B.SC.

MATHEMATICS

Course of Study, Schemes of Examinations & Syllabi
(Choice Based Credit System)

PG & Research Department of Mathematics
H.H. The Rajahs' College
(Autonomous)
Re-Accredited with B^+ by NAAC

Pudukkottai- 622 001.

SYLLABUS

FROM THE ACADEMIC YEAR
2023-2024

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

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 **Soft Skill –I (common Paper)**	2	2	2.6 Skill Enhancement Course SEC-2 **Soft Skill-II (common Paper)**	2	2	3.6 Skill Enhancement Course SEC-4, **Entrepreneurial Skills (common Paper)**	1	1	4.6 Skill Enhancement Course SEC-6 **(Nan Muthalvan) NMC -III**	2	2	5.6 Elective VI Generic/ Discipline Specific **(Online Objective)**	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course –**SEC-3(Nan Muthalvan) NMC-I**	2	2	3.7 Skill Enhancement Course SEC-5 **(Nan Muthalvan) NMC - II**	2	2	4.7 Value Education & Gender Studies	2	2	5.7 Skill Enhancement Course SEC-7 **(Nan Muthalvan) NMC -IV**	2	2	6.7 Skill Enhancement / Professional Competency Skill **(Nan Muthalvan) NMC -V**		2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training **(30Hrs)**	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	10	16	10	16	22	18	92
Part IV	4	4	3	6	4	1	22
Part V	-	-	-	-	-	2	2
Total	20	26	19	28	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.**

3. B.Sc Mathematics Curriculum Design

First Year Semester-I

Part	Sem.	List of Courses	Sub. Code	Credit	Hrs. Per week(L/T/P)
Part-I	1.1	Language –Tamil Paper-I / Hindi Paper - I	23ULT1/H1	3	6
Part-II	1.2	English Paper - I	23ULE1	3	6
Part-III	1.3	Core – I- Algebra &Trigonometry	23UMT1	5	5
	1.4	Core – II-Differential Calculus	23UMT2	5	5
		Generic Elective Course I - Allied Chemistry Paper - I	23UCHGE1		4
		Generic Elective Course II - Allied Chemistry Practical	23UCHGE2P		
Part-IV	1.5	Skill Enhancement Course-Foundation Course-Bridge Mathematics	23UMTSEF1	2	2
	1.6	Skill Enhancement Course-Soft Skill-I	23USE1	2	2
				20	**30**

Semester-II

Part		List of Courses	Sub. Code	Credit	Hrs. per week (L/T/P)
Part-I	2.1	Language –Tamil Paper-II / Hindi Paper - II	23ULT2/H2	3	6
Part-II	2.2	English Paper - II	23ULE2	3	6
Part-III	2.3	Core – III- Analytical Geometry (Two & Three Dimensions)	23UMT3	5	5
	2.4	Core – IV- Integral Calculus	23UMT4	5	5
	2.5	Generic Elective Course I - Allied Chemistry Paper - I	23UCHGE1	3	4
	2.6	Generic Elective Course II - Allied Chemistry Practical	23UCHGE2P	3	
Part-IV	2.7	Skill Enhancement Course-Soft Skill-II	23USE2	2	2
	2.8	Skill Enhancement Course-MNC1-Nan Muthalvan	23UMTNMC1	2	2
				26	**30**

Second Year Semester-III

Part	Sem.	List of Courses	Sub. Code	Credit	Hrs. per week (L/T/P)
Part-I	3.1	Language –Tamil Paper-III / Hindi Paper - III	23ULT3/H3	3	6
Part-II	3.2	English Paper - III	23ULE3	3	6
Part-III	3.3	Core – V- Sequences and Series	23UMT5	5	5
	3.4	Core – VI- Differential Equations and Fourier Series	23UMT6	5	5
		Generic Elective Course III- Allied Physics Paper - I	23UPHGE3		4
		Generic Elective Course IV - Allied Physics Practical	23UPHGE4P		
Part-IV	3.5	Skill Enhancement Course-Entrepreneurial Skill-Soft skill-III	23USE3	1	1
	3.6	Skill Enhancement Course- MNC2-Nan Muthalvan	23UMTNMC2	2	2
		EVS			1
				19	**30**

Semester-IV

Part		List of Courses	Sub. Code	Credit	Hrs. per week (L/T/P)
Part-I	4.1	Language –Tamil Paper-IV / Hindi Paper - IV	23ULT4/H4	3	6
Part-II	4.2	English Paper - IV	23ULE4	3	6

Part-III	4.3	Core – VII- Real Analysis	23UMT7	5	5
	4.4	Core – VIII-Modern Algebra	23UMT8	5	5
	4.5	Generic Elective Course III- Allied Physics Paper - I	23UPHGE3	3	3
	4.6	Generic Elective Course IV - Allied Physics Practical	23UPHGE4P	3	
Part-IV	4.7	Skill Enhancement Course- MNC3-Nan Muthalvan	23UMTNMC3	2	2
	4.8	Value Education and Gender studies	23UVEGS	2	2
	4.9	Environmental Studies	23UES	2	1
				28	**30**

Third Year Semester-V

Part		List of Courses		Sub. Code	Credit	Hrs. per week (L/T/P)
Part-III	5.1	Core – IX- Linear Algebra		23UMT9	4	5
	5.2	Core – X- Complex Analysis		23UMT10	4	5
	5.3	Core – XI-Mechanics		23UMT11	4	5
	5.4	Core – XII-Project with Viva voce		23UMT12PW	4	5
	5.5	Discipline Specific Elective ½	Vector Calculus and its Applications	23UMTE1A	3	4
			Automata Theory and Formal Languages (Online Exam)	23UMTE1B		
	5.6	Discipline Specific Elective – 3/4	Programming Language With C++	23UMTE2A	3	4
			Programming In C	23UMTE2B		
Part-IV	5.7	Skill Enhancement Course- MNC4-Nan Muthalvan		23UMTMNC4	2	2
	5.8	Internship / Industrial Training		23UIT	2	-
					26	**30**

Semester-VI

Part		List of Courses		Sub. Code	Credit	Hrs. per week (L/T/P)
Part-III	6.1	Core – XIII- Probability and Statistics		23UMT13	4	6
	6.2	Core – XIV-Numerical Analysis		23UMT14	4	6
	6.3	Core – XV- Operations Research		23UMT15	4	6
	6.4	Discipline Specific Elective– 5/6	Mathematical Modelling	23UMTE3A	3	5
			Astronomy	23UMTE3B		
	6.5	Discipline Specific Elective – 7/8	Graph Theory and its applications	23UMTE4A	3	5
			Fuzzy Mathematics	23UMTE4B		
Part-IV	6.6	Professional Competency Skill Enhancement Course – MNC5-Nan Muthalvan		23UMTNMC5	2	2
	6.7	Extension Activity		23UEA	1	-
					21	**30**

Total Credits : 140

B.Sc., MATHEMATICS SYLLABUS:

<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">23UMTSEF1</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 sub multiple 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	3
CLO1	1	1	1	1	1	1	1	1	1
CLO2	2	1	1	2	2	1	2	1	2
CLO3	2	1	1	2	2	1	2	1	1
CLO4	1	1	1	1	1	1	2	1	1
CLO5	1	1	1	1	1	1	2	1	2

