Bachelor of Science

Mathematics

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with ‘A’ Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

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DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

B.Sc. MATHEMATICS PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2023-2024 Onwards)

REGULATIONS AND SYLLABUS FOR B.SC. MATHEMATICS PROGRAMME

(For Students Admitted in the College from the Academic Year 2023-2024 Onwards)

1. Vision of the Department

To create teaching and research excellence in mathematics to fulfill the mathematical needs of the society and nation.

2. Mission of the Department

To provide high quality mathematical graduates who are relevant to industry and commerce, mathematical education and research in science and technology.

3. Definitions

(i) Programme: Programme means a course of study leading to the award of the degree in a discipline.

(ii) Course: Course refers to the subject offered under the Degree Programme.

4. Aims of the Programme

1. To attract mathematically able students and to provide for them academically coherent undergraduate programmes, with courses that range from the fundamental to the advanced, reflecting the scholarship and research interests of staff.
2. To provide Degree programmes in mathematics which are intellectually challenging and rigorous, and whose graduates are well-placed to pursue postgraduate studies or to enter employment.
3. To provide combined degree programmes, given with other UCL departments, which are designed for students seeking expertise in more than one discipline or additional skills such as a foreign language, computing or management processes.
4. To provide students with friendly pastoral and academic support which will help them develop their capabilities in an environment where both independent study and interaction with staff and fellow students are encouraged.
5. Gain in-depth knowledge by students in the subject discipline of taxonomy.
6. Mould students as accountable citizens having awareness of most basic domain-independent knowledge, including critical thinking and communication.
7. Enable students to prepare for different research/teaching qualification and competitive examinations, such as CSIR-NET, SET, TRB, TNPSC and UPSC.

5. Programme Outcomes (PO)

PO1	**Communicate Effectively** - Well versed in communicating both in English (as medium of instruction) and Tamil (mother's tongue), distinguish between professional and non-professional dialogues. Develop LSRW (Listening, Speaking, Reading, and Writing) skills with advanced technologies.
PO2	**Environment Concern** - Follow RRRR (Reduce, Reuse, Recycle, and Refuse) and develop affinity towards environment and practice save Nature and Water.
PO3	**Ethical and Healthy Practice** - Adhere to values in day to day life, practice yoga and other physical exercises, hence, develop self - respect and self-esteem, have strong integrity.
PO4	**Social Consciousness** - Understand the rural situations through ERP (Empowering Rural People), and develop social consciousness, solve the issues through interaction, become mediator/ moderator between government and people, and become true citizen of our Nation.
PO5	**Subject Specialist** - Acquaint their own subject and integrate with other disciplines (CBCS) with advanced technologies and become a Regional, National and Global competitor.

6. Programme Specific Outcomes (PSO)

PSO1	Students will develop and apply concepts of expressions, equations and inequalities to investigate and describe.
PSO2	Real Numbers and Algebraic Expressions. Classify and Define Properties of Real Numbers. Solve Multi-Step Linear Equations. Problem Solving.
PSO3	Simplify and perform arithmetic operations on rational algebraic expressions, including those with radicals and perform the basic arithmetic operations of addition, subtraction, multiplication and division on polynomials.
PSO4	Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration.

PSO5	The course includes axioms of real number systems, uniform convergence of sequences and series of functions, equi-continuity.
PSO6	Formulate and solve problems as networks and graphs. Develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transhipment problems. Use CPM and PERT techniques, to plan, Schedule and control project activities.
PSO7	Complex numbers, analytic functions, Cauchy integral theorem, Cauchy integral formula, power series and conformal mapping.
PSO8	Fluid, solid or continuum mechanics. You have good knowledge of a broad range of methods and techniques based on mechanics and can use them for analysis and problem solving.
PSO9	Correlation and Regression analysis, Multiple Regression and Statistical Forecasting.
PSO10	Analyse vector functions to find derivatives, tangent lines, integrals, arc length, and curvature, Differentiate vector fields, Determine gradient vector fields and find potential functions, Evaluate line integrals directly and by the fundamental theorem.
PSO11	To appreciate the basic principles of Boolean algebra, Logic, Set Theory, Permutations.

7. Eligibility for Admission

A candidate who has who has passed Higher Secondary Examination in Academic or vocational stream with Mathematics under higher secondary board of examination, Tamil Nadu or an examination accepted as Equivalent there to by the syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the B.Sc degree examination of this Autonomous College affiliated to Periyar University after a course of study of three academic years.

8. Duration of the Programme

The Programme for the Degree of Bachelor of Science (B.Sc.) in Mathematics shall consist of three academic years divided into six semesters. Each Semester consists of 90 working days (450 hours).

9. Features of Choice Based Credit System

Under Choice Based Credit System (CBCS), a set of Courses consisting of Core Courses, Elective Courses, Skill Based Elective Courses and Non-Major Elective Courses are offered. Beside the Core Courses, which are totally related to the major subject, the students have the advantage of studying supportive papers and Non-Major Courses. This provides enough opportunity to the students to learn not only the major courses but also inter disciplinary and application oriented courses.

10. Syllabus

The syllabus of the B.Sc. Mathematics Degree Programme is divided into the following Courses:

- **(i) Language Courses:**
- **(ii) Core Courses:** The Core Courses are related to the Programme concerned including practical and project offered under the Programme.
- **(iii) Elective Courses:** There are THREE Elective Courses offered under the Programme related to the major or non-major but are to be selected by the students.
- **(iv) Skill Based Elective Courses (SBEC):** This course aims to impart advanced and recent developments in the concerned discipline.
- **(v) Non-Major Elective Courses (NMEC):** Irrespective of the discipline, the student can select papers that are offered by other disciplines as non-major elective course.

11. Programme of Study

The Programme of study for the Degree shall be in the Branch – Mathematics (Choice Based Credit System) with internal assessment comprised of instructions in the following subjects according to the syllabi and books prescribed from time to time.

12. Credit

Weightage given to each course of study is termed as Credit.

13. Credit System

The weightage of credits are spread over to four different semesters during the period of study and the cumulative credit point average shall be awarded based on the credits earned by the student. A total of 140 Credits are prescribed for the B.Sc. Mathematics Degree Programme which is the minimum Credit requirement for the three year B.Sc. Mathematics Degree Programme.

14. Breakup of Marks and Credits

The break-up of marks and credits for the B.Sc. Mathematics Degree Programme is as follows:

Sl. No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil	400	12
2.	II	Language – English	400	12
3.	III	Core – Theory	1400	66
		Allied – Theory/Practical	600	21
		Major Elective Courses	300	12
4.	IV	Skill Based Elective Courses	400	9
		Non-Major Elective Courses	200	4
		Environmental Studies	100	2
		Value Education	100	2
5.	V	Add-on Couse	200	8
Total			**4100**	**148**

* The students are advised to complete a **SWAYAM/MOOC/NPTEL/CEC.,etc** Course before the completion of the even semester of each year of study and submit the course completion certificate to the HOD. Two credits will be given to the candidates who have successfully completed.

* The field trip preferably relevant to the course should be undertaken every year.

