapter 3 - 3.1 to 3.12 (omit 3.9.2, 3.9.3, 3.9.4)

UNIT II

Correlation: scatter diagram, Karl-Pearson coefficient of correlation - Probable error of correlation coefficient, Rank correlation.

Regression: - Lines of regression, Regression coefficients and its properties, angle between two lines of regression. **(12 hrs)**

Chapter 10 - 10.1 to 10.6.1 (omit 10.4), 10.7: 10.7.1, 10.7.3 to 10.7.5

UNIT III

Cumulants, Characteristic function – Uniqueness and inversion theorems (Statements and applications only), Chebychev's inequality.

Curve fitting and principle of least square: Fitting of straight line, parabola, power curve, exponential curves. **(12 hrs)**

Chapter 6 - 6.10 to 6.12. Chapter 9 - 9.1,9.3.

UNIT IV

Random Variables (Discrete and continuous), Distribution function- Expected values, variance Moment generating function- probability generating function. **(12 hrs)**
Chapter 5 - 5.1 to 5.4.1, 5.4.3 Chapter 6: 6.1, 6.9 sec. 6.9.1.

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UNIT V

Standard distributions – Binomial, Poisson, Normal and Uniform distributions-Geometric, Exponential, Inter- relationship among distributions. **(12 hrs)**
Chapter 7 - 7.2.1 to 7.2.3, 7.2.5 to 7.2.8, 7.3.1 to 7.3.7. Chapter 8 - 8.1 to 8.1.4, 8.2 to 8.2.9, 8.3, 8.6.

Content and treatment as in **"Elements of Mathematical Statistics"** by S.C Gupta and V.K.Kapoor (Third Edition), S.Chand Publishers.

REFERENCE BOOKS:

1. Hogg R.V. & Craig A.T. 1988): Introduction to Mathematical Statistics, Mcmillan.
2. Mood A.M & Graybill F.A & Boes D.G (1974) : Introduction to theory of Statistics, Mcgraw Hill.
3. Dr.P.R.Vittal, Mathematical Statistics, Margham publications.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY – 8: STATICS

SUBJECT CODE:	**THEORY**	**MARKS: 100**
SEMESTER - IV	**CREDITS: 4**	**TOTAL HOURS: 60**

COURSE FRAMEWORK:

To provide a basic knowledge of the behavior of various types of forces to give enough working knowledge to handle practical problems.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Study about Newton's law of forces and its impact on a particle under different condition.
2. Analyze about a body under forces.
3. Study about coplanar forces.
4. Apply differentiation to study about the stability of equilibrium.
5. Evaluate the virtual work by various methods.

UNIT I

Newton's laws of motion - resultant of two forces on a particle- Equilibrium of a particle- Limiting Equilibrium of a particle on an inclined plane **(12 hrs)**

Chapter 2: Sections 2 .1, 2.2, Chapter 3 - Sections 3.1 and 3.2

UNIT II

Forces on a rigid body – moment of a force – general motion of a rigid body- equivalent systems of forces – parallel forces – forces along the sides of a triangle – couples.

Chapter 4: Sections 4 .1 to 4.6 **(12 hrs)**

UNIT III

Resultant of several coplanar forces- equation of the line of action of the resultant- Equilibrium of a rigid body under three coplanar forces – Reduction of coplanar forces into a force and a couple.-problems involving frictional forces. **(12 hrs)**

Chapter 4: Sections 4.7 to 4.9, Chapter 5: Sections 5.1, 5.2

UNIT IV

Centre of mass – finding mass centre – a hanging body in equilibrium – stability of equilibrium – stability using differentiation. **(12 hrs)**

Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1, 7.2

UNIT V

Virtual work – hanging strings- equilibrium of a uniform homogeneous string – suspension bridge. **(12 hrs)**

Chapter 8: Sections 8.1, Chapter 9: Sections 9.1, 9.2

Contents and treatment as in **"Mechanics** – P. Duraipandian , Laxmi Duraipandian , Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

REFERENCE BOOKS:

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

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

SEMESTER - V

CORE THEORY– 9: ALGEBRAIC STRUCTURES

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - V	CREDITS: 4	TOTAL HOURS: 90

COURSE FRAMEWORK:

To provide fundamentals of Mechanical systems that are rudiments for the theory of relativity.

COURSE OUTCOMES:

After learning the concepts of this subject the student will be able to

1. Recognize the mathematical objects called groups. Link the fundamental concepts of groups. Analyze consequences of Lagrange's theorem.
2. Explain the significance of the notions of cosets, normal subgroups, factor groups, homomorphism and automorphism.
3. Learn about structure preserving maps between groups and their con sequences such as Cayley's Theorem, Permutation groups.
4. Apply the fundamental concepts in ring theory such as ideals, quotient rings.
5. Learn about field of quotients of an integral domain, Euclidean Rings.