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">ALGEBRA & TRIGONOMETRY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE M1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td>23UMT1</td></tr>
<tr><td>Semester</td><td>I</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="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• 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="7">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="7">Unit II: Summation of Series: Binomial– Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.</td></tr>
<tr><td colspan="7">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="7">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="7">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>Credits</td><td>4</td><td>Course Code</td><td colspan="2" rowspan="2">23UMT2</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
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. 4. S. Narayanan, T.K. Manicavachagom Pillay, Calculus Volume I, Anantha Book Depot.
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="6">ANALYTICAL GEOMETRY (Two & Three Dimensions)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">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">23UMT3</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2"></td><td>4</td><td>1</td><td>--</td><td colspan="3">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">• 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="6">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="6">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="6">UNIT-III: System of Planes-Length of the perpendicular–Orthogonal projection.</td></tr>
<tr><td colspan="6">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="6">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="6">INTEGRAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">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">23UMT4</td></tr>
<tr><td>Semester</td><td>II</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 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="4">Course Outline</td><td colspan="6">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="6">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="6">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="6">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.
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="6">SEQUENCES AND SERIES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">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">5</td><td rowspan="2">Course Code</td><td rowspan="2">23UMT5</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2"></td><td>4</td><td>1</td><td>--</td><td colspan="3">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">• 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="6">UNIT-I: Sequence of Real Numbers
Real numbers – Least upper bounds - Definition of sequence and subsequence – limit of a sequence – Convergent sequences – Divergent sequences
Chapter: 1 section 1.6, 1.7 Chapter: 2 Section: 2.1 –2.4</td></tr>
<tr><td colspan="6">UNIT-II: Sequence of Real Number
Bounded sequence – Monotone sequence – Operations on Convergent sequence – Operations on Divergent sequence.
Chapter: 2 Section: 2.5 – 2.8</td></tr>
<tr><td colspan="6">UNIT-III: Sequence of Real Numbers
Limit Superior and Limit Inferior – Cauchy Sequence – Summability of Sequences – Limit Superior and Limit Inferior for sequences of sets.
Chapter: 2 Section: 2.9 – 2.12</td></tr>
<tr><td colspan="6">UNIT-IV: Series of Real Numbers:
Convergence and Divergence – Series with non negative terms – Alternative Series – Conditional convergence and absolute Convergence.
Chapter: 3 Section: 3.1 – 3.4</td></tr>
<tr><td colspan="6">UNIT-V: Rearrangement of Series – Test for Absolute Convergence – Series whose terms form a non increasing sequences – Summation by parts - (C,1) Summability of series.
Chapter: 3 Section: 3.5 – 3.9</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	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. 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: Study some theorems on limits

CLO 3: To know about Subsequences, limit points and Cauchy sequences

CLO 4: Discuss about infinite series and some test.

CLO 5: Discuss about Kummer's test, Root test and condensation test and Alternative series

	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>Title of the Course</td><td colspan="6">DIFFERENTIAL EQUATIONS AND FOURIER SERIES</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE M6</td></tr>
<tr><td rowspan="2">Category Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">23UMT6</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td>--</td><td colspan="3">5</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">1. To study DEs and PDEs of first and second order.
2. To study Fourier series and application of Laplace transforms in solving DEs.
3. To train the students basic in the fourier series</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="6">Unit I:
Differential Equations of the first order: Equation of first order and of first degree –Exact differential equations Integrating factor – Linear Equations – Bernouli’s Equations – Equations of First and Higher Degree.
Chapter 1 : Section: 1.1 – 1.7</td></tr>
<tr><td colspan="6">Unit II:
Linear Equations of Higher Order
Linear equation with constant coefficients – Methods of finding complementary functions- Methods of finding particular integrals – Homogeneous linear equations
Chapter 2 : Sections 2.1 – 2.4</td></tr>
<tr><td colspan="6">Unit III:
Linear equations with variable coefficients – simultaneous linear differential equations – Total differential equations
Chapter 2: Sections 2.5 – 2.7</td></tr>
<tr><td colspan="6">Unit IV:
Partial Differential Equations: Formation of Partial Differential Equations – First order partiela differential equations – Methods of solving first order partial differential equations – Some standard forms – Charpit’s method
Chapter 4: Sections 4.1 – 4.5</td></tr>
</table>

	Unit V: Fourier Series: Definition of Fourier series – Finding Fourier coefficients for a given periodic function with period 2 and with period 2l – Use of Odd & Even functions in evaluating Fourier Coefficients – Half range sine & cosine series.
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. Narayanan and T.K.M. Pillay, Calculus vol. 3, Viswanathan Publishers. 2. Arumugam.S, Isaac, **"Differential Equations and Applications",**New Gamma Publishing House, 1993 3. Arumugam S, Somasundaram, Trignometry & Fourier series, New Gamma publishers, Hosur, 1999
Reference Books	1. J.N. Sharma R.K. Gupta, Differential Equations, Krishna PrakashanMandirMeerd.
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: Solve first-order ordinary differential equations
CLO 2: Solves higher differential equations
CLO 3: Solve the Higher order differential equations

CLO 4: To about the Fourier series and finding Fourier coefficients for a given periodic function

CLO 5: Discuss the use of Odd & Even functions in evaluating Fourier Coefficients – Half range sine & cosine series.

	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="7">REAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">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">5</td><td rowspan="2">Course Code</td><td rowspan="2">23UMT7</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>Lab Practice</td><td>Total</td></tr>
<tr><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="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• To study the real number system and its properties.
• To study the properties of functions defined on the Real line.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I: Limits and Metric spaces: Limit of a function on the Real line – Metric spaces – Limits in Metric spaces.
Chapter: 4 Section: 4.1- 4.3.</td></tr>
<tr><td colspan="7">UNIT-II: Continuous functions on metric spaces: Functions continuous at a point on the Real line – Reformulation – Functions continuous on a metric spaces – Open sets – Closed sets.
Chapter: 5 Section: 5.1- 5.5.</td></tr>
<tr><td colspan="7">UNIT-III: Connectedness and Completeness: More about open sets – connected sets – Bounded sets and totally bounded sets – Complete metric spaces.
Chapter: 6 Section:6.1 – 6.4</td></tr>
<tr><td colspan="7">UNIT-IV: Compactness: Compact metric spaces – Continuous functions on compact metric spaces – continuity of the inverse function – uniform continuity.
Chapter: 6 section: 6.5 -6.8</td></tr>
<tr><td colspan="7">UNIT-V: Calculus: Definition of the Riemann integrals – Derivatives - Rolle’s theorem - Fundamental Theorems of calculus.
Chapter: 7 section: 7.2, 7.5, 7.6 and 7.8</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="7">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. 3. S. Arumugam and others, "Modern Analysis", New Gamma publications, 2012.
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 Countable, uncountable and study some inequalities. , Connectedness, Completeness and Compactness

CLO 2: Explain the concepts of opens and close sets, bounded sets and dens sets.

CLO 3: Know about the concept of completeness and Baire's category theorem.

