BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620024
B.SC. MATHEMATICS
CHOICE BASED CREDIT SYSTEM–LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)
(Applicable to the candidates admitted from the academic year 2026-2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam. Hours	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –II (AEC - II)	English Course - I	6	3	3	30	70	100
	II	Core Course- (CC 1)	Differential Calculus and Trigonometry	4	4	3	30	70	100
		Core Course- 2 (CC - 2)	Integral calculus and Fourier Series	4	4	3	30	70	100
		Allied Course - 1 (AC - 1)	1. Computer Science (or) 2. Physics (or) 3. Financial Accounting	4	4	3	30	70	100
		Allied Course Practical - 1 (AP -1)	1. Computer Science (or) 2. Physics	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course – 1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**22**	--	--	--	**700**
II	I	Ability Enhancement Course –III (AEC - III)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –IV (AEC - IV)	English Course - II	6	3	3	30	70	100
	III	Core Course- 3 (CC - 3)	Differential Equations	4	4	3	30	70	100
		Core Course 4 – (CC -4)	Analytical Geometry of 3D	4	4	3	30	70	100
		Allied Course – 2 (AC - 2)	1. Computer Science (or) 2. Physics (or) 3. Financial Accounting	4	4	3	30	70	100
		Allied Course Practical - 1 (AP-1)	1. Computer Science (or) 2. Physics	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1(SEC - 1) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**

III	I	Ability Enhancement Course –V(AEC - V)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –VI (AEC - VI)	English Course - III	6	3	3	30	70	100
	III	Core Course- 5(CC - 5)	Classical Algebra and Theory of Numbers	4	4	3	30	70	100
		Core Course - 6 (CC- 6)	Operations Research	4	4	3	30	70	100
		Allied Course – 3 (AC - 3)	1. Chemistry (or) 2. Mathematical Statistics (or) 3. Management Accounting	4	4	3	30	70	100
		Allied Course Practical - 2 (AP-2)	1. Chemistry (or) 2. Mathematical Statistics	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 3 (IDC - 3) $$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
	Total			**30**	**23**	--	--	--	**800**
	I	Ability Enhancement Course –VII (AEC - VII)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
IV	II	Ability Enhancement Course –VIII (AEC - VIII)	English Course - IV	6	3	3	30	70	100
	III	Core Course- 7 (CC - 7)	Sequences and Series	4	4	3	30	70	100
		Core Course - 8(CC - 8)	Vector Calculus and Laplace Transforms	4	4	3	30	70	100
		Allied Course – 4 (AC - 4)	1. Chemistry (or) 2. Mathematical Statistics (or) 3. Management Accounting	4	4	3	30	70	100
		Allied Course Practical - 2 (AP-2)	Chemistry (or) Mathematical Statistics	2	4	3	40	60	100
	IV	Skill Enhancement Course - 3 (SEC - 3) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 4 (IDC - 4) $$	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**
	Summer Internship / Industrial Activity during the Summer Vacation after II Year								

V	III	Core Course - 9 (CC - 9)	Abstract Algebra	4	4	3	30	70	100
		Core Course - 10 (CC - 10)	Real Analysis	5	4	3	30	70	100
		Core Course - 11 (CC -11)	Mechanics	5	4	3	30	70	100
		Core Course - 12 (CC - 12)	Numerical Methods and MATLAB	5	4	3	30	70	100
		Core Practical –1(CP - 1)	MATLAB Programming Lab	5	4	3	40	60	100
	IV	Skill Enhancement Course - 4 (SEC - 4)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 5 (SEC - 5) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	--	20	80	100
	Total			**30**	**28**	--	--	--	**900**
VI	III	Core Course - 13(CC - 13)	Linear Algebra	4	4	3	30	70	100
		Core Course- 14(CC - 14)	Complex Analysis	5	4	3	30	70	100
		Core Course- 15(CC - 15)	Graph Theory	5	4	3	30	70	100
		Core Project Work (CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	--	30	70	100
		Skill Enhancement Course - 6 (SEC - 6)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 7 (SEC - 7) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	--	--	--	--
	Total			**30**	**25**	**--**	**--**	**--**	**900**
	Grand Total			**180**	**150**	--	**--**	**--**	**4900**

ALLIED COURSE

First Year	Second Year
1. Computer Science	1. Chemistry
2. Physics	2. Mathematical Statistics
3. Financial Accounting	3. Management Accounting

SKILL ENHANCEMENT COURSE(SEC)			
Sl. No.	**Title of paper**	**Sl. No.**	**MANDATORY Naan Mudhalvan Scheme##**
1.	Introduction to Python Programming	1.	**2nd Semester:**
2.	Introduction to latex		
3.	Introduction to data science	2.	**3rd Semester:**
4.	Mathematical logic		
5.	Vedic mathematics	3.	**4th Semester:**
6.	Number theory		
7.	Astronomy	4.	**5th Semester:**
--		5.	**6th Semester:**

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART-I (for other Department Students only)	
1st Semester	QUANTITATIVE APTITUDE-I
2nd Semester	QUANTITATIVE APTITUDE – II
3rd Semester	Mathematics for Competitive Examinations-I
4th Semester	Mathematics for Competitive Examinations -II

INTERDISCIPLINARY COURSE (IDC)# FOR WHO HAVE NOT OPT TAMIL AS PART - I		
Those who have studied Tamil upto10th+2 but opt for other languages in degree	1st Semester	Special Tamil - I
	2nd Semester	Special Tamil - II
Those who have not studied Tamil in school level	1st Semester	Basic Tamil - I
	2nd Semester	Basic Tamil – II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3rd and 4th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) $$ FOR NCCCADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	**NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:**
Introduction to NCC	1. Special Subject Army **(or)** 2. Special Subject Navy **(or)** 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1st and 2nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Course	15	4	60	1500
4.		Core Practical	1	4	4	100
5.		Allied Course (AC)	4	4	16	400
6.		Allied Course Practical (AP)	2	4	8	200
7.		Core Project Work (CPW)	1	4	4	100
8.	IV	Skill Enhancement Course (SEC)	7	2	14	700
9.		Interdisciplinary Course (IDC)	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health and Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	2	100
14.		Value Added Course	1	1	1	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	1	1	100
17.		**EXTENSIONACTIVITIES** (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities	--	1	1	--
Total			**49**	**-**	**150**	**4900**

$ For those who havestudiedTamilupto10th+2 (Regular Stream)

\+ Syllabus for other Languages hold be on par with Tamil at degree level

\# Those who havestudiedTamilupto10th+2butoptforotherlanguagesin degree level under Part-Is hold study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part–IV under the Interdisciplinary Course.

** Examination at the end of the next semester

Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions, 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.

$$ NCC Course is one of the Choices in the Interdisciplinary Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.

@ **Health and Wellness: Assessments:**

- Use self-reflective worksheets to assess their understanding
- submit the worksheets to internal audit / external audit
- Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		**100**

@@ **Summer Internship / Industrial Activity**

Internship will have carried us during the summer vacation after the second year. Viva-Voce will be conducted by the college, and Marks shall be sent to the University and the same will be included in the 5th semester Mark Statement.

Summer Internship / Industrial Activity& Project Work
Scheme of Evaluation:

Description	Marks
Report	80
Viva-Voce	20
Total	**100**

* Extension Activities Hall be outside instruction hours.

PO1	**Communication Skill:** Mandatory language courses facilitate to become proficient in communication, culturally aware, and more employable in both Indian and global contexts. Improve presentations skill, debates, and professional communication.
PO 2	**Disciplinary Knowledge:** Learn in-depth complex scientific concepts, demonstrate their ability to explain and apply their knowledge. Consistent in learning by earning extra credits in specialized courses within the science domain and enhance disciplinary knowledge.
PO 3	**Critical thinking:** Field and academic visits will help students to develop observation skills, grasping ability, collect and interpret data and propose models that will help them to understand hypotheses and conclusions.
PO 4	**Analytical Reasoning:** Through interactions, students will develop skills of critical reading of texts, identifying gaps in knowledge, formulating scientific questions, and on will recognizing the synthesis of new ideas.
PO 5	**Scientific Reasoning:** Skill oriented courses will provide details

	on principles, conduct of proper calibration and use of scientific instrumentation and appropriate use of scientific techniques in experimental design
PO 6	**Self-directed Learning: Preparation** of field reports helps them to present their results and discussion in a written format that is typically required for their future professions.
PO 7	**Reflective Thinking:** All core courses with laboratory components will provide exposure to a wide range of research techniques, therein enhancing their understanding of the application of techniques in their domain.
PO 8	**Problem Solving:** Students will develop the ability to reason, apply numerical concepts, and equations in their fields of study for interpreting scientific data and drawing relevant scientific conclusions.
PO 9	**Research-related Skills:** Students undertaking a internship will have the opportunity to design, develop and execute their own research ideas in their experiments, thus expanding their knowledge of research methods and laboratory skills.
PO 10	**Lifelong Learning:** Ability to understand the gaps in knowledge and skill, adapt to technological change, engage in self-directed learning.

Year: I	CORE COURSE 1	Semester: I
Code:	DIFFERENTIAL CALCULUS AND TRIGONOMETRY (THEORY)	Credit: 4

COURSE OBJECTIVE:

- To develop a fundamental understanding of functions, limits, and their classifications, which form the basis for advanced mathematical concepts.
- To acquire knowledge of successive differentiation, Leibnitz's theorem, and techniques for analysing increasing/decreasing functions and determining maxima and minima.
- To understand the concepts of curvature, radius of curvature, centre of curvature, evolutes, and involutes in Cartesian and polar coordinate systems.
- To apply expansion techniques for trigonometric functions and powers of trigonometric expressions using standard mathematical methods.
- To study hyperbolic functions, their properties, relationships with circular functions, an
- To study inverse hyperbolic functions for mathematical problem-solving.