UNIT I

Introduction to groups. Subgroups, cyclic groups and properties of cyclic groups; Lagrange's Theorem; A counting principle. **(18 hrs)**

Chapter 2: Section 2.4 and 2.5

UNIT II

Normal subgroups and Quotient group; Homomorphism; Automorphism. **(18 hrs)**

Chapter 2: Section 2.6 to 2.8

UNIT III

Cayley's Theorem; Permutation groups. **(18 hrs)**

Chapter 2: Section 2.9 and 2.10

UNIT IV

Definition and examples of ring- Some special classes of rings; homomorphism of rings; Ideals and quotient rings; More ideals and quotient rings. **(18 hrs)**

Chapter 3: Section 3.1 to 3.5

UNIT V

The field of quotients of an integral domain; Euclidean Rings; The particular Euclidean ring.

Chapter 3: Section 3.6 to 3.8 **(18 hrs)**

Contents and treatment as in "**Topics in Algebra"** – I. N. Herstein, Wiley Eastern Ltd.

REFERENCE BOOKS:

1. Modern Algebra by M.L.Santiago
2. Modern Algebra by S. Arumugam and others, New Gamma publishing House, Palayamkottai.
3. Modern Algebra by Visvanathan Nayak.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY– 10: REAL ANALYSIS I

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - V	CREDITS: 4	TOTAL HOURS: 90

COURSE FRAMEWORK:

To introduce the fundamentals concepts of Mathematical analysis and to develop the mathematical concepts in advanced level.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Define countable, uncountable sets and its properties with examples.
2. Define different types of sequence with examples and discuss about the limit of the sequence.
3. Prove properties of convergent and divergent sequence. And discuss about the limit inferior, limit superior and Cauchy sequence.
4. Different types of test used for testing the convergence of the series and discuss about the class l^2.
5. Demonstrate an understanding of limits of a function , continuous function in metric spaces.

UNIT I

Sets and elements; Operations on sets; functions; real valued functions; equivalence; countability; real numbers; least upper bounds. **(18 hrs)**

Chapter 1: Sections 1.1 to 1.7

UNIT II

Definition of a sequence and subsequence; limit of a sequence; convergent sequences; divergent sequences; bounded sequences; monotone sequences. **(18 hrs)**

Chapter 2: Sections 2.1 to 2.6

UNIT III

Operations on convergent sequences; operations on divergent sequences; limit superior and limit inferior; Cauchy sequences. **(18 hrs)**

Chapter 2: Sections 2.7 to 2.10

UNIT IV

Convergence and divergence; series with non-negative numbers; alternating series; conditional convergence and absolute convergence; tests for absolute convergence; series whose terms form a non-increasing sequence; the class l^2. **(18 hrs)**

Chapter 3: Sections 3.1 to 3.4, 3.6, 3.7 and 3.10

UNIT V

Limit of a function on a real line;. Metric spaces; Limits in metric spaces. Function continuous at a point on the real line, reformulation, Function continuous on a metric space. **(18 hrs)**

Chapter 4: Section 4.1 to 4.3 Chapter 5 Section 5.1-5.3

Contents and Treatment as in "**Methods of Real Analysis"**: Richard R. Goldberg (Oxford and IBH Publishing Co.)

REFERENCE BOOKS:

1. Principles of Mathematical Analysis by Walter Rudin
2. Mathematical Analysis Tom M Apostol.

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY– 11: DYNAMICS

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - V	CREDITS: 4	TOTAL HOURS: 90

COURSE FRAMEWORK:

To provide cogent knowledge on the basic principles and applications of varied dynamical systems in real life.

COURSE OUTCOMES:

On completion of the course, students would be able to

1. Explain in detail the fundamentals of vector analysis and kinematics.
2. Derive the equations of motion for a Rectilinear motion under constant/ varying forces and apply in problems of physical sciences.
3. Elucidate the theory of work, energy &power, examine relationship between them and solve practical problems.
4. Formulate and solve real-life mathematical model pertaining to concepts of Projectile motion and impact analysis.
5. Analyze various aspects of two-dimensional motion, evaluate Moment of Inertia of 2D, 3D objects and explore the theory of dimensions.

UNIT I

Basic units – velocity – acceleration- coplanar motion – rectilinear motion under constant forces – acceleration and retardation – thrust on a plane – motion along a vertical line under gravity – motion along an inclined plane – motion of connected particles.

