DEPARTMENT OF MATHEMATICS

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP)

(FIRST– SIXTH SEMESTER)

Approved by Academic Council vide Resolution no. AC – 03/2024/05 Dated: 04 – 05 – 24

ARYA VIDYAPEETH COLLEGE (AUTONOMOUS)

ARYA NAGAR, GUWAHATI – 16

CONTENT

PREFACE

"Education is not preparation for life; education is life itself." —John Dewey

The aim of imparting education is not only to increase the knowledge but also to create the possibilities for a student to invent and discover. The purpose of this syllabus is to establish minimum basic concepts for each course to meet the needs of all our students. All the elements in this syllabus amalgamate to bring out the best in every student and enable them to be on the path of continuous progress.

The syllabus is framed based on Learning Outcome Based Education (LOCF) - the spirit of NEP, 2020. The programmes offered by the college are :

i. Bachelor Degree in Arts
ii. Bachelor Degree in Science
iii. Bachelor Degree in Commerce

Under the above programme, the following courses are offered by the college:

i. Core Course
ii. Minor Course
iii. Skill Enhancement Course
iv. Interdisciplinary Course
v. Ability Enhancement Course
vi. Value Added Course
vii. Internship

Programme outcome of each programme and Programme Specific Outcomes of each discipline/subject offered by the college is mapped with course learning outcome of each course. Graduate attributes of students obtaining Undergraduate Degree from the college are also incorporated in the syllabus.

The syllabus includes eight semesters where there will be 23 Core Courses, 8 Minor Courses, 2 Value Added Courses, 3 SEC Courses, 3 IDC Courses, 4 AEC courses and internship. The total credit offered for eight semesters is 160.

The syllabus framed takes into account the different styles of learning – audio, visual and experiential. The syllabus correlates academics to real life situations balancing social and emotional stimulation among the students and imbibe human values. Also the syllabus gives the opportunity for the theoretical knowledge to be pursued ensuring maximum application of it.

Structure of Four Year Undergraduate Course

Semester	Type	Core	Minor	SEC	IDC	AEC	VAC/FC	IN
	Credit	4	4	3	3	2	4(2 + 2)	2
I		CE-1114	MN-1114	SE-1113	ID-1113	AE-1112	VL-1112 (Two Courses)	-
II		CE-2114	MN-2114	SE-2113	ID-2113	AE-2112	VL-2112 (Two Courses)	-
III		CE-3214	MN-3214	SE-3213	ID-3213	AE-3212	-	-
		CE-3224						
IV		CE-4214	MN-4214	-	-	AE-4212	-	IN-4212
		CE-4224						
		CE-4234						
V		CE-5314	MN-5214	-	-	-	-	-
		CE-5324						
		CE-5334						
		CE-5344						
VI		CE-6314	MN-6214	-	-	-	-	-
		CE-6324						
		CE-6334						
		CE-6344						
VII		CE-7414	MN-7314	-	-	-	-	-
		CE-7424						
		CE-7434						
		CE-7444						
VIII		CE-8414	MN-8314	-	-	-	-	-
		CE-8424**						
		CE-8434**						
		CE-8444**						

****Students who secure more than 7.5 CGPA at the end of third year (6th semester) may opt for a research dissertation of 12 credits instead of the three core papers.**

Course code: **First two letters is the abbreviation of course component**
First digit implies semester number
Second digit implies course level
Third digit implies course
Fourth digit implies credit points per course.

Digit	Course Level
1	100 - 199
2	200 - 299
3	300 - 399
4	400 - 499

Semester Wise Credit Distribution

Semester	CREDIT DISTRIBUTION							
	CORE	MINOR	SEC	AEC	IDC	VAC/FC	IN	TOTAL
FIRST	1 x 4	1 x 4	1 x 3	1 x 2	1 x 3	2 x 2	--	20
SECOND	1 x 4	1 x 4	1 x 3	1 x 2	1 x 3	2 x 2	--	20
THIRD	2 x 4	1 x 4	1 x 3	1 x 2	1 x 3	--	--	20
FOURTH	3 x 4	1 x 4	--	1 x 2	--	--	1 x 2	20
FIFTH	4 x 4	1 x 4	--	--	--	--	--	20
SIXTH	4 x 4	1 x 4	--	--	--	--	--	20
SEVENTH	4 x 4	1 x 4	--	--	--	--	--	20
EIGHT	4 x 4	1 x 4	--	--	--	--	--	20

SEC: SKILL ENHANCEMENT COURSE

AEC: ABILITY ENHANCEMENT COURSE

IDC: INTERDISCIPLINARY COURSE

VAC/FC: VALUE ADDED COURSE

IN: INTERNSHIP

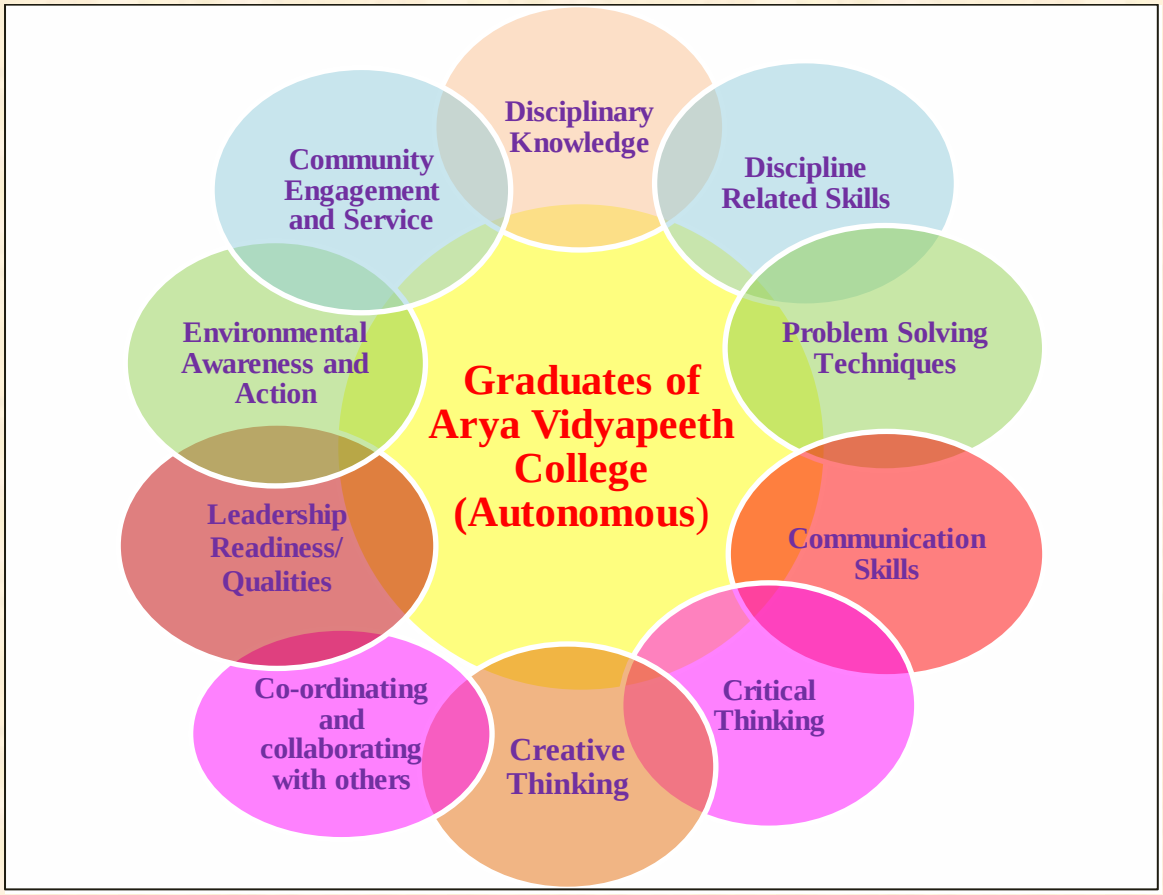
Abbreviation of Course Components:

CE (Core), MN (Minor), SE(Skill Enhancement Course), AE (Ability Enhancement Course), VL (Value added Course), ID (Interdisciplinary Course), IN (Internship)

GRADUATE ATTRIBUTES

Graduate Attributes:

Graduate Attributes are the qualities, skills and understandings that the students should develop during their time with the college. These attributes consequently shape the contribution they are able to make to their profession and society. They are the qualities that also prepare graduates as agents of social good in an unknown future. These attributes sets them apart from those without a degree. The graduate attributes of Arya Vidyapeeth College (Autonomous) are:



Model of Graduate Attributes

1. **Disciplinary knowledge:** Graduates shall acquire comprehensive knowledge and understanding of their subject area, the ability to engage with different traditions of thought, and the ability to apply their knowledge in practice including in multi-disciplinary or multi-professional contexts.
2. **Discipline related skills:** Skills in areas related to specialization in the chosen disciplinary/interdisciplinary/major/minor area(s) of learning in a broad multidisciplinary context. In addition create, select, and apply appropriate modern techniques, resources and IT tools.
3. **Problem solving skills:** A capacity for problem identification, the collection of evidence, synthesis and dispassionate analysis and apply one's learning in real – life situations.

4. **Communication Skills:** Ability to recognize and value communication as the tool for negotiating and creating new understanding, collaborating with others, and furthering their own learning.
5. **Critical thinking:** Graduates acquire the capacity for problem identification, collection of evidence, synthesis and dispassionate analysis. They also acquire the capacity for attentive exchange, informed argument and reasoning.
6. **Creative Thinking:** The graduates acquire an ability to create, perform or think in different and diverse ways about the same objects or scenarios and also the ability to communicate effectively for different purposes and in different contexts. They should also be able to work independently and as part of a team.
7. **Co-ordinating and collaborating with others:** The graduates need to possess the ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. They should also be able to work productively with others, no matter their culture, perspective or background, and complete joint projects and also to work in partnership.
8. **Leadership readiness/qualities:** The graduates should be able to lead and support others by inspiring them with a clear vision and motivating them to achieve goals. They also need to acquire ability to map out the tasks of a team or an organization and setting directions.
9. **Environmental Awareness and action:** The graduates shall earn the capacity to realize the individual's responsibility in protecting and conserving the environment. They need to gain the capacity to understand the impact of the professional solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
10. **Community engagement and service:** The graduates need to develop an understanding of social and civic responsibilities, and of the rights of individuals and groups. The graduates should be able to demonstrate the capability to participate in community-engaged services/ activities for promoting the wellbeing of the society which includes participation in NSS,NCC, adult literacy etc

UNDERGRADUATE PROGRAMME OUTCOME (PO)

BACHELOR DEGREE INSCIENCE: (B.Sc)

1. **SPO-1 Knowledge:** Learners are encouraged to apply the knowledge of mathematics and science fundamentals to various solutions of complex problems. As such, knowledge of the subject is the sole objective of any student learner. A student is exposed to a wide range of topics in various subjects and is given intensive training in each of the courses that have laboratory related work. The learner is encouraged to use various mathematical methods (analytical and numerical) and experimental methods as an application to the acquired concepts and principles that help in studying various branches of sciences. At the end of the program, students are able to gain thorough knowledge in key areas in the subjects offered.
2. **SPO-2 Problem Analyses**: Well equipped with an understanding of the analytical methods involved, they are in a position to interpret and analyze results so obtained from experiments and draw suitable conclusions against their supported data acquired. At the end of the program, students will be able to identify, formulate and analyze scientific problems and reach concrete solutions using various principles of mathematics and sciences.
3. **SPO-3 Designing Solutions**: Having acquired knowledge of subjects, students are trained to think out of the box, design and conduct an experiment or a series of experiments that demonstrate their understanding of the methods and processes involved.
4. **SPO-4 Modern tool usage**: Learners are trained to create, select, and apply appropriate techniques, resources and IT tools in the analysis and synthesis of data within limitations. (Outcome of final year project).
5. **SPO-5 Effective Communication**: Proficiency in speaking, reading, writing and listening in EnMTish and one Indian language and find meaning of the world by connecting people, ideas, books, media and technology.
6. **SPO-6 Employability**: This programme enables the learners to perform the jobs in diverse fields such as science, engineering, industries, survey, education, banking, development-planning, business, public service, self business etc. efficiently.They will also be able to appear for competitive examinations
7. **SPO-7 Ethics:** While it is necessary to instil the spirit of competitiveness among students in a world of increasing competition, it is equally vital to develop a strong sense of ethics among learners that will help them develop some positive attitudes and values. This includes appreciation of the various principles and theories that evolved in science, the impact that science has on social,

economical and environmental issues. One of the main objectives of any academic exercise, therefore, should be to produce well-groomed individuals who understand the significance of ethical values and abide by them even in the most pressing circumstances. In this programme, this process is enabled through courses and facilitators who integrate the teaching of ethics in everyday pedagogy. As such, at the end of this programme students will be able to develop, internalise and exercise ethics in their professional as well as personal practices.