UNIT–I

Functions and Limits: Constants and variables – Functions – Classification of functions - Limits.

UNIT–II

Methods of Successive Differentiation – Leibnitz's Theorem and its applications-Increasing & Decreasing functions –Maxima and Minima of functions of two variables.

UNIT–III

Curvature – Radius of curvature in Cartesian and Polar Coordinates – Centre of curvature–Radius of curvature–Evolutes & Involutes

UNIT–IV

Expansions of sin nx, cos nx, tannx- Expansions of $sin^n x$, $cos^n x$ -Expansions of $sinx$, $cosx$, $tanx$in powers of x.

UNIT–V

Hyperbolic functions – Relation between hyperbolic & Circular Functions-Inverse hyperbolic functions.

UNIT–VI

CURRENT CONTOUR (For Continuous Internal Assessment Only):

The Double angle formulas and The Half-angle identities.

RECOMMENDED BOOKS:

1. S. Narayanan and T.K. Manicavachagam Pillai, Calculus **Volume I**, S. Viswanathan (Printers &Publishers) Pvt. Limited, Chennai.,2024th edition May 2018

2. S. Arumugam & others, **Trigonometry and Fourier series**, New Gamma Publications -9th edition

UNIT–I: Chapter I; Sections 1to10 of [1]
UNIT- II Chapter III; Sections 1.1 to 2.2,
Chapter IV; Section 2.1, 2.2 & Chapter V 1.1 to 1.4 of [1]
UNIT – III: Chapter X; Sections 2.1 to 2.6 of [1]
UNIT – IV: Chapter 1; Section 1.2 to 1.4 of [2]
UNIT–V: Chapter2; Section 2.1&2.2 of [2]

REFERENCES BOOK:

1. S. Arumugam and Isaac, Calculus, Volume1, New Gamma Publishing House,
2. S. Narayanan, T. K. Manichavasagam Pillai,Trigonometry, S.Viswanathan Pvt. Limited, and Vijay Nicole Imprints Pvt.Ltd, 2004.

e-BOOK :

https://nptel.ac.in.

COURSE OUTCOMES:

After completing this course, the students will be able to;

CO1: Understand functions, classification of functions and evaluate limits in mathematical problems.

CO2: Apply successive differentiation, Leibnitz's theorem and analyse maxima and minima of functions of two variables.

CO3: Compute curvature, radius and centre of curvature in Cartesian and Polar coordinates and analyse evolutes and involutes.

CO4: Expand trigonometric functions using standard expansion techniques and represent functions in power series forms.

CO5: Understand hyperbolic functions, inverse hyperbolic functions and establish relations between circular and hyperbolic functions.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	1	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	2	3	1	1	1	3	1	2
CO5	1	3	2	2	1	1	1	2	1	2

Year: I **CORE COURSE 2** **Semester: I**

Code: **INTEGRAL CALCULUS AND FOURIER SERIES (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To study methods of evaluating definite integrals and reduction formulae.
- To understand the geometric applications of integration in Cartesian and polar coordinate systems.
- To develop skills in evaluating double and triple integrals and changing the order of integration.
- To understand Beta and Gamma functions and their use in integration.
- To study Fourier series and half-range expansions for periodic functions.

UNIT – I

Properties of Integration: Definite integrals - Integration by parts and reduction formulae.

UNIT – II

Geometric Application of Integration - Area under plane curves: Cartesian co-ordinates - Area of a closed curve - Examples - Areas in polar co-ordinates.

UNIT – III

Multiple Integrals - Double integrals – changing the order of Integration – Triple Integrals.

UNIT – IV

Improper Integrals - Beta and Gamma functions and the relation between them – Integration using Beta and Gamma functions.

UNIT – V

Fourier series- definition - Fourier Series expansion of periodic functions with Period 2π – Use of odd & even functions in Fourier Series. Half-range Fourier Series – Development in Cosine series – Development in Sine series.

UNIT – VI

CURRENT CONTOUR (For Continuous Internal Assessment Only): Chemical, Physical and Biomedical Applications of Fourier series.

RECOMMENDED BOOKS:

1. S. Narayanan and T.K. Manicavachagam Pillai, Calculus Volume II, S. Viswanathan (Printers & Publishers) Pvt. Limited, Chennai -2018
2. S. Narayanan and T.K. Manicavachagam Pillai, Calculus Volume III, S. Viswanathan (Printers & Publishers) Pvt. Limited, Chennai -2018

UNIT – I Chapter 1 section 11, 12 & 13 of [1]
UNIT – II Chapter 2 section 1.1, 1.2, 1.3.,1.4 of [1]
UNIT – III Chapter 5 section 2.1, 2.2 & 4 of [1]
UNIT – IV Chapter 7 section 2.1 to 2.5 of [1] -
UNIT – V: Chapter 6 Section 1, 2, 3, 4, 5.1, 5.2 of [2]

REFERENCE:

1. Shanti Narayan, Differential & Integral Calculus.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to,

CO1: Apply definite integrals, integration by parts and reduction formulae to solve mathematical problems.

CO2: Compute areas under curves in Cartesian and polar coordinates using integration techniques.

CO3: Evaluate double and triple integrals and apply change of order of integration in multivariable problems.

CO4: Understand and apply Beta and Gamma functions in solving integrals and related applications.

CO5: Analyse and construct Fourier series expansions of periodic functions including half-range cosine and sine series.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	1	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	2	3	2	1	1	3	2	2
CO5	2	3	3	3	2	1	2	3	2	2

Year: I **CORE COURSE 3** **Semester: II**

Code: **DIFFERENTIAL EQUATIONS (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To study first-order and first-degree differential equations and their solution techniques.
- To understand higher-degree differential equations and methods for obtaining their solutions.
- To develop skills in solving second-order linear differential equations using particular integrals and variation of parameters.
- To understand the formation of partial differential equations and methods of solving first-order PDEs.
- To study second-order homogeneous partial differential equations with constant coefficients and their integrals.

UNIT – I

Equations of the first order and first degree – Variable separable – Homogeneous, Non-homogeneous, Linear equations – Bernoulli's equation – Exact differential equations: Sufficient condition for exact differential equations – Practical rules for solving exact differential equations.

UNIT – II

First order, higher degree differential equations– Equations solvable for dy/dx, solvable for y, solvable for x, Clairaut's form – Homogeneous equations in x and y– simple problems.

UNIT – III

Particular integrals of second order differential equations with constant coefficients - Linear equations with variable coefficients – Method of Variation of Parameters (Omit third & higher order equations).

UNIT – IV

Formation of Partial Differential Equation – General, Particular & Complete integrals – Solution of PDE of the standard forms - Lagrange's method - Charpit's method and few standard forms.

UNIT – V

PDE of second order homogeneous equation with Constant co-efficients – Particular integrals of the forms e^{ax+by}, Sin(ax+by), Cos(ax+by), $x^r y^s$ and e^{ax+by}. f(x,y).

UNIT – VI

CURRENT CONTOUR (For Continuous Internal Assessment Only):

Moving Boundary Value Problems

RECOMMENDED BOOKS:

1. T.K. Manicavachagam Pillay & S. Narayanan, Differential Equations, S. Viswanathan Publishers Pvt. Ltd.,2023
2. Arumugam & Isaac, Differential Equations, New Gamma Publishing House, Palayamkottai, 2003.

UNIT – I : Chapter II – Sections 1,2,3,4,5,6 of [1]
UNIT – II : Chapter IV – Sections 1,2 & 3 of [1]
UNIT – III : Chapter V – Sections 1,2,3,4 & 5,
Chapter VIII – Section 4 of [1]
UNIT – IV : Chapter XII – Sections 1 – 6 of [1]
UNIT – V : Chapter V of [2]

REFERENCE:

1. M.D. Rai Singhania, Ordinary and Partial Differential Equations, S. Chand & Co.
2. M.K. Venkatraman, Engineering Mathematics, S.V. Publications, 1985 Revised Edition.

e-book:

https//nptel.ac.in

COURSE OUTCOMES:

On the successful completion of the course, students will be able to,

CO1: Solve first order and first-degree differential equations using standard methods such as variable separable, homogeneous, linear and exact equations.

CO2: Solve higher degree first order differential equations including Clairaut's form and homogeneous equations in x and y.

CO3: Apply methods for solving second order differential equations with constant and variable coefficients using variation of parameters.

CO4: Form and solve partial differential equations using Lagrange's and Charpit's methods.

CO5: Solve second order homogeneous partial differential equations with constant coefficients and evaluate particular integrals of standard forms.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1:	1	3	3	3	2	1	1	3	1	2
CO2:	1	3	3	3	2	1	1	3	1	2
CO3:	1	3	3	3	2	1	2	3	2	2
CO4:	1	3	3	3	2	1	2	3	2	2
CO5:	1	3	3	3	2	1	2	3	2	2

Year: I	CORE COURSE 4	Semester: II
Code:	ANALYTICAL GEOMETRY OF 3D (THEORY)	Credit: 4

COURSE OBJECTIVES:

- To study the equations and properties of straight lines and planes in three-dimensional geometry.
- To understand spheres, circles, tangent planes, and intersections involving spheres.
- To develop knowledge of cones, quadric surfaces, tangent planes, and normals.
- To analyse geometric conditions related to cones, tangent planes, and perpendicular generators.
- To study central quadrics and conicoid, including their intersections and tangent properties.

