B.SC.,

MATHEMATICS

SYLLABUS

FROM THE ACADEMIC YEAR

2023-2024

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION,
CHENNAI – 600 005

CONTENTS

1. Introduction

B.Sc. Mathematics : Programme Outcome, Programme Specific Outcome and Course Outcome

Mathematics is the study of quantity, structure, space and change, focusing on problem solving, with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The Bachelor's Degree B.Sc. Mathematics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements expected to be acquired by learners at the end of the Programme. Learning outcomes of Mathematics are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for gaining knowledge of Mathematics.

Bachelor's degree in Mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of Mathematics. This also leads to study of related areas like Computer science, Financial Mathematics, Statistics and many more. Thus, this programme helps learners in building a solid foundation for higher studies in Mathematics. The skills and knowledge gained have intrinsic aesthetics leading to proficiency in analytical reasoning. This can be utilised in Mathematical modelling and solving real life problems.

Students completing this programme will be able to present Mathematics clearly and precisely, make abstract ideas precise by formulating them in the language of Mathematics, describe Mathematical ideas from multiple perspectives and explain fundamental concepts of Mathematics to non-Mathematicians.

Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc., MATHEMATICS**
Programme Code:	
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with

	self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Under Graduate Programme

Programme Outcomes:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.

PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.

PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

B.Sc Mathematics

Programme Specific Outcomes:

PSO1: Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

PSO2: Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

PSO3: To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)can be carried out accordingly, assigning the appropriate level in the grids:

	POs							PSOs		
	1	2	3	4	5	6	…	1	2	…
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background • Emerging topics in higher education / industry /

		communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors
IV	Industrial Statistics	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; 'Mathematics for Advanced Explain' component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers; • 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: **For Advanced Learners / Honours degree**		• To cater to the needs of peer learners / research aspirants

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

2. Template for Curriculum Design for UG Programme in Mathematics

Credit Distribution for UG Programme in Mathematics
B.Sc Mathematics
First Year
Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC1, CC2)	8	10
	Elective Course 1 (Generic / Discipline Specific)EC1	3	4
Part-IV	Skill Enhancement Course SEC-1 (Non Major Elective)	2	2
	Foundation Course FC	2	2
	Ability Enhancement Compulsory Course (AECC 1) Soft Skill-1	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC3, CC4)	8	10
	Elective Course 1 (Generic / Discipline Specific) EC2	3	4
Part-IV	Skill Enhancement Course -SEC-2 (Non Major Elective)	2	2
	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic)	2	2
	Ability Enhancement Compulsory Course (AECC 2) Soft Skill-2	2	2
		23	**30**

Second Year
Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC5, CC6)	8	10
	Elective Course 1 (Generic / Discipline Specific) EC3	3	4
Part-IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline Specific/ Generic)	2	2
	Ability Enhancement Compulsory Course (AECC 3) Soft Skill-3	2	2
	Environmental Studies (EVS)	1	1
		23	**30**

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC7, CC8)	8	9
	CC7: Core Industry Module -1 - **Industrial Statistics**		
	CC8: Any Core paper		
	Elective Course 1 (Generic / Discipline Specific) EC4	3	4
Part-IV	Skill Enhancement Course -SEC7	2	2
	Skill Enhancement Course -SEC-8 (Discipline Specific / Generic)	2	2
	Ability Enhancement Compulsory Course (AECC 4) Soft Skill-4	2	2
	Environmental Studies EVS	1	1
		24	**30**

Third Year - Semester-V

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core Courses 3(CC9, CC10, CC11)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC5, EC6	6	10
	Core /Project with Viva voce CC12	4	4
Part-IV	Value Education	1	1
	Internship / Industrial Training (Carried out in II Year Summer vacation) (30 hours)	2	
		25	**30**

Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core Courses 3 (CC13, CC14, CC15)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC7, EC8	6	10
Part IV	Professional Competency Skill Enhancement Course SE8	2	4
	Value Education	1	1
Part-V	Extension Activity (Outside college hours)	1	-
		22	**30**

Total Credits: 140

Credit Distribution for UG Programmes

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement -(Foundation Course)	2	2	2.7 Skill Enhancement Course –SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	1	22
Part V	-	-	-	-	-	2	2
Total	23	23	22	25	26	21	**140**

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

5. Illustration for B.Sc Mathematics Curriculum Design

First Year Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	6
Part-III	Core – I, Algebra &Trigonometry	5	5
	Core – II, Differential Calculus	5	5
	Elective – I, Numerical Methods with Applications	3	4
Part-IV	Skill Enhancement Course (Non Major Elective)	2	2
	Foundation Course FC	2	2
		23	**30**

Semester-II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	6
Part-III	Core – III, Analytical Geometry (Two & Three Dimensions)	5	5
	Core – IV, Integral Calculus	5	5
	Elective – II, Calculus of Finite Differences	3	4
Part-IV	Skill Enhancement Course – Data Analytic Skill,	2	2
	Skill Enhancement Course (Discipline / Subject Specific) – Computational Mathematics	2	2
		23	**30**

