



**THIRUVALLUVAR UNIVERSITY  
SERKKADU, VELLORE-632115**

**B. Sc. MATHEMATICS**

**SYLLABUS**

**FROM THE ACADEMIC YEAR  
2023 – 2024**

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## 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.

<b>LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME</b>	
<b>Programme:</b>	<b>B.Sc., MATHEMATICS</b>
<b>Programme Code:</b>	
<b>Duration:</b>	<b>3 years [UG]</b>
<b>Programme Outcomes:</b>	<p><b>PO1: Disciplinary knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p><b>PO2: Communication Skills:</b> 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.</p> <p><b>PO3: Critical thinking:</b> 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.</p> <p><b>PO4: Problem solving: Capacity</b> 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.</p> <p><b>PO5: Analytical reasoning:</b> 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.</p> <p><b>PO6: Research-related skills:</b> 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</p> <p><b>PO7: Cooperation/Team work:</b> 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</p> <p><b>PO8: Scientific reasoning:</b> Ability to analyse, interpret and draw</p>

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 to embrace 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 demonstrating the 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 learning 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:

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	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:**

<b>Semester</b>	<b>Newly introduced Components</b>	<b>Outcome / Benefits</b>
<b>I</b>	<b>Foundation Course</b> 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.	<ul style="list-style-type: none"> <li>• Instil confidence among students</li> <li>• Create interest for the subject</li> </ul>
<b>I, II, III, IV</b>	<b>Skill Enhancement papers</b> (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> <li>• Industry ready graduates</li> <li>• Skilled human resource</li> <li>• Students are equipped with essential skills to make them employable</li> </ul>
		<ul style="list-style-type: none"> <li>• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects</li> </ul>
		<ul style="list-style-type: none"> <li>• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</li> </ul>
		<ul style="list-style-type: none"> <li>• Entrepreneurial skill training will provide an opportunity for independent livelihood</li> <li>• Generates self – employment</li> <li>• Create small scale entrepreneurs</li> <li>• Training to girls leads to women empowerment</li> </ul>
		<ul style="list-style-type: none"> <li>• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools</li> </ul>
<b>III, IV, V &amp; VI</b>	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	<ul style="list-style-type: none"> <li>• Strengthening the domain knowledge</li> <li>• Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature</li> <li>• Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background</li> <li>• Emerging topics in higher education / industry /</li> </ul>

		communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors
<b>IV</b>	Industrial Statistics	<ul style="list-style-type: none"> <li>• Exposure to industry moulds students into solution providers</li> <li>• Generates Industry ready graduates</li> <li>• Employment opportunities enhanced</li> </ul>
<b>II year Vacation activity</b>	Internship / Industrial Training	<ul style="list-style-type: none"> <li>• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.</li> </ul>
<b>V Semester</b>	Project with Viva – voce	<ul style="list-style-type: none"> <li>• Self-learning is enhanced</li> <li>• Application of the concept to real situation is conceived resulting in tangible outcome</li> </ul>
<b>VI Semester</b>	Introduction of Professional Competency component	<ul style="list-style-type: none"> <li>• 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;</li> <li>• ‘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.</li> </ul>
<b>Extra Credits: For Advanced Learners / Honours degree</b>		<ul style="list-style-type: none"> <li>• To cater to the needs of peer learners / research aspirants</li> </ul>

<b>Skills acquired from the Courses</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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## 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
		<b>23</b>	<b>30</b>

#### 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
		<b>23</b>	<b>30</b>

#### 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
		<b>23</b>	<b>30</b>

### 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 - <b>Industrial Statistics</b>		
	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
		<b>24</b>	<b>30</b>

### 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	
		<b>25</b>	<b>30</b>

### 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	-
		<b>22</b>	<b>30</b>

**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	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5

												Specific					
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				
	<b>23</b>	<b>30</b>		<b>23</b>	<b>30</b>		<b>22</b>	<b>30</b>		<b>25</b>	<b>30</b>		<b>26</b>	<b>30</b>		<b>21</b>	<b>30</b>
<b>Total – 140 Credits</b>																	

### 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
<b>Total</b>	<b>23</b>	<b>23</b>	<b>22</b>	<b>25</b>	<b>26</b>	<b>21</b>	<b>140</b>

**\*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. B.Sc Mathematics Curriculum Design**  
**First Year Semester-I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
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(Chose any one) 1) Numerical Methods with Applications 2) Allied Physics – I	3	4
Part-IV	Skill Enhancement Course – I (Non Major Elective)	2	2
	Mathematics for Competitive examinations		
	Foundation Course FC- Bridge Mathematics	2	2
		<b>23</b>	<b>30</b>