8. **SPO-8 Environment and Sustainability**: 'Environmental sustainability' has become the watchword of the 21st century. An increased engagement with environment related concerns is appearing tangibly on MTobal fronts; academics cannot and should not remain quarantined from this massive development. Through classroom discussions and research projects, this programme facilitates active dialogues with factors which influence human-ecology interactions. As such, at the end of this programme students will be able to identify and analyze socio-political, cultural and economic problems which act as deterrents to environmental sustainability and provide creative solutions towards the same.

9. **SPO-9 Soft-Skill Development**: Apart from the attainment of knowledge and hands on skills in practical applicability of the subject, learners need to be equipped with soft-skills and values which will help them function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary groups. These soft skills include leadership, teamwork, project-management, positive outlook, innovative approaches and effective articulation. Several soft skill programs are organized for learners through various agencies that tie up with the state government. As such, at the end of this programme, students will be able to hone the soft-skills required in positively enhancing their academic, professional and personal pursuits towards self and societal advancement.

10. **SPO-10 Science and Society**: The learners are encouraged to apply logical reasoning based on the knowledge, skills, designing solutions to assess societal, health, safety issues and the responsibilities that go along with the scientific practice. As an extension activity to society, learners are encouraged to take up specific projects such as impact of salinity on fresh water wells in an adopted village, and provide effective solutions.

11. **SPO-11 Life-long learning**: With the pursuit of knowledge for either personal or professional reasons, learners are also encouraged to volunteer and be self motivated that not only enhances society values, active participation and personality development, but also enhances self-sustainability, competiveness and employability. As such, learners will be able to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in every broad context of technological changes.

CORE

LIST OF COURSES:

Semester	Course Name	Course Code
1	ALGEBRA	MT – CE – 1114
2	CALCULUS	MT – CE – 2114
3	ANALYTICAL GEOMETRY OF 2D	MT – CE – 3214
	REAL ANALYSIS-I	MT – CE – 3224
4	ORDINARY DIFFERENTIAL EQUATION	MT – CE – 4214
	ABSTRACT ALGEBRA-I	MT – CE – 4224
	REAL ANALYSIS-II	MT – CE – 4234
5	MECHANICS	MT – CE – 5314
	METRIC SPACES	MT – CE – 5324
	LINEAR ALGEBRA	MT – CE – 5334
	THREE DIMENSIONAL GEOMETERY AND VECTOR ANALYSIS	MT – CE – 5344
6	NUMERICAL ANALYSIS-I	MT – CE – 6314
	OPERATION RESEARCH	MT – CE – 6324
	PARTIAL DIFFERNTIAL EQUATIONS	MT – CE – 6334
	COMPLEX ANALYSIS-I	MT – CE – 6344

Programme Specific Outcome of Bachelor of Science – Mathematics: Core (PSO)

PSO No.	Name	Outcome
PSO–1	Depth of Understanding	Students will get adequate exposure to basic and advanced knowledge in different aspects of mathematical sciences. They will acquire the logical skills necessary to create and develop mathematical arguments. They will be capable of analyzing problems, determining computer needs and defining suitable solutions.
PSO–2	Critical Thinking	Students will be well equipped to critically analyze a given problem, understand and build a mathematical model to represent the problem, solve the resulting equations and critically interpret the resulting solution..
PSO–3	Scientific Communication Skills	Students will develop the ability to apply their skills and knowledge to convert given information into mathematical expressions, select and use appropriate mathematical formulae or techniques to process the information and draw the relevant conclusion..
PSO–4	Modern tool use	Students will learn to utilize computer technology appropriate to solve problems and promote understanding, to apply mathematical knowledge to carrier related to mathematical sciences, thus cultivating a proper attitude to higher studies in mathematics.
PSO–5	Employability	Students possess the essential skills of mathematical modelling, problem-solving, creativity and effective communication, preparing them for a wide range of employment opportunities
PSO–6	Evaluate and Conduct Research	Ability to pursue advanced studies and research in pure and applied mathematical sciences.

Course Learning Outcome (CLO) – Core

Semester	Course Name & Code	Course Learning Outcome (CLO)	
1	ALGEBRA MT – CE – 1114	CLO - 1	Analyze a given system of equations, and tell the nature of the roots of the given system
		CLO - 2	Apply De Moivre's theorem as and when applicable.
		CLO - 3	Learning the basic operations in matrices, and hence check the consistency of a given system of equations. Also, solve both homogeneous and non-homogeneous system of equations
2	CALCULUS MT – CE – 2114	CLO - 1	Learn about basic concepts of real sequences.
		CLO - 2	Understand concepts of limit and continuity of functions.
		CLO - 3	Learn about differentiability of a function, and understand the various applications of real valued functions.
		CLO - 4	Apply reduction formulae to solve complicated integrals, and also to apply them in the real world problems.
3	ANALYTICAL GEOMETRY OF 2D MT – CE – 3214	CLO - 1	Knowledge about transformation of co-ordinate systems.
		CLO - 2	Learn about the conditions on coefficients such that the general equation of second degree represents a pair of straight lines.
		CLO - 3	Learn about general and central conics and various properties
	REAL ANALYSIS-I MT – CE – 3224	CLO - 1	Knowledge of fundamental properties associated with the real number system.
		CLO - 2	Thorough understanding of real sequences along with the concept of their
		CLO - 3	Apply various tests to check convergence of infinite series of real numbers.
4	ORDINARY DIFFERENTIAL EQUATION MT – CE – 4214	CLO - 1	Understand that physical systems can be described by differential equations
		CLO - 2	Understand the practical importance of solving differential equations.
		CLO - 3	Recognize an appropriate solution method for a given problem

4	ORDINARY DIFFERENTIAL EQUATION MT – CE – 4214	CLO - 4	Analytically solve a wide range of ordinary differential equations
		CLO - 5	Solve differential equations using Mathematica
	ABSTRACT ALGEBRA-I MT – CE – 4224	CLO - 1	Recognize the fundamental concept of groups, rings and fields.
		CLO - 2	Explain the significance of cyclic groups, symmetric groups, normal subgroups, factor groups.
		CLO - 3	Describe structure preserving mappings: group homomorphisms
		CLO - 4	Explain the fundamental concept of Ideals and Integral Domains
	REAL ANALYSIS-II MT – CE – 4234	CLO - 1	Identifying convergence through sequential criteria.
		CLO - 2	Using continuity of functions, learn to evaluate every value intermediate to two values it attains, also maximum and minimum value can be determined which has use in various fields.
		CLO - 3	Learn about some of the classes and properties of Riemann integrable functions and the applications of the fundamental theorems of integration
		CLO - 4	Learn about the improper integrals
		CLO - 5	Learn about functions of several variables
5	MECHANICS MT – CE – 5314	CLO - 1	Understand the concepts of moments, couples, equilibrium in both two and three dimensions
		CLO - 2	Understand the friction and center of gravity
		CLO - 3	Understand the motion of a particle and work-energy equations
		CLO - 4	Understand the motion of a particle with resisting medium
		CLO - 5	Understand the concept of projectile motion
	METRIC SPACES MT – CE – 5324	CLO - 1	Define and understand the concept of metric spaces with different types of metric spaces such as Euclidean spaces, discrete spaces and function spaces.
		CLO - 2	Understanding of various geometrical concepts, viz. balls, derived sets, Cantor set and subspaces.

5	METRIC SPACES MT – CE – 5324	CLO - 3	Definition and test of convergence and completeness in metric space
		CLO - 4	Understand the concept of continuity and its various characterizations between two metric spaces
		CLO - 5	Learn to identify connected sets in various metric spaces and recognize the properties that characterize them
	LINEAR ALGEBRA MT– CE – 5334	CLO - 1	Understand the concepts of vector spaces, subspaces, bases, dimension and their properties
		CLO - 2	Relate matrices and linear transformations; compute eigen values and eigen vectors of linear transformations.
		CLO - 3	Understand properties of inner product spaces and determine orthogonality in inner product spaces
	THREE DIMENSIONAL GEOMETERY AND VECTOR ANALYSIS MT – CE – 5344	CLO - 1	Derive and apply different forms of equations of planes and straight lines.
		CLO - 2	Identify and classify quadric surfaces.
		CLO - 3	Understand the Triple Product of vectors, vector calculus and applications
		CLO - 4	Understanding planetary motion and modelling ballistics
6	NUMERICAL ANALYSIS-I MT – CE – 6314	CLO - 1	Investigate the numerical solutions of equations in single variable, while understanding the error analysis involved in the various methods
		CLO - 2	Construct a function which closely fits given n-points in the plane by using various interpolation methods
		CLO - 3	Evaluate derivatives and integrals using numerical techniques
	OPERATION RESEARCH MT – CE – 6324	CLO - 1	Understand optimization problems and their applications in real life problems
		CLO - 2	Find solution to linear optimization problems.
		CLO - 3	Understand the multistage problems and derive solutions
		CLO - 4	Apply search techniques to constrained and unconstrained optimization problems.

6	PARTIAL DIFFERNTIAL EQUATIONS MT – CE – 6334	CLO - 1	Grasping the basic concepts, classifications, and properties of partial differential equations.
		CLO - 2	Learn about method of characteristics and separation of variables to solve first order partial differential equations
		CLO - 3	Learn to classify and solve second order linear PDEs
		CLO - 4	Apply the method of separation of variables for solving second order PDEs.
	COMPLEX ANALYSIS-I MT – CE – 6344	CLO - 1	Explore the theory of analytic functions, the Cauchy-Riemann equations and their significance.
		CLO - 2	Learn about various elementary functions in terms of complex variable.
		CLO - 3	Evaluate complex contour integrals applying the Cauchy's integral theorem and Cauchy's integral formula.

MAPPING OF PROGRAME OUTCOME (PO) AND COURSE LEARNING OUTCOME (CLO)

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

Course Code	CLO	PROGRAMME OUTCOME										
		SPO1	SPO2	SPO3	SPO4	SPO5	SPO6	SPO7	SPO8	SPO9	SPO10	SPO11
MT-CE-1114	CLO - 1	3	3	3	-	-	3	2	-	3	-	3
	CLO - 2	3	3	3	-	-	3	2	-	3	-	3
	CLO - 3	3	3	3	-	-	3	2	-	3	1	3
MT-CE-2114	CLO - 1	3	3	3	-	-	3	1	-	2	1	3
	CLO - 2	3	3	3	-	-	3	1	-	2	2	3
	CLO - 3	3	3	3	-	1	3	2	-	3	3	3
	CLO - 4	3	3	3	-	2	3	2	-	3	3	3
MT-CE-3214	CLO - 1	3	3	3	-	3	3	2	-	3	3	3
	CLO - 2	3	3	3	-	2	2	2	-	1	3	3
	CLO - 3	3	3	3	-	2	3	2	-	-	3	3
MT-CE-3224	CLO - 1	3	3	2	-	-	3	2	-	1	3	3
	CLO - 2	3	3	2	-	-	3	3	-	2	3	3
	CLO - 3	3	3	2	-	-	3	3	-	2	3	3
MT-CE-4214	CLO - 1	3	3	3	2	2	2	1	-	-	2	3
	CLO - 2	3	3	3	2	2	2	1	-	-	2	3
	CLO - 3	3	3	3	2	2	3	1	-	-	2	3
	CLO - 4	3	3	3	2	2	2	1	-		2	3
	CLO - 5	3	3	2	2	2	1	1	-	-	-	-
MT-CE-4224	CLO - 1	3	3	2	-	-	1	1	-	-	2	3
	CLO - 2	3	3	1	-	-	1	1	-	-	2	3
	CLO - 3	3	3	2	-	-	1	1	-	-	2	3
	CLO - 4	3	3	-	-	-	1	1	-	-	2	3
MT-CE-4234	CLO - 1	3	3	2	-	1	1	1	-	-	2	3
	CLO - 2	3	3	2	-	1	2	1	-	-	2	3
	CLO - 3	3	3	2	-	1	1	1	-	-	2	3
	CLO - 4	3	3	1	-	1	1	1	-		2	3
	CLO - 5	3	3	2	-	1	1	1	-	-	2	3
MT-CE-5314	CLO - 1	3	3	2	-	-	1	1	-	1	1	3
	CLO - 2	3	3	2	-	1	1	1	-	1	1	3
	CLO - 3	3	3	2	-	1	1	1	-	1	2	3
	CLO - 4	3	3	2	-	1	-	1	-	1	2	3
	CLO - 5	3	3	2	-	2	2	1	-	1	1	3
MT-CE-5324	CLO - 1	3	3	3	-	2	2	1	-	-	2	3
	CLO - 2	3	3	3	-	2	2	1	-	-	3	3
	CLO - 3	3	3	3	-	1	2	1	-	-	2	3
	CLO - 4	3	3	3	-	2	2	1	-	-	2	3
	CLO - 5	3	3	3	-	2	2	1	-	-	3	3