Second Year Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	6
Part-III	Core – V, Vector Calculus and Applications	5	5
	Core – VI, Differential Equations and Applications	5	5
	Elective – III, Mathematical Statistics Theory & Practical	3	4
Part-IV	Skill Enhancement Course (Entrepreneurial Based)	1	1
	Statistics with R Programming	2	2
	Environmental Studies	-	1
		22	**30**

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	6
Part-III	Core – VII, Industry Module – Industrial Statistics	5	5
	Core – VIII, Elements of Mathematical Analysis	5	5
	Elective – IV, Transformation Techniques	3	3
Part-IV	Skill Enhancement Course -(Introduction to Data Science)	2	2
	Skill Enhancement Course - (Computing Mathematics)	2	2
	Environmental Studies	2	1
		25	**30**

Third Year Semester-V

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core – IX, Abstract Algebra	4	5
	Core – X, Real Analysis	4	5
	Core – XI, Mathematical Modelling	4	5
	Core - XII, Project with Viva voce	4	5
	Elective – V, Optimization Techniques	3	4
	Elective – VI, Introduction to Machine Learning – Theory & Practical	3	4
Part-IV	Value Education	2	2
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-
		26	**30**

Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core – XIII, Linear Algebra	4	6
	Core – XIV, Complex Analysis	4	6
	Core – XV, Mechanics	4	6
	Elective – VII, Programming Language with C++ with Practical	3	5
	Elective – VIII, Graph Theory and Applications	3	5
Part-IV	Professional Competency Skill	2	2
	Extension Activity	1	
		21	**30**

Total Credits : 140

7 7.1 Suggestive Topics in Core Component

- Classical Algebra
- Trigonometry
- Differential Calculus
- Integral Calculus
- Analytical Geometry (2D / 3D)
- Vector Analysis
- Differential Equations
- Abstract Algebra
- Linear Algebra
- Sequences & Series
- Fourier Series
- Real Analysis
- Transform Techniques (Laplace, Fourier)
- Complex Analysis
- Mechanics (Statics / Dynamics)
- Mathematical Modeling
- Industrial Mathematics and more

7.2 Suggestive Topics in Elective Courses (Generic / Discipline-centric)

Group I:

- Allied Physics
- Allied Chemistry
- Statistical Methods
- Bio Mathematics
- Bio Statistics
- Programming Language with practical (C, Python, Java, R, etc.)
- Object Oriented Programming with C++
- Principles of Econometrics
- Introduction to Actuarial Science
- Principles of Accounting practices
- Logistics & Supply chain management
- Forecasting Techniques
- Simulation
- Introduction to Data Science
- Cloud Computing
- Introduction to Machine Learning
- Data Structures
- Introduction to Artificial Intelligence
- Neural network models
- Financial Mathematics and more

Group II –Suggestive Elective Courses (Discipline-centric)

- Numerical Methods with Applications
- Mathematical Statistics
- Optimization Techniques
- Graph Theory & Applications
- Special functions with Applications
- Discrete Mathematics
- Combinatorial Mathematics
- Number Theory& Cryptography
- Difference equations with application
- Formal Languages & Automata Theory
- Astronomy / Elements of Space Science
- Stochastic Processes
- Fuzzy Sets & its applications
- Introduction to Research Methodology
- Integral Transforms & Z Transforms
- Algorithms
- Computational Geometry and more

7.3 Suggestive Topics in Skill Enhancement Courses (SEC)

Group III - Skill Enhancement Courses (SEC)

- Statistics with R / Excel / SPSS
- LaTeX
- E- Commerce & Tally
- Computing skills (Office Automation)
- Android App development
- Web Designing
- Mathematics for Competitive examinations
- Computational Mathematics
- Data Analysis using latest package
  (R / Matlab / Maxima/ Torus / GeoGebra /GIMP) and more

B.Sc Mathematics
Core Component Model Syllabus

8. Model Syllabus for different Courses of B.Sc Mathematics

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Foundation course - Bridge Mathematics</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">FOUNDATION 1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">FC</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To bridge the gap and facilitate transition from higher secondary to tertiary education;
To instil confidence among stakeholders and inculcate interest for Mathematics;</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Algebra: Binomial theorem, General term, middle term, problems based on these concepts</td></tr>
<tr><td colspan="6">Unit II: Sequences and series (Progressions). Fundamental principle of counting. Factorial n.</td></tr>
<tr><td colspan="6">Unit III: Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.</td></tr>
<tr><td colspan="6">Unit IV: Trigonometry: Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule</td></tr>
<tr><td colspan="6">Unit V: Calculus: Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. NCERT class XI and XII text books.
2. Any State Board Mathematics text books of class XI and XII</td></tr>
</table>

Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome

After completion of this course successfully, the students will be able to

CLO 1: Prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems

CLO 2: Find the various sequences and series and solve the problems related to them. Explain the principle of counting.