15. Examinations

The examinations consist of Continuous Internal Assessment (CIA) and end of semester examinations (ESE). The ESE shall be of Three Hours duration for each theory course at the end of every semester. The candidate failing in any course(s) will be permitted to appear for each failed course(s) in the subsequent examination. The end of semester practical examinations shall be of Three Hours for the each practical course conducted at the end of every even semester. To maintain uniformity, particularly for interdepartmental transfer of credits, there shall be a uniform pattern of examination to be adopted by all the teachers offering courses. There shall be three tests, one seminar and one assignment for CIA and ESE during each semester. The distribution of marks for CIA and ESE shall be 25 marks and 75 marks, respectively. Further, the distribution of CIA will be 15 marks for test, 5 marks for assignment and 5 marks for attendance. The average of the highest two test marks out of the three CIA tests will be taken for CIA.

16. Components of Continuous Internal Assessment (CIA)

Components		Marks	Total Marks
Theory			
CIA I	75	(75+75 = 150/10) 15	25
CIA II	75		
Assignment		05	
Attendance		05	
Practical			
CIA		25	40
Practical Observation Notebook		10	
Attendance		05	

17. Question Paper Pattern

Bloom’s Taxonomy Based Assessment Pattern

(**K1** – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate)

(i) Theory Examinations (CIA I & CIA II = 25 Marks and ESE = 75 Marks)

Knowledge Level	Section	Marks	Description	Total Marks
K1	A(Answer All) Q1–Q15	15 × 1 = 15	Multiple Choice Questions (MCQ) (Three questions from each unit)	15
K2	B (Answer any TTREE out of FIVE) Q16–Q20	3 × 5 = 15	Short Answers (One question from each unit)	15
K3 & K4	C(Either or Pattern)	5 × 9 = 45	Descriptive/Detailed Answers	45

	Q20–Q25		(Two questions from each unit)	
Total Marks				**75**

Passing Minimum (CIA) 40% = 10 Marks
Passing Minimum (ESE) 40% = 30 Marks
40 Marks

(ii) Practical Examinations (CIA = 40 Marks and ESE = 60 Marks)

Knowledge Level	**Components**	**Marks**	**Total**
K3	Experiments Record Work	50	60
K4		10	
K5			

Passing Minimum (CIA) 40% = 16 Marks
Passing Minimum (ESE) 40% = 24 Marks
40 Marks

The candidate shall be declared to have passed the examination if the candidates secure not less than 30 marks out of 75 marks in the semester examination in each theory course and 10 marks out of 25 marks in the CIA and in total not less than 40 marks. For the practical course, 24 marks out of 60 marks in the semester examination and the record notebook taken together and 16 marks out of 40 marks in the CIA and in total 40 marks. There is no passing minimum for the record notebook. However, submission of the record notebook is necessary. Candidate who does not obtain the required minimum marks for a pass in a Course/Practical shall be declared Re-Appear (RA) and the candidate has to appear and pass the same at a subsequent appearance.

18. Maximum duration for the completion of the B.Sc. Mathematics programme

The maximum duration for completion of the B.Sc. Mathematics Programme shall not exceed twelve semesters.

19. Commencement of this Regulation

This regulation and syllabus shall take effect from the academic year 2023-2024 for students who are admitted to the first year of the Programme during the academic year 2023-2024 and thereafter.

20. Grading

Once the marks of the cumulative CIA and ESE are available, they will be added. The marks thus obtained will then be graded as per details given below:

Marks and Grades:

The following table gives the marks grade points, letter grades and classification to indicate the performance of the candidate.

Range of Marks	Grade Points	Letter Grade	Description
90–100	9.0–10.0	O	Outstanding
80–89	8.0–8.9	D+	Excellent
75–79	7.5–7.9	D	Distinction
70–74	7.0–7.4	A+	Very Good
60–69	6.0–6.9	A	Good
50–59	5.0–5.9	B	Average
40–49	4.0–4.9	C	Satisfactory
00–39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Ci= Credits earned for course i in any semester, Gi= Grade Point obtained for course i in any semester, n = Semester in which such course were credited

For a semester

Grade Point Average [GPA] = ΣiCiGi / ΣiCi

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

For the entire Programme

Cumulative Grade Point Average [CGPA] = ΣnΣiCniGni / ΣnΣiCni

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

21. Classification of Successful Candidates

A candidate who passes all the examinations and securing following CGPA and Grades shall be declared as follows

CGPA	Grade	Classification of Final Result
9.5–10.0	O+	First Class – Exemplary
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	Third Class
4.0 and above but below 4.5	C	

22. Ranking

A candidate who qualifies for the B.Sc. Mathematics, passing all the Examinations in the first attempt within the minimum period prescribed for the Programme from the date of admission to the Programme and secures first, second or third class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular subject to a maximum of 10 ranks.

23. Conferment of the Degree

No candidate shall be eligible for conferment of the Degree unless he/she has undergone the prescribed Programme of study for a period of not less than six Semesters in an Institution approved by and affiliated to the Periyar University and earns has passed the Examinations as have been prescribed.

24. Transitory Provision

Candidates who have undergone the Programme of Study prior to the Academic Year 2023-2024 will be permitted to take the Examinations under those Regulations for a period of six years i.e. up to and inclusive of the Examination of April 2027. Thereafter, they will be permitted to take the Examination only under the Regulations in force at that time.

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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.

Programme Outcomes (POs)

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	• Instil confidence among students • Create interest for the subject

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

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

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

2. Template for Curriculum Design for UG Programme in Mathematics

Credit Distribution for UG Programme in Mathematics

B.Sc Mathematics

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Bachelor of Science (B.Sc.) in Mathematics

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2023-2024 Onwards)

Sl. No.	Part	Nature of Course	Course Code	Name of the Course	Hours/ Week	Credits	Marks		
							CIA	ESE	Total
SEMESTER I									
1	I	Language	23UTA1F01	Tamil - I	6	3	25	75	100
2	II	Language	23UEN1F01	English – I	6	3	25	75	100
3	III	Core Course I	23UMA1C01	Algebra and Trigonometry	4	4	25	75	100
4		Core Course II	23UMA1C02	Differential Calculus	4	4	25	75	100
5		Allied – I	23UPH1A01	Allied Physics – I	4	3	25	75	100
6		Allied Practical – I	23UPH1AP01	Allied Physics Practical – I	2	2	25	75	100
7	IV	Skill Enhancement Course (SEC-1) (Non Major Elective)	23UMA1S01	Mathematics For Competitive Examinations-I	2	2	25	75	100
8		Foundation Course	23UMA1FC01	Bridge Mathematics	2	2	25	75	100
Total					**30**	**23**	**200**	**600**	**800**
SEMESTER II									

9	I	Language	23UTA2F02	Tamil – II	6	3	25	75	100
10	II	Language	23UEN2F02	English – II	6	3	25	75	100
11	III	Core Course– III	23UMA2C03	Analytical Geometry(2D&3D	4	4	25	75	100
12		Core Course – IV	23UMA2C04	Integral Calculus	4	4	25	75	100
13		Allied – II	23UPH2A02	Allied Physics– II	4	3	25	75	100
14		Allied Practical – II	21UPH2AP02	Allied Physics Practical-II	2	2	25	75	100
15	**IV**	Skill Enhancement Course (SEC-2) (Non Major Elective)	23UCSS2E07	Office Automation	2	2	25	75	100
16		Skill Enhancement Course (SEC-3)	23UMA2S03	Computational Mathematics	2	2	25	75	100
Total					30	**23**	**200**	**600**	800