CLO 4: Understand the definition of homeomorphism and connectedness and continuity.

CLO 5: Learn the concept of compactness and continuity.

CLO 5: Model using difference equations

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

<table>
<tr><td>Title of the Course</td><td colspan="6">MODERN ALGEBRA</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE M8</td></tr>
<tr><td rowspan="2">Category Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">23UMT8</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td>--</td><td colspan="3">5</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">• Concepts of Sets, Groups and Rings.
• Construction, characteristics and applications of the abstract algebraic structures</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Groups: Definition and examples – elementary properties of group - Permutations groups – order of an element- subgroups – cyclic groups.
Chapter: I Section: 3,6,7,8,12, 13 & Chapter: II Section: 1-7.</td></tr>
<tr><td colspan="6">UNIT-II: Cosets and Langrange's theorem – Normal subgroups and quotient group
Chapter: II Section: 8 – 11. & Chapter: V Section: 2 – 10.</td></tr>
<tr><td colspan="6">UNIT-III: Isomorphism -Homomorphisms
Chapter: VI Section: 1-7.</td></tr>
<tr><td colspan="6">UNIT-IV: Rings: Definition and examples – elementary properties of ring – Types of rings – Integral domain – Field – Isomorphism of two Rings.
Chapter: III Section: 1 -10.</td></tr>
<tr><td colspan="6">UNIT-V: Sub Rings - Ideals – quotient rings – Maximal and prime ideals – homomorphism of rings – Field of quotients of an integral domain.
Chapter: III Section: 12 – 26.</td></tr>
<tr><td>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>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	M.L. Khanna, **"Modern Algebra",** Jai Prakash Narth& Co
Reference Books	1. S. Arumugam and others, Modern Algebra, Scitech Publication, India. 2013. 2. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002. 3. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011. 4. 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

CLO2: Explain about Normal subgroup, Quotient groups. Homomorphisms and Automorphisms and verify the functions for homomorphism and automorphism properties.

CLO3: Explain Homomorphisms and Automorphisms and verify the functions for homomorphism and automorphism properties.

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="7">LINEAR ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">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">23UMT9</td></tr>
<tr><td>Semester</td><td>V</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>4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">❖ To facilitate a better understanding of Linear Algebra
❖ To develop analytical thinking</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT-I:
A Motivating Examples – System Of Linear Equations
Chapter: I Section 1.1, 1.2</td></tr>
<tr><td colspan="7">UNIT-II: Vector Spaces:
Definitions and examples – Vector Subspace – Basis and Dimensions Of a Vector Space
Chapter: II Section 2.1, 2.2, 2.3</td></tr>
<tr><td colspan="7">UNIT-III: Linear Transformations:
Linear Transformation – Representation Of Linear Maps By Matrices – Kernel And Image Of a Linear Transformation – Linear Isomorphism
Chapter: IV Section 4.1, 4.2, 4.3, 4.4</td></tr>
<tr><td colspan="7">UNIT – IV: Inner Product Spaces:
Inner Product Spaces – The Euclidean Plane and The Dot Product – General Inner Product Space – Orthogonality – Some Geometry Applications' – Orthonormal Basis – Orthogonal Complements
Chapter: V Section 5.1 – 5.6</td></tr>
<tr><td colspan="7">UNIT-V:
Eigen values And Eigen Vectors – Cayley-Hamilton Theorem
Chapter: VII Section 7.2, 7.2.1</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="7">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="7">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	Linear Algebra: **A Geometric Approach** by S. Kumaresan,2021, PHI Learning Private Ltd. Delhi.
Reference Books	1. S. Arumugam And Others, **"Modern Algebra",** Scitech Publications, India. 2013. **2.** Dr.AlokanathChakarabarti, **"A First course in Linear Algebra",** Vijay Nicole Imprints P. Ltd 3.M.L. Khanna, **"Modern Algebra",** Jai Prakash Narth& Co
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 Elementary transformations and rank of matrices.

CLO5: Explain about Cayley Hamilton theorem – Eigen vector

	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 M10</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">23UMT10</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
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">• To study the behavior of complex-valued functions.
• To train the students in the operative techniques on complex–valued functions..</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Complex Numbers: Sum and Product of two complex numbers – Geometric interpretation- Algebraic properties – Conjugate of a complex number-Exponentialform.
Chapter 1</td></tr>
<tr><td colspan="8">UNIT-II: Limits, Continuity and Analytic Function.
Chapter 2</td></tr>
<tr><td colspan="8">UNIT-III: Complex integration: Properties –Contour-Line Integral – Cauchy’s Integral Theorem – Cauchy’s integral formula –Morera’s Theorem-Cauchy’s Inequality-Lioulle’s Theorem Fundamental Theorem of Algebra-Maximum Modulus Theorem.
Chapter4</td></tr>
<tr><td colspan="8">UNIT – IV: Series expansions: Taylor’s series –Laurant’s Series – Zeroes of analytic functions.
Chapter 5</td></tr>
<tr><td colspan="8">UNIT-V: Residues: Cauchy’s Residue Theorem –Evaluation of definite integrals (Type I and
II) and its Examples. Chapter 6</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] T.K.Manicavachagon Pillay-Dr.S.P.Rajagopalan-Dr.R.Sattanathan, Complex Analysis, S.Viswanathan (Printers & Publishers Pvt Ltd, 2011.
Reference Books	[1] P.P Gupta – Kedarnath & Ramnath, **Complex Variables**, Meerut -Delhi [2] J.N. Sharma, Functions of a **Complex variable**, Krishna PrakasanMedia (P) Ltd, 13th Edition, 1996-97. [3] T S.Arumugam,A.Thangapandi Isaac&amps A.Somasundaram, Complex Analysis, New Scitech Publications (India) Pvt Ltd, 2002.
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: Know the definition of analytic functions and understand their properties.

CLO 2: Know the bilinear transformations and understand its properties.

CLO 3: Understand the integration of complex valued functions and their higher derivatives.

CLO 4: Understand the zeros and singularities of an analytic function and to apply their properties in the evaluation of definite integrals.

CLO 5: Explain about zeros and poles and to evaluate real improper integrals

	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="6">MECHANICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M11</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">23UMT11</td></tr>
<tr><td>Semester</td><td>V</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">• Equilibrium of a particle under the action of given forces
• Simple Harmonic Motion
• Projectiles</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">UNIT-I: Force acting at a point: Forces acting at a point – resultant and components – Parallelogram law of forces – Triangle law of forces – converse – Lami’s theorem
Chapter 2</td></tr>
<tr><td colspan="6">UNIT-II: Parallel Forces and Moments: To find the Resultant of two like parallel forces acting on a rigid body – to find the resultant of two unlike parallel forces acting on a rigid body Moment of a force – Varigon’s Theorem of moments – Principle of Moments
Chapter – 3</td></tr>
<tr><td colspan="6">UNIT-III: Friction: Friction – Law of friction – Cone of friction – angle of friction – some simple problems.
Chapter 4</td></tr>
<tr><td colspan="6">UNIT – IV Projectiles: Projectiles – Path of projectile is a parabola – range – range of a particle projected on an inclined plane.
Chapter 6</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-V: Impulsive forces: Impact - Impulse – Impact in a fixed plane – direct and oblique impact.
Chapter 7</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. M.K. Venkatraman, "**Statics",** Agasthiar Publications. 2. M.K. Venkatraman, "**Dynamics"**, Agasthiar Publications.
Reference Books	1. S.G.Venkatachalapathy, **Mechanics,**MarghamPublications,Chennai 2012. 2. P.duraipandian, **Mechanics,** Emerald Publishers, Chennai.
Website and e-Learning Source	https://nptel.ac.in

Course Outcome

On completion of the course, the student will be able to

CLO1: Know various methods of finding the resultant of a finite number of forces and methods of resolving forces.