UNIT – I

Symmetrical form of equation of a straight line – Equation of a straight line passing through two given points – Condition for a line to be parallel to a plane – Angle between a plane and a line – Condition for two straight lines to be coplanar – Shortest Distance between two given lines.

UNIT – II

Sphere – Equation of a sphere when the center and radius are given – Plane section of a sphere – Equation of a circle – Intersection of two spheres – The equation of a tangent plane to a sphere.

UNIT – III

Equation of a surface – Cone – Right Circular cone – Intersection of a straight line and quadric cone – Tangent plane and normal.

UNIT – IV

Condition for a plane to touch a quadric cone - angle between lines in which a plane cuts a cone – Condition that a cone has three mutually perpendicular generators.

UNIT – V

Central quadrics – intersection of a line and a quadric – tangents and tangent planes – condition for a plane to touch a conicoid.

UNIT – VI

CURRENT CONTOUR (For Continuous Internal Assessment Only):

An Introduction to GeoGebra software.

RECOMMENDED BOOKS:

1. T Manickavasagam Pillay, T.K. and Natarajan. T, A Text of Analytical Geometry – Part II – Three dimensions, S. Viswanathan (Printers & Publishers) Pvt. Ltd. 2005,

   UNIT – I: Chapter III – Sections 1 to 8.
   UNIT – II: Chapter IV – Sections 1 to 8

UNIT – III: Chapter V – Sections 1 to 4.
UNIT – IV: Chapter V – Sections 5 to 7.
UNIT – V: Chapter V – Sections 9 to 12

REFERENCE:

1. Shanthi Narayanan and Mittal P.K, Analytical Solid Geometry, 16thEdition S. Chand & Co., New Delhi.

e-book :

https://nptel.ac.in.

COURSE OUTCOME:

After completing this course, the students will be able to:

CO1: Apply the concepts of straight lines and planes in three-dimensional geometry to solve problems involving angles, coplanarity and shortest distance.

CO2: Analyse spheres, circles and tangent planes and solve problems related to intersections of spheres.

CO3: Understand equations of surfaces and cones and determine tangent planes and normals to quadric cones.

CO4: Solve problems involving tangent planes, angles between generators and conditions related to quadric cones.

CO5: Analyse central quadrics, tangent planes and conditions for a plane to touch a conicoid.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	2	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	1	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	2

Year: II **CORE COURSE 5** **Semester: III**

Code: **CLASSICAL ALGEBRA AND THEORY OF NUMBERS (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To study the relationships between roots and coefficients of polynomial equations and properties of symmetric functions.
- To understand Newton's theorem and various transformations of algebraic equations.
- To develop skills in forming transformed equations, removing terms, and applying Descartes' Rule of Signs.
- To understand classical inequalities and apply them to solve optimization problems.
- To study number theoretic concepts such as divisors, Euler's function, congruences, and fundamental theorems of number theory.

UNIT – I

Theory of equations: Relation between roots & coefficients of Polynomial Equations – Symmetric functions – Sum of the rth Powers of the Roots

UNIT – II

Theory of equations - Newton's theorem on the sum of the power of the roots- Transformations of Equations – Diminishing, Increasing & Multiplying the roots by a constant - Reciprocal equations - To increase or decrease the roots of an equation by a given quantity.

UNIT – III

Theory of equations - Form of the quotient and remainder – Removal of terms – To form an equation whose roots are of any power – Transformation in general – Descartes's rule of sign.

UNIT – IV

Inequalities – elementary principles – Geometric & Arithmetic means – Weir strass inequalities – Cauchy inequality – Applications to Maxima & Minima.

UNIT – V

Theory of Numbers – Prime & Composite numbers – divisors of a given number N – Euler's Function $\phi(N)$ and its value – The highest Power of a prime P contained in N! – Congruences – Fermat's, Wilson's & Lagrange's Theorems.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only):

Linear Diophantine equation

RECOMMENDED BOOKS:

1. T.K. Manickavasagam Pillai & others, Algebra Volume I, S.V. Publications 2018
2. T.K. Manickavasagam Pillai & others, Algebra Volume II, S.V. Publications 2018

UNIT – I: Chapter 6 Section 11 to 13 of (1)

UNIT – II: Chapter 6 Section 14 to 17 of (1)
UNIT – III: Chapter 6 Section 18- 21 & 24 of (1)
UNIT – IV: Chapter 4 of (2)
UNIT – V: Chapter 5 of (2)

REFERENCE:

1. H.S. Hall and S.R. Knight, Higher Algebra, Prentice Hall of India, New Delhi.
2. L.E Dickson, History of the Theory of Numbers, Dover Books on mathematics 2005.

e: book

https//nptel.ac.in

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand the relation between roots and coefficients of polynomial equations and evaluate symmetric functions and sums of powers of roots.

CO2: Apply Newton's theorem and transformation techniques to modify and analyse polynomial equations.

CO3: Determine quotients, remainders and transformed equations and apply Descartes's rule of signs in solving algebraic equations.

CO4: Analyse inequalities and apply arithmetic mean, geometric mean, Weier strass and Cauchy inequalities in maxima and minima problems.

CO5: Understand number theory concepts including prime numbers, Euler's function, congruences and fundamental theorems of Fermat, Wilson and Lagrange.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	1	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: II **CORE COURSE 6** **Semester: III**

Code: **OPERATIONS RESEARCH (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To introduce the various techniques of Operations Research.
- To formulate the L.P.P and solve the L.P.P by graphical and simplex methods.
- To introduce the artificial variables and the methods to solve L.P.P
- To solve transportation and assignment problems.
- To make the students solve real life problems in Business and Management.

UNIT I

Linear programming problem - Mathematical formulation- Illustrations on Mathematical formulation on Linear Programming Problems - Graphical solution method - Some exceptional cases- Canonical and standard forms of Linear Programming Problem-Simplex method.

UNIT II

Use of Artificial Variables - Big M method- Two phase method - Assignment problem -Solution methods of assignment problem- special cases in assignment problem.

UNIT III

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

UNIT IV

Queuing theory - Queuing system - Classification of Queuing models- Poisson Queuing systems Model I(M/M/1)(∞/FIFO) only- Games and Strategies - Two-person zero sum - Some basic terms - the maximum- minimax principle - Games without saddle points - Mixed strategies - graphic solution 2 x n and m x 2 games.

UNIT V

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

UNIT VI

CURRENT COUNTORS: (for Continuous Internal Assessment only)-

Applications for OR in Financial Management, Budgeting and Investments.

RECOMMENDED BOOKS:

1. Kanti Swarup, P.K. Gupta and Man Mohan, "Operations Research 13th edition, Sultan Chand and Sons, Reprint 2013.
   Unit 1: Chapter 2, sec 2.1 to 2.4; Chapter 3, sec 3.1 -3.5 Chapter 4- sec 4.1, 4.3,
   Unit II: Chapter 4- sec 4.4, Chapter 11- Sec 11.1 to 11.4.
   Unit III: Chapter 10- sec 10.1, 10.2, 10.8, 10.9, 10.12 and 10.13.

Unit IV: Chapter 21- sec 21.1,21.2,21.7 to 21.9, Chapter 17- sec 17.1 to 17.6
Unit V: Chapter 25- sec 25.1 to 25.4,25.6,25.7.

REFERENCE BOOK(S):

1. V.Sundaresan, Ganapathy Subramanian K.S. and K. Ganesan. Resource Management Techniques, A.R. Publications, 2002
2. Taha H.A., Operations Research: An introduction, 7th edition, Pearson Prentice Hall, 2002.

Website and e-Learning Source(s):

1. https://www.pdfdrive.com.
2. https://nptel.com.

COURSE OUTCOMES: After completing this course, the students will be able to

CO1: Formulate and solve Linear Programming Problems using graphical and simplex methods.

CO2: Apply Big M method, two phase method and solve assignment problems including special cases.

CO3: Solve transportation problems using various methods such as NWCM, LCM, VAM and MODI method.

CO4: Analyse queuing models and game theory concepts including mixed strategy games and minimax principles.

CO5: Apply PERT and CPM techniques for project scheduling, network analysis and probability estimation.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	2	1	1	3	2	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	2	3	3	3	2	2	2	3	3	3

Year: II **CORE COURSE 7** **Semester: IV**

Code: **SEQUENCES AND SERIES (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To study the properties and behaviour of sequences and their convergence characteristics.
- To understand limits and the algebraic properties associated with convergent sequences and monotonic functions.
- To develop knowledge of subsequence's, limit points, and Cauchy sequences in real analysis.
- To understand infinite series and apply comparison-based convergence criteria.
- To analyse the convergence of series using ratio tests, root tests, and alternating series criteria**.**

UNIT – I

Sequences – Bounded Sequences – Monotonic Sequences – Convergent Sequences – Divergent Sequences – Oscillating sequences

UNIT – II

Algebra of Limits – Behaviour of Monotonic functions

UNIT – III

Some theorems on limits – sub sequences – limit points – Cauchy sequences.

UNIT – IV

Series – infinite series – Cauchy's general principal of convergence – Comparison – test theorem and test of convergence using comparison test (comparison test statement only, no proof).

UNIT – V

Test of convergence using d'Alembert's ratio test – Cauchy's root test – Alternating Series – Absolute Convergence (Statement only for all tests).

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only): An introduction Power series.