Sl. No.	**Part**	**Nature of Course**	**Course Code**	**Name of the Course**	**Hours/ Week**	**Credits**	**Marks**		
							CIA	**ESE**	**Total**
SEMESTER III									
17	I	Language	23UTA3F03	Tamil-III	6	3	25	75	100
18	II	Language	23UEN3F03	English-III	6	3	25	75	100
19	III	Core Course – I	23UMA3C05	Vector Calculus and Applications	4	4	25	75	100
20		CoreCourse – II	23UMA3C06	Differential Equations and Applications	4	4	25	75	100
21		Allied – I	23UCH3A01	Allied	4	5	25	75	100

				Chemistry-I					
22		Allied Practical – I	23UPCH3AP01	Allied Chemistry Practical-II	2	**5**	**25**	**75**	**100**
23	IV	Skill Enhancement Course (Entrepreneurial Based) (SEC-4)	23UMA3S04	Statistics with Excel Programming	1	1	25	75	100
		(Non Major Elective)	23UCSS3E08	Quantitative Aptitude	1	2	25	75	100
24		Skill Enhancement Course (SEC-5)	23UMA3S05	Mathematics For Competitive Examinations-III	1	2	25	75	100
25				Environmental Studies	1	-	25	75	100
Total					**30**	**24**	**225**	**675**	**900**
SEMESTER IV									
26	I	Language	23UTA4F04	Tamil-IV	6	3	25	75	100
27	II	Language	23UEN4F04	English-IV	6	3	25	75	100
28	III	Core Course– VII	23UMA4C07	Industrial Statistics	3	4	25	75	100
29		Core Course – VIII	23UMA4C08	Elements of Mathematical Analysis	4	4	25	75	100
30		Allied – II	23UCH4A02	Allied Chemistry-II	4	3	25	75	100
31		Allied Practical – II	23UPCH4AP02	Allied Chemistry Practical-II	2	2	25	75	100
32	**IV**	Skill	23UMA4S06	Mathematics For	2	2	25	75	100

		Enhancement Course (SEC-6)		Competitive Examinations-IV					
33		Skill Enhancement Course (SEC-7)	23UMA4S07	LaTeX Practical	2	2	25	75	100
34				Environmental Studies	1	2	25	75	100
Total					30	**25**	**225**	**675**	900

Sl. No.	**Part**	**Nature of Course**	**Course Code**	**Name of the Course**	**Hours/ Week**	**Credits**	**Marks**		
							CIA	**ESE**	**Total**
SEMESTER V									
35	III	Core Course – IX	23UMA5C09	Abstract Algebra	5	4	25	75	100
36		Core Course – X	23UMA5C10	Real Analysis	5	4	25	75	100
37		Core Course – XI	23UMA5C11	Mathematical Modelling	4	4	25	75	100
38		Core Course – XII	23UMA5C12	Optimization Techniques	4	4	25	75	100
39		Elective Course -I	23UMAME01	Numerical Methods with Applications	5	3	25	75	100
40		Elective Course -II	23UMAME05	Discrete Mathematics	5	3	25	75	100
41	IV	Value Education		Value Education Yoga	2	2	25	75	100
42		Internship		Internship / Industrial Training (Summer	-	2			

				vacation at the end of IV semester activity)					
Total					**30**	**26**	**175**	**525**	**700**

Sl. No.	**Part**	**Nature of Course**	**Course Code**	**Name of the Course**	**Hours/ Week**	**Credits**	**Marks**		
							CIA	**CIA**	**CIA**
SEMESTER VI									
43	III	Core Course – XIII	23UMA6C013	Linear Algebra	6	4	25	75	100
44	III	Core Course – XIV	23UMA6C014	Complex Analysis	6	4	25	75	100
45		Core Course – XV	23UMA6C015	Mechanics	6	4	25	75	100
46		Elective Course -III	23UMAME03	Mathematical Statistics	5	3	25	75	100
47		Elective Course -IV	23UMAME06	Graph Theory with Applications	5	3	25	75	100
48	**IV**	Professional Competency Skill	23UMAPC01	Professional Competency Skill - Statistics with R Programming	2	2	25	75	100
49				Extension Activity	-	1			
Total					**30**	**21**	**150**	**450**	600

Total Credits: 142

Credit Distribution for UG Programme in Mathematics

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	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6

									Module								
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC - XII	4	5	6.4 Elective - VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic / Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5

1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic / Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course – SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Ind	2				

												ustrial Training					
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

5. Consolidated Semester wise and Component wise Credit distribution

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

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

Elective Course for the I year B. Sc Mathematics:

Name Name of the course	**Paper Code**
Paper I- Allied Physics -I & Practical-I	23UPH1A01 & 23UPH1AP01
Paper II- Allied Physics -II & Practical - II	23UPH2A02 & 21UPH2AP02

Elective Course for the II year B. Sc Mathematics:

Name Name of the course	**Paper Code**
Paper I- Allied Chemistry-I & Practical-I	23UCH3A01&23UPCH3AP01

Paper II- Allied Chemistry-II & Practical-II	23UCH4A02 &23UPCH4AP02

Elective Course for the III year B. Sc Mathematics: Group-I

Name Name of the course	**Paper Code**
Numerical Methods with Applications	23UMAME01
Number Theory	23UMAME02
Mathematical Statistics	23UMAME03

Elective Course for the III year B. Sc Mathematics: Group-II

Name Name of the course	**Paper Code**
Difference Equations with Applications	23UMAME04
Discrete Mathematics	23UMAME05
Graph Theory with Applications	23UMAME06

5. 5.1 Suggestive Topics in Core Component

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

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

Group I:

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

Group II –Suggestive Elective Courses (Discipline-centric)

- Numerical Methods with Applications
- Mathematical Statistics
- Optimization Techniques
- Graph Theory & Applications
- Special functions with Applications
- Discrete Mathematics
- Combinatorial Mathematics
- Number Theory& Cryptography

- Difference equations with application
- Formal Languages & Automata Theory
- Astronomy / Elements of Space Science
- Stochastic Processes
- Fuzzy Sets & its applications
- Introduction to Research Methodology
- Integral Transforms & Z Transforms
- Algorithms
- Computational Geometry and more

7.3 Suggestive Topics in Skill Enhancement Courses (SEC)

Group III - Skill Enhancement Courses (SEC)

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

Note: For Semester I & II [if other department select our paper as Non Major Elective choose from the above Skill Enhancement Course]

B.Sc Mathematics

Core Component Model Syllabus

Note

CBCS	– Choice Based Credit system
CIA	– Continuous Internal Assessment
ESE	– End of Semester Examinations
SWAYAM	–Study Webs of Active-Learning for Young Aspiring Minds
NPTEL	–National Programme on Technology Enhanced Learning

List of Extension Activities

1. National Cade Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

Program: B.Sc Mathematics				
Foundation Course	**Course Code:**23UMA1FC01	Foundation course - **Bridge Mathematics**		
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	2	30	2	100

Course Objectives

1. To bridge the gap and facilitate transition from higher secondary to tertiary education;
2. To instil confidence among stakeholders and inculcate interest for Mathematics;

UNIT-I:

Algebra: Binomial theorem, General term, middle term, problems based on these concepts

Unit II:

Sequences and series (Progressions). Fundamental principle of counting. Factorial n.