CLO 3: Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations

CLO 4: Explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.

CLO 5: Find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.

Mapping of Course Learning Outcomes (CLOs) with Programme Learning Outcomes (PLOs) and Programme Specific Outcomes (PSOs)

	POs						PSOs	
	1	2	3	4	5	6	1	2
CLO1	1	1	1	1	1	1	1	1
CLO2	2	1	1	2	2	1	2	1
CLO3	2	1	1	2	2	1	2	1
CLO4	1	1	1	1	1	1	2	1
CLO5	1	1	1	1	1	1	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ALGEBRA & TRIGONOMETRY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Basic ideas on the Theory of Equations, Matrices and Number Theory.
• Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">Unit I: Reciprocal Equations-Standard form–Increasing or decreasing the roots of a given equation- Removal of terms, Approximate solutions of roots of polynomials by Horner’s method – related problems.</td></tr>
<tr><td colspan="8">Unit II: Summation of Series: Binomial– Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.</td></tr>
<tr><td colspan="8">Unit III: Characteristic equation – Eigen values and Eigen Vectors-Similar matrices - Cayley – Hamilton Theorem (Statement only) - Finding powers of square matrix, Inverse of a square matrix up to order 3, Diagonalization of square matrices - related problems.</td></tr>
<tr><td colspan="8">Unit IV: Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$ - Expansion of $\tan n\theta$ in terms of $\tan\theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$ –Expansions of $\tan(\theta_1+\theta_2+,\ldots,+\theta_n)$-Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of θ - related problems.</td></tr>
<tr><td colspan="8">Unit V: Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems.</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.
Recommended Text	1. W.S. Burnstine and A.W. Panton, Theory of equations 2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007 3. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005 4. C. V. Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003 5. J. Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012. 6. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Classify and Solve reciprocal equations

CLO 2: Find the sum of binomial, exponential and logarithmic series

CLO 3: Find Eigen values, eigen vectors, verify Cayley – Hamilton theorem and diagonalize a given matrix

CLO 4: Expand the powers and multiples of trigonometric functions in terms of sine and cosine

CLO 5: Determine relationship between circular and hyperbolic functions and the summation of trigonometric series

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	1	-	-	3	2	1
CLO3	3	1	3	1	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DIFFERENTIAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• The basic skills of differentiation, successive differentiation, and their applications.
• Basic knowledge on the notions of curvature, evolutes, involutes and polar co-ordinates and in solving related problems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Successive Differentiation: Introduction (Review of basic concepts) – The n^{th} derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product – Feynman’s method of differentiation.</td></tr>
<tr><td colspan="8">UNIT-II: Partial Differentiation: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.</td></tr>
<tr><td colspan="8">UNIT-III: Partial Differentiation (Continued): Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of functions of two variables - Lagrange’s method of undetermined multipliers.</td></tr>
<tr><td colspan="8">UNIT-IV: Envelope: Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.</td></tr>
<tr><td colspan="8">UNIT-V: Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutes – Radius of Curvature in Polar Co-ordinates.</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010. 3. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
Reference Books	1. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989. 2. T. Apostol, Calculus, Volumes I and II. 3. S. Goldberg, Calculus and mathematical analysis.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with PLOs and PSOs)

Students will be able to

CLO 1: Find the nth derivative, form equations involving derivatives and apply Leibnitz formula

CLO 2: Find the partial derivative and total derivative coefficient

CLO 3: Determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers

CLO 4: Find the envelope of a given family of curves

CLO 5: Find the evolutes and involutes and to find the radius of curvature using polar co-ordinates

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	2	1	3	-	-	-	3	2	1
CLO3	3	2	3	2	-	-	3	2	1
CLO4	3	2	3	2	1	-	3	2	1
CLO5	3	2	3	2	1	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ANALYTICAL GEOMETRY (Two & Three Dimensions)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Necessary skills to analyze characteristics and properties of two- and three-dimensional geometric shapes.
• To present mathematical arguments about geometric relationships.
• To solve real world problems on geometry and its applications.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Pole, Polar - conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse - semi diameters- conjugate diameters of hyperbola.</td></tr>
<tr><td colspan="8">UNIT-II: Polar coordinates: General polar equation of straight line – Polar equation of a circle given a diameter, Equation of a straight line, circle, conic – Equation of chord, tangent, normal. Equations of the asymptotes of a hyperbola.</td></tr>
<tr><td colspan="8">UNIT-III: System of Planes-Length of the perpendicular–Orthogonal projection.</td></tr>
<tr><td colspan="8">UNIT-IV: Representation of line–angle between a line and a plane – co – planar lines–shortest distance between two skew lines –length of the perpendicular–intersection of three planes.</td></tr>
<tr><td colspan="8">UNIT-V: Equation of a sphere-general equation-section of a sphere by a plane-equation of the circle- tangent plane- angle of intersection of two spheres- condition for the orthogonality- radical plane.</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. S. L. Loney, Co-ordinate Geometry. 2. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions. 3. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016.
Reference Books	1. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010. 2. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961. 3. Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, Cengage Learning, CA, USA, 2010. 4. William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc, New York, 2006. 5. John F. Randelph, Calculus and Analytic Geometry, Wadsworth Publishing Company, CA, USA, 1969. 6. Ralph Palmer Agnew, Analytic Geometry and Calculus with Vectors, McGraw-Hill Book Company, Inc. New York, 1962.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Find pole, polar for conics, diameters, conjugate diameters for ellipse and hyperbola