RECOMMENDED BOOKS:

1. Dr. S. Arumugam & Mr. A. Thangapandi IsaacSequences and Series – New Gamma Publishing House, 2002 Edition.
   UNIT – I: Chapter 3- Sections 3.0 – 3.5(Page No: 39-55)
   UNIT – II: Chapter 3- Sections 3.6, 3.7(Page No:56 – 82)
   UNIT – III: Chapter 3- Sections 3.8-3.11, (Page No:82-102)
   UNIT – IV: Chapter 4- Sections (4.1 & 4.2) (Page No: 112-128
   UNIT – V: Relevant part of Chapter 4 and
   Chapter 5: Sec. 5.1- & 5.2(-Page No: 157-167)

REFERENCE:

1. Introduction to Real Analysis" by Robert G. Bartle and Donald RSherbert
2. Principles of Mathematical Analysis" by Walter Rudin

3. Understanding Analysis" by Stephen

e-book:

https//nptel.ac.in

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand sequences and classify them as bounded, monotonic, convergent, divergent and oscillating sequences.

CO2: Apply algebra of limits and analyse the behaviour of monotonic functions.

CO3: Analyse sub sequences, limit points and Cauchy sequences using theorems on limits.

CO4: Examine convergence of infinite series using comparison test and Cauchy's convergence principle.

CO5: Test convergence of series using ratio test, root test and analyse alternating and convergent series.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	1	3	1	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: II **CORE COURSE 8** **Semester: IV**

Code: **VECTOR CALCULUS AND LAPLACE TRANSFORMS (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To study vector differentiation and the properties of scalar and vector fields.
- To understand line, surface, and volume integrals and their physical interpretations.
- To apply Green's, Gauss Divergence, and Stokes' theorems in vector calculus problems.
- To understand the concepts, properties, and applications of Laplace transforms.
- To develop skills in inverse Laplace transforms and solving differential equations using transform methods.

UNIT - I

Vector differentiation –velocity & acceleration-Vector & scalar fields –Gradient of a vector- Directional derivative – divergence & curl of a vector, solenoidal & irrotational vectors – Laplacian double operator –simple problems.

UNIT - II

Vector integration –Tangential line integral –Conservative force field –scalar potential-Work done by a force - Normal surface integral- Volume integral – simple problems.

UNIT - III

Gauss Divergence Theorem – Stoke's Theorem- Green's Theorem – Simple problems - Verification of the theorems for simple problems.

UNIT - IV

Laplace Transforms – Standard formulae – Laplace transform of Periodic functions – Some general theorems & simple applications**.**

UNIT - V

Inverse Laplace Transforms – Use of Laplace Transforms in solving ODE with constant coefficients**.**

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only):

Z Transforms

RECOMMENDED BOOKS:

1. M.L. Khanna, Vector Calculus, Jai Prakash Nath and Co., 14th edition 2001.
2. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol. III, S. Viswanathan Pvt. Limited, and Vijay Nicole Imprints Pvt. Ltd, 2004.

UNIT – I: Chapter 1- Section :1 & Chapter 2- Sections: 2.3 to 2.6, 3, 4, 5, 7 of [1]
UNIT – II: Chapter 3- Sections 1, 2, 4 of [1].
UNIT – III: Chapter 3- Sections 5 & 6 of [1].
UNIT – IV: Chapter 5- Section 1,2,3,4,5 of [2]:
UNIT – V: Chapter 5- Section 6,7,8 of [2]

REFERENCE:

1.. P. Duraipandiyan and Lakshmi Duraipandian, Vector Analysis, Emarald Publishers (1986).

2. Dr. S. Arumugam and Prof. A. Thangapandi Issac, Fourier series, New Gamma Publishing House (Nov 12).

e-book:

1. https://users.scilab.narkive.com/CBGtibfE/scilab-queries-about-vector-and-complex-numbers

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1: Apply vector differentiation concepts including gradient, divergence, curl and Laplacian operators in vector fields.

CO2: Evaluate vector integration, line integrals, surface integrals and volume integrals in physical applications.

CO3: Understand and verify Gauss Divergence, Stoke's and Green's theorems through simple problems.

CO4: Apply Laplace transforms and related theorems to solve periodic functions and mathematical problems.

CO5: Use inverse Laplace transforms to solve ordinary differential equations with constant coefficients.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	2	1	2	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	1	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: III **CORE COURSE 9** **Semester: V**

Code: **ABSTRACT ALGEBRA (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To understand the fundamental concepts, properties, and examples of groups and permutation groups.
- To study subgroups, cyclic groups, cosets, and Lagrange's theorem and their applications.
- To develop knowledge of normal subgroups, quotient groups, homomorphisms, and isomorphisms in group theory.
- To understand ring structures, ring properties, subrings, ideals, quotient rings, and ring homomorphisms.
- To analyse advanced ring-theoretic concepts such as maximal ideals, prime ideals, quotient fields, Euclidean domains, and unique factorization domains.

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.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only):

Polynomial rings

RECOMMENDED BOOKS:

1. S Arumugam and A. Thangapandi Isaac, Modern Algebra, SciTech Publications, Chennai, edition 2022.
   UNIT – I: Chapter 3 -Sections 3.1-3.4.
   UNIT – II: Chapter 3- Sections 3.5-3.8.
   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, 4.13-4.14.

REFERENCE:

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 Pt. Ltd.

e-book:

https://nptel.com
https://algebra.com

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand the fundamental concepts of groups, permutation groups and their elementary properties.

CO2: Analyse subgroups, cyclic groups, cosets and apply Lagrange's theorem in group theory problems.

CO3: Apply concepts of normal subgroups, quotient groups, homomorphism and isomorphism in abstract algebra.

CO4: Understand rings, subrings, ideals and quotient rings along with their properties and types.

CO5: Analyse maximal and prime ideals, quotient fields, Euclidean domains and unique factorization domains.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: III **CORE COURSE 10** **Semester: V**

Code: **REAL ANALYSIS (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To develop a rigorous understanding of the real number system and its properties.
- To introduce the concepts of sets, limits, and topology in $\mathbb{R}$ (open sets, closed sets, compactness, connectedness).
- To study the theory of continuous functions and their fundamental properties.
- To understand the concept of derivatives from a theoretical perspective.
- To explore important theorems such as Mean Value Theorems and their applications.

UNIT – I

Real Number system – Field axioms – Order relation in R. Absolute value of a real number & its properties – Supremum & Infimum of a set – Order completeness property – Countable & Uncountable sets.

UNIT – II

Neighbourhoods and Limit points: Introduction – Neighbourhoods – Open & closed sets – Limit points of a set – Closure & Interior of a set – Compactness – Connectedness.

UNIT – III

Continuity: Continuous functions – Types of discontinuities – Algebra of continuous functions – Boundedness of continuous functions – Intermediate value theorem – Inverse function theorem – Uniform continuity.

UNIT – IV

Derivatives: Introduction – Derivability and continuity – Algebra of derivatives – Inverse function theorem for derivatives – Darboux's Theorem.

UNIT – V

Mean value theorems: Rolle's theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's theorem – Taylor's series – Power series expansions of some standard functions.

UNIT – VI

CURRENT COUNTOURS

(For continuous Internal Assessment Only):

Introduction to maxima & minima and intermediate forms.

BOOK RECOMMENDED:

1. M. K. Singhal & Asha Rani Singhal, A First Course in Real Analysis, R. Chand & Co., Edition.2000

   UNIT – I: Chapter 1.
   UNIT –II: Chapter 2.
   UNIT – III: Chapter 5 (Section (2-8)
   UNIT – IV: Chapter 6 (Section 1-5)

UNIT – V: Chapter 8 (Section 1- 6)

REFERENCE(S):

1. Shanthi Narayanan, A Course of Mathematical Analysis, S. Chand & Co., 1995.
2. Goldberg, Richard R, Methods of Real Analysis, Oxford & IBHP Publishing Co.,
e-book:
https://nptel.com

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO1: Understand the real number system, order properties, completeness and countability concepts in real analysis.

CO2: Analyse neighbourhoods, open and closed sets, compactness and connectedness in metric spaces.

CO3: Apply continuity concepts, intermediate value theorem and uniform continuity in real-valued functions.

CO4: Examine differentiability, algebra of derivatives and Darboux's theorem in real analysis.

CO5: Apply mean value theorems and Taylor's theorems for function approximation and power series expansions.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1:	1	3	2	3	1	1	1	3	1	2
CO2:.	1	3	3	3	2	1	2	3	2	2
CO3:	1	3	3	3	2	1	2	3	2	2
CO4:	1	3	3	3	2	1	2	3	2	2
CO5:	1	3	3	3	2	1	2	3	2	3

Year: III **CORE COURSE 11** **Semester: V**

Code: **MECHANICS (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To provide the basic knowledge of equilibrium of a particle.
- To develop a working knowledge to handle practical problems.
- Understand the fundamental concepts of velocity and acceleration.
- Understand the work done in stretching an elastic string Simple Harmonic motion.
- Study the motion of projectiles, impact of sphere and central orbits.

UNIT – I

Introduction – Forces acting at a point: Triangle of forces – Lami's theorem- An extended form of the parallelogram law of forces- Theorem.

UNIT – II

Parallel forces and Moments: Resultant of parallel forces – Conditions of equilibrium of three coplanar parallel forces - Generalized theorem of Moments (Principle of moments). **Friction**: Introduction – Laws of Friction – Definitions – Equilibrium of a particle on a rough inclined plane under any force.

UNIT – III

Kinematics: Velocity- composition of velocities- Triangle of velocities- Relative Velocity-Angular Velocity of a particle- Relative angular between two points.

UNIT – IV

Projectile: Projectile-Path of a projectile-Characteristics-Horizontal Projection-Given the magnitude of the velocity of the projection.

UNIT – V

Simple Harmonic Motion: Introduction-S.H.M in straight line-Compositions ofSimple Harmonic Motion of the same period- Compositions of simple harmonic motion of the same period in two perpendicular directions.