Course Code	CLO	PROGRAMME OUTCOME										
		SPO1	SPO2	SPO3	SPO4	SPO5	SPO6	SPO7	SPO8	SPO9	SPO10	SPO11
MT-CE-5334	CLO - 1	3	3	3	-	2	2	1	-	-	2	3
	CLO - 2	3	3	3	-	2	2	1	-	-	3	3
	CLO - 3	3	3	3	-	1	2	1	-	-	2	3
MT-CE-5344	CLO - 1	3	3	3	-	3	3	3	-	2	3	3
	CLO - 2	3	3	3	-	3	1	3	-	1	2	3
	CLO - 3	3	3	3	-	3	2	3	-	2	2	3
	CLO - 4	3	3	3	-	2	1	3	-	2	3	3
MT-CE-6314	CLO - 1	3	3	3	2	2	2	1	-	-	3	3
	CLO - 2	3	3	3	2	1	2	1	-	-	3	3
	CLO - 3	3	3	3	2	1	2	2	-	-	3	3
MT-CE-6324	CLO - 1	3	3	3	2	2	1	1	-	1	2	3
	CLO - 2	3	3	3	2	2	-	1	-	1	1	3
	CLO - 3	3	3	3	2	1	-	1	-	1	1	3
	CLO - 4	3	3	3	2	2	1	1	-	1	2	3
MT-CE-6334	CLO - 1	3	3	2	2	1	2	-	-	-	2	3
	CLO - 2	3	3	1	2	1	2	-	-	-	2	3
	CLO - 3	3	3	2	2	1	2	-	-	-	2	3
	CLO - 4	3	3	2	2	1	2	-	-	-	2	3
MT-CE-6344	CLO - 1	3	3	3	2	1	1	-	-	1	2	3
	CLO - 2	3	3	3	2	1	1	-	-	1	2	3
	CLO - 3	3	3	3	2	1	1	-	-	1	2	3

MAPPING OF PROGRAME SPECIFIC OUTCOME (PSO) AND COURSE LEARNING OUTCOME (CLO)

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

Course Code	CLO	PROGRAMME SPECIFIC OUTCOME					
		PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
MT-CE-1114	CLO - 1	3	3	3	-	2	3
	CLO - 2	3	3	3	-	2	3
	CLO - 3	3	3	2	-	2	3
MT-CE-2114	CLO - 1	3	3	3	-	2	3
	CLO - 2	3	3	3	-	2	3
	CLO - 3	3	3	3	-	2	3
	CLO - 4	3	3	3	-	2	3
MT-CE-3214	CLO - 1	3	3	3	-	2	2
	CLO - 2	3	3	3	-	2	2
	CLO - 3	3	3	3	-	2	2
MT-CE-3224	CLO - 1	3	3	3	-	2	3
	CLO - 2	3	3	3	-	2	3
	CLO - 3	3	3	3	-	2	3
MT-CE-4214	CLO - 1	3	3	3	3	2	3
	CLO - 2	3	3	3	3	2	3
	CLO - 3	3	3	3	3	2	3
	CLO - 4	3	3	3	3	2	3
	CLO - 5	3	3	3	3	2	3
MT-CE-4224	CLO - 1	3	3	3	-	2	3
	CLO - 2	3	3	3	-	2	3
	CLO - 3	3	3	3	-	2	3
	CLO - 4	3	3	3	-	2	3
MT-CE-4234	CLO - 1	3	3	3	-	1	3
	CLO - 2	3	3	3	-	1	3
	CLO - 3	3	3	3	-	1	3
	CLO - 4	3	3	3	-	1	3
	CLO - 5	3	3	3	-	1	3
MT-CE-5314	CLO - 1	3	3	3	-	1	3
	CLO - 2	3	3	3	-	1	3
	CLO - 3	3	3	3	-	1	3
	CLO - 4	3	3	3	-	1	3
	CLO - 5	3	3	3	-	1	3
MT-CE-5324	CLO - 1	3	3	3	-	1	3
	CLO - 2	3	3	3	-	1	3
	CLO - 3	3	3	3	-	1	3
	CLO - 4	3	3	3	-	1	3
	CLO - 5	3	3	3	-	1	3

Course Code	CLO	PROGRAMME SPECIFIC OUTCOME					
		PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
MT-CE-5334	CLO - 1	3	3	3	-	2	3
	CLO - 2	3	3	3	-	2	3
	CLO - 3	3	3	3	-	2	3
MT-CE-5344	CLO - 1	3	3	3	-	1	3
	CLO - 2	3	3	3	-	1	3
	CLO - 3	3	3	3	-	1	3
	CLO - 4	3	3	3	-	1	3
MT-CE-6314	CLO - 1	3	3	3	3	1	3
	CLO - 2	3	3	3	3	2	3
	CLO - 3	3	3	3	3	1	3
MT-CE-6324	CLO - 1	3	3	3	-	2	3
	CLO - 2	3	3	3	-	2	3
	CLO - 3	3	3	3	-	2	3
	CLO - 4	3	3	3	-	2	3
MT-CE-6334	CLO - 1	3	3	3	2	2	3
	CLO - 2	3	3	3	2	2	3
	CLO - 3	3	3	3	2	2	3
	CLO - 4	3	3	3	2	2	3
MT-CE-6344	CLO - 1	3	3	3	2	1	3
	CLO - 2	3	3	3	2	1	3
	CLO - 3	3	3	3	2	1	3

COURSE NAME: ALGEBRA

COURSE CODE: MT – CE – 1114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 CREDITS

Total Lectures: 45

COURSE OBJECTIVE:

Algebra is the study of operations and their applications to solving system of equations. This course intends to introduce students to the basic concepts of the theory of equations, the complex numbers and also, the matrices and determinants.

Course Learning Outcome:

CLO-01: *Analyze a given system of equations, and tell the nature of the roots of the given system.*

CLO-02: *Apply De Moivre's theorem as and when applicable.*

CLO-03: *Learning the basic operations in matrices, and hence check the consistency of a given system of equations. Also, solve both homogeneous and non-homogeneous system of equations*

Unit 1: Theory of Equations: (15 LECTURES)

General properties of equations, theorems related to real roots of equations, existence of a root in the general equation, imaginary roots, equal roots, theorems determining the number of roots of an equation, relation between roots and coefficients of n^{th} degree equation, solution of cubic and bi-quadratic equations.

Unit 2: Complex Numbers: (10 LECTURES)

De Moivre's theorem (both integral and rational index), roots of complex numbers, solutions of equations using trigonometry and De Moivre's theorem.

Unit 3: Matrices: (20 LECTURES)

Matrix algebra, transposition, symmetry, matrix inversion and properties, row echelon form and rank of a matrix, reduced row echelon form, consistency of linear systems, solutions of system of homogeneous and non-homogeneous linear equations with number of equations and unknowns up to four, invariance of rank under elementary transformations, reduction to normal form.

Books Recommended:

1. Gilbert, L.& Gilbert, J., *Elements of Modern Algebra*,(8^{th}edition),Cengage Learning, 2013.
2. Burnside, W.S.& Panton, Arthur W., *The Theory of Equations*,Vol.1,Dublin University Press Series, 2023.
3. Meyer, C. D., *Matrix Analysis and Applied Linear Algebra*, Society for Industrial and Applied Mathematics (Siam), 2000.

Reference Books:

1. Dickson, L. E., *First Course in The Theory of Equations*, The Project Gutenberg eBook (http://www.gutenberg.org/ebooks/29785), 2009.

2. Gilbert, W. J., *Modern Algebra with Applications* (2nd edition). John Wiley & Sons, 2004.
3. Andreescu, T. and Andrica, D., *Complex Numbers from A to .... Z*, Birkhauser, 2006.

COURSE NAME: CALCULUS

COURSE CODE: MT – CE – 2114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 Credits

TOTAL LECTURES: 45 COURSE

OBJECTIVE:

Calculus is the mathematical study of 'change'. This course intends to introduce students to the significant concepts of limit, continuity and differentiability of real valued functions. Also, students will acquire the knowledge of solving complicated integrals using reduction formulae and hence, able to evaluate arc length, surface area and volume..

Course Learning Outcome:

CLO-01: *Learn about basic concepts of real sequences*.

CLO-02: *Understand concepts of limit and continuity of functions*

CLO-03: *Learn about differentiability of a function, and understand the various applications of real valued functions*

CLO-04: *Apply reduction formulae to solve complicated integrals, and also to apply them in the real world problems***.**

Unit1: Real Sequences (5 LECTURES)

Sequences, limit of a sequence, monotone sequences.

Unit 2: Limits and continuity (15 LECTURES)

Limit and continuity of a function, properties of continuous functions including intermediate value theorem.

Unit 3: Differentiability (15 LECTURES)

Differentiability, successive differentiation, recursion formulae using Leibnitz theorem, Rolle's theorem, Lagrange's mean value theorem, Taylor's theorem, Taylor's series and Maclaurin's series.

Unit 4: Application of Integration: (10 LECTURES)

Volumes by slicing, disks and washers' methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

Books Recommended:

1. Anton, H., Bivens, I. ,& Davis, S., *Calculus* (10th edition), John Wiley & Sons Singapore Pvt. Ltd .(Reprint by Wiley India Pvt. Ltd. Delhi), 2017.
2. Narayan, S.and Mittal, P. K.; *Differential Calculus,* S.Chand,2005.

Reference Books:

1. Strauss, M. J.,Bradley, G. L. and Smith, K. J.,*Calculus* (3rd edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. Bradley, G. L.and Smith, K. J.,*Calculus,* Prentice Hall Inc, (3rd edition) 2002.
3. Thomas, Jr. G. B., Weir, M. D., & Hass, J.,*Thomas*' *Calculus* (13th edition). Pearson Education, Delhi, Indian, 2014.

COURSE NAME: ANALYTICAL GEOMETRY OF 2D

COURSE CODE: MT - CE - 3214

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objectives:

Main objective of this course is to introduce and describe the two-dimensional coordinates systems and the properties of two-dimensional shapes

Course Learning Outcome:

CLO 1: *Knowledge about transformation of co-ordinate systems.*

CLO 2: *Learn about the conditions on coefficients such that the general equation of second degree represents a pair of straight lines.*

CLO 3: *Learn about general and central conics and various properties*

Unit1: Coordinates and Locus (15 LECTURES)

Coordinates and locus: straight lines, transformation of axes, standard equations (circle, parabola, ellipse and hyperbola), invariants under orthogonal transformation.

Unit 2: Pair of straight lines (15 LECTURES)

Pair of straight lines: homogeneous and non-homogeneous equations of second degree.

Unit 3: General conics and central conics (15 LECTURES)

Parabola, parametric coordinates tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes. General conics: tangent, condition of tangency, pole and polar, central conics.

Book Recommended:

1. Khan, R. M., *Analytical Geometry of two and three dimensions and vector analysis*, New Central Book Agency, 2017.

Reference Books:

1. Askwith, E. H., *The Analytical Geometry of the Conic Sections*, Nabu Press,2012.
2. Das, B., *Analytical Geometry and Vector Analysis*, Orient Book Company, Kolkata-712018.
3. Jain P. K. and Ahmed, K., *Textbook of Analytical Geometry*, New Age International Publishers, Third Edition, 2014.

COURSE NAME: REAL ANALYSIS-I

COURSE CODE: MT - CE - 3224

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

The course will develop a thorough understanding of the world of real numbers and their functions. It helps develop skills in mathematical reasoning and analysis and also a deep comprehension of the properties of real-valued functions, which are fundamental in various branches of mathematics and applied sciences.