CLO 2: Find the polar equations of straight line and circle, equations of chord, tangent and normal and to find the asymptotes of hyperbola

CLO 3: Explain in detail the system of Planes

CLO 4: Explain in detail the system of Straight lines

CLO 5: Explain in detail the system of Spheres

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	2	2	2	1	-	-	3	2	1
CLO2	2	2	2	1	-	-	3	2	1
CLO3	3	2	2	1	-	-	3	2	1
CLO4	3	2	3	1	-	-	3	2	1
CLO5	3	2	3	1	-	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">INTEGRAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
• Knowledge about Beta and Gamma functions and their applications.
• Skills to Determine Fourier series expansions.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli’s formula, Feyman’s technique of integration.</td></tr>
<tr><td colspan="8">UNIT-II: Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates - Change of order of integration.</td></tr>
<tr><td colspan="8">UNIT-III: Triple integrals –applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces–change of variables - Jacobian.</td></tr>
<tr><td colspan="8">UNIT-IV: Beta and Gamma functions – infinite integral - definitions–recurrence formula of Gamma functions – properties of Beta and Gamma functions- relation between Beta and Gamma functions - Applications.</td></tr>
<tr><td colspan="8">UNIT-V: Geometric and Physical Applications of Integral calculus.</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007. 3. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd. 4. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001 (second edition).
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae

CLO 2: Evaluate double and triple integrals and problems using change of order of integration

CLO 3: Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution

CLO 4: Explain beta and gamma functions and to use them in solving problems of integration

CLO 5: Explain Geometric and Physical applications of integral calculus

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	3	1	3	-	-	-	3	2	1
CLO3	3	1	3	-	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	2	1	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">VECTOR CALCULUS AND ITS APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Knowledge about differentiation of vectors and on differential operators. Knowledge about derivatives of vector functions.
• Skills in evaluating line, surface and volume integrals.
• The ability to analyze the physical applications of derivatives of vectors.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Vector point function - Scalar point function - Derivative of a vector and derivative of a sum of vectors - Derivative of a product of a scalar and a vector point function - Derivative of a scalar product and vector product.</td></tr>
<tr><td colspan="8">UNIT-II: The vector operator ‘del’, The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications.</td></tr>
<tr><td colspan="8">UNIT-III: Laplacian operator, Vector identities - Line integral - simple problems.</td></tr>
<tr><td colspan="8">UNIT-IV: Surface integral - Volume integral – Applications.</td></tr>
<tr><td colspan="8">UNIT-V: Gauss divergence Theorem, Stoke’s Theorem, Green’s Theorem in two dimensions – Applications to real life situations.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. J.C. Susan ,Vector Calculus, , (4th Edn.) Pearson Education, Boston, 2012. 2. A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014. 3. J.E. Marsden and A. Tromba ,Vector Calculus, , (5^{th}edn.) W.H. Freeman, New York, 1988.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Find the derivative of vector and sum of vectors, product of scalar and vector point function and to Determine derivatives of scalar and vector products

CLO 2: Applications of the operator 'del' and to Explain soleonidal and ir-rotational vectors

CLO 3: Solve simple line integrals

CLO 4: Solve surface integrals and volume integrals

CLO 5: Verify the theorems of Gauss, Stoke's and Green's(Two Dimension)