Chapter 1: Sections 1.1 to 1.4, Chapter 10: Sections 10.1 to 10.3, 10.5, 10.6 **(18 hrs)**

UNIT II

Work, Energy and power – work – conservative field of force – power – Rectilinear motion under varying Force simple harmonic motion (S.H.M.) – S.H.M. along a horizontal line- S.H.M. along a vertical line – motion under gravity in a resisting medium.

Chapter 11: Sections 11.1 to 11.3, Chapter 12: Sections 12.1 to 12.4 **(18 hrs)**

UNIT III

Forces on a projectile- projectile projected on an inclined plane, impact – impact of sphere - impact of two smooth spheres – impact of a smooth sphere on a plane – oblique impact of two smooth spheres.

Chapter 13: Sections 13.1 to 13.3, Chapter 14: Sections 14.2 to 14.5 **(18 hrs)**

UNIT IV

Circular motion – simple pendulum – central orbits -general orbits - central orbits- conic as centered orbit. **(18 hrs)**

Chapter 15: Section 15.1, 15.6, Chapter 16: Section 16.1 to 16.3

UNIT V

Moment of inertia. Two dimensional motion of a rigid body –equations of motion for two dimensional motion – theory of dimensions- definition of dimensions. **(18 hrs)**

Chapter 17: Sections 17.1: Cases 1 to 12, Book works 17.1, 17.2'

Chapter 18: Sections 18.1.1, 18.1.2, 18.2, Chapter 19: Section 19.1

Contents and treatment as in **"Mechanics""** – P. Duraipandian, Laxmi Duraipandian , Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

REFERENCE BOOKS:

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

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY– 12: PROGRAMMING LANGUAGE 'C' WITH PRACTICALS

SUBJECT CODE:	**THEORY**	**MARKS: 100**
SEMESTER - V	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE FRAMEWORK:

The main objective of this course is to learn how to write C-programs and used to develop the technological concepts.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Demonstrate an understanding of computer programming language concepts and operators.
2. Write the algorithm of a given problem using various statements.
3. Learn the methods of iteration or looping and branching. Make use of different data-structures like arrays, structures and files.
4. Able to understand and develop program using strings and functions.
5. Make use of different data-structures like arrays, pointers, structures and files. Know the alternative ways of providing solution to a given problem.

Unit I

Introduction. Constants-Variables-Data-types (Fundamental and user defined) Operators-Precedence of operators – Library functions. **(12 hrs)**

Chapter 2 Sections 2.1 - 2.8 , Chapter 3 Sections 3.1 – 3.12.

Unit II

Input, Output statements-Escape sequences. Formatted outputs – Storage classes - Compiler directives.

Decision making and branching: Simple if, if else, nested if, else if ladder and switch statement –conditional operator – go to statement. **(12 hrs)**

Chapter 4 Sections 4.2 – 4.5, Chapter 5 Sections 5.1 – 5.9.

Unit III

Decision making and looping: while, do while and for statement – nested for loops – continue and break statements.

Arrays: One dimensional and 2 dimensional arrays – declarations – initialization of arrays.

Chapter 6 Sections 6.1 – 6.5, Chapter 7 Sections 7.1 – 7.5. **(12 hrs)**

Unit IV

Operation on strings-String handling functions.

Functions: Function definition and declaration. **(12 hrs)**

Chapter 8 Sections 8.1 – 8.8, Chapter 9 Sections 9.1 – 9.8

Unit V

Function: – Categories of functions, Nesting of function, Recursion.

Pointers: Introduction, Understanding pointers, declaration and initialization of pointers.

Chapter 9 Section 9.9 to 9.16, Chapter 11 Sections 11.1-11.5. **(12 hrs)**

Content and Treatment as in

Programming in ANSI C 6th edition by E.Balagurusamy, Tata-McGraw Hill Publishing Company.

REFERENCE BOOKS:

1. Venugopal, programming in C
2. Gottfied, B.S : programming with C , Schuam's outline series, TMH 2001
3. Yashvant Kanitkar, Let us "C" BPB Publications.