Course Learning Outcome

CLO 1: *Knowledge of fundamental properties associated with the real number system*

CLO 2: *Thorough understanding of real sequences along with the concept of their convergence criterion*

CLO 3: *Apply various tests to check convergence of infinite series of real numbers.*

Unit 1: Real Numbers and Properties (15 LECTURES)

Finite and infinite sets, algebraic and order properties of $\mathbb{R}$, absolute value and real line, bounded sets, supremum and infimum, completeness property of $\mathbb{R}$, the Archimedean property, the density theorem, intervals, nested interval theorem.

Unit 2: Real sequences (15 LECTURES)

Sequence and convergence, bounded sequence, theorems on limit, monotone sequences, monotone convergence theorem, subsequences, Bolzano Weierstrass theorem for sequences, Cauchy sequences, Cauchy's convergence criterion, properly divergent sequences.

Unit 3: Infinite series (15 LECTURES)

Convergence and divergence of infinite series, Cauchy criterion, tests for convergence: comparison test, limit comparison test, ratio test, Raabe's test, Gauss test, root test, integral test, absolute convergence, rearrangement theorem, alternating series, Leibniz test, conditional (non-absolute) convergence.

Book Recommended:

1. Bartle, R. G. and Sherbert, D. R., *Introduction to Real Analysis*, (3rd edition), John Wiley and Sons,2002.

Reference Books:

1. Kumar A. and Kumaresan, S., *Basic Course in Real Analysis*, CRC Press,2014.
2. Apostol, *Mathematical Analysis*, (2nd edition), Pearson Higher Education, 1974.
3. Bali, N. P, *Real analysis*, Golden Maths series, Firewall media (Laxmi publications pvt. Ltd), 2021.

COURSE NAME: ORDINARY DIFFERENTIAL EQUATION

COURSE CODE: MT - CE - 4214

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

Differential equations are used as a fundamental tool in different fields of science and engineering. It provides a mathematical description (Mathematical Model) of real-world problems to enabling predictions, optimizations, and control of dynamic systems in various scientific disciplines. Differential equations are used to make predictions about future behavior based on current conditions.

Course Learning Outcome:

CLO 1: *Understand that physical systems can be described by differential equations*.

CLO 2: *Understand the practical importance of solving differential equations*

CLO 3: *Recognize an appropriate solution method for a given problem*

CLO 4: *Analytically solve a wide range of ordinary differential equations*

CLO 5: *Solve differential equations using Mathematica*

Unit 1: Linear and higher order differential equations (15 LECTURES)

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Unit 2: Mathematical Models (15 LECTURES)

Introduction to compartmental model, exponential decay model, exponential growth of population, limited growth of population, limited growth with harvesting.

Unit 3: Homogeneous and non-homogeneous differential equations (15 LECTURES)

General solution of homogeneous equations, Wronskian: its properties and applications, linear homogeneous and nonhomogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, methods of finding particular integrals.

List of Practical (Using Mathematica)

Total Lectures: 30

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).

6. Case of single cold pill and a course of cold pills.

7. Limited growth of population (with and without harvesting).

Books Recommended:

1. Barnes, B. and Fulford, G. R., *Mathematical Modelling with Case Studies, Using Maple and MATLAB* (3rd edition). CRC Press, Taylor & Francis Group, 2015.
2. Edwards, C. H., Penney, D. E., and Calvis, D.T., *Differential Equation and Boundary Value Problems: Computing and Modelling* (5th edition). Pearson Education, 2015.
3. Ross, S. L., *Differential Equations* (3rd edition). John Wiley & Sons. India, 2004.

Reference Books:

1. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA*, (3rdedition), Elsevier Academic Press, 2004.
2. Ross, Clay C., *Differential Equations: An Introduction with Mathematica* (2nd edition). Springer, 2004.

COURSE NAME: ABSTRACT ALGEBRA-I

COURSE CODE: MT - CE - 4224

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

The basic objective of the course is to introduce the fundamental concept of groups, subgroups, cyclic groups, symmetric group, group homomorphism and isomorphism. The Lagrange's theorem on finite group is also discussed. Also rings, integral domain, field and ideals and their properties are introduced in details.

Course Learning Outcome:

CLO 1: *Recognize the fundamental concept of groups, rings and fields.*

CLO 2: *Explain the significance of cyclic groups, symmetric groups, normal subgroups, factor groups*

CLO 3: *Describe structure preserving mappings: group homomorphisms*

CLO 4: *Explain the fundamental concept of Ideals and Integral Domains*

Unit 1: Groups (25 LECTURES)

Definition and properties of groups, permutation groups and quaternion groups, order of a group, order of an element of a group, subgroups, centralizer, normalizer, center of a group, properties of cyclic groups, classification of subgroups of cyclic groups, fundamental theorem of cyclic group, cycle notation for permutations, alternating group, cosets, Lagrange's theorem, Fermat's Little theorem, normal subgroups, factor groups.

Unit 2: Group Homomorphism (5 LECTURES)

Group homomorphism, properties of group homomorphism, kernel of a group homomorphism, isomorphisms, properties, fundamental theorem of homomorphism, second and third theorems of isomorphism, Cayley's theorem.

Unit 3: Rings (15 LECTURES)

Definition and examples of rings, properties of rings, subrings, zero-divisors in a ring, integral domains and fields, characteristic of a ring, ideals, operations on ideals, prime and maximal ideals, factor ring.

Books Recommended:

1. Gallian, J. A., *Contemporary Abstract Algebra*(8thedition), Cengage Learning India Private Limited, Delhi, Fourth impression, 2015**.**

Reference Books:

1. John, B. F., *A First Course in Abstract Algebra*, (7th edition), Pearson, 2002.
2. Santhanam, G., Algebra, Narosa PublishingHouse, 2017.
3. Dummit, D. S. and Foote, R. M., *Abstract Algebra* (2ndedition), John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2003.
4. Rotman, J. J., *An Introduction to the Theory of Groups*, (4th edition), Springer Verlag, 1995.

COURSE NAME: REAL ANALYSIS-II

COURSE CODE: MT - CE - 4234

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

It is a course on the study of real valued functions that would develop an analytical ability to have a more matured perspective of the key concepts of calculus like limit, continuity, differentiability and their applications..

Course Learning Outcome:

CLO 1: *Identifying convergence through sequential criteria*

CLO 2: *Using continuity of functions, learn to evaluate every value intermediate to two values it attains, also maximum and minimum value can be determined which has use in various fields.*

CLO 3: *Learn about some of the classes and properties of Riemann integrable functions and the applications of the fundamental theorems of integration.*

CLO 4: *Learn about the improper integrals.*

CLO 5: *Learn about functions of several variables.*

Unit 1: Limits (10 LECTURES)

Limit point of a set, limits of a function (ε-δ approach), sequential criterion for convergence and divergence, theorems on limit, one sided limits, infinite limits and limits at infinity.

Unit 2: Continuous functions (15 LECTURES)

Continuous functions, ε-δ definition of continuity, sequential criterion for continuity and discontinuity, combination of continuous functions, boundedness theorem, maximum-minimum theorem, location of roots theorem, preservation of intervals theorem, uniform continuity, uniform continuity theorem.

Unit 3:Riemann Integration (15 LECTURES)

Darboux integrability, properties of integral, fundamental theorems of calculus, mean value theorems for integrals, Riemann sum and Riemann integrability, sum of infinite series as Riemann integrals, improper integrals.

Unit 4: Functions of several variables (5 LECTURES)

Explicit and implicit functions of two variables, limit, repeated limit, simultaneous limit, continuity, differentiability, necessary and sufficient conditions of differentiability, Young's and Schwarz's theorems.

Books Recommended:

1. Bartle, R. and Sherbert, D. R., *Introduction to Real Analysis*, (4th edition), John Wiley and Sons, 2015.
2. Kumar, A. and Kumaresan, S., *A Basic Course in Real Analysis*, CRC Press, Indian Edition, 2014.
3. Thomas, G.B, and Finney, R.L., *Calculus and Analytic Geometry*, (9th edition),Addison-Wesley Publishing Company, 1998.

Reference Books:

1. Bali, N. P, *Real analysis*, Golden Maths series, Firewall media (Laxmi publications pvt. Ltd), 2021.
2. Ross, K.A., *Elementary Analysis: The Theory of Calculus*, Springer, 2004.
3. Mattuck, A., *Introduction to Analysis*, Prentice Hall, 1999.
4. Ghorpade S. R. and Limaye, B. V., *A Course in Calculus and Real Analysis*, Springer, 2006.

COURSE NAME: MECHANICS

COURSE CODE: MT - CE - 5314

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

The course aims at understanding the various concepts of physical quantities and the related effects on different bodies using mathematical techniques. It emphasizes knowledge building for applying mathematics in physical world.

Course Learning Outcome:

CLO 1: *Understand the concepts of moments, couples, equilibrium in both two and three dimensions*.

CLO 2: *Understand the friction and center of gravity*.

CLO 3: *Understand the motion of a particle and work-energy equations*

CLO 4: *Understand the motion of a particle with resisting medium*

CLO 5: *Understand the concept of projectile motion*

Unit 1: Statics: (20 LECTURES)

Composition and resolution of forces, parallelogram of forces, triangle of forces, converse of triangle of forces, Lami's theorem, parallel forces, moment of a force about a point and an axis. Couple, resultant of a system of forces, equilibrium of coplanar forces, friction, center of gravity of an arc, plane area, surface of revolution.

Unit 2: Dynamics of a Particle: (20 LECTURES)

Velocities and acceleration along radial and transverse directions and along tangential and normal directions, motion in a straight line under variable acceleration, simple harmonic motion and elastic string. Newton's law of motion, work, energy and momentum, conservative forces-potential energy, impulsive forces, motion in resisting medium.

Unit 3: Projectile motion: (5 LECTURES)

Path of a projectile in vacuum, time of flight, range and maximum height.

Books Recommended:

1. Loney, S. L., *The elements of Statics and Dynamics* (Vol I & II),Arihant Publication, (4thedition), 2014.
2. Rana, N.C. and Joag, P.S., *Classical Mechanics*, Tata Mc-GrawHill, 2017.

Reference books:

1. Ramsay, A. S., *Statics*, Cambridge University Press, 2009.
2. Ramsay, A. S., *Dynamics*, Cambridge University Press,2009.
3. Spiegel, M. R., *Theoretical Mechanics*, Schaum Series, 2010.
4. Chorlton, F., *Textbook of Dynamics*, CBS, Publications, (2ndedition), 1985.
5. Goldstein. H. and Poole. C.P., and Safko. J., Classical Mechanics, Pearson, (3rd edition), 2011.

COURSE NAME: METRIC SPACES

COURSE CODE: MT - CE - 5324

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective :

The main objective of this course is to demonstrate an understanding of metric spaces. Studying metric spaces typically involves understanding the properties of distance functions, topological concepts like open and closed sets, convergence of sequences, continuity, connectedness and completeness. These concepts serve as foundational tools for analyzing spaces in various branches of mathematics, including analysis, topology and geometry

Course Learning Outcome :

CLO 1: *Define and understand the concept of metric spaces with different types of metric spaces such as Euclidean spaces, discrete spaces and function spaces*

CLO 2: *Understanding of various geometrical concepts, viz. balls, derived sets, Cantor set and subspaces*

CLO 3: *Definition and test of convergence and completeness in metric space*

CLO 4: *Understand the concept of continuity and its various characterizations between two metric spaces*

CLO 5: *Learn to identify connected sets in various metric spaces and recognize the properties that characterize them.*

Unit 1: Introduction (15 LECTURES)

Definition and examples, open and closed balls, neighborhood, open set, interior of a set, closed set, theorems on open and closed sets, limit point of a set, closure of a set, diameter of a set, subspaces,

Unit 2: Convergence in a Metric space (10 LECTURES)

Convergence sequences in metric spaces, Cauchy sequences, complete metric spaces, Cantor's theorem.

Unit 3: Continuity in Metric space (10 LECTURES)

Continuous mappings, sequential criterion for continuity, various characterizations of continuity, uniform continuity, homeomorphism, contraction mappings.

Unit 4: Connectedness in Metric space (10 LECTURES)

Connectedness, connected subsets of $\mathbb{R}$, connectedness and continuous mappings**.**

Books Recommended:

1. Shirali S., and Vasudeva, H. L., *Metric Spaces*, Springer Verlag London, 2009.
2. Simmons, G. F., *Introduction to Topology and Modern Analysis*, McGraw-Hill, 2004.

Reference Books:

1. Kumaresan, S., *Topology of Metric Spaces*, (2nd edition), Narosa Publishing House, 2011.
2. M O' Searcoid,. Metric Spaces, Springer, 2008.