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	1	-	-	3	2	1
CLO2	3	2	3	1	2	-	3	2	1
CLO3	3	3	3	3	-	-	3	3	1
CLO4	3	3	3	3	-	-	3	3	1
CLO5	3	3	3	3	2	-	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DIFFERENTIAL EQUATIONS AND APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
1</td><td>Lab Practice
--</td><td>Total
5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Knowledge about the methods of solving Ordinary and Partial Differential Equations.
• The understanding of how Differential Equations can be used as a powerful tool in solving problems in science.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Ordinary Differential Equations: Variable separable - Homogeneous Equation-Non-Homogeneous Equations of first degree in two variables -Linear Equation - Bernoulli’s Equation-Exact differential equations.</td></tr>
<tr><td colspan="6">UNIT-II: Equation of first order but not of higher degree: Equation solvable for dy/dx- Equation solvable for y-Equation solvable for x-Clairauts’ form - Linear Equations with constant coefficients-Particular integrals of algebraic, exponential, trigonometric functions and their products.</td></tr>
<tr><td colspan="6">UNIT-III: Simultaneous linear differential equations- Linear Equations of the Second Order -Complete solution in terms of a known integrals-Reduction to the Normal form-Change of the Independent Variable-Method of Variation of Parameters.</td></tr>
<tr><td colspan="6">UNIT-IV: Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions – complete integral – singular integral-General integral-Lagrange’s Linear Equations –Simple Applications.</td></tr>
<tr><td colspan="6">UNIT-V: Special methods – Standard forms-Charpit’s Methods – Simple Applications</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984. 2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967. 3. G.F. Simmons, Differential equations with applications and historical notes, 2nd Ed, Tata Mcgraw Hill Publications, 1991.
Reference Books	1. D.A. Murray, Introductory course in Differential Equations, Orient and Longman 2. H.T. H. Piaggio, Elementary Treaties on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi,1985. 3. Horst R. Beyer, Calculus and Analysis, Wiley, 2010. 4. Braun, M. Differential Equations and their Applications. (3rd Edn.), Springer- Verlag, New York. 1983. 5. Tyn Myint-U and Lognath Debnath. Linear Partial Differential Equations for Scientists and Engineers. (4th Edn.) Birhauser, Berlin. 2007. 6. 6.. Boyce, W.E. and R.C.DiPrima. Elementary Differential Equations and Boundary Value Problems. (7th Edn.) John Wiley and Sons, Inc., New York. 2001. 7. Sundrapandian, V. Ordinary and Partial Differential Equations, Tata McGraw Hill Education Pvt.Ltd. New Delhi, 2013
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables, solve Bernoulli's equations and exact differential equations

CLO 2: Find the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic, exponential, trigonometric functions and their products

CLO 3: Find solutions of simultaneous linear differential equations, linear equations of second order and to find solutions using the method of variations of parameters

CLO 4: Form a PDE by eliminating arbitrary constants and arbitrary functions,
find complete, singular and general integrals, to solve Lagrange's equations

CLO 5: Explain standard forms and Solve Differential equations using Charpit's method

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	1	-	3	2	1
CLO2	3	1	3	2	1	-	3	2	1
CLO3	3	1	3	2	1	-	3	3	1
CLO4	3	1	3	2	2	1	3	3	1
CLO5	3	1	3	2	2	1	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">INDUSTRIAL MATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To bridge the gap between industry academia interface – to apply the theory learnt to industrial applications</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">Core Industry Module / Industrial Statistics can be designed as per HEI’s need.</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication, Transferrable Skill and designing mathematical models towards solving mathematical applications</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">1. Papoulis A. Probability, Random Variables and Stochastic process, Tata McGraw Hill Education Pvt. Ltd., New Delhi
2. Baisnab A., Jas M., Elements of Probability and Statistics, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 1993
3. Fruend John E, Mathematical Statistics, Prentice Hall of India, New Delhi</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="8">https://nptel.ac.in</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ELEMENTS OF MATHEMATICAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series.
• Understand metric spaces with suitable examples</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Sets and Functions: Sets and elements- Operations on sets- functions- real valued functions- equivalence-countability- real numbers- least upper bounds.</td></tr>
<tr><td colspan="8">UNIT-II: Sequences of Real Numbers: Definition of a sequence and subsequence-limit of a sequence – convergent sequences–divergent sequences- bounded sequences-monotone sequences</td></tr>
<tr><td colspan="8">UNIT-III: Operations on convergent sequences – operations on divergent sequences – limit superior and limit inferior-Cauchy sequences.</td></tr>
<tr><td colspan="8">UNIT-IV: Series of Real Numbers: Convergence and divergence – series with non –negative terms-alternating series-conditional convergence and absolute convergence- tests for absolute convergence.</td></tr>
<tr><td colspan="8">UNIT-V: Limits and Metric Spaces: Limit of a function on a real line - Metric spaces - Limits in metric spaces – Continuous Functions on Metric Spaces: Function continuous at a point on there a line-Function continuous on a metric space.</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Richard R. Goldberg, Methods of Real Analysis: Oxford and IBH Publishing, (1 January 2020). 2. Ethan D. Bloch, The Real Numbers and Real Analysis, Springer, 2011. 3. G.M. The fundamentals of Mathematical Analysis, vol I. Pergamon Press, New York, 1965.
Reference Books	1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002. 2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000. 3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983. 4. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain in detail about sets and functions, equivalence and countability and the LUB axiom

CLO 2: Explain Sequence and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent, bounded and monotone sequences

CLO 3: Explain the operations on convergent and divergent sequences and to Explain the concepts of limit superior and limit inferior and the notion of Cauchy sequences