**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**

**B.Sc. Degree Course in Mathematics**

**PART I – TAMIL - TO BE GIVEN BY THE TAMIL DEPARTMENT**

**PART II – ENGLISH - TO BE GIVEN BY THE ENGLISH DEPARTMENT**

**PART III – CORE COMPONENTS**

<b>Title of the Course</b>		<b>ALGEBRA &amp; TRIGONOMETRY</b>					
<b>Paper Number</b>		<b>CORE M1</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		4		1		--	5
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• Basic ideas on the Theory of Equations, Matrices and Number Theory.</li> <li>• Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.</li> </ul>					
<b>Course Outline</b>		<p><b>Unit I:</b> 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.</p> <p>Book 1. Chapter 6. (pg 321) 16.1, 16.2, 17, 19, 30. Hours: 15</p>					
		<p><b>Unit II:</b> Summation of Series: Binomial– Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.</p> <p>Book 1. Chapter 3. (pg 143) 10, 14. Chapter 4 (1-7 , 11) Hours: 15</p>					
		<p><b>Unit III:</b> 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.</p>					
		<p>Book 2. Chapter 2. (pg 170) 16, 16.1, 16.2, 16.3, 16.4. Hours: 15</p>					

	<p><b>Unit IV:</b> Expansions of <math>\sin n\theta</math>, <math>\cos n\theta</math> in powers of <math>\sin\theta</math>, <math>\cos\theta</math> - Expansion of <math>\tan n\theta</math> in terms of <math>\tan \theta</math>, Expansions of <math>\cos^n\theta</math>, <math>\sin^n\theta</math>, <math>\cos^m\theta\sin^n\theta</math> –Expansions of <math>\tan(\theta_1+\theta_2+\dots+\theta_n)</math>-Expansions of <math>\sin\theta</math>, <math>\cos\theta</math> and <math>\tan\theta</math> in terms of <math>\theta</math> - related problems.</p> <p>Book 3. Chapter 3. (1-5). <span style="float: right;">Hours: 15</span></p>
	<p><b>Unit V:</b> Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems.</p> <p>Book 3. Chapter 4, Chapter 5, (5 only) , Chapter 6, <span style="float: right;">Hours: 15</span></p>
<p><b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</b></p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>
<p><b>Skills acquired from this course</b></p>	<p>Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.</p>
<p><b>Recommended Text</b></p>	<ol style="list-style-type: none"> <li>1. Algebra, Volume I, T.K.Manivachagom Pillay, T.Natarajan, K.S.Ganapathy, S.Viswanathan (Printers &amp; Publishers) PVT.LTD., 2013.</li> <li>2. Algebra, Volume II, T.K.Manivachagom Pillay, T.Natarajan, K.S.Ganapathy, S.Viswanathan (Printers &amp; Publishers) PVT.LTD., 2008.</li> <li>3. Trigonometry, S.Narayanan, T.K.Manivachagom Pillay , S.Viswanathan (Printers &amp; Publishers) PVT.LTD., 2013.</li> </ol>

<b>Reference Books</b>	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, 9 <sup>th</sup> Edition, 2010.
<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in">https://nptel.ac.in</a>

**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

<b>Title of the Course</b>		<b>DIFFERENTIAL CALCULUS</b>					
<b>Paper Number</b>		<b>CORE M2</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	5	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>		
	4	1		--	5		
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>• The basic skills of differentiation, successive differentiation, and their applications.</li> <li>• Basic knowledge on the notions of curvature, evolutes, involutes and polar co-ordinates and in solving related problems.</li> </ul>					
<b>Course Outline</b>		<p><b>UNIT-I: Successive Differentiation:</b> Introduction (Review of basic concepts) – The <math>n^{th}</math> derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the <math>n^{th}</math> derivative of a product – Feynman's method of differentiation.</p> <p>Chapter III (Volume I): Sections 1.1 to 1.6, 2.1                          Hours: 15</p> <p><b>UNIT-II: Partial Differentiation:</b> Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.</p> <p>Chapter VIII (Volume I): Sections 1.1 to 1.5                                          Hours: 15</p> <p><b>UNIT-III: Partial Differentiation (Continued):</b> Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers.</p> <p>Chapter VIII (Volume I): Sections 1.6 to 1.7;  Chapter VIII (Volume I): Sections 2.4 to 2.5;                                          Hours: 15</p>					