Unit III:

Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.

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

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.

Text Books:

1. NCERT class XI and XII text books.

2. Any State Board Mathematics text books of class XI and XII

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

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	**CO Statement**	**Knowledge Level**
CO1	Prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems	K1
CO2	Find the various sequences and series and solve the problems related to them. Explain the principle of counting	K2
CO3	Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations	K3
CO4	Explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations..	K4
CO5	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.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

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

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

Program: B.Sc Mathematics				
Core Course – I	**Course Code:**23UMA1C01	**Course Title**: Algebra and Trigonometry		
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

- Basic ideas on the Theory of Equations, Matrices and Number Theory.
- Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.

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. (Book1 – Chapter6: Sections 16,17,19,30)

Unit II:

Summation of Series:Binomial–Exponential–Logarithmic series (Theorems without proof)– Approximations- related problems.(Book1– Chapter3: Sections 10,14; Chapter4: Sections-1,2,3,5,7,8,9. 11).

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. (Book2 – Chapter2: Sections -8,16)

Unit IV:

Expansions of sinnθ, cosnθ in powers of sinθ, cosθ - Expansion of tannθ in terms of tan θ, 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 sinθ, cosθ and tanθ in terms of θ - related problems. (Book3 - Chapter3: Sections 1 to 5)

Unit V:

Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems. **(**Book3 - Chapter4; Chapter5; Chapter6: Sections 1,3,3.1 Related problems)

Text Book

1. Manickavasagam Pillai, T.K., T. Natarajan and Ganapathy KS – Algebra Vol-I, Viswanathan Publishers and Printers Pvt Ltd., - 2008.
2. Manickavasagam Pillai, T.K., T. Natarajan and Ganapathy KS – Algebra Vol-II, Viswanathan Publishers and Printers Pvt Ltd., - 2008.
3. Manichavasagam Pillai, T.K. and S. Narayanan, Trigonometry– Viswanathan Publishers and Printers Pvt. Ltd. 2013

Reference Books:

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., PearsonEducation, Delhi, 2005
4. C.V.Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003
5. J.Stewart,L.Redlin,and S.Watson,AlgebraTrigonometry, Cengage Learning, 2012.
6. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.

E-Learning Source https://nptel.ac.in

Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Classify and Solve reciprocal equations	K1
CO2	Find the sum of binomial, exponential and logarithmic series	K2
CO3	Find Eigen values, eigen vectors, verify Cayley – Hamilton theorem and diagonalize a given matrix	K2& K3
CO4	Expand the powers and multiples of trigonometric functions in terms of sine and cosine	K4&K5
CO5	Determine relationship between circular and hyperbolic functions and the summation of trigonometric series.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics		
Core Course – II	**Course Code:**23UMA1C02	Cource Title:DIFFERENTIAL CALCULUS

Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	4	60	4	100

Course Objectives

- 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.

UNIT-I:

Successive Differentiation: Introduction (Review of basic concepts) – The nth derivative – Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the nth derivative of a product – Feynman's method of differentiation. (Chapter3: Sections 1.1 to 1.6 and 2.1, Related problems.

UNIT-II:

Partial Differentiation: Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions. (Chapter8: Sections 1.1 to 1.5.

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. (Chapter8: Sections 1.6, 1.7 and Sections 4, 5.)

UNIT-IV:

Envelope: Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter. (Chapter10: Sections 1.1 to 1.4.)

UNIT-V:

Curvature: Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutes – Radius of Curvature in Polar Co-ordinates. **(Chapter10: Sections 2.1 to 2.6)**

Text Book

1. S. Narayanan and T.K. Manicavachagom Pillay, Calculus-Volume I, (2004), S. Viswananthan Printers Pvt. Ltd

Reference Books

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.
4. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
5. T. Apostol, Calculus, Volumes I and II.
6. S. Goldberg, Calculus and mathematical analysis

E–Learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Find the nth derivative, form equations involving derivatives and apply Leibnitz formula	K1
CO2	Find the partial derivative and total derivative coefficient	K1&K2
CO3	Determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers	K2& K3
CO4	Find the envelope of a given family of curves	K4&K5
CO5	Find the evolutes and involutes and to find the radius of curvature using polar co-ordinates	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics				
Core – III	**Course Code:**23UMA2C03	ANALYTICAL GEOMETRY (Two & Three Dimensions)		
Semester II	**Hours/Week** 4	**Total Hours** 60	**Credits** 4	**Total Marks** 100

Course Objectives

- 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.

UNIT-I:

Pole, Polar - conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse - semi diameters- conjugate diameters of hyperbola. (Book1: Chapter9, 10)

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. (Book2: Chapter9)

UNIT-III:

System of Planes-Length of the perpendicular–Orthogonal projection.(Book3: Chapter2:Sections 2.5,2.7,2.9

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. (Book3: Chapter3:Sections 3.1, 3.2, 3.4, 3.6, 3.7, 3.8

UNIT-V:

Equation of a sphere-general equation-section of a sphere by a plane-equation of the circle- tangent plane- angle of intersection of two spheres- condition for the orthogonality-radical plane. **(Book3: Chapter6:Sections 6.1, 6.2, 6.3, 6.4, 6.6, 6.7, 6.8)**

Text Books

1. VittalP.R.andMaliniV,Algebra,AnalyticalGeometry& Trignometry,Margam Publications, India.2018.
2. Manicavachagom Pillay T.K.and Natarajan T, A Text book of Analytical Geometry Part I-Two Dimensions, Divya Subramanian for Ananda Book Depot. 1996.
3. Shanti Narayan and Mittal P.K., Analytical Solid Geometry, S Chand Publishing, 2021.

Reference Books

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, NewYork, 2016.
4. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.
5. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961.
6. Earl W. Swokowski and Jeffery A. Cole, Algebra and Trigonometry with Analytic Geometry, Twelfth Edition, Brooks/Cole, Cengage Learning, CA, USA, 2010.
7. William H. McCrea, Analytical Geometry of Three Dimensions, Dover Publications, Inc, New York, 2006.
8. John F. Randelph, Calculus and Analytic Geometry, Wadsworth Publishing Company, CA, USA, 1969.

9. Ralph Palmer Agnew, Analytic Geometry and Calculus with Vectors, McGraw-Hill Book Company, Inc. New York, 1962.

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Find pole, polar for conics, diameters, conjugate diameters for ellipse and hyperbola.	K1
CO2	Find the polar equations of straight line and circle, equations of chord, tangent and normal and to find the asymptotes of hyperbola	K2
CO3	Explain in detail the system of Planes	K2& K3
CO4	Explain in detail the system of Straight lines	K4
CO5	Explain in detail the system of Spheres	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics				
Core – IV	**Course Code:**23UMA2C04		Course Title: INTEGRAL CALCULUS	
Semester II	**Hours/Week** 4	**Total Hours** 60	**Credits** 4	**Total Marks** 100

Course Objectives

- 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.