COURSE NAME: LINEAR ALGEBRA

COURSE CODE: MT - CE - 5334

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

Linear Algebra is the study of linear mappings on finite dimensional vector spaces. The main aim of this course is to bring out the geometric ideas underlying the concepts of vectors, matrices and linear transformation and entice the students to geometric way of thinking.

Course Learning Outcome:

CLO 1: *Understand the concepts of vector spaces, subspaces, bases, dimension and their properties..*

CLO 2: *Relate matrices and linear transformations; compute eigen values and eigen vectors of linear transformations.*

CLO 3: *Understand properties of inner product spaces and determine orthogonality in inner product spaces.*

Unit 1: **Vector spaces (20 LECTURES)**

Vector spaces, subspaces, null space and column space of a matrix, linear transformations, kernel and range, linearly independent sets, bases, the spanning set theorem, bases for null space and column space of a matrix, coordinate systems, the coordinate mapping, dimension of a vector space, rank, change of basis.

Unit 2: Eigenvalues and Eigenvectors (10 LECTURES)

Eigenvectors and eigenvalues of a matrix, the characteristic equation, diagonalization, eigenvectors of a linear transformation, complex eigenvalues, Cayley-Hamilton theorem.

Unit 3: Inner Product space (15 LECTURES)

Inner product, length of a vector, orthogonal vectors, orthogonal sets, orthogonal projections, the Gram–Schmidt process and orthonormal bases, inner product spaces, diagonalization of symmetric matrices, the spectral theorem.

Books Recommended:

1. Lay, D. C., *Linear Algebra and its Applications* (3rd edition), Pearson Education Asia, Indian Reprint, 2007.
2. Poole. D., *Linear Algebra: A Modern Introduction* (4th edition), Cengage Learning India Pvt. Ltd., 2014.

Reference Books:

1. Axler, S., *Linear Algebra Done Right* (2nd edition), Springer, 1997.
2. Strang, G., *Linear Algebra and its Applications*, Thomson, 2007.
3. Hoffman, K., Kunze, R. A., *Linear Algebra*, (2nd edition), Prentice-Hall of India Pvt. Ltd., 1971.

COURSE NAME: THREE-DIMENSIONAL GEOMETRY AND VECTOR ANALYSIS

COURSE CODE: MT - CE - 5344

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

The main objective is to develop a solid understanding of three-dimensional space, lines and planes and their geometric interpretations. Develop the ability to identify and classify quadric surfaces, understanding their basic properties and characteristics. Gain proficiency in vector algebra, including dot product, scalar triple product as well as their geometric interpretations. Introduce vector functions and their significance. Limits and continuity of vector valued functions, learn techniques for differentiating vector functions. Understand the integration of vector functions and its applications. Investigate the acceleration vector and its components. Explore the tangent and normal components in the context of motion. Apply vector functions to model projectile motion. Explore planetary motion using vector calculus. Understand Kepler's laws of planetary motion specifically on Kepler's second law and its mathematical representation.

Course Learning Outcome:

CLO 1: *Derive and apply different forms of equations of planes and straight lines*.

CLO 2: *Identify and classify quadric surfaces*

CLO 3: *Understand the Triple Product of vectors, vector calculus and applications*

CLO 4: *Understanding planetary motion and modelling ballistics*

Unit 1: Plane (15 LECTURES)

Plane: Different forms of equation of a plane, straight lines and shortest distance between a point and a plane or between two skew lines.

Unit 2: Quadratic Surfaces (15 LECTURES)

Quadric Surfaces: sphere, cylinder, cone and surfaces of revolution and their geometric properties.

Unit 3: Planetary Motion (15 LECTURES)

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modelling ballistics and laws of planetary motion.

Book Recommended:

1. Khan, R. M., *Analytical Geometry of two and three dimension and vector analysis*, New Central Book agency, 2012.
2. Loney, S. L., *The elements of Statics and Dynamics* (Vol I & II), Arihant Publication, (4th edition), 2014.

Reference Books:

1. Askwith, E. H., *The Analytical Geometry of the Conic Sections*, Nabu Press, 2012.
2. Jain P. K. and Ahmed, K., *Textbook of Analytical Geometry*, New Age International Publishers, (3rd edition), 2014.

COURSE NAME: NUMERICAL ANALYSIS-I

COURSE CODE: MT - CE - 6314

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

This course aims to develop methods for solving mathematical problems using numerical techniques, understanding error analysis, and gaining proficiency in implementing algorithms for tasks like root finding, interpolation, integration and differential equations. Also, aim to equip the students with practical skills for solving real-world problems by using Mathematica software.

Course Learning Outcome:

CLO 1: *Investigate the numerical solutions of equations in single variable, while understanding the error analysis involved in the various methods.*

CLO 2: *Construct a function which closely fits given n-points in the plane by using various interpolation methods.*

CLO 3: *Evaluate derivatives and integrals using numerical techniques.*

Unit 1: Root-finding (15 LECTURES)

Algorithms, convergence, bisection method, false position method, fixed point iteration method, Newton's method, secant method.

Unit 2: **Interpolation (15 LECTURES)**

Finite difference operators, linear and quadratic interpolation: Lagrange and Newton interpolation.

Unit 3: **Numerical differentiation and Integration (15 LECTURES)**

Numerical differentiation: Forward difference, backward difference and central difference.

Numerical integration: Newton-Cotes and composite Newton-Cotes quadratures (trapezoidal rule, Simpson's rule).

Practical / Lab work to be performed using Mathematica:

Total Lectures: 30

i. Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ----------+ 1/ N.

ii. To find the absolute value of an integer.

iii. Enter 100 integers into an array and sort them in an ascending order.

iv. Bisection method

v. Newton Raphson method

vi. Secant method

vii. Regular falsi method

viii. Lagrange interpolation or Newton interpolation

ix. Simpson's rule

Books Recommended:

1. Bradie, B., *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., *Numerical Methods for Scientific and Engineering Computation*, New age International Publisher, India, (5th edition), 2007.

Reference Book:

1. Gerald, C. F. and Wheatley, P. O., *Applied Numerical Analysis*, Pearson Education, India, (7thedition), 2008.
2. Burden, R. L., Faires J. D., Numerical Analysis, (9th Edition), Cengage Learning, 2010.

COURSE NAME: OPERATION RESEARCH

COURSE CODE: MT - CE - 6324

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints. The objective of this course is to enable the student to understand and analyze managerial and engineering problems to equip him to use the resources such as capitals, materials, productions, controlling, directing, staffing, and machines more effectively. To apply various optimization techniques for decision making.

Course Learning Outcome:

CLO 1: *Understand optimization problems and their applications in real life problems.*

CLO 2: *Find solution to linear optimization problems*

CLO 3: *Understand the multistage problems and derive solutions.*

CLO 4: *Apply search techniques to constrained and unconstrained optimization problems***.**

Unit 1: Basics of Operational Research (10 LECTURES)

Origin & development of operational research, definition and meaning of operational research, different phases of an operational research study, scope and limitations of operational research, mathematical modeling of real life problems.

Unit 2: Linear Programming Problem (10 LECTURES)

Linear Programming Problem (LPP): Introduction, lines and hyper plane, convex set, convex hull.

Unit 3: Methods to solve LPP (15 LECTURES)

Formulation of LPP, graphical method of LPP, simplex method, Big M method and two phase method, dual problem.

Unit 4: Transportation and Assignment Problem (15 LECTURES)

Transportation and assignment problem.

Books Recommended:

1. Hadley, G., *Linear Programming*, Narosa Publishing House, New Delhi, 2002.
2. Gupta, R. K., *Operation Research*, Krishna Prakashan Media (P), Ltd, 2010.
3. Swarup, Kanti, Gupta, P.K. and Man Mohan, *Operations Research*, S. Chand & Sons, 2017.

Reference Books:

1. Kambo, N.S., *Mathematical Programming Techniques*, Affiliated East-West Press, 2008.
2. Rao, S.S.: *Optimization Theory and Applications*, Wiley Eastern Ltd, 2005.
3. Sharma, J. K., *Operation Research Theory and Application*, Macmillan Publishers India Ltd, 2017.

COURSE NAME: PARTIAL DIFFERNTIAL EQUATIONS

COURSE CODE: MT - CE - 6334

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

Partial differential equation provides a mathematical framework to understand and solve problems involving multiple variables and their rate of change. The main objectives of this course are to teach the students to form and solve partial differential equations and use them in solving some physical problems. Also this course involves hands-on experience in solving, simulating and visualizing partial differential equations using Mathematica, enhancing both theoretical knowledge and computational skill.

Course Learning Outcome:

CLO 1: *Grasping the basic concepts, classifications, and properties of partial differential equations*

CLO 2: *Learn about method of characteristics and separation of variables to solve first order partial differential equations*

CLO 3: *Learn to classify and solve second order linear PDEs.*

CLO 4: *Apply the method of separation of variables for solving second order PDEs.*

Unit 1: First order PDE (15 LECTURES)

Introduction, classification, construction of first order partial differential equations (PDE). Cauchy's problem for first order equations, linear equations of the first order, integral surfaces passing through a given curve, nonlinear partial differential equations of the first order, Cauchy's method of characteristics, Charpit's method, solutions satisfying given conditions, Jocobi's method.

Unit 2: Canonical Form (15 LECTURES)

Canonical form of first order PDE, method of separation of variables for first order PDE.

Unit 3: Second order PDE (15 LECTURES)

Second order equations in two independent variables, reduction to canonical forms, equations with constant coefficients, equations with variable coefficients, general solution.

Practical /Lab work to be performed in a Computer lab using Mathematica:

Total Lectures: 30

1. Solving systems of differential equations.
2. Solution of Cauchy problem for first order PDE.
3. Plotting the characteristics for the first order PDE.
4. Plot the integral surfaces of a given first order PDE with initial data.
5. Solution of wave equation $\frac{\partial^2 u}{\partial^2 t} = c^2 \frac{\partial^2 u}{\partial^2 x}$ for any two of the following associated conditions:
   a. $(x, 0) = \phi(x); u(x, 0) = \psi(x);$ x$\in R; t > 0$
   b. $u(x, 0) = \phi(x); u(x, 0) = \psi(x), u(0, t) = 0;$ x$> 0; t > 0$

c. $u(x,0) = \phi(x); u_t(x,0) = \psi(x), u_x(0,t) = 0; x > 0; t > 0$

d. $u(x,0) = \phi(x); u_t(x,0) = \psi(x), u\ \ (0,t) = 0, u\ \ (l,t) = 0; x > 0; t > 0$

6. Solution of one-dimensional heat equation $u_t = ku_{xx}$, for a homogeneous rod of length l i.e. solve the IBVP:

$$u_t = ku_{xx}, 0 < x < l, t > 0$$

$$u\ \ (0,t) = 0, u\ \ (l,t) = 0, t \geq 0$$

$$u\ \ (0,t) = f(x), 0 \leq x \leq l$$

Books Recommended:

1. Tyn Myint-U and Debnath, L., *Linear Partial Differential Equation for Scientists and Engineers*, Springer, Indian reprint, 2006.
2. Sneddon, I. N., *Elements of Partial Differential Equations*, Dover Publications, Indian Reprint, 2006.

Reference Book:

1. Stavroulakis, I. P. &Tersian, S. A., *Partial Differential Equations: An Introduction with Mathematica and MAPLE*, (2nd edition), World Scientific, 2004.
2. Rao, K. S., Introduction to Partial Differential Equations, PHI Learning Pvt. Ltd., 2011.

COURSE NAME: COMPLEX ANALYSIS-I

COURSE CODE: MT - CE - 6344

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

Complex analysis provides a framework for understanding functions of complex variables, which are essential in various areas of mathematics, physics, engineering, and other sciences. The main aim of this course is to introduce the basic theory of complex valued functions and some applications. Fundamental ideas and rigorous proofs will be emphasized. Students are expected to understand the classical theory of complex analysis from the analytic, algebraic and geometric point of view.

Course Learning Outcome :

CLO 1: *Explore the theory of analytic functions, the Cauchy-Riemann equations and their significance*.

CLO 2: *Learn about various elementary functions in terms of complex variable*

CLO 3: *Evaluate complex contour integrals applying the Cauchy's integral theorem and Cauchy's integral formula.*

Unit 1: Complex valued function (20 LECTURES)

Properties of complex numbers, regions in the complex plane, functions of complex variable, limits, limits involving the point at infinity, continuity, differentiability, Cauchy-Riemann equations, sufficient conditions for differentiability, analytic functions, harmonic functions.