CLO 4: Classify the series of real numbers and the alternating series and their convergence and divergence, the conditional convergence and absolute convergence and solve problems on convergence of the sequences

CLO 5: Explain about the metric spaces and functions continuous on a Metric space

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	2	3	2	-	3	2	1
CLO2	3	3	2	3	2	-	3	2	1
CLO3	3	3	3	3	2	-	3	2	1
CLO4	3	3	3	3	2	-	3	2	1
CLO5	3	3	2	3	2	-	3	2	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ABSTRACT ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M9</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Concepts of Sets, Groups and Rings.
• Construction, characteristics and applications of the abstract algebraic structures</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Introduction to groups- Subgroups- cyclic groups and properties of cyclic groups- Lagrange’s Theorem-A counting principle – Examples</td></tr>
<tr><td colspan="8">UNIT-II: Normal subgroups and Quotient group- Homomorphism- Automorphism -Examples.</td></tr>
<tr><td colspan="8">UNIT-III: Cayley’s Theorem-Permutation groups - Examples</td></tr>
<tr><td colspan="8">UNIT-IV: Definition and examples of ring- Some special classes of rings- homomorphism of rings- Ideals and quotient rings- More ideals and quotient rings.</td></tr>
<tr><td colspan="8">UNIT-V: The field of quotients of an integral domain-Euclidean Rings - The particular Euclidean Ring – Examples</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">Topics in Algebra–I.N.Herstein, Wiley Eastern Ltd. Second Edition (1st January 2006)</td></tr>
</table>

Reference Books	1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002. 2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011. 3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain groups, subgroups and cyclic groups

CLO 2: Explain about Normal subgroup, Quotient groups, Homomorphisms and Automorphisms and verify the functions for homomorphism and automorphism properties

CLO 3: Explain Permutation groups and apply Cayley's theorem to problems

CLO 4: Explain Rings, Ideals and Quotient Rings and examine their structure

CLO 5: Discuss about the field of quotient of an integral domain and to Explain in detail about Euclidean Rings

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	2	3	1	-	3	3	1
CLO2	3	3	2	3	1	-	3	3	1
CLO3	3	3	2	3	2	-	3	3	1
CLO4	3	3	2	3	1	-	3	3	1
CLO5	3	3	2	3	2	-	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">REAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M10</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Real Numbers and properties of Real–valued functions.
• Connectedness, Compactness, Completeness of Metric spaces.
• Convergence of sequences of functions, Examples and counter examples</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Continuous Functions on Metric Spaces: Open sets– closed sets–Discontinuous function on R^1. Connectedness, Completeness and Compactness: More about open sets-Connected sets.</td></tr>
<tr><td colspan="8">UNIT-II: Bounded sets and totally bounded sets: Complete metric spaces- compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.</td></tr>
<tr><td colspan="8">UNIT-III: Calculus: Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral-properties of Riemann integral.</td></tr>
<tr><td colspan="8">UNIT-IV: Derivatives-Rolle’s theorem, Law of mean, Fundamental theorems of calculus.</td></tr>
<tr><td colspan="8">UNIT-V: Taylor’s theorem-Point wise convergence of sequences of functions, uniform convergence of sequences of functions.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Methods of Real Analysis-Richard R.Goldberg (John Wiley & sons, 2nd edition) (Indian edition –Oxford and IBH Publishing Co, New Delhi, 1st January 2020)
Reference Books	1. Principles of Mathematical Analysis by Walter Rudin, Tata McGraw Hill Education, Third edition (1 July 2017). 2. Mathematical Analysis Tom M A postal, Narosa Publishing House, 2nd edition (1974), Addison-Wesley publishing company, New Delhi.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain the concepts of Continuous and Discontinuous functions, open and close sets, Connectedness, Completeness and Compactness

CLO 2: Explain the concepts of bounded and totally bounded sets, continuity of inverse functions and Uniform continuity

CLO 3: Define the sets of measure zero, to Explain about the existence and properties of Riemann integral

CLO 4: Explain the concept of differentiability and to Explain Rolle's theorem, Law of mean, and Fundamental theorem of calculus

CLO 5: Explain the point wise and uniform convergence of sequence of function and to derive the Taylor's theorem