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. (Chapter1: Sections 13 and 14)

UNIT-II:

Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates - Change of order of integration. (Chapter5: Sections 1, 2.1, 2.2 and 3.1)

UNIT-III:

Triple integrals –applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces–change of variables - Jacobian. (Chapter5: Sections 4, 5.1, 5.2, 5.3, 6.1,7 and Chapter6: 1.1,1.2)

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. (Chapter7: Sections 2.1,2.2,2.3, 3, 4, and 6

UNIT-V

Geometric Applications of Integration – Areas under plane curves: Cartesian coordinates-Area of a closed curve – Areas in polar coordinates-Trapezoidal rule – Simpson's rule and Physical Applications of Integral calculus – Centroid – Centre of mass of an arc - Centre of mass of a plane area- Centroid of a solid of revolution – Centroid of a surface of revolution.(Chapter2: Sections 1.1 to 1.4 , 2.1,2.2 and Chapter3: 1.1 to 1.5 Simple Applications)

Text Books

1. Narayanan S and Manicavachagom Pillay T.K. Calculus-Volume II, (2006), S. Viswananthan Printers Pvt. Ltd.

Reference Books:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons,., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. D. Chatterjee, Integral Calculus and Differential Equations, Tata- McGraw Hill Company Ltd.
4. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Mathematics Series, 2001 (second edition).

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae	K1
CO2	Evaluate double and triple integrals and problems using change of order of integration	K2
CO3	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution	K3
CO4	Explain beta and gamma functions and to use them in solving problems of integration.	K4
CO5	Explain Geometric and Physical applications of integral calculus	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics				
Core – V	**Course Code:** 23UMA3C05	Course Title : VECTOR CALCULUS AND ITS APPLICATIONS		
Semester III	**Hours/Week** 4	**Total Hours** 60	**Credits** 4	**Total Marks** 100

Course Objectives

- Knowledge about differentiation of vectors and on differential operators. Knowledge about derivatives of vector functions.
- Skills in evaluating line, surface and volume integrals.

UNIT-I:

Vector point function - Scalar point function - Derivative of a vector and derivative of a sum of vectors - Derivative of a product of a scalar and a vector point function - Derivative of a scalar product and vector product. (Chapter1: Sections 1.1 to 1.5)

UNIT-II:

The vector operator ‘del’, The gradient of a scalar point function - Divergence of a vector - Curl of a vector - solenoidal and irrotational vectors – simple applications. (Chapter1: Sections 1.1 to 1.5

UNIT-III:

Laplacian operator, Vector identities - Line integral - simple problems. Chapter2: Sections 2.8 and Chapter3: 3.1, 3.2, 3.3, 3.4)

UNIT-IV:

Surface integral - Volume integral – Applications (Chapter3: 3.5, 3.6

UNIT-V:

Gauss divergence Theorem, Stoke’s Theorem, Green’s Theorem in two dimensions – Applications to real life situations. (Chapter4: 4.1 to 4.5)

Text Book

1. 1. Duraipandian, P and Laxmiduraipandian - Vector Analysis (Revised Edition-Reprint 2005) Emerald Publishers.

Reference Books

1. J.C. Susan ,Vector Calculus, , (4th Edn.) Pearson Education, Boston, 2012.
2. A. Gorguis, Vector Calculus for College Students, Xilbius Corporation, 2014.

2. J.E. Marsden and A. Tromba ,Vector Calculus, , (5th edn.) W.H. Freeman, New York, 1988.

E-learning Sources :https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO	CO Statement	Knowledge

Number		**Level**
CO1	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	K1
CO2	Applications of the operator ‘del’ and to Explain soleonidal and ir-rotational vectors	K2
CO3	Solve simple line integrals	K3& K4
CO4	Solve surface integrals and volume integrals	K4 &K5
CO5	Verify the theorems of Gauss, Stoke’s and Green’s(Two Dimension)	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

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

Program: B.Sc Mathematics				
CORE-VI	**Course Code:**23UMA3C06		**Course Title : DIFFERENTIAL EQUATIONS AND APPLICATIONS**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	4	60	4	100

Course Objectives

- Knowledge about the methods of solving Ordinary and Partial Differential Equations.
- The understanding of how Differential Equations can be used as a powerful tool in solving problems in science.

UNIT-I:

Ordinary Differential Equations: Variable separable - Homogeneous Equation-Non-Homogeneous Equations of first degree in two variables -Linear Equation -Bernoulli's Equation-Exact differential equations. (Chapter2: Sections 1 to 6)

UNIT-II:

Equation of first order but not of higher degree: Equation solvable for dy/dx-Equation solvable for y-Equation solvable for x- Clairauts' form - Linear Equations with constant coefficients-Particular integrals of algebraic, exponential, trigonometric functions and their products. (Chapter4: Sections 1,2 ,3 and Chapter5: 1 to 4)

UNIT-III:

Simultaneous linear differential equations- Linear Equations of the Second Order -Complete solution in terms of a known integrals-Reduction to the Normal form-Change of the Independent Variable-Method of Variation of Parameters. **(Chapter6 and Chapter 8: Sections 1 to 4)**

UNIT-IV:

Partial differential equation: Formation of PDE by Eliminating arbitrary constants and arbitrary functions – complete integral – singular integral-General integral-Lagrange's Linear Equations –Simple Applications. (Chapter12: 1,2,3, and 4)

UNIT-V:

Special methods – Standard forms-Charpit's Methods – Simple Applications (Chapter12: 5, and 6)

Text Book:

1. Narayanan S and Manicavachagom Pillay T.K. Differential equations and its application, 2006, S. Viswananthan Printers Pvt.Ltd.

Reference Books:

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I.Sneddon, Elements of Partial Differential Equations, McGraw- Hill, International Edition, 1967.
3. G.F. Simmons, Differential equations with applications and historical notes, 2ndEd, Tata Mcgraw Hill Publications, 1991.
4. D.A. Murray, Introductory course in Differential Equations, Orient and Longman
5. H.T. H.Piaggio, Elementary Treaties on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi,1985.
6. Horst R. Beyer, Calculus and Analysis, Wiley, 2010.
7. Braun, M. Differential Equations and their Applications. (3rd Edn.), Springer- Verlag, New York. 1983.
8. TynMyint-U and Lognath Debnath. Linear Partial Differential Equations for Scientists and Engineers. (4th Edn.) Birhauser, Berlin. 2007.
9. Boyce, W.E. and R.C.DiPrima. Elementary Differential Equations and Boundary Value Problems. (7th Edn.) John Wiley and Sons, Inc., New York. 2001.
10. Sundrapandian, V. Ordinary and Partial Differential Equations, Tata McGraw Hill Education Pvt.Ltd. New Delhi, 2013

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Determine solutions of homogeneous equations, non-homogeneous equations of degree one in two variables, solve Bernoulli's equations and exact differential equations	K1
CO2	Find the solutions of equations of first order but not of higher degree and to Determine particular integrals of algebraic,	K2

	exponential, trigonometric functions and their products.	
CO3	Find solutions of simultaneous linear differential equations, linear equations of second order and to find solutions using the method of variations of parameters	K3& K4
CO4	Form a PDE by eliminating arbitrary constants and arbitrary functions, find complete, singular and general integrals, to solve Lagrange's equations	K4 &K5
CO5	Explain standard forms and Solve Differential equations using Charpit's method	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Creat

Mapping of COs with POs

	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><th colspan="5">Program: B.Sc Mathematics</th></tr>
<tr><td>Core Course– VII</td><td colspan="2">Course Code:
23UMA4C07</td><td colspan="2">Course Title :
Industry module -Industrial Statistics</td></tr>
<tr><td>Semester
IV</td><td>Hours/Week
3</td><td>Total Hours
45</td><td>Credits
4</td><td>Total Marks
100</td></tr>
</table>

Course Objectives

To bridge the gap between industry academia interface – to apply the theory learnt to industrial applications

UNIT-I:

Introduction- Combinatorial Methods- Binomial coefficients

(Chapter1: Section-1.1, 1.2, 1.3.)