CLO2: Be able to understand the effect of different types of forces acting at a point in equilibrium.

CLO3: Know the various properties of motion of a projectile, a simple harmonic motion and orbital motion.

CLO4: Resolve a given force and find equation of catenary.

CLO5: Analyse the motion of a projectile and simple harmonic and orbital motions.

	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

Title of the Course		PROJECT WITH VIVA VOCE					
Paper Number		CORE M12					
Category	Core	Year	III	Credits	4	Course Code	23UMTP12
		Semester	V				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		5		-		--	5

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">PROBABILITY AND STATISTICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M13</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">23UMT13</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td>5</td><td>1</td><td>--</td><td colspan="2">6</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 between industry academia interface – to apply the theory learnt to industrial applications</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit – I Theory of Probability
Concept of probability - definition of various terms - classical probability - empirical probability - Axiomatic Probability - Definition of probability sample space - Probability of an event - Addition theorem - Multiplication theorem - Conditional probability - Independence of events - Baye’s theorem (related problems).
Chapter 3, Sec. 3.1, 3.3-3.5, 3.8.5, 3.9-3.12 &Chapter 4, Sec. 4.2</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit - II Unit II - Random Variables
Introduction of random variables - Distribution function and its properties - Discrete random variables - Probability mass function - Discrete distribution function - Continuous random variables - Probability density function - Joint probability law - Joint probability mass function - Joint probability distribution function - Marginal distribution function - Joint probability density function - Conditional distribution function - Conditional probability density function (Related Problems).
Chapter 5, Sec. 5.1 - 5.5.5</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit III - Discrete Distributions
Binomial Distribution :Moments - Recurrence relation - Mean deviation about mean - Mode - Moment generating function - Additive property - Characteristic function - Recurrence relation for cumulants - Fitting of binomial.
Poisson Distribution :Moments - Mode - Recurrence relation - Moment generating function - Characteristic function - Additive property - Fitting of poisson.
Chapter 8, Sec. 8.4 - 8.4.12, 8.5-8.5.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit IV – Statistics- Introduction and Presentation of Data
Definition of statistics - importance and scope of statistics - limitations of statistics - statistical data - primary and secondary data - frequency distribution - discrete and continuous frequency distribution - histogram - frequency polygon.
Chapter 1 : Sec. 1.2 , 1.4 and 1.5 & Chapter 2 : Sec. 2.1 and 2.2</td></tr>
</table>

	Unit V – Unit II - Measures of Averages and Dispersion Definition - requisites - Arithmetic Mean - Geometric Mean - Harmonic Mean -Median - Mode. (definition, merits & demerits, graphical location, problems based on raw, discrete and continuous frequency distribution) *Measures of Dispersion :* Definition - range - Quartile Deviation - Mean Deviation - Standard Deviation and Coefficient of Variation (Definition, Merits and Demerits, problems based on Raw, Discrete and Continuous Frequency Distribution)-Concept of Skewness and Kurtosis **Chapter 2 : Sec. 2.3 - 2.9 & Chapter 3 : Sec. 3.1 – 3.7, 3.8.1, 3.13 - 3.14**
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication, Transferrable Skill and designing mathematical models towards solving mathematical applications
Recommended Text	1.“ Fundamentals of Mathematical Statistics” by S.C Gupta and V.K Kapoor, Sultan chand & sons Publictions, New Delhi.
Website and e-Learning Source	https://nptel.ac.in
Reference Books	[1] “Mathematical statistics” - J.N.Kapur, H.C.Sazena - S.Chand& Company Ltd. - New Delhi. [2]**“**Introduction to Biostatistics” – Sokal and Rohlf – Toppan Co. Japan [3]. “Primer of Biostatistics” – Stanton A. Clantz – The McGraw Hill Inc. Newyork.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Use appropriate statistical methods in Random variables.

CLO2: Calculate mathematical expectation and derive the Moment Generating Function.

CLO3: Develop the skills pertinent to practice Theory of estimation.

CLO4: Understand the concepts of testing of hypothesis.

CLO5: Collect and analyze data using ANOVA.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">NUMERICAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE14</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">23UMT14</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hoursper week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td colspan="2">1</td><td>--</td><td colspan="2">6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">To introduce the exciting world of programming to the students through numerical methods.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT I: Algebraic & Transcendental equations:
Finding a root of the given equation using Bisection Method, Method of False Position, Newton- Raphson Method, Iteration method. Chapter 2 section 2.1 to 2.5</td></tr>
<tr><td colspan="7">UNIT II: Interpolation: Finite differences –Forward , Backward & Central differences –Their symbolic relations –Newton’s forward & backward difference interpolation formulae – Interpolation with unevenly spaced intervals –Application of Lagrange’s interpolating Polynomial
Chapter 3 Sections 3.1, 3.3, 3.6, 3.9, 3.9.1</td></tr>
<tr><td colspan="7">UNIT III: Numerical differentiation and Integration: Numerical differentiation - Numerical Integration using Trapezoidal rule & Simpson’s 1/3 & 3/8 rules - Theory & problems.
Chapter 5 Sections 5.1- 5.2, 5.4.1 – 5.4.3</td></tr>
<tr><td colspan="7">UNIT IV: Solutions to Linear Systems: Gaussian Elimination Method – Jacobi & Gauss Siedal iterative methods – Theory & problems. Chapter 6 Sections 6.3.2 & 6.4</td></tr>
<tr><td colspan="7">UNIT V: Numerical solution of ODE: Solution by Taylor Series Method, Picard’s method, Euler’s Method, Modified Euler’s Method, Runge Kutta 2nd and 4th order methods
Chapter 7 Sections 7.1 – 7.5</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="7">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	S. S. Sastry, **Introductory Methods of Numerical Analysis**, Prentice Hall of India Pvt.Limited, 2000.
Reference Books	[1] Narayanan & Others, **Numerical Analysis**, S. Viswanathan Publishers, 1994. [2] S.Arumugam, **Numerical Methods**, New Gamma Publishing, Palamkottai, 2003. [3] A.Singaravelu, **Numerical Methods**, Meenakshi Agency, Chennai, 2004.
Website and e-Learning Source	**Web Link:**

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Course Outcomes:

CLO1: To Know how to find our solution of algebraic equations using different Methods under different conditions, and numerical solution of system of Algebraic equations.
CLO2: To learn how to interpolate the given set of values.
CLO3: How to works numerical differentiation whenever and wherever routine Methods are not applicable.
CLO4: To understand the curve fitting for various polynomials
CLO5: To know how to solve the numerical solution of differential equations.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">OPERATIONS RESEARCH</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE 1</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">23UMT15</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
5</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics, Matrix Algebras.</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The main objective of the course is to enable the students to apply Mathematics in everyday situations and develop model of decision making problems that involve constraints and linear programs.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">UNIT I: LINEAR PROGRAMMING PROBLEM
Linear programming problem - Mathematical formulation – Illustrations on Mathematical formulation on Linear Programming Problems – Graphical solution method - some exceptional cases - Canonical and standard forms of Linear Programming Problem - Simplex method.
Chapter 2: Sec 2.1to 2.4,
Chapter 3:Sec3.1to 3.5,
Chapter4: Sec4.1,4.3.</td></tr>
<tr><td colspan="8">UNIT II: LINEAR PROGRAMMING PROBLEM
Use of Artificial Variables (Big M method - Two phase method) – Duality in Linear Programming - General primal-dual pair - Formulating a Dual problem - Primal-dual pair in matrix form -Dual simplex method.
Chapter 4: Sec 4.4,
Chapter 5:Sec5.1to5.4,5.9.</td></tr>
<tr><td colspan="8">UNIT III: TRANSPORTATION PROBLEM
Transportation problem- Solution of a TP-Finding an initial basic feasible solution (NWCM - LCM -VAM) – Degeneracy in TP - Transportation Algorithm (MODI Method)
Chapter10: Sec10.1,10.2, 10.8,10.9,10.12,10.13.</td></tr>
<tr><td colspan="8">UNIT IV: ASSIGNMENT PROBLEM
Assignment problem – Balanced and unbalanced A.P. – Hungarian method.
Chapter11: Sec11.1to11.4.</td></tr>
<tr><td colspan="8">UNIT V: PERT AND CPM
PERT and CPM – Basic components – logical sequencing - Rules of network construction- Critical path analysis - Probability considerations in PERT.
Chapter 25: Sec25.1to25.4,25.6, 25.7.</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	**Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research,** 13th edition, Sultan Chand and Sons, 2007.
Reference Books	**1. S. Kalavathy – OPERATIONS RESEARCH – Second edition, year ofpublication 2002, Vikas publishing house, New Delhi,** 2. P.K. Gupta and D.S.Hira - OPERATIONS RESEARCH year of publication 2004 second edition , S.Chand and Co, New Delhi **3. Hamdy Taha - OPERATIONS RESEARCH year of publication 1996.Prentice Hall publications, New Delhi.** **4 Arumugam. S. Isaac, "Topics in Operations Research** – Linear Programming", New Gamma Publishing House, March 2015.
Website and e-Learning Source	**Web Link:** 1 https://archive.nptel.ac.in/courses/112/106/112106134/ 2. https://archive.nptel.ac.in/courses/112/106/112106134/ 3. https://www.youtube.com/watch?v=kiDZjlSSlFw 4. https://www.youtube.com/watch?v=I3CNzKUFINY 5. https://www.youtube.com/watch?v=rq5nedNYaXE 6. https://www.youtube.com/watch?v=WrAf6zdteXI

Course Outcomes

On successful completion of this course students will be able to

CLO1: Formulate simple reasoning and learning optimization problems.

CLO2: Analyze a problem and can select a suitable strategy.

CLO3: Apply an appropriate method to obtain the solution to a problem.

CLO4: Manipulate the basic mathematical structures underlying these methods.

CLO5: Evaluate analytically the limitations of these methods.

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

<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">ELECTIVE 1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE1A</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
3</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
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">• 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: Vectors in Two and Three Dimensions – More about Vectors – The Dot Product – The Cross Product
Chapter 1 Section 1.1 to 1.4</td></tr>
<tr><td colspan="8">UNIT-II: Vector: Equations for Planes – Distance problems – some n dimensional geometry - New coordinate system
Chapter 1 Section 1.5 to 1.7</td></tr>
<tr><td colspan="8">UNIT-III: Vector –Valued Functions: Vector Fields – An Introduction – Gradient – Divergence – Curl and the Del Operator
Chapter 3 Section 3.3 to 3.4</td></tr>
<tr><td colspan="8">UNIT-IV: Line integrals : Scalar and Vector Line Integrals – Green’s Theorem.
Chapter 6 Section 6.1 to 6.2</td></tr>
<tr><td colspan="8">UNIT-V: Surface Integral: Surface Integral - Stoke’s and Gauss Theorem.
Chapter 7 Section 7.2 & 7.3</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.C. Susan ,Vector Calculus, , (4th Edn.) Pearson Education, Boston, 2012.
Recommended Text	1. Arumugam Isaac, Vector Calculus, New Gamma Publishing house, Palayamkottai. 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: Find the equations planes and the distance of coordinates system

CLO 3: Applications of the operator 'del' and to Explain solenoid and ir-rotational vectors

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	-	2-	3	2	1
CLO2	3	2	3	1	2	-	3	2	1
CLO3	3	3	3	3	1	1	3	3	1
CLO4	3	3	3	3	1	1	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">AUTOMATA THEORY AND FORMAL LANGUAGES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE 2</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">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE1B</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2"></td><td>3</td><td>1</td><td>--</td><td colspan="3">4</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 impart knowledge in Finite automata, regular languages, regular grammars, context free grammars, languages, and pushdown automata which play a crucial role to Identify different formal language classes and their relationship.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I: Phrase Structure Languages.: Introduction– phrase structure languages.</td></tr>
<tr><td colspan="6">UNIT-II: Closure Operations : Closure operations.</td></tr>
<tr><td colspan="6">UNIT-III: Context Free Languages: Context free languages.</td></tr>
<tr><td colspan="6">UNIT – IV: Finite State Automata : Finite state automata.</td></tr>
<tr><td colspan="6">UNIT-V:Push Down Automata.: Push down automata.</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>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Formal Languages and Automata – Rani Siromoney. (Revisededition1984)(Published bythe Christian Literary Society, Madras-3) Chapters 1 to 6.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">3. Automata theory : Machines and Languages - Richard.Y.Kain (McGraw Hill 1972)</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="6">https://nptel.ac.in/courses/106/103/106103070/</td></tr>
<tr><td colspan="2"></td><td colspan="6">https://www.digimat.in/nptel/courses/video/111103016/L02.html</td></tr>
</table>