UNIT – VI

CURRENT COUNTOURS (For continuous Internal Assessment Only):

Work, Energy and Power.

RECOMMEDED BOOKS:

1. M. K. Venkataraman, Statics, Agasthiyar Publications, 20thedition, 2020.
   UNIT – I: Chapter 2: (sec 1-10)
   UNIT –II: Chapter 3: (sec-1-13). Chapter 7:(sec 1-12)

2. M. K. Venkataraman, Dynamics, Agasthiyar Publications 21stedition2022.
   UNIT – III:Chapter 3: (3.1-3.15)
   UNIT – IV**:** Chapter 6: (sec 6.1-6.11)
   UNIT – V**:** Chapter 10, (Section 10.1-10.7)

e-book:
https://nptel.com

REFERENCES:

1. V. Dharmapadham, Statics, S. Viswanathan Publishers Pvt.Ltd, 2006.
2. P. Duraipandiyan,LaxmiDuraipandiyan and Muthamizh Jayapragasam Mechanics S. Chand & Company PVT, LTD, 2014.

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand the principles of forces, equilibrium, triangle of forces and Lami's theorem in mechanics.

CO2: Apply concepts of parallel forces, moments and friction to solve equilibrium problems on rough inclined planes.

CO3: Analyse kinematics concepts including velocity, relative velocity and angular velocity of particles.

CO4: Solve projectile motion problems and determine the characteristics and path of projectiles.

CO5: Understand and apply the principles of simple harmonic motion and composition of SHM in different directions.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	2	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: III **CORE COURSE 12** **Semester: V**

Code: **NUMERICAL METHODS AND MATLAB (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To Introduce Numerical techniques to solve algebraic and transcendental equations.
- To solve numerical problems using interpolation.
- To know about numerical differentiation and integration.
- To solve differential equations using the method of successive approximations
- To develop skills in solving problems using numerical techniques.

UNIT – I

MATLAB Environment: Getting Started – Solving Problems in MATLAB –Saving your works – Predefined MATLAB Functions – Using Predefined Functions – Manipulating Matrices – Computational Limitations - Special Values and Functions.

UNIT – II

Plotting: Introduction to Two-Dimensional Plotting – Three-Dimensional Plotting – Editing Plots from the Menu Bar – Creating Plots from the Workshop Window. Programming in MATLAB: Introduction – Problems with Two Variables – Input/Functions – Statement level Control Structures.

UNIT – III

Numerical Techniques: Introduction – Curve Fitting: Linear and Polynomial Regression – Using the Interactive Fitting Tools – Numerical Integration – Numerical Differentiation.

UNIT – IV

Curve Fitting – Fitting Linear and parabolic curves by the method of least squares principles Solving algebraic and transcendental equations-Bisection method, false position method and Newton Raphson method – Solving simultaneous algebraic equations – Guass-seidal method – Guass elimination method.

UNIT – V

Interpolation – Newton's forward and backward difference formulae –Lagrange's interpolation formula – Numerical integrations using Trapezoidal and Simpson's one – third rules – solution of ODE's – Euler method and Runge-Kutta fourth order
method.

UNIT – VI

CURRENT COUNTOURS (For continuous Internal Assessment Only):

Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved. (Is a part of internal component only, not to be included in the External Examination question paper).

RECOMMENDED BOOKS:

1. S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, "Numerical Methods", Second Edition, SciTech Publications (India) Pvt. Ltd., Chennai, 2010.
   Unit I: Chapter 3 - § 3.0, 3.2-3.5.
   Unit II: Chapter 6 - § 6.0, 6.1(up to fundamental theorem for finite Differences: pages160-166),
   Chapter 7 - § 7.0, 7.1, 7.2 (i, ii), 7.3.
   Unit III: Chapter 8 - § 8.0 - 8.2, 8.5 (3 Methods only).
   Unit IV: Chapter10 - § 10.0 -10.3.
   Unit V: Chapter10 - §10.4 - 10.6.

REFERENCE:

1. S.S. Sastry, "Introductory Methods of Numerical Analysis", Fifth Edition, Prentice Hall of India private limited, NewDelhi,2013.
2. M.K. Venkatraman, "Numerical methods in Science and Engineering", National Publisher Company, Fifth Edition, 2001.

e-BOOK :

3. https://www.pdfdrive.com
4. https://nptel.com.

Course Outcomes: The students will be able to

CO1: Understand the MATLAB environment, predefined functions and matrix manipulations for solving computational problems.

CO2: Create two-dimensional and three-dimensional plots and develop MATLAB programs using control structures and functions.

CO3: Apply numerical techniques such as curve fitting, numerical integration and differentiation using MATLAB tools.

CO4: Solve algebraic and transcendental equations using numerical methods such as Bisection, Newton-Raphson and Gauss methods.

CO5: Apply interpolation, numerical integration and numerical methods for solving ordinary differential equations.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	3	3	1	2	3	2	2
CO2	2	3	3	3	3	2	2	3	2	2
CO3	1	3	3	3	3	1	2	3	3	2
CO4	1	3	3	3	3	1	2	3	3	2
CO5	1	3	3	3	3	2	2	3	3	3

Year: III	CORE PRACTICAL 1	Semester: V
Code:	MATLAB PROGRAMMING LAB (PRACTICAL)	Credit: 4

COURSE OBJECTIVES:

- To solve numerical problems using MATLAB programming.

LIST OF PRACTICALS

1. Linear Interpolation
2. Linear Regression
3. Curve Fitting
4. Trapezoidal rule of Integration
5. Simpson's 1/3 rule of Integration
6. Newton – Raphson method of solving equations
7. Gauss Elimination method of solving simultaneous equations
8. Gauss – Seidel method of solving simultaneous equations
9. R-K fourth order method of solving differential equations
10. Lagrange's method of interpolation

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Apply interpolation techniques such as linear interpolation and Lagrange's interpolation for numerical data analysis.

CO2: Perform linear regression and curve fitting techniques to analyse and model data.

CO3: Apply numerical integration methods such as Trapezoidal rule and Simpson's 1/3 rule for approximating definite integrals.

CO4: Solve algebraic and simultaneous equations using Newton–Raphson, Gauss Elimination and Gauss–Seidel methods.

CO5: Solve ordinary differential equations using Runge–Kutta fourth order numerical method.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	3	1	2	3	2	2
CO2	1	3	3	3	3	2	2	3	3	2
CO3	1	3	3	3	3	1	2	3	2	2
CO4	1	3	3	3	3	1	2	3	3	2
CO5	1	3	3	3	3	2	2	3	3	3

Year: III	CORE COURSE 13	Semester: VI
Code:	LINEAR ALGEBRA (THEORY)	Credit: 4

COURSE OBJECTIVES:

- To inculcate the concepts of Vector Spaces, Linearly Independence and Linearly Dependence.
- To develop working knowledge on Bases and Dimension of basis
- To learn about Matrix of Linear Transformation, Inner product Space.
- To apply the concepts of Finding the Inverse of a Matrix, Rank of a Matrix.
- To apply the concepts of Finding the Eigen values and Eigen vectors of a Matrix.

UNIT - I

Vector spaces: Vector spaces - Definition and examples - Subspaces – linear transformation - Span of a set.

UNIT - II

Basic Dimension: Linear Dependence and Linear independence-Bases and Dimensions- Rank of Nullity.

UNIT - III

Matrix and Inner product space: Matrix of a linear transformation - Inner product space - Definition and examples - Orthogonality - Gram Schmidt orthogonalization process - Orthogonal Complement.

UNIT - IV

Theory of Matrices: Algebra of Matrices - Types of Matrices - The Inverse of a Matrix - Elementary Transformations - Rank of matrix.

UNIT - V

Characteristic equation: Characteristic equation and Cayley - Hamilton theorem - Eigen values and Eigen vectors.

UNIT - VI

CURRENT COUNTORS (for Continuous Internal Assessment only)

The algebra of polynomials

RECOMMENDED BOOKS(s):

1. Arumugam S and Thangapandi Isaac A, Modern Algebra, SciTech Publications (India) Ltd., Chennai, Edition March 2022.
   UNIT – I: Chapter 5- Sec 5.1 to 5.4
   UNIT – II: Chapter 5- Sec 5.5 to 5.7
   UNIT – III: Chapter 5- Sec 5.8, Chapter 6, Sec 6.1 to 6.3
   UNIT – IV: Chapter 7 Sec 7.1 to 7.5
   UNIT – V: Chapter 7- Sec 7.7, 7.8

Reference Book(s):

1. N. Herstein, Topics in Algebra, Wiley Eastern Ltd Second Edition, 2006.
2. Stephen H. Friedberg, Arnold J Insel, Lawrence E Spence, Linear Algebra, 4th Ed. Prentice Hall of India Pvt. Ltd. New Delhi, 2004
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed. Pearson Education Asia, Indian Reprint, 2007

Website and e-Learning Source(s):

1. https://nptel.ac.in

COURSE OUTCOMES:

The students will be able to

CO1: Understand vector spaces, subspaces, linear transformations and span of sets in linear algebra.

CO2: Analyse linear dependence, linear independence, bases, dimensions and rank-nullity theorem.

CO3: Apply concepts of inner product spaces, orthogonality and Gram–Schmidt orthogonalization process.

CO4: Perform algebraic operations on matrices and determine inverse, elementary transformations and rank of matrices.