PRACTICAL **(30 hrs)**

Writing "C" programs for the following:

1. To convert centigrade to Fahrenheit
2. To find the area, circumference of a circle
3. To convert days into months and days
4. To solve a quadratic equation
5. To find sum of n numbers
6. To find the largest and smallest numbers
7. To generate Pascal's triangle, Floyd's triangle
8. To find the trace of a matrix
9. To add and subtract two matrices
10. To multiply two matrices
11. To generate Fibonacci series using functions
12. To compute factorial of a given number, using functions
13. To add complex numbers using functions
14. To concatenate two strings using string handling functions

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

ELECTIVE: IDE – INTER DISCIPLINARY ELECTIVENUMERICAL ANALYSIS

SUBJECT CODE:	**THEORY**	**MARKS: 100**
SEMESTER - V	**CREDITS: 5**	**TOTAL HOURS: 90**

COURSE FRAMEWORK:

To find numerical solutions to problems where the exact relationship between the variables are not known.

COURSE OUTCOMES:

On completion of the course, students would be able to

1. Learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.
2. Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
3. Understand differences of a polynomial, factorial polynomial, differences of zero and summation series.
4. Find the solution using Newton's forward and backward stirling, Bessels interpolation methods .
5. Illustrate Interpolations with unequal intervals using Lagrange's method and reversions of series method.

UNIT I

Solutions of algebraic and transcendental equations, Bisection method, Iteration method, Regula false method, Newton - Raphson method. **(18 hrs)**

Chapter 1: Sections 1.1- 1.4

UNIT II

Solutions of simultaneous linear equations: Gauss - elimination method, Gauss – Jordan method, Gauss – Seidal method, Croute's method. **(18 hrs)**

Chapter 2: Sections 2.1 – 2.3

UNIT III

E - Operators and relation between them, Differences of a polynomial, Factorial polynomials differences of zero, summation of series. **(18 hrs)**

Chapter 3: Sections 3.1- 3.7

UNIT IV

Newton's forward and backward interpolation formulae, Central differences formulae – Gauss forward and backward formulae, Sterling's formula and Bessel's formula.

Chapter 4: Sections 4.1- 4.3, Chapter 5: Sections 5.1 – 5.6 **(18 hrs)**

UNIT V

Interpolation with unequal intervals: Divided differences and Newton's divided differences formula for interpolation and Lagrange's formula for interpolation; Inverse interpolation – Lagrange's method, Reversion of series method. **(18 hrs)**

Chapter 6: Sections 6.1 – 6.8

Content and treatment as in **Calculus of finite differences and Numerical analysis**–by P. Kandalama, Thilagavathy.K ; S. Chand Publications.

BOOKS FOR REFERENCE:

1. Numerical methods – S. Arumugam, A. Thangapandi Isaac, A. somasundaram, SciTech publications.
2. Numerical methods – E. Balagurusamy, McGraw Hill Education.
3. Numerical methods – S Kalavathy, Joice Punitha
4. Numerical methods – G. Bajaj.

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QUESTION PAPER PATTERN:

Section	Question Component	Number	Mark	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

SEMESTER - VI

CORE THEORY- 13: LINEAR ALGEBRA

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - VI	CREDITS: 4	TOTAL HOURS: 90

COURSE FRAMEWORK:

To strengthen the knowledge on vector spaces and linear transformations.

COURSE OUTCOMES:

After learning the concepts of this subject the student will be able to

1. Know the fundamental concepts vector spaces, subspaces, bases and dimension.
2. Understand concept of dual space.
3. Explain the significance of inner product spaces and their properties.
4. Link matrices and linear transformations. Learn to compute eigen values and eigen vectors of linear transformations. Analyze adjoint of a linear transformation.
5. Understand concepts of canonical and triangular forms of a vector space.

UNIT I

Vector spaces. Elementary basic concepts; linear independence and bases.
Chapter 4: Section 4.1 and 4.2 **(18 hrs)**

UNIT II

Dual spaces
Chapter 4: Section 4.3 **(18 hrs)**

UNIT III

Inner product spaces.
Chapter 4: Section 4.4 **(18 hrs)**

UNIT IV

Algebra of linear transformations; characteristic roots.
Chapter 6: Section 6.1 and 6.2 **(18 hrs)**

UNIT V

Matrices; canonical forms; triangular forms.
Chapter 6: Section 6.3 and 6.4 **(18 hrs)**

Treatment and content as in **"Topics in Algebra"** – I. N. Herstein-Wiley Eastern Ltd.

