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Undergraduate Programme

Curriculum and Syllabus for

B.Sc. Mathematics

(With effect from the Academic Year 2023-24)

JUNE 2023

Note: The Board of Studies in Mathematics (UG) designed the syllabus as per Common Model Syllabus provided by TANSCHÉ based on Learning Outcome based Curriculum Framework (LOCF) as prescribed by the UGC.

NEW INITIATIVE IN

MODERNISING

UNDER-GRADUATE PROGRAMME IN
MATHEMATICS

Revamped Curriculum Design and Syllabus

WITH EFFECT FROM 2023 - 24

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1. Introduction

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

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

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

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

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

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	B.Sc., MATHEMATICS
Programme Code:	
Duration:	3 years [UG]
Programme Outcomes:	<p>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</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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</p> <p>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</p> <p>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.</p> <p>PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p>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.</p> <p>PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p> <p>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.</p>

	<p>PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p>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.</p> <p>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.</p>
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Programme Outcomes and Programme Specific Outcomes of B.Sc. Degree Programme in Mathematics

- PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.
- PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
- PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
- PO4: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.
- PO5: Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative/ qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.
- PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

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, behaviours, and 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	--
CLO 1										
CLO 2										
CLO 3										
CLO 4										
CLO 5										

2. 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 interdisciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

3. Value additions in the Revamped Curriculum:

Semester	Newly Introduced Components	Outcome / Benefits
I	<p>Foundation Course</p> <p>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.</p>	<ul style="list-style-type: none"> • Instill confidence among students • Create interest for the subject
I, II, III, IV	Skill Enhancement papers (Discipline Centric / Generic / Entrepreneurial)	<p>Industry ready graduates</p> <p>Skilled human resource</p> <p>Students are equipped with essential skills to make them employable</p> <p>Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects</p> <p>Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</p> <p>Entrepreneurial skill training will provide an opportunity for independent livelihood</p> <p>Generates self – employment</p> <p>Create small scale entrepreneurs</p> <p>Training to girls leads to women Empowerment</p> <p>Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools</p>

III, IV, V & VI	<p>Elective papers-</p> <p>An open choice of topics categorized under</p> <p>Generic and Discipline Centric</p>	<p>Strengthening the domain knowledge</p> <ul style="list-style-type: none"> • 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 /9 communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors
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IV	Industrial Statistics	<ul style="list-style-type: none"> Exposure to industry moulds students into solution Providers Generates Industry ready graduates Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Self-learning is enhanced Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	<ul style="list-style-type: none"> 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

6. Template for Curriculum Design for UG Programme in Mathematics Credit

Distribution for UG Programme in Mathematics

B.Sc Mathematics

First Year SEMESTER-I

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

SEMESTER – II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part – I	Language	3	6
Part – II	English	3	6
Part – III	Core Courses 2 (CC1, CC2)	10	10
	Elective Course 1 (Generic / Discipline specific) EC2	3	4
Part – IV	Skill Enhancement Course -SEC-2 (Non Major Elective)	2	2
	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic)	2	2
		23	30

SECOND YEAR SEMESTER - III

Part	List of Courses	Credit	Hours Per Week (L/T/P)
Part – I	Language	3	6
Part – II	English	3	6
	Core Courses 2 (CC5, CC6)	10	10
Part – III	Elective Course 1 (Generic / Discipline Specific) EC3	3	4
Part – IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline Specific/ Generic)	2	2
	Environmental Studies (EVS)	-	1
		22	30

SEMESTER – IV

Part	List of Courses	Credit	Hours Per Week (L/T/P)
Part – I	Language	3	6
Part – II	English	3	6
Part – III	Core Courses 2 (CC7, CC8)	10	9
	Elective Course 2 (Generic / Discipline Specific) EC4	3	4
Part – IV	Skill Enhancement Course –SEC6	2	2
	Skill Enhancement Course -SEC-7 (Discipline Specific / Generic)	2	2
	Environmental Studies EVS	2	1
		25	30

THIRD YEAR SEMESTER – V

Part	List of Courses	Credit	Hours per week (L/T/P)
Part III	Core Courses 3(CC9, CC10, CC11)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC5,EC6	6	8
	Core /Project with Viva Voce CC12	4	5
Part IV	Value Education	2	2
	Internship / Industrial Training (Carried out in II YearSummer vacation) (30 hours)	2	
		26	30

SEMESTER – VI

Part	List of Courses	Credit	Hours Per Week (L/T/P)
Part – III	Core Courses 3 (CC13, CC14, CC15)	12	18
	Elective Courses 2 (Generic / Discipline Specific) EC7, EC8	6	10
Part – IV	Professional Competency Skill Enhancement Course SEC8	2	2
Part – V	Extension Activity (Outside college hours)	1	--
		22	30

TOTAL HOURS: 140

Credit Distribution for UG Programmes

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5.3 Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	4	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	4	5.5 Elective V Generic / Discipline Specific	3	4	6.5 Elective VIII Generic / Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic / Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course –SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	23	30		23	30		22	30		25	30		26	30		21	30
Total – 140 Credits																	