	<p><b>UNIT-IV: Envelope:</b> Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.</p> <p>Chapter X (Volume I): Sections 1.1 to 1.4 <span style="float: right;">Hours: 15</span></p>
	<p><b>UNIT-V: Curvature:</b> Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutives – Radius of Curvature in Polar Co-ordinates.</p> <p>Chapter X (Volume I): Sections 2.1 to 2.6 <span style="float: right;">Hours: 15</span></p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC // TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>
<p><b>Recommended Text</b></p>	<p>1. S.Narayanan and T.K.ManicavachagomPillay (2004) Calculus, Volume I, S.Viswanathan Printers &amp;Publishers Pvt. Ltd. Chennai.</p>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.</li> <li>2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010.</li> <li>3. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.</li> <li>4. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I &amp; II), Springer- Verlag, New York, Inc., 1989.</li> <li>5. T. Apostol, Calculus, Volumes I and II.</li> <li>6. S. Goldberg, Calculus and mathematical analysis.</li> </ol>
<p><b>Website and e-Learning Source</b></p>	<p><a href="https://nptel.ac.in">https://nptel.ac.in</a></p>



**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

**PART – III ELECTIVE COURSES I (CHOOSE ANY ONE)**

**1. NUMERICAL METHODS WITH APPLICATIONS**

**2. ALLIED PHYSIS – I – TO BE GIVEN BY THE PHYSIS DEPARTMEND**

<b>Title of the Course</b>		<b>NUMERICAL METHODS WITH APPLICATIONS</b>					
<b>Paper Number</b>		<b>ELECTIVE E1</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>		<b>Tutorial</b>		<b>Lab Practice</b>	<b>Total</b>
		4		--		--	4
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>➤ To know the methods of solving simultaneous linear equations.</li> <li>➤ To acquire knowledge about forward differences and Backward differences and their relationship.</li> <li>➤ Knowledge about central difference operators and problems based on various central differences formulae.</li> <li>➤ To study Newton's divided difference formula and problems based on Lagrange's interpolation formula.</li> </ul>					
<b>Course Outline</b>		<b>Unit I:</b> Solutions of algebraic and transcendental equations: Bisection method - Regula-falsi method - Newton-Raphson method. <b>Chapter 1 :</b> Section 1.1, 1.3, 1.4. <span style="float: right;">Hours : 12</span>					
		<b>Unit II:</b> Solutions of Simultaneous Linear Equations: Gauss-Elimination method, Gauss-Jordan method, Crout's method, Gauss-Seidel method. <b>Chapter 2 :</b> Section 2.1 to 2.4 & 2.6 <span style="float: right;">Hours : 12</span>					
		<b>Unit III:</b> Finite Differences: E operators and relation between them - Differences of a polynomial - Factorial polynomials - inverse operator $\Delta^{-1}$ - Summation Series. <b>Chapter 3 :</b> Section 3.1 to 3.4 & 3.6, 3.7 <span style="float: right;">Hours : 12</span>					
		<b>Unit IV:</b> Interpolation with Equal Intervals : Newton's Forward and Backward Interpolation formulae - Central Differences Formulae: Gauss-Forward and Backward Formulae - Stirling's Formula. <b>Chapter 4 :</b> Section 4.1 to 4.3 (omit 4.1a, 4.4) & 4.7 <b>Chapter 5 :</b> Section 5.1 to 5.4. <span style="float: right;">Hours : 12</span>					

	<p><b>Unit V:</b> Interpolation with Unequal Intervals: Divided Differences - Newton's Divided Differences Formula for Interpolation - Lagrange's Formula for Interpolation - Inverse Interpolation - Lagrange's method Reversion of Series method.</p> <p><b>Chapter 6 :</b> Section 6.1, 6.2, 6.5 &amp; 6.7 <span style="float: right;">Hours : 12</span></p>
<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</b>	<p>Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>
<b>Skills acquired from this course</b>	<p>Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.</p>
<b>Recommended Text</b>	<p>P.Kandasamy, K.Thilagavathy (2003) Calculus of Finite differences &amp; Numerical Analysis, S. Chand &amp; Company Ltd., New Delhi-55.</p>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. B.D. Gupta.(2001) <i>Numerical Analysis</i>.Konark Pub. Ltd., Delhi</li> <li>2. M.K. Venkataraman. (1992) <i>Numerical methods for Science and Engineering</i> National Publishing Company, Chennai.</li> <li>3. S. Arumugam. (2003) <i>Numerical Methods</i>, New Gamma Publishing, Palayamkottai.</li> <li>4. H.C. Saxena. (1991) <i>Finite differences and Numerical analysis</i> S.Chand &amp; Co., Delhi</li> </ol>
<b>Website and e-Learning Source</b>	<p><a href="https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus/">https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus/</a> <a href="https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2004/">https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2004/</a></p>

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO1:** After studied unit -1, the student will be able to solve Iteration method- Regula-falsi method- Newton-Raphson method.