UNIT-II:

Probability - Introduction-Sample spaces- Events –The Probability of event- Some Rules of Probability.

(Chapter2: Section-2.1, 2.2, 2.3, 2.4, 2.5.)

UNIT-III:

Conditional Probability- Independent Events- Baye’s Theorem(Only problems).

(Chapter2: Section-2.6, 2.7, 2.8.)

UNIT-IV:

Probability Distributions and Probability DensitiesIntroduction- Probability Distributions-Continuous Random variablesProbability Density functions-Multivariate Distributions.

(Chapter3: Section-3.1, 3.2, 3.3, 3.4, 3.5.)

UNIT-V:

Marginal Distributions- Conditional DistributionsMathematical Expectations-Introduction- The Expected value of a Random variable- Moments.

(Chapter3: Section-3.6, 3.7 and Chapter4: Section- 4.1, 4.2, 4.3.)

Text Book

1. Fruend John E, Mathematical Statistics, Prentice Hall of India, New Delhi

Reference Books:

1. Papoulis A. Probability, Random Variables and Stochastic process, Tata McGraw Hill Education Pvt. Ltd., New Delhi
2. Baisnab A., Jas M., Elements of Probability and Statistics, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 1993

E-learning Sources

https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the role and applications of data structure in real life	K1
CO2	Develop abstract data types fpr solving the complex perోblems.	K2
CO3	Understand the concepts of non linear data structers and applications	K3& K4
CO4	Analyze the efficiency of algorithms	K4 &K5
CO5	Explain standard forms and Solve Differential equations using Charpit's method	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Creat

	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

Program: B.Sc Mathematics				
Core Course – VIII	**Course Code:** 23UMA4C08	**Course Title:** ELEMENTS OF MATHEMATICAL ANALYSIS		
Semester IV	**Hours/Week** 4	**Total Hours** 60	**Credits** 4	**Total Marks** 100

Course Objectives

- Identify and characterize sets and functions and Understand, test and analyze the convergence and divergence of sequences, series.
- Understand metric spaces with suitable examples

UNIT-I:

Sets and Functions: Sets and elements- Operations on sets- functions- real valued functions- equivalence-countability- real numbers- least upper bounds. (Chapter1: Section-1.1 to 1.7)

UNIT-II:

Sequences of Real Numbers: Definition of a sequence and subsequence-limit of a sequence – convergent sequences–divergent sequences- bounded sequences-monotone sequences(Chapter2: Section-2.1 to 2.6)

UNIT-III:

Operations on convergent sequences – operations on divergent sequences – limit superior and limit inferior-Cauchy sequences. (Chapter2: Section-2.7 to 2.10)

UNIT-IV:

Series of Real Numbers: Convergence and divergence – series with non –negative terms-alternating series-conditional convergence and absolute convergence- tests for absolute convergence. (Chapter3: Section-3.1 to 3.4 and 3.6)

UNIT-V:

Limits and Metric Spaces: Limit of a function on a real line - Metric spaces - Limits in metric spaces – Continuous Functions on Metric Spaces: Function continuous at a point on there a line-Function continuous on a metric space. (Chapter4: Section-4.1 to 4.3 and Chapter5: 5.1 ,5.3)

Text Books

1. Richard R. Goldberg, Methods of Real Analysis: Oxford and IBH Publishing, 2017

Reference Books

1.Ethan D. Bloch, The Real Numbers and Real Analysis, Springer, 2011.

1. G.M. The fundamentals of Mathematical Analysis, vol I. Pergamon Press, New York, 1965.
2. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
3. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
4. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
5. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain in detail about sets and functions, equivalence and countability and the LUB axiom	K1 & K2
CO2	Explain Sequence and Subsequence of real numbers and to find the limit of sequence to test for convergent, divergent, bounded and monotone sequences	K3
CO3	Explain the operations on convergent and divergent sequences and to Explain the concepts of limit superior and limit inferior and the notion of Cauchy sequences	K3 & K4
CO4	Classify the series of real numbers and the alternating series and their convergence and divergence, the conditional	K5

	convergence and absolute convergence and solve problems on convergence of the sequences	
CO5	Explain about the metric spaces and functions continuous on a Metric space.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics				
Core Course – IX	**Course Code:** 23UMA5C09	**Course Title :** **ABSTRACT ALGEBRA**		
Semester V	**Hours/Week** 5	**Total Hours** 75	**Credits** 4	**Total Marks** 100

Course Objectives

- Concepts of Sets, Groups and Rings.
- Construction, characteristics and applications of the abstract algebraic structures

UNIT-I:

Introduction to groups- Subgroups- cyclic groups and properties of cyclic groups-Lagrange's Theorem-A counting principle – Examples (Chapter2: Section-2.1 to 2.5)

UNIT-II:

Normal subgroups and Quotient group- Homomorphism- Automorphism -Examples. (Chapter2: Section-2.6 to 2.8)

UNIT-III:

Cayley's Theorem-Permutation groups - Examples (Chapter2: Section-2.9 to 2.10)

UNIT-IV:

Definition and examples of ring- Some special classes of rings- homomorphism of rings- Ideals and quotient rings- More ideals and quotient rings. . (Chapter3: Section-3.1 to 3.5)

UNIT-V:

The field of quotients of an integral domain-Euclidean Rings - The particular Euclidean Ring – Examples (Chapter3: Section-3.6 to 3.8)

Text Books

1.Topics in Algebra–I.N.Herstein, Wiley Eastern Ltd. Second Edition (1st January 2006)

Reference Books

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain groups, subgroups and cyclic groups	K1 & K2
CO2	Explain about Normal subgroup, Quotient groups, Homomorphisms and Automorphisms and verify the functions for homomorphism and automorphism properties	K3
CO3	Explain Permutation groups and apply Cayley's theorem to	K3 & K4

	problems	
CO4	Explain Rings, Ideals and Quotient Rings and examine their structure	K5
CO5	Discuss about the field of quotient of an integral domain and to Explain in detail about Euclidean Rings	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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><th colspan="5">Program: B.Sc Mathematics</th></tr>
<tr><td colspan="2">Core Course – X</td><td colspan="1">Course Code:
23UMA5C10</td><td colspan="2">Course Title :
REAL ANALYSIS</td></tr>
<tr><td>Semester
V</td><td>Hours/Week
5</td><td>Total Hours
75</td><td>Credits
4</td><td>Total Marks
100</td></tr>
</table>