Unit 2: Elementary functions (10 LECTURES)

The exponential function, the logarithmic function, the power function, the trigonometric functions, hyperbolic functions.

Unit 3: Complex integration (15 LECTURES)

Derivatives of complex-valued functions of a real variable, definite integrals of functions, contour integrals, upper bounds for moduli of contour integrals, antiderivatives, Cauchy-Goursat theorem, simply and multiply connected domains, Cauchy integral formula and some consequences.

List of Practical (Using Mathematica):

Total Lectures: 30

1. Declaring a complex number and graphical representation.
2. The algebra of complex numbers.
3. To find conjugate, modulus and phase angle of an array of complex numbers.
4. To compute the integral over a straight line path between the two specified end points.
5. To perform contour integration.
6. To plot the complex functions and analyze the graph.

Books Recommended:

1. Brown, J. W. and Churchill, R. V.,*Complex Variables and Applications* (9th edition), McGraw – Hill International Edition, 2021.

Reference Books:

1. Ponnusamy, S., *Foundations of Complex Analysis*, (2nd edition),Narosa Publications, 2011.
2. Kumaresan, S., A Pathway to Complex Analysis, Techno World, 2022.
3. Bak, J. and Newman, D. J., *Complex analysis* (2nd edition), Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

MINOR

Programme Specific Outcome of Bachelor of Science – Mathematics: Minor

PSO No.	Name	Outcome
PSO–1	Depth of Understanding	Students will get adequate exposure to basic and advanced knowledge in different aspects of mathematical sciences. They will acquire the logical skills necessary to create and develop mathematical arguments. They will be capable of analyzing problems, determining computer needs and defining suitable solutions.
PSO–2	Scientific Communication Skills	Students will develop the ability to apply their skills and knowledge to convert given information into mathematical expressions, select and use appropriate mathematical formulae or techniques to process the information and draw the relevant conclusion..
PSO–3	Modern tool use	Students will learn to utilize computer technology appropriate to solve problems and promote understanding, to apply mathematical knowledge to carrier related to mathematical sciences, thus cultivating a proper attitude to higher studies in mathematics.
PSO–4	Employability	Students possess the essential skills of mathematical modelling, problem-solving, creativity and effective communication, preparing them for a wide range of employment opportunities

LIST OF COURSES:

Semester	Course Name	Course Code
1	ALGEBRA	MT – MN – 1114
2	CALCULUS	MT – MN – 2114
3	ANALYTICAL GEOMETRY OF 2D	MT – MN – 3214
4	ORDINARY DIFFERENTIAL EQUATION	MT – MN – 4214
5	REAL ANALYSIS	MT – MN – 5214
6	ABSTRACT ALGEBRA	MT – MN – 6214

Course Learning Outcome (CLO)

Semester	Course Name & Code	Course Learning Outcome (CLO)	
1	ALGEBRA MT – MN – 1114	CLO - 01	Analyze a given system of equations, and tell the nature of the roots of the given system
		CLO - 02	Apply De Moivre's theorem as and when applicable.
		CLO - 03	Learning the basic operations in matrices, and hence check the consistency of a given system of equations. Also, solve both homogeneous and non-homogeneous system of equations
2	CALCULUS MT – MN – 2114	CLO - 01	Learn about basic concepts of real sequences.
		CLO - 02	Understand concepts of limit and continuity of functions.
		CLO – 03	Learn about differentiability of a function, and understand the various applications of real valued functions.
		CLO – 04	Apply reduction formulae to solve complicated integrals, and also to apply them in the real world problems.
3	ANALYTICAL GEOMETRY OF 2D MT – MN – 3214	CLO - 01	Knowledge about transformation of co-ordinate systems.
		CLO - 02	Learn about the conditions on coefficients such that the general equation of second degree represents a pair of straight lines.
		CLO – 03	Learn about general and central conics and various properties.
4	ORDINARY DIFFERENTIAL EQUATION MT – MN - 4214	CLO - 01	Understand that physical systems can be described by differential equations.
		CLO - 02	Understand the practical importance of solving differential equations.
		CLO – 03	Recognize an appropriate solution method for a given problem.
		CLO – 04	Analytically solve a wide range of ordinary differential equations.
5	REAL ANALYSIS MT – MN – 5214	CLO - 01	Knowledge of fundamental properties associated with the real number system.
		CLO - 02	Thorough understanding of real sequences along with the concept of their convergence criterion.
		CLO – 03	Apply various tests to check convergence of infinite series of real numbers.

6	ABSTRACT ALGEBRA MT – MN – 6214	CLO - 01	Recognize the fundamental concept of groups, rings and fields.
		CLO - 02	Explain the significance of cyclic groups, symmetric groups, normal subgroups, factor groups.
		CLO – 03	Describe structure preserving mappings: group homomorphisms.
		CLO – 04	Explain the fundamental concept of ideals and integral domains

Mapping of Programe Outcome (PO) and Course Learning Outcome (CLO):

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

Course Code	CLO	Programme Outcome (SPO)										
		SPO - 1	SPO - 2	SPO - 3	SPO - 4	SPO - 5	SPO - 6	SPO - 7	SPO - 8	SPO - 9	SPO - 10	SPO -11
MT-MN-1114	CLO – 1	3	3	3	-	-	3	2	-	3	-	3
	CLO – 2	3	3	3	-	-	3	2	-	3	-	3
	CLO – 3	3	3	3	-	-	3	2	-	3	1	3
MT-MN-2114	CLO – 1	3	3	3	-	-	3	1	-	2	1	3
	CLO – 2	3	3	3	-	-	3	1	-	2	2	3
	CLO – 3	3	3	3	-	1	3	2	-	3	3	3
	CLO – 4	3	3	3	-	2	3	2	-	3	3	3
MT-MN-3214	CLO – 1	3	3	3	-	3	3	2	-	3	3	3
	CLO – 2	3	3	3	-	2	2	2	-	1	3	3
	CLO – 3	3	3	3	-	2	3	2	-	-	3	3
MT-MN-4214	CLO – 1	3	3	3	-	2	2	1	-	-	2	3
	CLO – 2	3	3	3	-	2	2	1	-	-	2	3
	CLO – 3	3	3	3	-	2	3	1	-	-	2	3
	CLO – 4	3	3	3	-	2	2	1	-		2	3
MT-MN-5214	CLO – 1	3	3	2	-	-	3	2	-	1	3	3
	CLO – 2	3	3	2	-	-	3	3	-	2	3	3
	CLO – 3	3	3	2	-	-	3	3	-	2	3	3
MT-MN-6214	CLO – 1	3	3	2	-	-	1	1	-	-	2	3
	CLO – 2	3	3	1	-	-	1	1	-	-	2	3
	CLO – 3	3	3	2	-	-	1	1	-	-	2	3
	CLO – 4	3	3	-	-	-	1	1	-	-	2	3

Mapping of Programe Specific Outcome (PSO) and Course Learning Outcome (CLO)

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation

"3" : Maximum Co-relation
"-" : No Co-relation

COURSE CODE	CLO	PROGRAMME SPECIFIC OUTCOME			
		PSO 1	PSO 2	PSO 3	PSO 4
MT-MN-1114	CLO - 1	3	3	-	2
	CLO - 2	3	3	-	2
	CLO - 3	3	2	-	2
MT-MN-2114	CLO - 1	3	3	-	2
	CLO - 2	3	3	-	2
	CLO - 3	3	3	-	2
	CLO - 4	3	3	-	2
MT-MN-3214	CLO - 1	3	3	-	2
	CLO - 2	3	3	-	2
	CLO - 3	3	3	-	2
MT-MN-4214	CLO - 1	3	3	1	2
	CLO - 2	3	3	1	2
	CLO - 3	3	3	1	2
	CLO - 4	3	3	1	2
MT-MN-5214	CLO - 1	3	3	-	2
	CLO - 2	3	3	-	2
	CLO - 3	3	3	-	2
MT-MN-6214	CLO - 1	3	3	-	2
	CLO - 2	3	3	-	2
	CLO - 3	3	3	-	2
	CLO - 4	3	3	-	2

COURSE NAME: ALGEBRA

COURSE CODE: MT – MN – 1114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 CREDITS

Total Lectures: 45

COURSE OBJECTIVE:

Algebra is the study of operations and their applications to solving system of equations. This course intends to introduce students to the basic concepts of the theory of equations, the complex numbers and also, the matrices and determinants.

Course Learning Outcome:

CLO-01: *Analyze a given system of equations, and tell the nature of the roots of the given system.*

CLO-02: *Apply De Moivre's theorem as and when applicable.*

CLO-03: *Learning the basic operations in matrices, and hence check the consistency of a given system of equations. Also, solve both homogeneous and non-homogeneous system of equations*

Unit 1: Theory of Equations: (15 LECTURES)

General properties of equations, theorems related to real roots of equations, existence of a root in the general equation, imaginary roots, equal roots, theorems determining the number of roots of an equation, relation between roots and coefficients of n^{th} degree equation, solution of cubic and bi-quadratic equations.

Unit 2: Complex Numbers: (10 LECTURES)

De Moivre's theorem (both integral and rational index), roots of complex numbers, solutions of equations using trigonometry and De Moivre's theorem.

Unit 3: Matrices: (20 LECTURES)

Matrix algebra, transposition, symmetry, matrix inversion and properties, row echelon form and rank of a matrix, reduced row echelon form, consistency of linear systems, solutions of system of homogeneous and non-homogeneous linear equations with number of equations and unknowns up to four, invariance of rank under elementary transformations, reduction to normal form.

Books Recommended:

1. Gilbert, L.& Gilbert, J., Elements of Modern Algebra,(8thedition),Cengage Learning, 2013.
2. Burnside, W.S.& Panton, Arthur W., *The Theory of Equations*,Vol.1,Dublin University Press Series, 2023.
3. Meyer, C. D., *Matrix Analysis and Applied Linear Algebra*, Society for Industrial and Applied Mathematics (Siam), 2000.

Reference Books:

1. Dickson, L. E., *First Course in The Theory of Equations*, The Project Gutenberg eBook (http://www.gutenberg.org/ebooks/29785), 2009.
2. Gilbert, W. J., *Modern Algebra with Applications* (2nd edition). John Wiley & Sons, 2004.
3. Andreescu, T. and Andrica, D., *Complex Numbers from A to .... Z*, Birkhauser, 2006.

COURSE NAME: CALCULUS

COURSE CODE: MT – MN – 2114

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY: 3 Credits

TOTAL LECTURES: 45 COURSE

OBJECTIVE:

Calculus is the mathematical study of 'change'. This course intends to introduce students to the significant concepts of limit, continuity and differentiability of real valued functions. Also, students will acquire the knowledge of solving complicated integrals using reduction formulae and hence, able to evaluate arc length, surface area and volume..

Course Learning Outcome:

CLO-01: *Learn about basic concepts of real sequences*.

CLO-02: *Understand concepts of limit and continuity of functions*

CLO-03: *Learn about differentiability of a function, and understand the various applications of real valued functions*

CLO-04: *Apply reduction formulae to solve complicated integrals, and also to apply them in the real world problems***.**

Unit1: Real Sequences (5 LECTURES)

Sequences, limit of a sequence, monotone sequences.

Unit 2: Limits and continuity (15 LECTURES)

Limit and continuity of a function, properties of continuous functions including intermediate value theorem.

Unit 3: Differentiability (15 LECTURES)

Differentiability, successive differentiation, recursion formulae using Leibnitz theorem, Rolle's theorem, Lagrange's mean value theorem, Taylor's theorem, Taylor's series and Maclaurin's series.

Unit 4: Application of Integration: (10 LECTURES)

Volumes by slicing, disks and washers' methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

Books Recommended:

1. Anton, H., Bivens, I. ,& Davis, S., *Calculus* (10th edition), John Wiley & Sons Singapore Pvt. Ltd (Reprint by Wiley India Pvt. Ltd. Delhi), 2017.
2. Narayan, S. and Mittal, P. K.; *Differential Calculus*, S.Chand, 2005.

Reference Books:

1. Strauss, M. J., Bradley, G. L. and Smith, K. J. *Calculus* (3rd edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. Bradley, G. L and Smith, K. J. *Calculus*, Prentice Hall Inc, (3rd edition) 2002.
3. Thomas, Jr. G. B., Weir, M. D., & Hass, J. *Thomas*' *Calculus* (13th edition). Pearson Education, Delhi, Indian, 2014.

COURSE NAME: ANALYTICAL GEOMETRY OF 2D

COURSE CODE: MT - MN - 3214

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objectives:

Main objective of this course is to introduce and describe the two-dimensional coordinates systems and the properties of two-dimensional shapes.