CO5: Determine characteristic equations, eigen values and eigen vectors and apply Cayley–Hamilton theorem.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: III **CORE COURSE 14** **Semester: VI**

Code: **COMPLEX ANALYSIS (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- Understand the function of complex variables, continuity differentiation of complex variable function, C – R equations of analytic function.
- Understand the concepts of complex integration and series expansions such as Cauchy's integral formula and its derivative, Taylor's series, Laurent series and singularities.
- Learn about elementary transformation concepts in complex variable.
- Understand the singularities concepts and residues solving definite integrals using the residue concepts.

UNIT – I

COMPLEX NUMBERS & ANALYTIC FUNCTIONS: Complex Numbers – Geometrical representation of Complex Numbers – Function of a complex variable – Limits – Theorems on limit – Continuous function – Differentiability – Cauchy-Riemann equations – Analytic functions – Harmonic functions.

UNIT – II

BILINEAR TRANSFORMATION: Elementary Transformations – Bilinear Transformations – Cross ratio – Fixed points of Bilinear Transformation some special Bilinear Transformation.

UNIT – III

COMPLEX INTEGRATION: Definite integral – Cauchy's Theorem – Cauchy's integral formula – Higher derivatives.

UNIT – IV

SERIES EXPANSIONS: Taylor's Series – Laurent's Series – Zeroes of an analytic function – Singularities.

UNIT – V

CALCULUS OF RESIDUES: Residues – Cauchy's Residue Theorem – Evaluation of Definite integrals.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment only)
Conformal Mapping.

RECOMMENDED BOOKS:

1. S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, Complex Analysis, New Scitech Publication (India) Pvt, Ltd 2002.
   UNIT – I: Chapter 1, Sections 1.1, 1.5 &
   Chapter 2, Section 2.1 – 2.8
   UNIT – II: Chapter 3, Section 3.1 – 3.5
   UNIT – III: Chapter 6, Section 6.1 – 6.4
   UNIT – IV: Chapter 7, Section 7.1 – 7.4
   UNIT – V: Chapter 8, Section 8.1 – 8.3

e-book:
https://nptel.com

REFERENCE:

1. J. N. Sharma, Functions of a Complex Variable Krishna Prakasan media Ltd, 13th Edition 1996 – 97.
2. T. K. Manickavasagam pillai, Complex Analysis, S. Viswanathan publisher Pvt Ltd, 1994.

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand complex numbers, analytic functions, Cauchy–Riemann equations and harmonic functions.

CO2: Apply bilinear transformations, cross ratios and fixed-point concepts in complex analysis.

CO3: Evaluate complex integrals using Cauchy's theorem and Cauchy's integral formula.

CO4: Expand analytic functions using Taylor's and Laurent's series and analyse singularities.

CO5: Apply residue theory and Cauchy's residue theorem to evaluate definite integrals.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	2	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: III **CORE COURSE 15** **Semester: VI**

Code: **GRAPH THEORY (THEORY)** **Credit: 4**

COURSE OBJECTIVES:

- To understand the basic concepts and terminology of graph theory and their mathematical foundations.
- To study graph operations, connectivity, paths, trails, walks, and Eulerian properties of graphs.
- To analyse Hamiltonian graphs, trees, and important properties such as tree centres.
- To understand planar graphs and criteria used for determining graph planarity.
- To apply directed graph concepts and graph algorithms for solving optimization and shortest path problems.

UNIT – I

Introduction - The Konigsberg Bridge Problem - Graphs and subgraphs: Definition and Examples - Degrees - Subgraphs -Isomorphism – independent sets and coverings.

UNIT – II

Matrices - Operations on Graphs - Walks, Trails and Paths –Connectedness and Components - Eulerian Graphs.

UNIT – III

Hamiltonian Graphs (Omit Chavatal Theorem) - Characterization of Trees - Centre of a Tree.

UNIT – IV

Planarity: Introduction - Definition and Properties - Characterization of Planar Graphs

UNIT – V

Directed Graphs: Introduction - Definitions and Basic Properties – Some Applications: Connector Problem - Kruskal's algorithm - Shortest Path Problem – Dijkstra's algorithm.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only): Independent Sets and Matchings**.**

RECOMMENDED BOOKS:

1. S. Arumugam and S. Ramachandran, Invitation to Graph Theory, SciTech Publications (India) Pvt. Ltd., Chennai, 2006.

UNIT – I: Chapter 1 Sec- 1.0, 1.1 and Chapter -2 Sec -2.0, 2.1, 2.2, 2.3, 2.4.2.6

UNIT – II: Chapter 2 -Sec 2.8, 2.9, Chapter 4 -Sec 4.1, 4.2 and Chapter 5- Sec 5.0, 5.1

UNIT – III: Chapter 5 -Sec 5.2, Chapter 6 -Sec 6.0, 6.1, 6.2.

UNIT – IV: Chapter 8- Sec 8.0, 8.1, 8.2.

UNIT – V: Chapter 10- Sec 10.0, 10.1. Chapter 11- Sec 11.0,11.1, 11.2

REFERENCE:

1. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science, Prentice Hall of India, 2004.
2. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata Mc Graw-Hill Edition, 2004.

COURSE OUTCOMES: After completing this course, the students will be able to

CO1: Understand the fundamental concepts of graph theory including graphs, subgraphs, degrees, isomorphism and coverings.

CO2: Apply matrix representation, graph operations, walks, paths and connectedness concepts in graph analysis.

CO3: Analyse Eulerian graphs, Hamiltonian graphs, trees and centres of trees.

CO4: Examine planar graphs and apply characterization properties of planarity in graph theory problems.

CO5: Apply directed graph concepts and algorithms such as Kruskal's and Dijkstra's algorithms in optimization problems.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	3	2	2	3	3	3

SKILL ENHANCEMENT COURSE

Code: **1. INTRODUCTION TO PYTHON PROGRAMMING (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To understand Linux commands, file management, text editing, and the fundamentals of programming.
- To develop Python programming skills using functions, loops, and basic computational tools.
- To learn mathematical functions, conditional structures, and naming conventions in Python programming.
- To understand list operations, sorting techniques, and iterative processing using Python.
- To apply Python programming techniques to solve mathematical and problem-oriented applications.

UNIT – I
Review of Linux commands; File management and permissions; Using VI editor; Introducing a programming language, syntax, basic tools, simple Programs, etc.

UNIT – II
Basic Tools; First Program file; Handling complex numbers; Functions and loops.

UNIT – III
Standard math functions; Conditionals; Python keywords and function names; Defining Names.

UNIT – IV
Lists in Python; Defining and accessing lists; Loops with lists; Range function; for loop with lists for sorting; Built-in sort functions; else class in loops.

UNIT – V
Math problems for practice which includes the following:
(a) Finding GCD of two or more integers;
(b) Primality checking; Finding primes up to a given integer;
(c) Plotting curves;
(d) Area of a triangle;
(e) Angle between vectors;
(f) Convert a number in decimal to a given base n.
(g) Transpose of a matrix; Product of two matrices.
(h) Finding the mean, median, mode, standard deviation etc., of a given data.

UNIT – VI
CURRENT CONTOURS (For Continuous Internal Assessment Only): Inheritance and Encapsulation

REFERENCE:

1. Real Python, A introduction to Practical https://static.realpython.com/python-basics-sample-chapters.pdf
2. Qingkai Kon et all, Python Programming and Numerical Methods - A Guide for Engineers and Python, Scientists, https://pythonnumericalmethods.berkeley.edu/notebooks/Index.html

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand Linux commands, file management, VI editor and the basics of Python programming syntax and tools.

CO2: Develop Python programs using functions, loops and basic computational tools including handling complex numbers.

CO3: Apply standard mathematical functions, conditionals and naming conventions in Python programming.

CO4: Use lists, loops, range functions and sorting techniques for data manipulation in Python.

CO5: Solve mathematical and computational problems such as GCD, prime numbers, matrix operations and plotting using Python programming.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	2	2	1	1	2	1	2
CO2	2	3	3	3	2	2	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	2	3	3	3	3	2	2	3	3	3

SKILL ENHANCEMENT COURSE

Code: **2. INTRODUCTION TO LATEX (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To understand the basic structure, compilation process, and document preparation workflow in LaTeX.
- To develop proficiency in creating and formatting simple documents using various LaTeX environments.
- To learn mathematical typesetting techniques using the amsmath package and cross-referencing tools.
- To understand the methods of incorporating and formatting figures and tables in LaTeX documents.
- To create professional academic documents, bibliographies, indexes, and Beamer presentations using LaTeX.

UNIT – I

Basic Structure of Latex - Input file structure - Layout -Editors – Forward Search Inverse Search - Compiling - Conversion to various formats.

UNIT – II

Typesetting simple documents - sectioning - Titles- page layout listing enumeratin - quote - letter formats.

UNIT – III

Using package am math typing equations, labeling and referring.

UNIT – IV

Figure inclusion - Table inclusion.

UNIT – V

Bibliography - Index typing - Beamer presentation Styles.

UNIT – VI

CURRENT CONTOURS (For Continuous Internal Assessment Only):

Type a mathematical article using various journal style files

BOOK RECOMMENDED:

1. Leslie Lamport. LATEX: A Document Preparation System, Addison Wesley, Reading, Massachusetts, second edition, 1994.
2. Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl., The (Not So) Short Introduction to LATEX2e, Samurai Media Limited (or available online at http://mirrors.ctan.org/info/lshort/english/lshort.pdf)
3. LATEX Tutorials - A Primer, Indian TeX Users Group, available online at https://www.tug.org/twg/mactex/tutorials/ltxprimer 1.0.pdf
4. H. J. Greenberg. A Simplified introduction to LATEX, available online at https://www.ctan.org/tex-archive/info/simplified 34 latex/
5. Using Kile - KDE Documentation, https://docs.kde.org/trunk4/en/extragear_office/kile/quick using.html
6. Amsmath and geometry package available in Ctan.org. COURSE OUTCOMES: At the end of the course, students will be able to 1. Type their own mathematical article/notes/book/journal

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the basic structure of LaTeX documents, editors, compiling methods and file conversions.