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	1	3	1	-	3	1	1
CLO2	3	3	1	3	1	-	3	1	1
CLO3	3	3	1	3	1	-	3	1	1
CLO4	3	3	1	3	1	-	3	1	1
CLO5	3	3	1	3	1	-	3	1	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">MATHEMATICAL MODELLING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M11</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Construction and Analysis of Mathematical models found in real life problems.
• Modelling through differential and difference equations</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Mathematical Modelling: Simple situations requiring mathematical modelling, characteristics of mathematical models.</td></tr>
<tr><td colspan="8">UNIT-II: Mathematical Modelling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models.</td></tr>
<tr><td colspan="8">UNIT-III: Mathematical Modelling, through system of Ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations. Epidemics: simple epidemic model, Susceptible-infected- susceptible (SIS) model, SIS model with constant number of carriers. Medicine: Model for Diabetes Mellitus.</td></tr>
<tr><td colspan="8">UNIT – IV: Introduction to difference equations.</td></tr>
<tr><td colspan="8">UNIT-V: Mathematical Modelling through difference equations: Harrod Model, cob web model application to Actuarial Science</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	J N Kapur, Mathematical Modeling, New Age International publishers (2009).
Reference Books	1. Mathematical Modeling by Bimalk. Mishra and Dipak K.Satpathi. Ane Books Pvt. Ltd(1 Januuary 2009) 2. Mathematical Modeling Models, Analysis and Applications, by Sandip Banerjee, CRC Press, Taylor & Francis group, 2014 3. Mathematical Modeling applications with Geogebra by Jonas Hall & Thomas Ligefjard, John Wiley & Sons, 2017 4. Mark M. Meerschaert: Mathematical Modeling, Elsevier Publ., 2007. 5. Edward A. Bender: An introduction to mathematical Modeling, CRC Press,2002 6. Walter J. Meyer, Concepts of Mathematical Modeling, Dover Publ., 2000
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain simple situations requiring Mathematical Modelling and to Determine the characteristics of such models

CLO 2: Model using differential equations in-terms of linear growth and Decay models

CLO 3: Model using systems of ordinary differential equations of first order, to discuss about various models under the categories ‘Epidemics’ and ‘Medicine’

CLO 4: Explain in detail about difference equations

CLO 5: Model using difference equations

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	2	3	3	3	2	2	2	3	2
CLO2	2	3	3	3	2	2	2	3	2
CLO3	2	3	3	3	2	2	2	3	2
CLO4	3	2	2	2	-	1	2	3	2
CLO5	2	3	3	3	2	2	2	3	2

Title of the Course		PROJECT WITH VIVA VOCE					
Paper Number		CORE M12					
Category	Core	Year	III	Credits	4	Course Code	
		Semester	V				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4		-		--	4

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">LINEAR ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M13</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Vector Spaces, linear dependence and independence of vectors . Dual spaces, Inner product and norm – orthogonalization process.
• Linear transformations. Various operators on vector spaces</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT-I: Vector spaces – Subspaces – Linear Combinations and linear span - Systems of Linear equations – Homogenous Equations – Non-homogenous Equations – Elementary Matrices – Row reduced - Echelon form.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II: Linear Dependence and Linear independence – Bases – Dimensions</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III: Linear transformations, null spaces and ranges – Matrix representation of a linear transformation –invertibility and isomorphisms – dual spaces</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – IV: Eigen values, eigen vectors, diagonalizability – invariant subspaces – Cayley– Hamilton theorem</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-V: Inner products and norms – Gram Schmidt Orthogonalization Process - Orthogonal complements</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	Linear Algebra - Stephen H Friedberg, Arnold J Insel and Lawrence E Spence, 5th edition (2018) Pearson
Reference Books	1. I.N.Herstein, Topics in Algebra, Wiley EasternLtd. Second Edition, 2006. 2. N.S.Gopalakrishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd. 3. John B.Fraleigh, First course in Algebra, Addison Wesley. 4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2004. 5. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007. 6. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005. 7. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Acquire a detailed knowledge about vector spaces and subspaces

CLO 2: Explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis

CLO 3: Explain the concept of Linear Transformations, their Matrix representation and the notion of dual spaces

CLO 4: Find the Eigen values and Eigen vectors, to apply the concepts for diagonalisation

CLO5: Explain about Inner product and norms and to apply Gram Schmidt Orthogonalization Process to problems on inner product spaces

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	2	3	-	-	3	3	1
CLO2	3	3	3	3	-	-	3	3	1
CLO3	3	3	2	3	1	-	3	3	1
CLO4	3	3	3	3	-	-	3	3	1
CLO5	3	3	3	3	1	-	3	3	1

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">COMPLEX ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M14</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Apply concept and consequences of analyticity and C-R equations.
• Understand the concept of mappings and transformations.
• Compute complex contour integrals and applying Cauchy‘s integral in various versions.
• Understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="8">UNIT-I: Analytic functions: Functions of a Complex variable –Limits –Theorem on limits –Continuity – Derivatives – Differentiation formulas – Cauchy Riemann equation – conditions for differentiability – Polar coordinates– Analytic functions– Harmonic functions.</td></tr>
<tr><td colspan="8">UNIT-II: Conformal mapping: Mappings – Mapping by exponential function – Linear transformation – The transformation w= $\frac{1}{z}$– Mappings by $\frac{1}{z}$ – Linear fractional transformations (bilinear)</td></tr>
<tr><td colspan="8">UNIT-III: Complex Integration: Contour integrals– Some examples – Simply and Multiply connected domains– Cauchy integral formula – Formula for derivatives– Liouville’s theorem –Fundamental theorem of Algebra– Maximum modulus principle.</td></tr>
<tr><td colspan="8">UNIT – IV: Sequences and Series: Convergence of sequences – Convergence of series– Taylor’s series – Laurent series– Absolute and uniform convergence of power Series – Continuity of sums of power series–Integration & differentiation of power series</td></tr>
</table>