Course Learning Outcome:

CLO 1: *Knowledge about transformation of co-ordinate systems..*

CLO 2: *Learn about the conditions on coefficients such that the general equation of second degree represents a pair of straight lines.*

CLO 3: *Learn about general and central conics and various properties.*

Unit 1: Coordinates and Locus (15 LECTURES)

Coordinates and locus: straight lines, transformation of axes, standard equations (circle, parabola, ellipse and hyperbola), invariants under orthogonal transformation.

Unit 2: Pair of straight lines (15 LECTURES)

Pair of straight lines: homogeneous and non-homogeneous equations of second degree.

Unit 3: General conics and central conics (15 LECTURES)

Parabola, parametric coordinates tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes. General conics: tangent, condition of tangency, pole and polar, central conics.

Book Recommended:

1. Khan, R. M., *Analytical Geometry of two and three dimensions and vector analysis*, New Central Book agency, 2017.

Reference Books:

1. Askwith, E. H., *The Analytical Geometry of the Conic Sections*, Nabu Press, 2012.
2. Das, B., *Analytical Geometry and Vector Analysis*, Orient Book Company, 2018.
3. Jain P. K. and Ahmed, K., *Textbook of Analytical Geometry*, New Age International Publishers, (3rd edition), 2014.

COURSE NAME: ORDINARY DIFFERENTIAL EQUATION

COURSE CODE: MT - MN - 4214

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objectives:

Differential equations are used as a fundamental tool in different fields of science and engineering. It provides a mathematical description (mathematical model) of real-world problems to enabling predictions, optimizations, and control of dynamic systems in various scientific disciplines. Differential equations are used to make predictions about future behavior based on current conditions.

Course Learning Outcome:

CLO 1: *Understand that physical systems can be described by differential equations.*

CLO 2: *Understand the practical importance of solving differential equations*

CLO 3: *Recognize an appropriate solution method for a given problem*

CLO 4: *Analytically solve a wide range of ordinary differential equations.*

Unit 1: Linear and higher order differential equations (15 LECTURES)

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation, exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Unit 2: Mathematical Models (15 LECTURES)

Introduction to compartmental model, exponential decay model, exponential growth of population, limited growth of population, limited growth with harvesting.

Unit 3: Homogeneous and non-homogeneous differential equations (15 LECTURES)

General solution of homogeneous equations, Wronskian: its properties and applications, linear homogeneous and nonhomogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Books Recommended:

1. Barnes, B. and Fulford, G. R., *Mathematical Modelling with Case Studies, Using Maple and MATLAB* (3rd edition), CRC Press, Taylor & Francis Group, 2015.
2. Edwards, C. H., Penney, D. E., and Calvis, D. T., *Differential Equation and Boundary Value Problems: Computing and Modeling* (5thedition), Pearson Education, 2015.
3. Ross, S. L., *Differential Equations* (3rd edition), John Wiley & Sons. India, 2004.

Reference Books:

1. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA*, (3rd edition), Elsevier Academic Press, 2004.
2. Ross, Clay C., *Differential Equations: An Introduction with Mathematica* (2nd edition). Springer, 2004.

COURSE NAME: REAL ANALYSIS

COURSE CODE: MT - MN - 5214

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objectives:

The course will develop a thorough understanding of the world of real numbers and their functions. It helps develop skills in mathematical reasoning and analysis and also a deep comprehension of the properties of real-valued functions, which are fundamental in various branches of mathematics and applied sciences.

Course Learning Outcome:

CLO 1: *Knowledge of fundamental properties associated with the real number system.*

CLO 2: *Thorough understanding of real sequences along with the concept of their convergence criterion*.

CLO 3: *Thorough understanding of real sequences along with the concept of their convergence criterion.*

Unit 1: Real Numbers and Properties (15 LECTURES)

Finite and infinite sets, Algebraic and order properties of R, absolute value and real line, bounded sets, supremum and infimum, completeness property of R, the Archimedean property.

Unit 2: Real sequences (15 LECTURES)

Sequence and convergence, bounded sequence, theorems on limit, monotone sequences, monotone convergence theorem, sub sequences, Bolzano Weierstrass theorem for sequences, Cauchy sequences, Cauchy's convergence criterion, properly divergent sequences.

Unit 3: Infinite series (15 LECTURES)

Convergence and divergence of infinite series, Cauchy criterion, tests for convergence: comparison test, limit comparison test, ratio test, root test, integral test, absolute convergence, rearrangement theorem, alternating series, Leibniz test, conditional (non-absolute) convergence.

Book Recommended:

1. Bartle, R. G. and Sherbert, D. R., *Introduction to Real Analysis*, (4^{th}Edition), John Wiley and Sons, 2002.

Reference Books:

1. Kumar A. and Kumaresan, S., *Basic Course in Real Analysis*, CRC Press,2014.
2. Apostol, *Mathematical Analysis*, (2^{nd} edition), Pearson Higher Education, 1974.
3. Bali, N. P, *Real analysis*, Golden Maths series, Firewall media (Laxmi publications pvt. Ltd), 2021.

COURSE NAME: ABSTRACT ALGEBRA

COURSE CODE: MT - MN - 6214

Total Credits: 4 (Theory: 3 + Practical/Tutorial: 1)

THEORY

Total Lectures: 45

Course Objective:

The basic objective of the course is to introduce the fundamental concept of groups, subgroups, cyclic groups, symmetric group, group homomorphism and isomorphism. The Lagrange's theorem on finite group is also discussed. Also rings, integral domain, field and ideals and their properties are introduced in details.

Course Learning Outcome :

CLO 1: *Recognize the fundamental concept of groups, rings and fields.*

CLO 2: *Explain the significance of cyclic groups, symmetric groups, normal subgroups, factor groups.*

CLO 3: *Describe structure preserving mappings: group homomorphisms.*

CLO 4: *Explain the fundamental concept of ideals and integral domains*

Unit 1: Groups (25 LECTURES)

Definition and properties of groups, permutation groups, order of a group, order of an element of a group, subgroups, centralizer, normalizer, center of a group, properties of cyclic groups, classification of subgroups of cyclic groups, fundamental theorem of cyclic group, cycle notation for permutations, cosets, Lagrange's theorem, normal subgroups, factor groups.

Unit 2: Group Homomorphism (5 LECTURES)

Group homomorphism, properties of group homomorphism, Kernel of a group homomorphism, isomorphisms, properties, fundamental theorem of homomorphism, second and third theorems of isomorphism, Cayley's theorem.

Unit 3: Rings (15 LECTURES)

Definition and examples of rings, properties of rings, subrings, zero-divisors in a ring, integral domains and fields, characteristic of a ring, ideals, prime and maximal ideals, factor ring.

Books Recommended:

1. Gallian, J. A., *Contemporary Abstract Algebra* (8th edition), Cengage Learning India Private Limited, Delhi, Fourth impression, 2015.

Reference Books:

1. John, B. F., *A First Course in Abstract Algebra*, (7th edition), Pearson, 2002.
2. Santhanam, G., Algebra, Narosa Publishing House, 2017.
3. Dummit, D. S. and Foote, R. M., *Abstract Algebra* (2nd edition), John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2003.
4. Rotman, J. J., *An Introduction to the Theory of Groups*,(4th edition), Springer Verlag, 1995.

SKILL ENHANCEMENT COURSE (SEC)

Programme Specific Outcome of Bachelor of Science – Botany (Skill Enhancement Course)

PSO No.	Name	Outcome
PSO–1	Knowledge	Students will acquire basic Practical skills and Technical knowledge along with domain knowledge of different subjects in the science stream.
PSO–2	Modern tool use	Prepare students for pursuing research or careers in industry in mathematical science and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++, LaTeX and Mathematica/ Matlab to various scientific investigations, problem solving and interpretation.
PSO–3	Problem solving skill	Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
PSO–4	Employability	Students possess the essential skills of mathematical modeling, problem-solving, creativity and effective communication, preparing them for a wide range of employment opportunities.

Basic Syllabus Structure of SEC

Semester	Course Name	Course code
1	COMPUTER ALGEBRA	MT – SE – 1113
2	LaTeX	MT – SE – 2113
3	C-PROGRAMMING	MT – SE – 3213

Course Learning Outcome - Skill Enhancement Course (SEC)

Semester	Course Name & Code	Course Learning Outcome (CLO)	
1	COMPUTER ALGEBRA MT-SE-1113	CLO – 01	Learn to plot graphs of various functions using Mathematica software.
		CLO – O2	Learn to solve various equations like trigonometric equation, transcendental equation using Mathematica software.
		CLO – 03	Acquire basic knowledge of algebra, trigonometry and calculus through Mathematica software
2	LaTeX MT-SE-2113	CLO – 01	Create and typeset a LaTeX document.
		CLO – 02	Typeset a mathematical document using LaTeX.
		CLO – 03	Learn about creating simple pictures using LaTeX.
		CLO – 04	Create a beamer presentations
		CLO – 05	Learn LaTeX through overleaf
		CLO – 06	Assamese writing using LaTeX
3	C-PROGRAMMING MT-SE-3213	CLO – 01	Understand the basic programming concept and knowledge about C programming.
		CLO – O2	To learn about control structure and to use different control structures in programming and hence to compare their structures
		CLO – 03	To learn about the use of array and functions for programming and to use them in programming
		CLO – 04	To solve different numerical problems practically using C programming.

Mapping of Course Learning Outcome and Programme Outcome

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

Course Code	CLO	PROGRAMME OUTCOME										
		SPO-1	SPO-2	SPO-3	SPO-4	SPO-5	SPO-6	SPO-7	SPO-8	SPO-9	SPO-10	SPO-11
MT-SE-1113	CLO 1	3	3	3	2	2	3	2	-	1	2	3
	CLO 2	3	3	3	2	2	3	2	-	2	1	3
	CLO 3	3	3	3	2	2	3	2	-	1	1	3
MT-SE-2113	CLO 1	3	3	3	2	3	3	2	-	2	3	3
	CLO 2	3	3	3	2	3	3	2	-	2	3	3
	CLO 3	3	3	3	2	3	3	2	-	3	2	3
	CLO 4	3	3	3	2	3	3	1	-	3	3	3
	CLO 5	3	3	3	2	3	3	3	-	1	3	3
	CLO 6	3	3	3	2	3	2	1		3	3	3
MT-SE-3213	CLO 1	3	2	3	-	1	2	2	-	-	2	3
	CLO 2	3	3	3	-	2	3	3	-	1	3	3
	CLO 3	3	3	3	-	2	3	3	-	2	3	3

Mapping of Course Learning Outcome and Programme Specific Outcome

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

COURSE CODE	CLO	PROGRAMME SPECIFIC OUTCOME			
		PSO - 1	PSO - 2	PSO - 3	PSO - 4
MT-SE-1113	CLO 1	3	3	3	3
	CLO 2	3	3	3	3
	CLO 3	3	3	3	3
MT-SE-2113	CLO 1	3	3	1	2
	CLO 2	3	3	1	2
	CLO 3	3	3	1	2
	CLO 4	3	3	1	2
	CLO 5	3	3	1	2
	CLO 6	3	3	1	2
MT-SE-3213	CLO 1	3	3	3	3
	CLO 2	3	3	3	3
	CLO 3	3	3	3	3

COURSE NAME: COMPUTER ALGEBRA

Course CODE: MT-SE-1113

Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY: 2 Credits

TOTAL LECTURES: 30

Course Objective:

Through this course, students can understand the basic applications of Algebra and Trigonometry using the Mathematica software. Emphasis is given on the plotting of graphs, both in two and three dimensions and also on working with matrices.

Course Learning Outcome:

CLO – 01: *Learn to plot graphs of various functions using Mathematica software*

CLO – 02: *Learn to solve various equations like trigonometric equation, transcendental equation using Mathematica software*

CLO – 03: *Acquire basic knowledge of algebra, trigonometry and calculus through Mathematica software*

Unit 1: Algebra and Trigonometry (10 LECTURES)

Polynomials, rational and algebraic functions, trigonometric functions, solving trigonometric, algebraic and transcendental equations.

Unit 2: Plotting of Graph of functions (10 LECTURES)

Computing and plotting functions in 2D, plotting functions of two variables using plot 3D and contour plot, plotting parametric curves surfaces, customizing plots, animating plots.

Unit 3: Matrices (10 LECTURES)

Simple programming in a CAS, working with matrices, performing Gauss elimination, operations (transpose, determinant, inverse), minors and cofactors, working with large matrices.