REFERENCE BOOKS:

1. University Algebra – N. S. Gopalakrishnan – New Age International Publications, Wiley Eastern Ltd.
2. First course in Algebra – John B. Fraleigh, Addison Wesley.
3. Text Book of Algebra – R. Balakrishna and N. Ramabadran, Vikas publishing Co.
   Algebra – S. Arumugam, New Gamma publishing house, Palayamkottai

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY- 14: REAL ANALYSIS II

SUBJECT CODE:	**THEORY**	**MARKS: 100**
SEMESTER - VI	**CREDITS: 4**	**TOTAL HOURS: 90**

COURSE FRAMEWORK:

To analyse the mathematical concepts and also to develop the mathematical concepts in advanced level.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Define and recognize the concept of metric spaces, open sets, closed sets, discontinuous function on R^1 and connected sets.
2. Define and Illustrate the concept of completeness, compactness and continuous function on the compactness, uniform continuity.
3. Define and illustrate the concept of Riemann integral and its properties.
4. Construct rigorous mathematical proofs of basic results in real analysis Rolle's theorem, fundamental theorem of calculus.
5. Taylor's theorem, pointwise and uniform convergence of sequence of functions.

UNIT I

Open sets; closed sets; Discontinuous function on R^1. More about open sets; Connected sets:

Chapter 5: Sections 5.4 to 5.6, Chapter 6: Sections 6.1, 6.2 **(18 hrs)**

UNIT II

Bounded sets and totally bounded sets: Complete metric spaces; compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.

Chapter 6: Sections 6.3 to 6.8 **(18 hrs)**

UNIT III

Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral; properties of Riemann integral.

Chapter 7: Sections 7.1 to 7.4 **(18 hrs)**

UNIT IV

Derivatives; Rolle 's Theorem, Law of mean, Fundamental theorems of calculus.

Chapter 7: Sections 7.5 to 7.8 **(18 hrs)**

UNIT V

Taylor's theorem; Pointwise convergence of sequences of functions, uniform convergence of sequences of functions. **(18 hrs)**

Chapter 8: Section 8.5, Chapter 9: Sections 9.1 and 9.2

Content and Treatment as in **"Methods of Real Analysis"-** Richard R. Goldberg (Oxford and IBH Publishing Co)

REFERENCE BOOKS:

1. Principles of Mathematical Analysis by Walter Rudin

2. Mathematical Analysis Tom M Apostal

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
Section B	**Short Answer** Answer any 5 out of 7 questions	13 – 19	6	**30**
Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

CORE THEORY- 15: COMPLEX ANALYSIS

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - VI	CREDITS: 4	TOTAL HOURS: 90

COURSE FRAMEWORK:

To enable students to build a strong intuition and support it with appropriate justification in analysing complex numbers, operations, sequences/ functions.

COURSE OUTCOMES:

On completion of the course, students would be able to

1. Justify the need for Complex Number System, perform operations on complex numbers, sketch regions in the plane and inspect zeros of complex polynomials.
2. Derive the necessary and sufficient conditions for differentiability and examine the properties of analytic functions.
3. Investigate different types of transformations and evaluate the image of curves under transformations.
4. Justify, illustrate and apply various theorems on complex integration along contours.
5. Determine the nature of singularity, calculate residues at singularities and evaluate definite/ indefinite integrals of some classes of functions using Cauchy's Residue Theorem.

Unit I

Functions of a complex variable - mappings, limits - theorems on limits, continuity, derivatives, differentiation formulae - Cauchy-Riemann equations - sufficient conditions for differentiability-Cauchy-Riemann equations in polar form - Analytic functions - Harmonic functions.

Chapter 2 Section 11, 12, 14 to 21 and 2 to 25. **(18 hrs)**

Unit II

Linear transformations - The transformation $w = 1/z$ - linear fractional transformations - an implicit form - exponential and logarithmic transformations – transformation $w = \sin z$ - Preservation of angles.

Chapter 8 Section 8 to 87, 89, Chapter 2: Section 13, Chapter 9: 94. **(18 hrs)**

Unit III

Contours - contour integrals - Anti derivatives - Cauchy-Goursat theorem. Cauchy integral formula - derivatives of analytic function – Liouvillie's theorem and fundamental theorem of algebra -maximum moduli of functions.

Chapter 4 Sections 38 to 45, 47 to 50. **(18 hrs)**

Unit IV

Convergence of sequences and series – Taylor's series –Laurent's series - zeros of analytic functions.

Chapter 5 Section 51 to 56. **(18 hrs)**

Unit V

Residues - Residue theorems- Three types of isolated singular points- Residues at poles- Zeros and poles of order "m" - Evaluation of improper integrals – Improper integrals involving sines and cosines - Definite integrals involving sines and cosines – Argument principle and Rouche's theorem.

Chapter 7 Sections 71 to 74, 79, 80. **(18 hrs)**

Content and treatment as in

Complex variables and Applications (Seventh Edition) by James Ward Brown and Ruel V.Churchill, Mc.Grawhill Inc.