7. Consolidated Semester wise and Component wise Credit distribution

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

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

METHOD OF EVALUATION

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	75	100	

The following distribution of marks for Computer related subjects which have both theory and practical (Syllabus combined both theory and practical in each paper together) in B.Sc Mathematics to be followed

Paper	Internal	External	Total
Theory	25	75	100
Practical	40	60	100

Finally, theory marks (100) to be reduced to 60% and practical marks (100) to be reduced to 40%

8. B.Sc Mathematics Curriculum Design

First Year - Semester-I			
Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language Paper-I	3	6
Part-II	100L1Z: English Paper-I	3	6
Part-III	134C1A: Core Paper – I Algebra & Trigonometry@	5	4
	134C1B: Core Paper - II Differential Calculus@	5	5
	Elective Course -1 (Any one)	3	5
	134E1A: Allied Physics – I 134E1B: Numerical Methods with Applications		
Part-IV	134S1A: Skill Enhancement Course – I Financial Mathematics *	2	2
	100L1L: Basic Tamil-I (Other Language Students) *		
	100L1M: Advanced Tamil-I (Other Language Students) *		
	134B1A: Foundation Course FC – Bridge Mathematics@	2	2
		23	30

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* **PART-IV: SEC-1 / Basic Tamil / Advanced Tamil (Any one)**

1. Students who have studied Tamil upto XII STD and also have taken Tamil in Part I shall take SEC-I.
2. Students who have **not** studied Tamil upto XII STD and have taken any Language other than Tamil in Part-I shall take **Basic Tamil** comprising of Two Courses (level will be at 6th Std.).
3. Students who have studied Tamil upto XII STD and have taken any Language other than Tamil in Part-I shall take **Advanced Tamil** comprising of Two Courses.

First Year - Semester-II			
Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language Paper-II	3	6
Part-II	100L2Z: English Paper-II	3	6
Part-III	134C2A: Core Paper III Analytical Geometry (Two & Three Dimensions)@	5	4
	134C2B: Core Paper IV Integral Calculus@	5	5
	Elective Course – 2 (Any one)	3	5
	134E2A: Allied Physics - II (Practical I and II) 134E2B: Calculus of Finite Differences		
Part-IV	134S2A: SEC – II - Basic Data Analysis Using Excel *	2	2
	100L2L: Basic Tamil-II (Other Language Students) *		
	100L2M: Advanced Tamil-II (Other Language Students) *		
	Skill Enhancement Course – III (Any One) 134S2B: Computational Mathematics 134S2C: Latex	2	2
		23	30

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Second Year- Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language Paper-III	3	6
Part-II	200L3Z: English Paper-III	3	6
Part-III	234C3A: Core Paper V - Vector Calculus and Applications@	5	4
	234C3B: Core Paper VI - Differential Equations and Applications@	5	5
	Elective Course – III (Any one) 234E3A: Mathematical Statistics Theory&PRACTICAL@ 234E3B: Chemistry I	3	5
Part- IV	234S3A: Skill Enhancement Course - IV (Entrepreneurial Based)	1	1
	Skill Enhancement Course – V (Any One) 234S3B: Statistics with R Programming 234S3C: E-Commerce & Tally	2	2
	Environmental Studies	--	1
		22	30

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Second Year - Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language Paper-IV	3	6
Part-II	200L4Z: English Paper-IV	3	6
Part-III	234C4A: Core Paper – VII Industrial Mathematics –Resource ManagementTechniques@	5	4
	234C4B: Core Paper – VIII Elements of Mathematical Analysis@	5	4
	Elective Course – IV (Any One) 234E4A: Transform Techniques@ 234E4B: Chemistry II (Practical I and II)	3	5
Part-IV	Skill Enhancement Course – VI (Any One) 234S4A: Introduction to Data Science 234S4B: Web Designing	2	2
	Skill Enhancement Course – VII (Any One) 234S4C: Data Analysis Using SPSS 234S4D: Introduction to Artificial Intelligence	2	2
	234V4A: Environmental Studies	2	1
		25	30

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Third Year- Semester-V

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	334C5A: Core Paper IX Abstract Algebra@	4	5
	334C5B: Core Paper X Real Analysis@	4	5
	334C5C: Core Paper XI Mathematical Modelling@	4	5
	Elective – V (Any One) 334E5A: Optimization Techniques@ 334E5B: Programming in C Theory and Practical	4	5
	Elective – VI (Any One) 334E5C: Introduction to Machine Learning – Theory & Practical 334E5D: Discrete Mathematics	3	4
	334C5D: Core Paper XII Project with Viva voce	3	4
Part-IV	334V5A: Value Education	2	2
	334V5B: Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	---
		26	30

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Third Year –Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	334C6A: Core Paper XIII Linear Algebra@	4	6
	334C6B: Core Paper XIV Complex Analysis@	4	6
	334C6C: Core Paper XV Mechanics@	4	6
	Elective Course – VII (Any one) 334E6A: Programming In C ++ Theory & Practical 334E6B: Fuzzy Sets and Applications@	3	5
	Elective Course – VIII (Any One) 334E6C: Graph Theory and Its Application@ 334E6D: Programming in Python with Practical	3	5
Part-IV	334V6A: Professional Competency Skill Mathematics for Competitive Examinations & General Studies	2	2
Part-V	334V6B: Extension Activity	1	---
		22	30

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