Course Objectives

- Real Numbers and properties of Real–valued functions.
- Connectedness, Compactness, Completeness of Metric spaces.
- Convergence of sequences of functions, Examples and counter examples

UNIT-I:

Continuous Functions on Metric Spaces: Open sets– closed sets–Discontinuous function on R^1. Connectedness, Completeness and Compactness: More about open sets-Connected sets. (Chapter5: Section-5.4 to 5.6 and Chapter6: Sections-6.1,6.2)

UNIT-II:

Bounded sets and totally bounded sets: Complete metric spaces- compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity. (Chapter6: Sections-6.3 to 6.8)

UNIT-III:

Calculus: Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral-properties of Riemann integral. (Chapter7: Sections-7.1 to 7.4)

UNIT-IV:

Derivatives-Rolle's theorem, Law of mean, Fundamental theorems of calculus. (Chapter7: Sections-7.5 to 7.8)

UNIT-V:

Taylor's theorem-Point wise convergence of sequences of functions, uniform convergence of sequences of functions. (Chapter8: Sections-8.5and Chapter9: Sections-9.1,9.2)

Text Book

1.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, 2^{nd}edition (1974), Addison-Wesley publishing company, New Delhi.

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the concepts of Continuous and Discontinuous functions, open and close sets, Connectedness, Completeness and Compactness	K1 & K2
CO2	Explain the concepts of bounded and totally bounded sets, continuity of inverse functions and Uniform continuity	K2 & K3
CO3	Define the sets of measure zero, to Explain about the existence and properties of Riemann integral	K3 & K4
CO4	Explain the concept of differentiability and to Explain Rolle's theorem, Law of mean, and Fundamental theorem of calculus	K5
CO5	Explain the point wise and uniform convergence of sequence of function and to derive the Taylor's theorem	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	3	1	3	1	-	3	1	1
CLO2	3	3	1	3	1	-	3	1	1

CLO3	3	3	1	3	1	-	3	1	1
CLO4	3	3	1	3	1	-	3	1	1
CLO5	3	3	1	3	1	-	3	1	1

<table>
<tr><th colspan="5">Program: B.Sc Mathematics</th></tr>
<tr><td colspan="2">Core Course – XI</td><td>Course Code:
23UMA5C11</td><td colspan="2">Course Title:
MATHEMATICAL MODELLING</td></tr>
<tr><td>Semester
V</td><td>Hours/Week
4</td><td>Total Hours
60</td><td>Credits
4</td><td>Total Marks
100</td></tr>
</table>

Course Objectives

- Construction and Analysis of Mathematical models found in real life problems.
- Modelling through differential and difference equations

UNIT-I:

Mathematical Modelling: Simple situations requiring mathematical modelling, characteristics of mathematical models. (Chapter1: Section-1.1, 1.4)

UNIT-II:

Mathematical Modelling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models (Chapter2: Section-2.1 to 2.4)

UNIT-III:

Mathematical Modelling, through system of Ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations. Epidemics: simple epidemic model, Susceptible-infected- susceptible (SIS) model, SIS model with constant number of carriers. Medicine: Model for Diabetes Mellitus. (Chapter3: Section-3.1: 3.1.1, 3.1.2; 3.2: 3.2.1to 3.2.4, 3.2.6, 3.5:3.5.1)

UNIT – IV:

Introduction to difference equations. (Chapter5: Section-5.1, 5.2: 5.2.1, 5.2.2, 5.2.3)

UNIT-V:

Mathematical Modelling through difference equations: Harrod Model, cob web model application to Actuarial Science (Chapter5: Section-5.3: 5.3.1, 5.3.2, 5.3.4)

Text Book

J N Kapur, Mathematical Modeling, New Age International publishers (2009).

Reference Books

1. Mathematical Modeling by Bimalk. Mishra and Dipak K.Satpathi. Ane Books Pvt. Ltd(1 Januuary 2009)
2. Mathematical Modeling Models, Analysis and Applications, by Sandip Banerjee, CRC Press, Taylor & Francis group, 2014
3. Mathematical Modeling applications with Geogebra by Jonas Hall & Thomas Ligefjard, John Wiley & Sons, 2017
4. Mark M. Meerschaert: Mathematical Modeling, Elsevier Publ., 2007.
5. Edward A. Bender: An introduction to mathematical Modeling, CRC Press,2002
6. Walter J. Meyer, Concepts of Mathematical Modeling, Dover Publ., 2000

E-Learning Source

https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain simple situations requiring Mathematical Modelling and to Determine the characteristics of such models	K1
CO2	Model using differential equations in-terms of linear growth and Decay models	K2
CO3	Model using systems of ordinary differential equations of first order, to discuss about various models under the categories 'Epidemics' and 'Medicine'	K2& K3
CO4	Explain in detail about difference equations	K4&K5
CO5	Model using difference equations.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

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

Program: B.Sc Mathematics				
Core Course – XII	**Course Code:** 23UMA5C12		**Course Title:** Optimization Techniques	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	4	60	4	100

Course Objectives

- To provide knowledge on Formulating real life problems into LP.P
- To teach the techniques foR converting the industrial problems as mathematical problems and solving them.

UNIT-I:

Operations Research – An Overview: Introduction to Operations Research – Modeling in O.R-Advantages and limitations of models – Linear Programming Problem (LPP) – Mathematical formulation –Illustrations on Mathematical formulation of LPP's – Graphical solution – Some exceptional cases-Introduction(Simplex method) – Computational Procedure-Big-M method only. (Chapter1:Sections 1.1 ,1.5 & 1.6; Chapter2: Sections 2.1 to

2.4; Chapter3:Sections 3.1 to 3.3; Chapter4:Sections 4.1, 4.3, 4.4

UNIT-II:

Transportation Problem : Introduction - Mathematical formulation – North West Corner rule - Matrix Minima method – Vogel's Approximation Method – Degeneracy in TP-MODI method – Some exceptional Cases(Unbalanced TP &Maximization case in TP).

Assignment Problem : Introduction Mathematical formulation - Hungarian method – - Special cases in AP(Unbalanced AP& Maximization case in AP)– Travelling Salesman Problem. (Chapter10:Sections 10.1, 10.2, 10.9, 10.12,10.13, 10.15 Chapter11: Sections 11.1 to 11.3 &11.4, 11.7)

UNIT-III:

Sequencing problem – Introduction –Problem of sequencing- Basic in sequencing- n jobs to be operated on two machines – Problems – n jobs to be operated on three machines – Problems – n jobs to be operated on m machines – Problems - Two jobs to be operated on m machines (Graphical method) – Problem (Chapter12: Sections 12.1 to 12.6)

UNIT-IV

Games and Strategies - Introduction - Two person zero sum game -Some basic terms- The maximum and minimum principle games - Games without saddle points - Mixed strategies - Graphical method 2xn and mx2 games–– Dominance Property. (Chapter17:Sections 17.1 to 17.7)

UNIT-V:

Network and scheduling by PERT/CPM : Introduction– Network basic concepts- Logical Sequencing -Rules of network construction––-Concurrent Activities– Critical Path Analysis–Probability consideration in PERT-Differences between CPM and PERT. (Chapter25: Sections 25.1 to 25.8)

Text Book

1.Kantiswarup., Gupta, P.K. and Man Mohan. Operations Research.[Seventeenth Edition]. Sultan Chand and Sons, NewDelhi.2020.