	UNIT-V: Residues and Poles: Isolated singular points – Residues – Cauchy Residue theorem – Residue at infinity – The three types of isolated singular points – Residues at poles – Zeros of analytical functions – Zeros and poles – Evaluation of real improper integrals (excluding poles on the real axis).
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Complex variables and application, Seventh Edition by James Ward Brown and Ruel V. Churchill, Mc-Graw Hill Book Co., International Edition, 2009.
Reference Books	1. Theodore W. Gamelan, Complex Analysis, Springer Verlag, 2008 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997. 3. Richard A. Silverman, Introductory Complex Analysis. Dover Publications, 1972. 4. S. Ponnusamy and H. Silverman, Complex variables with applications, Birkhauser, 2006.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Explain about analytic functions, their differentiation and continuity and to verify the Harmonic functions using analyticity conditions

CLO 2: Explain the concept of Conformal mappings and mappings by linear transformations and linear fractional transformations

CLO 3: Explain about the integrations of functions over simply and multiply connected domains and to derive the Cauchy integral formula, Liouvlle's theorem, Fundamental theorem of Algebra and Maximum Module Principle

CLO 4: Find the convergence the sequences and series, to derive Taylor's and Laurent's series

CLO 5: Find the nature of singularities, to find the residue of a given function at a given singular point, to Explain about zeros and poles and to evaluate real improper integrals (Excluding poles on the real axis)

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	3	2	1	-	3	3	2
CLO2	3	3	3	2	1	-	3	3	2
CLO3	3	3	3	2	1	-	3	3	2
CLO4	3	3	3	2	1	-	3	3	2
CLO5	3	3	3	2	1	-	3	3	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">MECHANICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE M15</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Equilibrium of a particle under the action of given forces
• Simple Harmonic Motion
• Projectiles</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Force: Newton’s laws of motion – Resultant of two forces on a particle - Equilibrium of a Particle: Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane.</td></tr>
<tr><td colspan="8">UNIT-II: Forces on a Rigid Body: Moment of a Force – General motion of a body – Equivalent systems of forces- Parallel Forces – Forces acting along a Triangle - A specific reduction of Forces: Reduction of coplanar forces into a force and couple – Problems involving frictional forces.</td></tr>
<tr><td colspan="8">UNIT-III: Work, Energy and Power: Work – Conservative field of force – Power -Rectilinear Motion under Varying Force: Simple Harmonic Motion - along a horizontal line – along a vertical line.</td></tr>
<tr><td colspan="8">UNIT – IV: Projectiles: Forces on a projectile – Projectile projected on an inclined plane</td></tr>
<tr><td colspan="8">UNIT-V: Central Orbits: General orbits – Central orbit – Conic as a centered orbit</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. A. Ruina and R. Pratap, Introduction to Statics and Dynamics, , Oxford University Press, 2014. 2. S.L. Loney, The Elements of Statics and Dynamics, Cambridge University Press, 1904.
Reference Books	1. J.L. Meriam and L. G. Kraige, Engineering Mechanics: Statics, Seventh Edition,Wiley and sons Pvt ltd., New York, 2012. 2. J.L. Meriam, L. G. Kraige, and J.N. Bolton, Engineering Mechanics: Dynamics, 8thedn, Wiley and sons Pvt ltd., New York, 2015. 3. A. K. Dhiman, P.Dhinam and D. Kulshreshtha, Engineering Mechanics (Statics and Dynamics) ,McGraw Hill Education(India) Private Limited, New Delhi, 2015.
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will able to

CLO 1: Define Resultant, Component of a Force, Coplanar forces, like and unlike parallel forces, Equilibrium of a Particle, Limiting equilibrium of a particle on an inclined plane.

CLO 2: Define Moment of a force and Couple with examples. Define Parallel Forces and Forces acting along a Triangle, Solve problems on frictional forces

CLO 3: Define work, energy, power, rectilinear motions under varying forces. Define Simple Harmonic Motion and find its Geometrical representation.

CLO 4: Define Projectile, impulse, impact and laws of impact. Prove that the path of a projectile is a parabola. Find the direct and oblique impact of smooth elastic spheres

CLO 5: Define central orbits, explain conic as centered orbits and solve problems related to central orbits

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	2	3	2	1	1	3	3	2
CLO2	3	2	3	2	1	1	3	3	2
CLO3	3	2	3	2	1	1	3	3	2
CLO4	3	2	3	2	1	1	3	3	2
CLO5	3	2	3	2	1	1	3	3	2