CLO1	Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
CLO2	Design grammars and automata for different language classes.
CLO3	Describe the types of grammar and derivation tree.
CLO4	To apply context-free languages, push-down automata.
CLO5	Design automata, regular expressions and context-free grammars accepting or Generating a certain language.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">PROGRAMMING LANGUAGE WITH C++</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Elective 3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE2A</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
3</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To impart basic knowledge of Programming Skills in C++ language</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">Unit I
Principles of Object- Oriented Programming – Beginning with C++
Chapters: 1.1 -1.8, 2.1 – 2.8,</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit II
Tokens, Expressions and Control Structures - Functions in C++
Chapters: 3.1 – 3.24, 4.1 – 4.11</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit III
Classes and Objects – Constructors and Destructors.
Chapters: 5.1 – 5.19, 6.1 – 6.11</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit IV
Operator Overloading and Type Conversions - Inheritance: Extending Classes.
Chapters: 7.1 – 7.8</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit V
Pointers- Virtual Functions and Polymorphism Managing Console I/O Operations.
Chapters: 8.1 – 8.12, 9.1 – 9.6</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	**Text Book**: Balagursamy E - "Object Oriented Programming with C++", Tata McGraw Hill
Reference Books	Ashok Kamthane, Programming in C++, Pearson Education, 2013
Website and e-Learning Source	**Web Link** **https://www.programiz.com/cpp-programming/online-compiler/** **https://www.onlinegdb.com/online_c++_compiler** **https://www.tutorialspoint.com/compile_cpp_online.php** **https://cpp.sh/**

Course Outcomes

CLO1: Students know about principles of OOPs concept.
CLO2: To learn about tokens and functions in C++.
CLO3: To acquire the knowledge about classes and objects.
CLO4: To understand the inheritance concepts.
CLO5: Know about how to use the pointers in C++.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">PROGRAMMING IN C</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE 4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE2B</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
3</td><td colspan="2">Tutorial
1</td><td>Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To introduce the techniques of C programming.
• To solve numerical problems using C.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT I: Introduction – Importance of C- Basic structure of C program - Character set - Constants – Keywords and identifiers – Variables Data types – Declaration of variables –Defining symbolic constants</td></tr>
<tr><td colspan="6">UNIT II: Arithmetic operators - Relational operators - logical operators – assignment operators –increment and decrement operates –Conditional operators – Arithmetic expressions – Evaluation of expressions –Precedence of arithmetic operators.</td></tr>
<tr><td colspan="6">UNIT III: Decision making with IF statement – Simple IF statement – The if ELSE statement - Nesting of IF…..ELSE statement – The ELSE IF ladder. The Switch statement –The GOTO statement.</td></tr>
<tr><td colspan="6">UNIT IV: The WHILE statement - the DO statement the FOR statement –Jumps in loops.</td></tr>
<tr><td colspan="6">UNIT V: One, Two dimensional arrays – Initiating two dimensional arrays – Multidimensional arrays –Declaring and initializing string variables –reading strings from terminal – Writing strings on the screen – Arithmetic operations on characters.</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	E.Balagurusamy"Programming in ANSI C" Second Edition – Tata McGraw –Hill PublishingCompany limited, New Delhi.
Reference Books	1. Byron Gottfried "Programming with C" (Schaum's outline series)-Tata McGrawHill publishingcompany -1998. 2. Ashok N.Kamthane "Programming with Ansi and Turbo C", Pearson Education publishers, 2002 3. HentryMullish and Herbert L cooper , "The spirit of C" Jaico publisher, 1996. 4. THE ANSI C, Second edition , October 1992.
Website and e-Learning Source	**Web Link:** **https://www.programiz.com/c-programming/online-compiler/** **https://www.w3schools.com/c/c_compiler.php** **https://www.tutorialspoint.com/compile_c_online.php** **https://www.jdoodle.com/c-online-compiler/** **https://www.codechef.com/ide**

Course Outcomes

CLO1: Students know about basic structure of C Program
CLO2: To learn about C-tokens and Operators in C.
CLO3: To acquire the knowledge about conditional statements.
CLO4: To understand the looping statements.
CLO5: Know about the arrays.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL MODELLING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE 5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE3A</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td>Tutorial
1</td><td colspan="2">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">• Construction and Analysis of Mathematical models found in real life problems.
• Modelling through differential and difference equations</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">Unit I : Mathematical modelling Through ODE of first Order

Mathematical Modelling Through Differential Equation - Linear Growth and Decay Models, Compartment Models - Mathematical modelling in Dynamics Through ODE of first order.
Unit I: Chapter 2. Sec 2.1, 2.2, 2.4, 2.5</td></tr>
<tr><td colspan="6">Unit II : Mathematical modelling Through Systems ODE of first Order
Mathematical Modelling in Population Dynamics – Mathematical Modelling of Epidemics Through Systems of ODE of First - Compartment Model Through ODE - Mathematical modelling Economics Through System ODE of first order.
Unit II: Chapter 3. Sec 3.1-3.5</td></tr>
<tr><td colspan="6">Unit III : Mathematical Modelling Through ODE of Second Order
Mathematical modelling of Planetary Motions - Mathematica modelling of Circular Motion and Motion off Satellites - Mathematica modelling Through Linear Differential Equation of Second order.
. Unit III: Chapter 4. Sec 4.1- 4.3</td></tr>
<tr><td colspan="6">Unit IV: Mathematical modelling Through Linear Differential Equations
The Need for Mathematical modelling Through Linear Differential Equations: Some Simple Models – Basic Theory For Linear Differential Equation with Constant Coefficients - Mathematical Modelling Through Linear Differential Equations in Economics and Finance - Mathematical Modelling Through Linear Differential Equations in Dynamics and Genetics.
Unit IV: Chapter 5. Sec 5.1-.5.4</td></tr>
</table>

	Unit V: Mathematical modelling Through Graphs Situations that can be Modelled through Graphs - Mathematical Modelling in terms of Directed Graphs - Mathematical Modelling in terms of signed Graphs - Mathematical Modelling in terms of Weighted Digraphs. **Unit V: Chapter 7. Sec 7.1- 7.4**
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 Modelling, 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.
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	*3*	*1*	*3*	*2*	*3*	*3*	*3*	*2*	*1*
CLO2	*2*	*1*	*3*	*1*	*3*	*3*	*3*	*2*	*1*
CLO3	*3*	*2*	*3*	*1*	*3*	*3*	*3*	*2*	*1*
CLO4	*1*	*2*	*3*	*2*	*3*	*3*	*3*	*2*	*1*
CLO5	*2*	*3*	*3*	*2*	*3*	*2*	*3*	*2*	*1*

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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ASTRONOMY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE 6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE3B</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
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"></td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">UNIT I: Relevant properties of a sphere & relevant formulae for spherical trigonometry(All without Proof) –Celestial sphere – Diurnal motion.
Chapters 1 & 2</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT II: Earth – Dip of the horizon - Twilight
Chapter 3 Section 1, 2, 5, 6</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT III: Astronomical refraction –Tangent &Cosine’s formula – Properties & simple problems applying them.
Chapter 4 Sections 117 to 120, 129, 130</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT IV: Kepler’s Laws of Planetary motion (statement only) – Newton’s deductions from them –Three anomalies of the Earth and relation between them.
Chapter</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT V: Moon (except Moon’s liberations)-Motions of planet (assuming that orbits arc circular - Eclipses.
Chapter 12</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>
</table>

Recommended Text	S. Kumaravelu and SusheelaKumaravelu, Astronomy, SKV Publications,2004.
Reference Books	[1] V. Thiruvenkatacharya, A Text Book of Astronomy, S. Chand and Co., Pvt Ltd.,1972.
Website and e-Learning Source	**Web Link:** https://nptel.ac.in

Course Outcomes

CLO1: Be inspired to continue and share their interest in astronomical advances and discoveries throughout their lives.