REFERENCE BOOKS:

1. Theory and problems of Complex Variables – Murray R. Spiegel, Schaum outline series
2. Complex Analysis – P.Duraipandian
3. Introduction to Complex Analysis S. Ponnuswamy , Narosa Publishers 1993

QUESTION PAPER PATTERN:

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Section A	**Definition/Principles** Answer any 10 out of 12 questions	1 – 12	3	**30**
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Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

ELECTIVE- I: OPERATIONS RESEARCH

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - V	CREDITS: 5	TOTAL HOURS: 90

COURSE FRAMEWORK:

The central objective of operations research is optimization. To impart knowledge on formulating mathematical models for quantitative analysis of managerial problems in industry, understand and analyze managerial problems in industry so that they are able to use resources.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Mathematically formulate an applied word problem involving revenue, costs, and constraints as a linear program. Geometrically solve a linear program in two variables. Apply the simplex algorithm to solve a linear programming problem. Solve a linear programming problem using either the M-Method. . Associate the Primal and Dual models. Use shadow prices to analyze changes to a linear programming problem's optimal solution.
2. The basic tools of Operations Research, namely the Hungarian Assignment Problem and Transportation Problem. Solve a variety of problems including unbalanced problems, degenerate problems maximization problems. You will learn the technique of Transportation Problem where in phase 1 we obtain the Initial Feasible Solution or Basic Feasible Solution and improve the same till optimality.
3. To understand the advanced analytical methods for sequencing problems to help make better decisions. Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying sequencing models. To explain concepts of players, strategies, payoffs, rationality, equilibrium, to describe simple simultaneous-move games using game tables, and to explain concepts of dominant, dominated, and rationalizable strategies, pure and mixed strategies, and best responses.
4. Define and explain basic concepts in descriptive statistics and probability theory and explain basic concepts in the theory Markov processes, M/M/1, M/M/N and M/M/ queuing system. Derive and apply main formulas for some properties (such as stationary probabilities, average waiting and system time, expected number of customers in the que, etc.) of M/M/1, M/M/N and M/M/ queuing system. To calculate the traffic intensity, blocked traffic and the utilization of some queuing system.
5. What tasks must be carried out .Where parallel activity can be performed. The shortest time in which you can complete a project. Resources needed to execute a project. The sequence of activities, scheduling and timings involved .Task priorities. The most efficient way of shortening time on urgent projects.

Unit I

Linear programming: Formulation – graphical solution – simplex method, Big-M method.

Chapter 2: Sections 2.1 to 2.7, Chapter3: Sections 3.1 to 3.3 **(18 hrs)**

Unit II

Transportation problem, Assignment problem.

Chapter6: Sections 6.1 to 6.9, Chapter 7: Sections 7.1 to 7.5 **(18 hrs)**

Unit III

Sequencing problem: n jobs through 2 machines – n jobs through 3 machines – two jobs through m machines – n jobs through m machines;

Game theory: Two person Zero-sum game with saddle point – without saddle point – dominance – solving 2 x n or m x 2 game by graphical method. **(18 hrs)**

Chapter 10: Sections 10.1 to 10.5, Chapter 9: Sections 9.1 to 9.7

Unit IV

Queueing theory: Basic concepts - Steady state analysis of M/M/1 and M/M/S models with infinite and finite capacities. **(18 hrs)**

Chapter 17: Sections 17.1 to 17.10

Unit V

PERT and CPM: Project network diagram – Critical path (crashing excluded) – PERT computations.

Chapter 21: Sections 21.1 to 21.8 (**18 hrs)**

Content and treatment as in **Operations Research** by Kanti Swaroop, Gupta P K and Manmohan, Sultan Chand & Sons. (Eighth Edition).

BOOKS FOR REFERENCE:

1. Gauss S.I. – Linear programming, Mc Graw – Hill Book company.
2. Gupta P.K. and Hira D.S. – Problems in Operations Research, S.Chand & Co.
3. Kanti Swaroop, Gupta P.K. and Manmohan – Problems in Operations Research, Sultan Chand & sons.
4. Ravindran A., Philips D.T. and Solberg J.J. – Operations Research, John Wiley & Sons.
5. Taha H.A. – Operations Research, Macmillan publishing Company, New York.
6. Dr. Paria – Linear programming, transportation, assignment game, . Books and Allied (p) Ltd, 1999.