**CLO2:**After studied unit -2, the student will be able to calculate interpolation values by applying Gauss-Elimination method, Gauss-Jordan method.

**CLO3:**After studied unit -3, the student will be able to calculate Differences of a polynomial- Factorial polynomials- inverse operator  $\Delta^{-1}$  -Summation Series.

**CLO4:**After studied unit -4, the student will be able to estimate one or more missing terms of the given set of data.

**CLO5:** After studied unit -5, the student will be able to estimate the interpolation value for unequal intervals based on Lagrange's formula of inverse interpolation.

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

**SKILL ENHANCEMENT COURSE – I**

**MATHEMATICS FOR COMPETITIVE EXAMINATIONS-I**

<b>Title of the Course</b>		<b>MATHEMATICS FOR COMPETITIVE EXAMINATIONS-I</b>					
<b>Paper Number</b>		<b>ELECTIVE (S EC2)</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		2	--	--	2		
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		After taking the course, <ul style="list-style-type: none"> <li>• The student will able to answer the questions related to the number system.</li> <li>• The student will able to answer real life simple problems by using HCF and LCM.</li> <li>• The student will able to apply the correct sequence of operations to find out the value of a given mathematical expressions.</li> <li>• The student will able to solve the problem involving square roots, cube roots and average.</li> <li>• The student will able to carry out the problems related to age and simple product.</li> </ul>					
<b>Course Outline</b>		Using R Programming develop the programmes in the following topics:					
		<b>Unit I:</b> Number System.				Hours: 6	
		<b>Unit II:</b> H.C.F and L.C.M of numbers , Decimal Fractions.				Hours: 6	
		<b>Unit III:</b> Simplification.				Hours: 6	
		<b>Unit IV:</b> Square root and Cube Roots, Averages.				Hours: 6	
		<b>Unit V:</b> Problems on numbers, Problems on Age, Surds and Indices.				Hours: 6	

<b>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</b>	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
<b>Skills acquired from this course</b>	Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.
<b>Recommended Text</b>	1. R.S. Aggarwal [2017], Quantitative Aptitude for Competitive Examinations, S.Chand and Company , New Delhi. Chapters 11-13, 18, 19, 22, 23
<b>Reference Books</b>	1. Praveen R.V, Quantitative Aptitude and reasoning ,PHI Learning Pvt, New Delhi.

### Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO1:** Solve Mathematical Problems using Mathematical formulae.

**CLO2:** Understand the knowledge of application of Mathematics

**CLO3:** Understand the concepts of simplification.

**CLO4:** Calculate the square root and cube root.

**CLO5:** Solve the problems on age.

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

<b>Title of the Course</b>		Foundation course - <b>Bridge Mathematics</b>					
<b>Paper Number</b>		<b>FOUNDATION 1</b>					
<b>Category</b>	Core	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	<b>FC</b>
		<b>Semester</b>	I				
<b>Instructional Hours per week</b>		<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>	<b>Total</b>		
		2	-	--	2		
<b>Pre-requisite</b>		12 <sup>th</sup> Standard Mathematics					
<b>Objectives of the Course</b>		<p>To bridge the gap and facilitate transition from higher secondary to tertiary education;</p> <p>To instil confidence among stakeholders and inculcate interest for Mathematics. <span style="float: right;">Hours: 6</span></p>					
<b>Course Outline</b>		<b>UNIT-I:</b> Algebra: Binomial theorem, General term, middle term, problems based on these concepts. <span style="float: right;">Hours: 6</span>					
		<b>Unit II:</b> Sequences and series (Progressions). Fundamental principle of counting. Factorial n. <span style="float: right;">Hours: 6</span>					
		<b>Unit III:</b> Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups. <span style="float: right;">Hours: 6</span>					
		<b>Unit IV:</b> 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. <span style="float: right;">Hours: 6</span>					
		<b>Unit V:</b> 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. <span style="float: right;">Hours: 6</span>					
<b>Recommended Text</b>		<p>1. NCERT class XI and XII text books.</p> <p>2. Any State Board Mathematics text books of class XI and XII</p>					

<b>Website and e-Learning Source</b>	<a href="https://nptel.ac.in">https://nptel.ac.in</a>
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### 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