CO2: Create and format simple LaTeX documents using sectioning, titles, page layouts, lists and letter formats.

CO3: Apply mathematical packages such as amsmath for typing equations, labeling and referencing in LaTeX.

CO4: Include and format figures and tables effectively in LaTeX documents.

CO5: Prepare bibliographies, indexes and professional Beamer presentations using LaTeX styles and tools.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	2	2	1	1	2	1	2
CO2	3	3	2	2	2	2	1	2	1	2
CO3:	2	3	3	3	2	1	2	3	2	2
CO4:	2	3	2	2	2	1	2	2	1	2
CO5:	3	3	2	2	2	2	2	2	2	3

SKILL ENHANCEMENT COURSE

Code: **3. INTRODUCTION TO DATA SCIENCE (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To understand the fundamentals, scope, applications, and lifecycle of Data Science.
- To study data collection methods, data preprocessing techniques, and common data formats.
- To understand different types of data analysis and their applications in decision-making.
- To develop basic programming skills in Python and use data science libraries for computational tasks.
- To apply data manipulation and visualization techniques using Pandas and Matplotlib/Seaborn.

UNIT - I

Definition and scope of Data Science - Importance and applications of data science - Role of a data scientist - Data science lifecycle - Types of data: structured, unstructured, semi-structured.

UNIT - II

Sources of data: primary and secondary - Data collection methods - Data cleaning and preprocessing: Handling missing values - Removing duplicates - Data transformation - Introduction to data formats (CSV, JSON, Excel).

UNIT - III

What is data analysis? - Types of data analysis: descriptive, diagnostic, predictive, prescriptive.

UNIT - IV

Introduction to Python programming - Libraries for data science: NumPy, Pandas, Matplotlib.

UNIT - V

Data manipulation using Pandas - Data visualization using Matplotlib/Seaborn.

RECOMMENDED BOOKS.

A. Campbell, Data Science for Beginners.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the concepts, scope, applications and lifecycle of Data Science along with different types of data.

CO2: Apply data collection, cleaning and preprocessing techniques including handling missing values, duplicates and data transformation.

CO3: Analyse data using descriptive, diagnostic, predictive and prescriptive analysis methods.

CO4: Use Python programming and libraries such as NumPy, Pandas and Matplotlib for data science applications.

CO5: Perform data manipulation and create visual representations of data using Pandas, Matplotlib and Seaborn tools.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	2	2	1	1	2	1	3
CO2	1	3	3	3	3	2	2	3	3	2
CO3	1	3	3	3	3	1	2	3	3	2
CO4	2	3	3	3	3	2	2	3	3	3
CO5	2	3	3	3	3	2	2	3	3	3

SKILL ENHANCEMENT COURSE

Code: **4. MATHEMATICAL LOGIC (THEORY)** **Credit: 2**

COURSE OBJECTIVES

- To introduce the basic concepts of logic and reasoning
- To develop the ability to translate statements into symbolic form
- To understand truth tables and logical equivalences
- Learning fundamental methods of mathematical proof
- To build a foundation for advanced topics in mathematics

UNIT - I

Introduction to Logic and Propositions - Statements and propositions – simple and compound statements – logical connectives – negation, conjunction, disjunction – formation of logical statements – truth values – truth tables of basic connectives.

UNIT - II

Logical Equivalences - Tautologies, contradictions, contingencies – logical equivalence.

UNIT - III

LAWS-Basic laws of logic – commutative, associative, distributive laws – De Morgan's laws – implication and biconditional – construction of equivalent statements using truth tables.

UNIT - IV

Predicate Logic -Predicates and open statements – quantifiers – universal and existential quantifiers – domain of discourse – simple quantified statements – negation of quantified statements.

UNIT - V

Introduction to Boolean Algebra-Boolean operations – AND, OR, NOT – truth tables for Boolean expressions – basic Boolean laws – simplification of expressions – introduction to logic gates.

RECOMMENDED BOOK(S):

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 2019 (8th Edition), McGraw-Hill.
2. Daniel J. Velleman, How to Prove It, 2019 (3rd Edition), Cambridge University Press.

REFERENCE:

1. J.P. Trembley and R. Manohar, Discrete Mathematical Structures with Applications Computer Science, 2008, Tata-McGraw Hill
2. B.S. Vatssa, Discrete Mathematics, 2002, third edition, Wishwa Prakashan
3. Bernard Kolman, Robert Busby, Sharon Ross, Discrete Mathematical Structures, 2013, 8th edition, Pearson.
4. C. L. Liu, Elements of Discrete Mathematics, 1885, 2nd Edition McGraw-Hill.
5. Patrick Suppes, A First Course in Mathematical Logic, 2012 (Dover Reprint; original 1957) Dover Publications.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand statements, propositions, logical connectives and construct truth tables for logical expressions.

CO2: Analyse tautologies, contradictions, contingencies and determine logical equivalences.

CO3: Apply basic laws of logic including De Morgan's laws, implication and biconditional statements in logical reasoning.

CO4: Understand predicates, quantifiers and quantified statements in predicate logic and apply negation rules.

CO5: Apply Boolean algebra concepts, simplify Boolean expressions and understand the basics of logic gates.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	2	2	1	1	2	1	3
CO2	1	3	3	3	3	2	2	3	3	2
CO3	1	3	3	3	3	1	2	3	3	2
CO4	2	3	3	3	3	2	2	3	3	3
CO5	2	3	3	3	3	2	2	3	3	3

SKILL ENHANCEMENT COURSE

Code: **5. VEDIC MATHEMATICS (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To study the history of arithmetic, number systems, and the contributions of Indian mathematicians.
- To understand division, divisibility rules, and their applications in arithmetic problem-solving.
- To develop proficiency in finding and applying HCF and LCM in numerical computations.
- To understand arithmetic techniques involving Meru-Prastra, higher powers, square roots, and cube roots.
- To solve linear equations in two variables and apply them to practical problems.

UNIT - I

Introduction and history of Arithmetic and Number - Contribution of Indian Mathematicians – Multiplication.

UNIT - II

Division – Divisibility - Applications of Division and Divisibility.

UNIT - III

LCM & HCF - Application of LCM & HCF.

UNIT - IV

Arithmetic application of binomial by Meru-Prastra - Cube and Higher Powers - Square roots & cube roots by division method.

UNIT - V

Solutions of linear equations in two variables - Practical application of linear equations in two variables.

RECOMMENDED BOOK(S):

1. Vedic Ganit Nirdeshika Bhag-2, Vidya Bharti Akhil Bhartiya Shiksha Sansthan Kurushetra
2. Lilavati of Bhaskracarya: A Treatise of Mathematics of Vedic Tradition

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the history and development of arithmetic and number systems including contributions of Indian mathematicians and multiplication techniques.

CO2: Apply division and divisibility rules to solve arithmetic problems and practical applications.

CO3: Compute LCM and HCF and apply them in solving mathematical and real-life problems.

CO4: Apply arithmetic techniques such as Meru-Prastra, higher powers and methods for finding square roots and cube roots.

CO5: Solve linear equations in two variables and apply them to practical situations.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	2	2	1	1	1	2	1	3
CO2	1	3	3	3	2	1	1	3	1	2
CO3	1	3	3	3	2	1	1	3	1	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

SKILL ENHANCEMENT COURSE

Code: **6. NUMBER THEORY (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To study divisibility properties, Euclid's division lemma, Diophantine equations, and prime factorization.
- To understand permutations, combinations, generating functions, and classical number theoretic theorems.
- To develop proficiency in congruences, residue systems, and linear congruence equations.
- To apply Fermat's and Wilson's theorems and the Chinese remainder theorem in solving number theoretic problems.
- To analyse polynomial congruences and arithmetic functions such as $d(n)$and $\sigma(n)$.

UNIT - I

Euclid's Division Lemma – Divisibility – The Linear Diophantine Equation – The Fundamental Theorem of Arithmetic.

UNIT - II

Permutations and Combinations – Fermat's Little Theorem – Wilson's Theorem – Generating Functions.

UNIT - III

Basic Properties of Congruences – Residue Systems – Linear Congruences.

UNIT - IV

The Theorems of Fermat and Wilson Revisited – The Chinese Remainder Theorem.

UNIT - V

Polynomial Congruences – Combinational Study of F(n) – Formulae for d(n) and σ(n).

RECOMMENDED BOOKS:

1. Number Theory by George E. Andrews, Hindustan Publishing Corporation – 1984, Edition.
   UNIT – I : Chapter – 2- Sec. 2.1 – 2.4(pages 12-29)
   UNIT – II : Chapter – 3- Sec. 3.1, 3.4(pages 30-440
   UNIT – III : Chapter – 4-Sec. 4.1, 4.2(Pages 49 – 55,)
   Sec. 5.1(Pages 58 – 60)
   UNIT – IV : Chapter – 5- Sec. 5.2, 5.3 (pages 61-70).
   UNIT – V : Chapter – 5- Sec. 5.4, Chapter – 6- Sec. 6.1, 6.2 (Pages 71-85)

REFERENCE:

1. Basic Number Theory by S.B. Malik, Vikas Publishing House Pvt. Ltd.,
2. A First Course Theory of Numbers by K.C. Chowdhury. Asian Books Pvt. Ltd., I Edition (2004)

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand Euclid's Division Lemma, divisibility concepts, linear Diophantine equations and the Fundamental Theorem of Arithmetic.