CLO2: Have a solid grounding in many areas of modern astronomy and their basic underlying physical principles.

CLO3: Know about and understand the observed properties of physical systems that comprise the known universe, on various scales.

CLO4: Demonstrate the ability to design, make, analyze, and interpret quantitative observations of celestial objects.

CLO5: Know about the Moon and motions of planet.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Graph Theory and its Applications</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE 7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credit</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE4A</td></tr>
<tr><td>Semester</td><td>VI</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 – Set theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">1. To introduce the notion of graph theory and its applications.
2. To introduce some of the most important notions of Graph Theory and develop their skills and solving basic exercises.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I:Definition of graph – Application of graph – Finite and infinite graphs – incidence and degree– isolated vertex – pendant vertex and null graph – sub graphs – walks – paths – circuits – connected graphs –disconnected graph and components.
Chapter 1: 1.1 – 1.5, 2-2, 2.4 and 2.5</td></tr>
<tr><td colspan="8">Unit II:Euler graph – Operation on graphs - more on Euler graphs – Hamiltonian paths and circuits-Travelling Salesman Problem.
Chapter 2: 2.6 – 2.10</td></tr>
<tr><td colspan="8">Unit III:Trees – Properties of trees – spanning trees – fundamental circuits – Finding all spanning trees of a graph - spanning trees in a weighted graph.
Chapter 3: 3.1 – 3.4, 3.7 - 3.10</td></tr>
<tr><td colspan="8">Unit IV: Cut sets – properties – fundamental circuits and cut sets – connecting and separability.
Chapter 4: 4.1 – 4.5</td></tr>
<tr><td colspan="8">Unit V: Incidence matrix – Submatrices of A(G) – Circuit matrix – Fundamental circuit matrix and rank of B – cut - set matrix – Path matrix – Adjacency matrix
Chapter 5: 7.1 – 7.4, 7.6, 7.8 – 7.9.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">NarsinghDeo, Graph theory with Application to Engineering and computer Science, Prentice, Hall of India Private Limited., New Delhi, 2001.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. F. Harary, Graph Theory, Addison –Wesley, 1969
2. J.A. Bondy and U.S.R. Murthy, “Graph Theory with Applications”, North Holland Publications, 2008.
3. Kennth H. Rosen, Discrete Mathematics and its Applications, Seventh Edition, Tata McGraw – Hill Publications, 2012.</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="8">https://nptel.ac.in</td></tr>
</table>

Course Learning Outcome(for Mapping with Pos and PSOs)

Students will be able to

CLO1: Understand and apply the fundamentals concepts in graph.

CLO2: Determine whether graphs are Hamiltonian and/or Eulerian

CLO3: Determine the minimum mileage travelled through Traveling Salesman Problem.

CLO4: Solve problems involving weighted graph using spanning tree.

CLO5: Apply graph theory-based tools in solving practical problems.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">FUZZY MATHEMATICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE 8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTE4B</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="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">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">• To make the students understand the nuances of Fuzzy Analysis.
• To make them understand the applications of these techniques in fuzzyanalysis</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT – I
Fuzzy sets: Basic types – Basic concepts – α-cuts – Additional properties of α-cuts – Extension principle for Fuzzy sets.
Chapter 1 Section 1.3, 1.4 and Chapter 2 Section 2.1, 2.3</td></tr>
<tr><td colspan="7">UNIT – II
Operations on Fuzzy sets: Types of operations – Fuzzy complements – t-Norms – Fuzzy Unions.
Chapter 3 Section 3.1 to 3.4</td></tr>
<tr><td colspan="7">UNIT – III
Combinations of operations -Fuzzy Arithmetic – Fuzzy Arithmetic: Fuzzy numbers.
Chapter 3 Section 3.5 to 3.6 and Chapter 4 Section: 4.1</td></tr>
<tr><td colspan="7">UNIT – IV
Fuzzy Arithmetic:Arithmetic operations on intervals – Arithmetic operations on Fuzzy numbers - Fuzzy relations: Binary fuzzy relations – Fuzzy equivalence relations – Fuzzy compatibility relations.
Chapter 4 Section 4.3 to 4.4 and Chapter 5 Section: 5.3, 5.5, 5.6.</td></tr>
<tr><td colspan="7">UNIT - V
Fuzzy ordering relations – fuzzy morphisms
Chapter 5 Section 5.7 to 5.8.</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="7">-</td></tr>
</table>

Skills acquired from this course	Knowledge of fuzziness and helpful for higherstudies.
Recommended Text	George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 2004.
Reference Books	H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited, New Delhi, 1991.
Website and e-Learning Source	**Web Link:** https://giocher.wordpress.com/chapter-2-par-2-2-fuzzy-relations-and-the-extension- principle/ https://nptel.ac.in/courses/108/104/108104157/

Course Outcomes

After the completion of this course, the students will be able to develop applications.
CLO1 **:** Discuss the Basic types and operations on fuzzy sets,
CLO2 : Study Fuzzy complements and t- norms and fuzzy arithmetic.
CLO3: Understand the Combinations of operations and fuzzy arithmetic.
CLO3: Understand the Combinations of operations and fuzzy arithmetic.
CLO5: Gain the knowledge of fuzzy morphisms.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NUMERICAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ALLIED for Computer Science PAPER 1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCMGE1</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></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"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To know the basic concepts of Numerical analysis
2. To solve the numerical problem in efficiency with various methods.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT – I
Solution of Algebraic & Transcendental equations: Finding a root of the given equation (Derivation of the formula not needed) using Bisection Method, Method of False Position, Newton Raphson Method, Iteration method.
Chapter 2 section 2.1 to 2.5</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – II
Interpolation:Forward and Backward differences –Newton’s forward & backward difference interpolation formulae –Lagrange’s interpolating Polynomial (Proof not needed).
Chapter 3 Sections 3.3.1, 3.3.2, 3.6and 3.9.1</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – III
Numerical Differentiation and Integration: Numerical differentiation - Numerical Integration using Trapezoidal rule & Simpson’s 1/3&3/8 rules.
Chapter 5 Sections 5.1- 5.2, 5.4.1 – 5.4.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – IV
Solutions to Linear Systems: Gaussian Elimination Method – Jacobi & Gauss Siedal iterative methods.
Chapter 6 Sections 6.3.2 & 6.4</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT - V
Numerical solution of ODE: Solution by Taylor Series Method, Euler’s Method , Modified Euler’s Method , RungeKutta 2nd and 4th order methods (Derivation of the formula not needed).
Chapter 7 Sections 7.1, 7.2, 7.4 and 7.5</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"></td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Text	**1**. S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt.Limited, 2000.
Reference Books	H1] S. Narayanan & Others, Numerical Analysis, S. Viswanathan Publishers, 1994. [2] S.Arumugam , Numerical Methods, New Gamma Publishing, Palamkottai, 2003. [3] A.Singaravelu, Numerical Methods, Meenakshi Agency, Chennai, 2004
Website and e-Learning Source	**Web Link:** 1. https://en.wikipedia.org/wiki/Numerical_analysis

Course Outcomes

Upon completion of this course the student will be able to

CLO1: Solve Algebraic and Transcendental Equations by applying appropriate methods.