Practical:

Total Lectures: 30

Practical problems will be based on theory syllabus and will be performed in the computer laboratory

Book Recommended:

1. Don, E., *Mathematica*(2nd edition),Schaum's Outline series, McGraw Hill, 2009.

Reference Books:

1. Bindner, D.& Erickson, M.,*A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*, CRC Press, Taylor & Francis Group, LLC, 2011.
2. Torrence, B. F., &Torrence, E. A., *The Student's Introduction to Mathematica: A Handbook for Pre Calculus, and Linear Algebra* (2nd edition.), Cambridge University Press, 2009.

COURSE NAME: LaTeX

COURSE CODE: MT-SE-2113

Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY

Total Lectures: 30

Course Objectives:

The course aims to familiarize students with typesetting software LaTeX which will enable them to prepare documents especially with mathematical equations, graphs and figures. This course will also acquaint them with the Beamer presentation techniques.

Course Learning Outcome:

CLO – 01: *Create and typeset a LaTeX document*

CLO – 02: *Typeset a mathematical document using LaTeX.*

CLO – 03: *Learn about creating simple pictures using LaTeX***.**

CLO – 04: *Create a beamer presentations.*

CLO – 05: *Learn LaTeX through overleaf.*

CLO – 06: *Assamese writing using LaTeX*.

Unit 1: Elements of LaTeX (15 LECTURES)

Typing a LaTeX document, typing a mathematical document.

Unit 2: Graphics in LaTeX (10 LECTURES)

Creating simple pictures, PS Tricks.

Unit 3: Beamer (5 LECTURES)

Beamer presentation, LaTeX through Overleaf, LaTeX in Assamese language writing.

Practical:

Total Lectures: 30

LATEX Programmes based on the theory above

Book Recommended:

1. Erickson, M. J. and Bindner, D., *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*, CRC Press, 2011.

Reference Book:

1. Lamport, L., *LATEX: A Document Preparation System, User's Guide and Reference Manual.* Addison-Wesley, New York, (2nd edition), 1994.

COURSE NAME: C-PROGRAMMING

COURSE CODE: MT-SE-3213

Total Credits: 3 (Theory: 2 + Practical/Tutorial: 1)

THEORY

Total Lectures: 30

Course Objectives:

This course will help to understand and visualize the workings of computer systems. It will help the students to write computer programs using C language for solving numerical problems in different ways..

Course Learning Outcome:

CLO 1: *Understand the basic programming concept and knowledge about C programming*

CLO 2: *To learn about control structure and to use different control structures in programming and hence to compare their structures.*

CLO 3: *To learn about the use of array and functions for programming and to use them in programming*

CLO 4: *To solve different numerical problems practically using C programming.*

Unit 1: Introduction to C (10 LECTURES)

Stages of development of computer software, algorithm and flow chart, fundamentals of C Language: variables, constants, reserved words, variable declaration and initialization, basic data types and their uses, operators and expression (arithmetic, relational, logical, assignment, conditional, increment and decrement), hierarchy of operations for arithmetic operators, library functions, structure of a C program, input/output functions and statements.

Unit 2: Control Statements in C (10 LECTURES)

If-else statement, nested if-else statement, switch statement, loop control structures: for loop, nested for, while loop and do-while loop, comparison of the loop control structures, break, continue, go to statements, exit function.

Unit 3: Arrays and Functions (10 LECTURES)

One and two-dimensional array declaration, accessing and initializing values in an array, sorting of numbers in an array, some examples using array declaration, addition, subtraction and multiplication of matrices with the help of array. Functions: function declaration, function prototype, actual and formal arguments, examples.

Practical:

Total Lectures: 30

Programs for practical:

1. To exchange the values of two variables
2. To find the biggest of three numbers
3. To find roots of a quadratic equation
4. Programme to print natural numbers
5. Programme to find the factorial of a given integer

6. Value of a piecewise defined function (single variable)
7. Factorial of a given positive integer
8. Fibonacci numbers
9. Square root of a number
10. Sum of different algebraic and trigonometric series,
11. A given number to be prime or not
12. Sum of the digits of any given positive integer
13. Reversing digits of an integer
14. Sorting of numbers in an array
15. To find addition, subtraction and multiplication of matrices
16. To find the values of trigonometric series
17. Programmes using user defined function.

Book Recommended:

1. Jeyapoovan, T, *A First Course in Programming in C*, (1st edition), Vikash Publishing House Pvt. Ltd, 2005.

Reference books:

1. Kanetkar, Y., *Let us C*, (19th edition) B.P.B. Publication, 2022.

INTER-DISCIPLINARY COURSE (IDC)

Programme Specific Outcome of Bachelor of Science – MATHEMATICS (IDC)

PSO No.	Name	Outcome
PSO–1	Knowledge	Acquire good knowledge and understanding in basic facts about mathematics and should be able to display knowledge of conventions such as notions, terminology. Apply the knowledge of mathematical concepts in interdisciplinary fields.
PSO–2	Reflective Thinking	Identify the importance of information provided in theorems, axioms and problems for further justification and application.
PSO–3	Problem Solving Skill	Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
PSO–4	Proficiency in Employments	Assisting the students to enhance their employability for government jobs, banking, insurance and jobs in various other public and private sectors.

Basic Syllabus Structure of IDC

Semester	Course Name	Course Code
1	MATHEMATICAL APTITUDE	MT-ID-1113
2	SETS AND NUMBERS	MT-ID-2113
3	MATRICES	MT-ID-3213

Course Learning Outcome (CLO)

Semester	Course Name & Code	Course Learning Outcome (CLO)	
1	MATHEMATICAL APTITUDE MT-ID-1113	CLO - 01	This course helps the students to develop logical and problem-solving skills and thus help them to prepare for different competitive examinations.
		CLO - 02	To equip the students with problem solving skills that are invaluable in various aspects of life.
		CLO - 03	To enhance the ability of students in the measurement of geometric figures
		CLO - 04	To enhance the students ability in data interpretation and helps them in predicting upcoming trends and future competitions
2	SETS AND NUMBERS MT-ID-2113	CLO - 01	Learn about the presence of sets in the world around us.
		CLO - 02	Learn about complex number system
		CLO - 03	Develop the ability to think logically, analyse, reason etc
3	MATRICES MT-ID-3213	CLO - 01	Learn about basic concepts of matrix and determinants.
		CLO - 02	Learn to use matrices in solving system of equations
		CLO - 03	Learn to solve linear system of equations using Gaussian elimination method

Mapping of Course Learning Outcome (CLO) and Programme Outcome (PO)

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

Course Code	CLO	Programme Outcome (PO)										
		SPO - 1	SPO - 2	SPO - 3	SPO - 4	SPO - 5	SPO - 6	SPO - 7	SPO - 8	SPO - 9	SPO - 10	SPO - 11
MT-ID-1113	CLO - 1	3	2	1	-	2	3	1	-	-	1	3
	CLO - 2	3	2	1	-	1	3	1	-	-	1	3
	CLO - 3	3	2	1	-	1	3	1	-	-	2	3
	CLO - 4	3	2	1	-	2	3	1	-	-	1	3
MT-ID-2113	CLO - 1	3	3	3	-	1	3	1	-	3	3	3
	CLO - 2	3	3	2	-	-	1	1	-	2	3	2
	CLO - 3	3	3	3	-	2	3	2	-	3	3	3
MT-ID-3213	CLO - 1	3	3	3	-	1	2	1	-	1	3	3
	CLO - 2	3	3	3	-	2	2	1	-	1	3	3
	CLO - 3	3	3	3	-	2	2	2	-	1	2	3

Mapping of Course Learning Outcome (CLO) and Programme Specific Outcome (PSO)

Attributes: Co-relation Levels

"1" : Minimum Co-relation
"2" : Moderate Co-relation
"3" : Maximum Co-relation
"-" : No Co-relation

Course Code	CLO	Programme Specific Outcome (PSO)			
		PSO – 1	PSO - 2	PSO - 3	PSO - 4
MT-ID-1113	CLO - 1	3	3	3	3
	CLO - 2	3	3	3	3
	CLO - 3	3	3	3	3
	CLO - 4	3	3	3	3
MT-ID-2113	CLO - 1	3	3	3	2
	CLO - 2	3	3	3	2
	CLO - 3	3	3	3	2
MT-ID-3213	CLO - 1	3	3	3	2
	CLO - 2	3	3	3	2
	CLO - 3	3	3	3	2

COURSE NAME : MATHEMATICAL APTITUDE

COURSE CODE : MT – ID – 1113

TOTAL CREDITS : 3 (Theory: 3)

THEORY

Total Lectures - 45

Course Objective:

The main objective of this course is to grow interest in mathematics, to recognize that mathematics permeates the world around us and to appreciate the usefulness, power and beauty of mathematics. Studying Mathematics also develop patience and persistence when solving problems. It also develops fundamental skills like logical reasoning, critical thinking among the students.

Course Learning Outcome:

CLO – 01: *This course helps the students to develop logical and problem-solving skills and thus help them to prepare for different competitive examinations..*

CLO – 02: *To equip the students with problem solving skills that are invaluable in various aspects of life.*

CLO – 03: *To enhance the ability of students in the measurement of geometric figures*

CLO – 04: *To enhance the students ability in data interpretation and helps them in predicting upcoming trends and future competitions.*

Unit 1: Mathematical Aptitude (15 LECTURES)

Fraction, average, time and distance, ratio, proportion and percentage, profit and loss, interest (simple and compound) and discounting, shares and stocks.

Unit 2: Mensurations (15 LECTURES)

Area, perimeter, volume and surface area of geometric shapes.

Unit 3: Data Interpretation (10 LECTURES)

Classification and representation of data, tabulation, mean, median, mode, pi-diagram and bar diagram.

Unit 4: Reasoning and Aptitude: (5 LECTURES)

Logical reasoning, series, mirror image, figure matrix, cubes and dices, coding-decoding, puzzles, blood relation test and patterns.

COURSE NAME : SETS AND NUMBERS

COURSE CODE : MT – ID – 2113

TOTAL CREDITS : 3 (Theory: 3)

THEORY

Total Lectures - 45

Course Objective:

The main objective of this course is to grow interest in mathematics, to recognize that mathematics permeates the world around us and to appreciate the usefulness, power and beauty of mathematics. Studying mathematics also develop patience and persistence when solving problems. It also develops fundamental skills like logical reasoning, critical thinking among the students.

Course Learning Outcome :

CLO – 01: *Learn about the presence of sets in the world around us*.

CLO – 02: *Learn about complex number system.*

CLO – 03: *Develop the ability to think logically, analyse, reason etc*

Unit 1: Sets (15 LECTURES)

Sets and their representations, empty set, finite and infinite sets, equal sets, subsets, power set, universal set, Venn diagrams, union and intersection of sets, difference of sets, complement of a set, cartesian product of two sets.

Unit 2: Complex Numbers (15 LECTURES)

Introduction, complex numbers, algebra of complex numbers, modulus and the conjugate of a complex number, argand plane and polar representations.

Unit 3: Mathematical Reasoning (15 LECTURES)

Introduction, statements, new statements from old, special words/phrases, implications, validating statements.

COURSE NAME : MATRICES

COURSE CODE : MT – ID – 3213

TOTAL CREDITS : 3 (Theory: 3)

THEORY

Total Lectures - 45

Course Objective :

Matrices and determinants are fundamental mathematical concepts with extensive applications across numerous fields, including physics, engineering, computer science, economics, and beyond. They offer a convenient framework for representing and solving systems of linear equations, which are present in real-world problems. Techniques such as Gaussian elimination or matrix inversion provide efficient methods for solving these equations, facilitating problem-solving in various domains.

Course Learning Outcome:

CLO 1: *Learn about basic concepts of matrix and determinants*

CLO 2: *Learn to use matrices in solving system of equations*.

CLO 3: *Learn to solve linear system of equations using Gaussian elimination method*

Unit 1: Matrices and Determinants (25 LECTURES)

Definition of a matrix, types of matrices, operations on matrices and properties of matrix operations, invertible matrices.

Determinant of a square matrix (up to 3 x 3 matrices), minors, co-factors, adjoint and inverse of a square matrix, consistency, inconsistency and number of solutions of system of linear equations, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix, rank(using determinants), Cramer's rule.

Unit 2: Solutions of Linear system of equations using Gaussian Elimination (20 LECTURES)

Systems of Linear Equations, row reduction and echelon forms, vector equations, the matrix equation $Ax = b$, solution sets of linear systems.