CO2: Apply permutations, combinations, Fermat's Little Theorem, Wilson's Theorem and generating functions in problem solving.

CO3: Analyse congruences, residue systems and solve linear congruence equations.

CO4: Apply Fermat's and Wilson's theorems along with the Chinese Remainder Theorem in number theoretic problems.

CO5: Solve polynomial congruences and analyse arithmetic functions such as d(n) and σ(n).

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

SKILL ENHANCEMENT COURSE

Code: **7. ASTRONOMY (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To study the celestial sphere, celestial coordinates, and the apparent daily motion of celestial objects.
- To understand sidereal time, geographical latitude, rising and setting times of stars, and circumpolar stars.
- To analyse astronomical phenomena related to the Earth, including perpetual day, dip of horizon, and twilight.
- To understand atmospheric refraction and apply refraction laws and formulas in astronomical observations.
- To study Kepler's laws of planetary motion and apply them to understand planetary and Earth orbital dynamics.

UNIT-I

Celestial sphere – Celestial Co-ordinates – Diurnal motion.

UNIT-II

Sidereal time – Latitude of a place – Time for Rising – Circumpolar star.

UNIT-III

The Earth- The zones of Earth- perpetual day -Dip of Horizon -Twilight.

UNIT-IV

Refraction -laws of refraction -tangent formula-Cassini's formula-horizontal refraction.

UNIT-V

Kepler's law-verification of 1^{st}& 2^{nd} laws in the case of earth -Anomalies-Kepler's equation.

UNIT-VI

Introduction to Astrophysics.

BOOKS RECOMMENDED:

1. Kumaravel, S. and Susheela Kumaravel, Astronomy, 8th Edition, SKV Publications, 2004.

Unit I: Chapter 2: Sec 39-68
Unit: II: Chapter 2: Sec-69-83
Unit: III: Chapter 3: Sec-87-90,106-116
Unit IV: Chapter 4: Sec-117-134
Unit V: Chapter 6: Sec-146-162

REFERENCE:

G V Ramachandran, of Astronomy, Mission Press, Palayamkottai, 1965.

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Understand the celestial sphere, celestial coordinates and diurnal motion in astronomy.

CO2: Apply concepts of sidereal time, latitude, rising time and circumpolar stars in astronomical calculations.

CO3: Analyse the Earth's zones, perpetual day, dip of horizon and twilight phenomena.

CO4: Understand atmospheric refraction, tangent formula, Cassini's formula and horizontal refraction.

CO5: Apply Kepler's laws, anomalies and Kepler's equation in the study of planetary motion.

Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	1	3	2	3	2	1	1	2	1	2
CO2	1	3	3	3	2	1	2	3	1	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: I **INTER DISCIPLINARY COURSE 1** **Semester: I**

Code: **QUANTITATIVE APTITUDE-I (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To understand the properties of numbers and apply HCF and LCM techniques in problem-solving.
- To develop accuracy and efficiency in solving problems involving decimal fractions and simplification.
- To apply concepts of square roots, cube roots, and averages in quantitative aptitude problems.
- To analyse and solve problems related to numbers and ages using logical reasoning and mathematical methods.
- To understand and apply concepts of surds, indices, and percentages in practical and competitive examination problems.

UNIT – I

Numbers - H.C.F and L.C.M. of Numbers. (Chapter – 1 & 2)

UNIT – II

Decimal Fractions – Simplification. (Chapter – 3 & 4)

UNIT – III

Square Roots and Cube Roots – Average. (Chapter – 5 & 6)

UNIT – IV

Problems on Numbers - Problems on Ages. (Chapter – 7 & 8)

UNIT – V

Surds & Indices – Percentage. (Chapter – 9 & 10)

BOOKS RECOMMENDED

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai, 2010.

REFERENCES

1. Quantitative Aptitude _ 'by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005).
2. https://nptel.ac.in

COURSE OUTCOME

After completing this course, the students will be able to

CO1: Understand number systems and compute H.C.F and L.C.M of numbers for arithmetic problem solving.

CO2: Apply decimal fractions and simplification techniques in numerical computations.

CO3: Solve problems involving square roots, cube roots and averages using arithmetic methods.

CO4: Analyse and solve problems related to numbers and ages using logical and arithmetic reasoning.

CO5: Apply concepts of surds, indices and percentages in mathematical and practical applications.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	2	3	1	1	1	3	1	2
CO2	1	3	3	3	1	1	1	3	1	2
CO3	1	3	3	3	2	1	1	3	1	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: I **INTER DISCIPLINARY COURSE 2** **Semester: II**

Code: **QUANTITATIVE APTITUDE – II (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To understand and apply concepts of profit, loss, ratio, and proportion in quantitative problem solving.
- To develop proficiency in solving partnership and chain rule problems.
- To apply mathematical techniques for solving time and work and pipes and cistern problems.
- To analyse and solve problems involving time, distance, and trains.
- To solve aptitude problems related to boats and streams and alligation or mixture

UNIT – I

Profit & Loss – Ratio & Proportion. (Chapter – 11 & 12)

UNIT – II

Partnership – Chain Rule. (Chapter – 13 & 14)

UNIT – III

Time & Work – Pipes & Cistern. (Chapter – 15 &16)

UNIT – IV

Time & Distance – Problems on Trains. (Chapter – 17 &18)

UNIT – V

Boats & Streams – Alligation or Mixture. (Chapter – 19 &20)

BOOKS RECOMMENDED

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai, 2010.

REFERENCE

1. Quantitative Aptitude by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)

COURSE OUTCOME

After completing this course, the students will be able to

CO1: Apply concepts of profit & loss and ratio & proportion in solving arithmetic and commercial problems.

CO2: Solve problems involving partnership and chain rule using mathematical reasoning.

CO3: Analyse and solve problems related to time & work and pipes & cisterns using quantitative techniques.

CO4: Apply concepts of time & distance and train problems in practical and analytical situations.

CO5: Solve problems involving boats & streams and alligation or mixture using arithmetic methods.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	1	3	1	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: II **INTER DISCIPLINARY COURSE 3** **Semester: III**

Code: **MATHEMATICS FOR COMPETITIVE EXAMINATIONS – I (THEORY)** **Credit: 2**

COURSE OBJECTIVES:

- To understand and apply the concepts of simple interest and compound interest in financial calculations.
- To develop proficiency in logarithmic computations and area-related mensuration problems.
- To solve quantitative aptitude problems involving volumes, surface areas, races, and games of skill.
- To apply logical and mathematical reasoning to calendar and clock problems.
- To understand the fundamentals of stocks and shares and perform related financial computations.

UNIT – I
Simple Interest – Compound Interest. (Chap – 21 & 22)

UNIT – II
Logarithms - Area. (Chap – 23 & 24)

UNIT – III
Volume & Surface Areas – Races & Games of Skill. (Chap – 25 & 26)

UNIT – IV
Calendar - Clocks. (Chap – 27 & 28)

UNIT – V
Stocks & Shares. (Chap – 29)

BOOKS RECOMMENDED

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai,2010.

REFERENCES

1. Quantitative Aptitude by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)
2. https://nptel.ac.in

COURSE OUTCOMES:
After completing this course, the students will be able to

CO1: Apply concepts of simple and compound interest in financial and commercial calculations.

CO2: Use logarithms and area calculations to solve mathematical and practical problems.

CO3: Analyse problems involving volume, surface area and games of skill using quantitative reasoning.

CO4: Solve calendar and clock problems using logical and analytical methods.

CO5: Understand and apply concepts related to stocks and shares in financial mathematics.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	1	1	1	3	1	2
CO2	1	3	3	3	2	1	1	3	1	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	1	3	3	3	2	1	2	3	2	2
CO5	1	3	3	3	2	1	2	3	2	3

Year: II **INTER DISCIPLINARY COURSE 4** **Semester: IV**

Code: **MATHEMATICS FOR COMPETITIVE EXAMINATIONS – II** **Credit: 2**

(THEORY)

COURSE OBJECTIVES:

- To understand and apply the concepts of permutations and combinations in solving counting problems.
- To develop proficiency in probability and true discount calculations.
- To apply banker's discount and heights-and-distances concepts in quantitative problem solving.
- To improve logical reasoning skills through odd-man-out and series-based problems.
- To analyse and interpret data using tabulation and bar graphs.

UNIT – I
Permutation & Combinations. (Chapter – 30)

UNIT – II
Probability – True Discount. (Chapter – 31 & 32)

UNIT – III
Banker 's Discount - Heights & Distances. (Chapter – 33 & 34)

UNIT – IV
Odd Man Out & Series. (Chapter – 35)

UNIT – V
Tabulation – Bar Graphs. (Chapter – 36 & 37)

BOOKS RECOMMENDED

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S.Chand co Ltd., 152. Anna Salai, Chennai,2010.

REFERENCES

1. Quantitative Aptitude 'by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005)
2. https://nptel.ac.in

COURSE OUTCOME
After completing this course, the students will be able to

CO1: Apply permutation and combination techniques in solving counting and arrangement problems.

CO2: Analyse probability concepts and true discount problems using mathematical reasoning.

CO3: Solve problems involving banker's discount, heights and distances using quantitative techniques.

CO4: Identify patterns and solve logical reasoning problems related to odd man out and series.

CO5: Interpret and represent data using tabulation and bar graphs for analytical purposes.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	3	3	2	1	1	3	1	2
CO2	1	3	3	3	2	1	2	3	2	2
CO3	1	3	3	3	2	1	2	3	2	2
CO4	2	3	3	3	2	1	2	3	1	2
CO5	2	3	3	3	2	2	2	3	2	3