QUESTION PAPER PATTERN:

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DISTRIBUTION OF QUESTIONS:

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		Theory	Problems
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	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
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	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

ELECTIVE – II: GRAPH THEORY

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - VI	CREDITS: 5	TOTAL HOURS: 90

COURSE FRAMEWORK:

To translate real life situations to diagrammatic representations to develop problem solving skills and solve real life problems.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Understand the different types of graphs
2. Elucidate degree sequences and graphic sequences,
3. Evaluate Euler and Hamiltonian graphs.
4. Understand trees and polarity characteristics.
5. Study about digraphs and matrices

Unit I

Graphs, sub graphs, degree of a vertex, isomorphism of graphs, independent sets and coverings, intersection graphs and line graphs, adjacency and incidence matrices, operations on graphs,

Chapter 2 Sections 2.0 – 2.9 **(18 hrs)**

Unit II

Degree sequences and graphic sequences – simple problems. Connectedness, walks, trails, paths, components, bridge, block, connectivity.

Chapter 3 Sections 3.0 – 3.2, Chapter 4 Sections 4.0 – 4.4 **(18 hrs)**

Unit III

Eulerian and Hamiltonian graphs

Chapter 5 Sections 5.0 – 5.2 **(18 hrs)**

Unit IV

Trees, problems.

Planarity: Definition and properties, characterization of planar graphs.

Chapter 6 Sections 6.0 – 6.2, Chapter 8 Sections 8.0 – 8.2 **(18 hrs)**

Unit V

Digraphs and matrices, tournaments, some application connector problem

Chapter 10 Sections 10.0 – 10.4, Chapter 11 Sections 11.0 – 11.1 **(18 hrs)**

Content and treatment as in **"Invitation to Graph Theory"** by S.Arumugam and S.Ramachandran, New Gamma Publishing House, Palayamkottai

REFERENCE BOOKS:

1. A first book at graph theory by John Clark and Derek Allan Holton, Allied publishers
2. Graph Theory by S.Kumaravelu and Susheela Kumaravelu,Publishers authors C/o 182 Chidambara Nagar, Nagarkoil

QUESTION PAPER PATTERN:

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Section C	**Essay Answer** Answer any 4 out of 6 questions	20 – 25	10	**40**
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
		Theory	**Problems**
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	Unit – 2	2	
	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

ALLIED MATHEMATICS

(For B.Sc., Physics & Chemistry)

SYLLABUS FOR ALLIED MATHEMATICS

ALLIED MATHEMATICS - I

(For Physics & Chemistry Students)

SUBJECT CODE:	**THEORY**	**MARKS: 100**
SEMESTER - I	**CREDITS: 5**	**TOTAL HOURS: 90**

COURSE FRAMEWORK:

To develop the knowledge on linear, polynomial, exponential, and logarithmic functions, matrices and systems of equations with an emphasis on problem solving and multiple representations.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Finding the summation of the infinite serious by applying binomial, exponential and logarithmic series.
2. Finding the various roots of the algebraic equations, reciprocal equation. Transform the equation through roots multiplied by a given number, increase the roots, decrease the roots, removal of terms. Newton's method.
3. Verifying Cayley Hamilton Theorem Compute inverse of a matrix using Cayley – Hamilton Theorem. Find Eigen values and Eigen vectors of a given matrix.
4. Derive expression for sinnq, cosnq and tannq, sinnq, cosnq. Expand sinq, cosq, tanq in powers of q. Define hyperbolic and inverse hyperbolic functions.
5. Finding the nth derivative, Leibnitz theorem and finding curvature , radius of curvature. Also finding the maxima and minima of functions of two variable.

Unit I

ALGEBRA: Partial Fractions, binomial, exponential and logarithmic series (without proof) summation and approximations. **(15 hrs)**

Chapter 1: Sections 1.1 to 1.4.

Unit II

THEORY OF EQUATIONS: Polynomial equations with real coefficients, irrational roots, complex roots, transformation of equation by increasing or decreasing roots by a constant, reciprocal equations. Newton's method to find a root approximately. **(30 hrs)**

Chapter 2: Sections 2.1 to 2.4, 2.7.

Unit III

MATRICES: Symmetric, Skew-Symmetric, Hermitian, Skew-Hermitian matrices, Orthogonal and Unitary Matrices. Characteristic roots and characteristic vectors-Cayley-Hamilton theorem (statement only) verification, to find the inverse using the above theorem. **(15 hrs)**

Chapter 3: Sections 3.1, 3.4

Unit IV

FINITE DIFFERENCES: Operator E, difference tables, Newton's forward and backward interpolation formulae, Lagrange's interpolation formulae.

Chapter 4: Sections 4, 4.1, 4.3.