CLO2: Find the approximate values to the problems related to Interpolation.

CLO3: Find the value of the Differentiation and Integration of the given function using appropriate methods.

CLO4: Choose suitable method to find solution to the linear systems.

CLO5: Apply appropriate method to find the approximate solution to the ODE.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">OPERATIONS RESEARCH</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ALLIED for Computer Science PAPER 2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCMGE2</td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></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"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To introduce the various techniques of Operations Research.
• To make students solve real life problems in Business and Management</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT – I
Introduction to Operations Research: Application of OR - Elementary treatment of Linear Programming – Graphical Method.</td></tr>
<tr><td colspan="6">UNIT – II
Slack variable – surplus variable - Simplex Method – Artificial variable – Big-M method – Two Phase Method.</td></tr>
<tr><td colspan="6">UNIT – III
Transportation problem: Transportation algorithm – Degeneracy algorithm - Degeneracy in Transportation problem - Unbalanced Transportation problem.</td></tr>
<tr><td colspan="6">UNIT – IV
Assignment Problems: Assignment algorithm – Unbalanced Assignment problem.</td></tr>
<tr><td colspan="6">UNIT - V
PERT CPM network:PERT CPM network –Determining the Critical Path – Network Calculation of PERT networks – Probability of PERT.</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"></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>
<tr><td colspan="2">Recommended Text</td><td colspan="6">[1] KantiSwarop, Gupta. P.K &Manmohan, Operations Research, Sultan Chand & Co.</td></tr>
</table>

Reference Books	**[**1] Hamdy A. Taha, Operations Research (7th Edn.), Prentice Hall of India,2002. [2] Richard Bronson, Theory and Problems of Operations Research, Tata McGraw Hill Publishing Company Ltd, New Delhi, 1982.For B.Sc., Physics and Chemistry.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes

Upon completion of this course the student will be able to

CLO 1: Understand the OR models and Solve them towards optimality by applying appropriate simplex methods.
CLO 2: Apply the Transportation algorithm to reduce transportation cost.
CLO 3: Apply the Assignment algorithm to allocate the job in such a way that to reduce the total cost for that job.
CLO 4: Apply the concepts of PERT and CPM for decision making and optimally managing projects.
CLO 5: Analyze and covert the real life problems in Business and Management to the operations research model and solve them towards optimality by applying suitable OR methods.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ALGEBRA AND CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ALLIED for Physics & Chemistry PAPER 1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UMTGE1</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></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"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To introduce Algebra from the basic concepts of set theory, Functions, etc.
• To introduce Vector Calculus basic concepts and its application</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT – I
Matrices:Various types of matrices – Characteristic roots of a square matrix – evaluation of eigen values and eigen vectors – verification of Cayley's Hamilton theorem.
Chapter 5
UNIT – II
Derivatives: Higher Derivatives - n^{th} derivative of standard functions – Leibnitz's theorem (statement only) for the n^{th} derivative of product of functions – applicable to suitable problems.
Chapter
UNIT – III
Reduction formula: Reduction formula for $\int e^{ax}x^n dx$; $\int sin^n x\, dx$; $\int cos^n x\, dx$; where n is a positive integer. Evaluation of $\int_0^\infty e^{ax}x^n dx$; $\int_0^{\frac{\pi}{2}} sin^n x\, dx$; $\int_0^{\frac{\pi}{2}} cos^n x\, dx$, where n is a positive integer.
Chapter 16
UNIT – IV
Vector Calculus: Vector differentiation – velocity and acceleration – circular motion – angular velocity vector – scalar and vector fields – Divergence and curl applications.
Chapter 28
UNIT - V
Vector integration – application of Gauss,Green's and Stroke's theorem (no proof).
Chapter 29</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"></td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Text	[Dr.PR. Vittal, **Allied Mathematics**, Margham Publications – 2014.
Reference Books	1. **[**T.K.ManickavachagamPillai and others,**Calculus vol I and vol II**, S.Viswanathan Publishers Pvt Ltd. 2. M.L. Khanna, **Vector Calculus**,JaiPrakashNarth&co.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes

On completion of the course, the student will be able to

CLO 1: Find the eigen values, eigen vectors of a given matrix.

CLO2 : Find higher derivatives of given functions.

CLO 3: Be able to understand properties of straight lines and spheres.

COL 4: Understand the reduction formula.

COL 5: Know about vector integration and application of Gauss,Green's and Stroke's Theorem.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND FOURIER SERIES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ALLIED for Physics & Chemistry PAPER 2</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UMTGE2</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture
4</td><td>Tutorial
1</td><td>Lab Practice
--</td><td colspan="2">Total
5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• To inculcate the basic knowledge of differentiation, expansion of functions and their applications.
• To introduce the notion of envelopes, curvatures and polar co-ordinates.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT – I
Differential equations of first order and higher degree: Equations solvable for p, y and x – Clairaut's equation – Exact equation – Equations reducible to exact form.
Chapter 22</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – II
Linear equations with constant coefficients: evaluation of particular integral of the equation for $e^{ax}, \sin ax, \cos ax,\ x^k, e^{ax}\, f(x)$ where a, k are constants and $f(x)$ is any function of x.
Chapter 23</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – III
Formation of equations by elimination of constants and arbitrary functions – definition of general, particular and complete solutions – singular integral (geometrical meaning not expected). Solutions of first order equations in their standard forms. $F(p,q)=0; F(x,p,q)=0; F(y,p,q)=0; F(z,p,q)=0; f(x,p)=g(y,q); z=px+qy+f(p,q)$; Lagrange's method of solving the linear equations $Pp+Qq=R$ (Geometrical interpretation not expected).
Chapter 26</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT – IV
Definition – Laplace transform of functions $e^{at}, \cos at, \sin at, t^n$. First shifting theorem – Laplace transform of $e^{-at}f(t)$ is $\varphi(s+a)$ - Laplace transform of $e^{-at}\cos bt,\ e^{-at}\sin bt$, and $e^{-at}f(t)$ - Laplace transform of $f'(t), f''(t)$ - Inverse Laplace transform relating to the above standard forms – applications to the solution of ordinary differential equations with constant coefficients involving above transformations.
Chapter 27</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT - V
Definition of Fourier series – finding Fourier coefficient for a given periodic function with period 2π (odd or even function) – sine and cosine series.
Chapter 21</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill.
Recommended Text	[Dr.PR. Vittal, **Allied Mathematics**, Margham Publications – 2014.
Reference Books	**1.[**T.K.ManickavachagamPillai and others,**Calculus vol I and vol II**, S.Viswanathan Publishers Pvt Ltd. 2.M.L. Khanna, **Vector Calculus**,JaiPrakashNarth&co.
Website and e-Learning Source	https://nptel.ac.in

Course Outcomes

The Students will be able to

CLO 1: Solve first-order ordinary differential equations

CLO 2: Solves higher differential equations

CLO 3: Solve the Higher order differential equations

CLO 4: Solve differential and integral equations using Laplace transforms.

CLO 5: Find Fourier coefficient for a given periodic function with period 2π

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