TRIGONOMETRY: Expansions of sinnθ, cosnθ, tannθ. Expansions of $\sin^n\theta$, $\cos^n\theta$, $\tan^n\theta$. Hyperbolic and inverse hyperbolic function. **(30 hrs)**
Chapter 5: Sections 5.1, 5.2, 5.4,

Unit V

DIFFERENTIAL CALCULUS: n^{th} derivatives, Leibnitz theorem (without proof) and applications, Jacobians. Curvature and radius of curvature in Cartesian coordinates, maxima and minima of functions of two variables, Lagrange's Multipliers. **(30 hrs)**
Chapter 6: Sections 6.1, 6.2, 6.4, 6.5.

Contents and treatment as in "Ancillary Mathematics: S.Narayanan and T.K.Manickavasagam pillai (Viswanathan Printers)"- Volume I (2015).

REFERENCE BOOKS:

1. Allied Mathematics Volume I&II: P.Kandasamy and K.Thilagavathi (S.Chand and Co.)
2. Ancillary Mathematics Volume I&II: P.Balasubramanian & K.G.Subramanian.
3. Allied Mathematics: P.R.Vittal (Margham Publications)

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TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Sections	Units	No. of Questions	
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	Unit – 3	2	
	Unit – 4	2	
	Unit – 5	2	
	Any Unit	2	
Section B	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	

ALLIED MATHEMATICS - II

(For Physics & Chemistry Students)

SUBJECT CODE:	THEORY	MARKS: 100
SEMESTER - II	CREDITS: 5	TOTAL HOURS: 90

COURSE FRAMEWORK:

To determine how differential equations can be used in solving many applicable oriented problems and Laplace transformation as a tool for solving it.

COURSE OUTCOMES:

After learning the concepts of this subject, the student will be able to

1. Understand the reduction formula, to solve complex formula by changing the order of integration.
2. Solve ordinary differential equations.
3. Apply partial differential equations to solve Lagrange's equations.
4. Evaluate differential equation by using Laplace and inverse Laplace transforms.
5. Apply various differential functions to a system and to understand the theorem associated with it.

Unit I

Integral Calculus: Reduction formulae –Integration by parts, Reduction formulae: $\int_0^{\frac{\pi}{2}} sin^n x\, dx,\ \int_0^{\frac{\pi}{2}} cos^n x\, dx,\ \int_0^{\frac{\pi}{2}} sin^m x\, cos^n x\, dx,$ multiple integrals, Fourier series for functions in $(0,2\pi)$.

Chapter 1: Sections 13.3, 13.4, 13.5; Chapter 2: Sections 1, 2; Chapter 3: Sections 1 to 3. **(30 hrs)**

Unit II

Ordinary Differential Equations: Second order linear differential equations with constant coefficients. $ay'' + by' + cy = \phi(x)$, where $\phi(x) = x^m$, $e^{ax}\ x^m$, $e^{ax}\sin mx$, $e^{ax}\cos mx$. (**15 hrs)**

Chapter 6: Sections 1- 4

Unit III

Partial Differential Equations: Formation, complete integrals and general integrals, four standard types of Lagrange's equations. **(30 hrs)**

Chapter 12: Sections 1 – 5.4

Unit IV

Laplace Transforms: Laplace transformations of standard functions and simple properties, inverse Laplace transforms, Solving Differential equations of second order with constant coefficients using Laplace transform. **(15 hrs)**

Chapter 7 (omit simultaneous equation)

Unit V

Vector Analysis: Scalar point functions, Vector point functions, gradient, divergence, curl, directional derivatives, unit normal to a surface. Line and surface integrals, Gauss, Stoke's and Green's theorems (without proof)- verification only. **(30 hrs)**

Chapter 8: Sections 8.1 to 8.10

Contents and treatment as in

1. **"**Ancillary Mathematics**"**: S.Narayanan and T.K.Manickavachagom pillai (Viswanathan Printers)"- Volume II . (2015) for units I, IV, V
2. "Differential Equations & its Applications" by S.Narayanan and T.K.Manickavachagom pillai (Viswanathan Printers)" for units II, III. (2017).

Reference books:

1. Allied Mathematics Volume I&II: P.Kandasamy and K.Thilagavathi (S.Chand and Co.)
2. Ancillary Mathematics Volume I&II: P.Balasubramanian & K.G.Subramanian.
3. Allied Mathematics: P.R.Vittal (Margham Publications)

QUESTION PAPER PATTERN:

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	Unit – 2	1	
	Unit – 3	1	
	Unit – 4	1	
	Unit – 5	1	
	Any Unit	2	
Section - C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	1	
	Unit– 4	1	
	Unit – 5	1	
	Any Unit	1	