Reference Books

1.Gupta, P.K. and Hira, D.S. Operations Research. [Eighth Edition]. Sulthan .Chand and Co., NewDelhi.2020.

2. Gupta, P.K. and Man Mohan. Problems in Operations Research.[Ninth Edition]. Sultan Chand and Sons, New Delhi.2014.

3. Kalavathy.S. Operations Research[Fourth Edition],Vikas Publishing

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1 : Define linear programming problem and to solve the problems using graphical method, Simplex method and Big-M method.

E-Learning Source

https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define linear programming problem and to solve the problems using graphical method, Simplex method and Big-M method.	K1
CO2	Solve Transportation problems and Assignment problems.	K2
CO3	Find solutions for sequencing problems.	K2& K3
CO4	Discuss game, strategies on dominance property.	K4&K5
CO5	Construct network and do PERT calculations.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

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

Program: B.Sc Mathematics				
Core Course – XIII	**Course Code:** 23UMA6C013		**Course Title: LINEAR ALGEBRA**	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	6	90	4	100

Course Objectives

- Vector Spaces, linear dependence and independence of vectors . Dual spaces, Inner product and norm – orthogonalization process.
- Linear transformations. Various operators on vector spaces

UNIT-I:

Vector spaces – Subspaces – Linear Combinations and linear span - Systems of Linear equations – Homogenous Equations – Non-homogenous Equations – Elementary Matrices – Row reduced -Echelon form. (Chapter1: Section-1.2 to 1.4; Chapter2: 2.7; Chapter3: 3.1)

UNIT-II:

Linear Dependence and Linear independence – Bases – Dimensions. (Chapter1: Section-1.5, 1.6)

UNIT-III

Linear transformations, null spaces and ranges – Matrix representation of a linear transformation –invertibility and isomorphisms – dual spaces. (Chapter2: Section-2.1,2.2,2.4, 2.6)

UNIT-IV

Eigen values, eigen vectors, diagonalizability – invariant subspaces – Cayley–Hamilton theorem **.** (Chapter5: Section-5.1,5.2, 5.4)

UNIT-V:

Inner products and norms – Gram Schmidt Orthogonalization Process - Orthogonal complements. (Chapter6: Section-6.1,6.2)

Text Book

1.Linear Algebra - Stephen H Friedberg, Arnold J Insel and Lawrence E Spence, 5th edition (2018) Pearson

Reference Books

1. I.N.Herstein, Topics in Algebra, Wiley EasternLtd. Second Edition, 2006.
2. N.S.Gopalakrishnan, University Algebra, New Age International Publications, Wiley Eastern Ltd.
3. John B.Fraleigh, First course in Algebra, Addison Wesley.
4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
5. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
6. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

7.Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

E-learning Sources https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire a detailed knowledge about vector spaces and subspaces	K1 & K2
CO2	Explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension of basis	K2 & K3
CO3	Explain the concept of Linear Transformations, their Matrix representation and the notion of dual spaces	K3 & K4
CO4	Find the Eigen values and Eigen vectors, to apply the concepts for diagonalisation	K5
CO5	Explain about Inner product and norms and to apply Gram Schmidt Orthogonalization Process to problems on inner product spaces	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics				
Core Course – XIV	**Course Code:** 23UMA6C014		**Course Title:** COMPLEX ANALYSIS	
Semester VI	**Hours/Week** 6	**Total Hours** 90	**Credits** 4	**Total Marks** 100

Course Objectives

- Apply concept and consequences of analyticity and C-R equations.
- Understand the concept of mappings and transformations.
- Compute complex contour integrals and applying Cauchy‘s integral in various versions.
- Understand zeros and singularities of an analytic function, apply their properties in the evaluation of definite integral.

UNIT-I:

Analytic functions: Functions of a Complex variable –Limits –Theorem on limits – Continuity – Derivatives – Differentiation formulas – Cauchy Riemann equation – conditions for differentiability – Polar coordinates– Analytic functions– Harmonic functions. (Chapter2: Section-11,14,15,17,18,19,20,21,22,23,25)

UNIT-II:

Conformal mapping: Mappings – Mapping by exponential function – Linear transformation – The transformation $w=\frac{1}{z}$– Mappings by $\frac{1}{z}$ – Linear fractional transformations (bilinear). (Chapter2: Section-12,13;Chapter8: Section- 83 to 86)

UNIT-III:

Complex Integration: Contour integrals– Some examples – Simply and Multiply connected domains– Cauchy integral formula – Formula for derivatives– Liouville's theorem –Fundamental theorem of Algebra– Maximum modulus principle. (Chapter4:39,40,46 to 50)

UNIT – IV:

Sequences and Series: Convergence of sequences – Convergence of series– Taylor's series – Laurent series– Absolute and uniform convergence of power Series – Continuity of sums of power series–Integration & differentiation of power series (Chapter5: Section-51,52,53,55,57,58,59)

UNIT-V:

Residues and Poles: Isolated singular points – Residues – Cauchy Residue theorem – Residue at infinity – The three types of isolated singular points – Residues at poles – Zeros of analytical functions – Zeros and poles – Evaluation of real improper integrals (excluding poles on the real axis). (Chapter6:Section- 62,63,65,66,68,69:Chapter7: Section-71)

Text Book

1.Complex variables and application, Seventh Edition by James Ward Brown and Ruel V. Churchill, Mc-Graw Hill Book Co., International Edition, 2009.

Reference Books

1. Theodore W. Gamelan, Complex Analysis, Springer Verlag, 2008
2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
3. Richard A. Silverman, Introductory Complex Analysis. Dover Publications, 1972.

S. Ponnusamy and H. Silverman, Complex variables with applications, Birkhauser, 2006.

E-learning Sources

https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain about analytic functions, their differentiation and	K1 & K2

	continuity and to verify the Harmonic functions using analyticity conditions	
CO2	Explain the concept of Conformal mappings and mappings by linear transformations and linear fractional transformations	K2 & K3
CO3	Explain about the integrations of functions over simply and multiply connected domains and to derive the Cauchy integral formula, Liouvlle’s theorem, Fundamental theorem of Algebra and Maximum Module Principle	K3 & K4
CO4	Find the convergence the sequences and series, to derive Taylor’s and Laurent’s series for diagonalisation	K5
CO5	Find the nature of singularities, to find the residue of a given function at a given singular point, to Explain about zeros and poles and to evaluate real improper integrals (Excluding poles on the real axis)	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc Mathematics				
Core Course – XV	**Course Code:** 23UMA6C015		**Course Title:** MECHANICS	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	6	90	4	100

Course Objectives

- Equilibrium of a particle under the action of given forces
- Simple Harmonic Motion
- Projectiles

UNIT-I:

Force: Newton's laws of motion – Resultant of two forces on a particle - Equilibrium of a Particle: Equilibrium of a particle – Limiting equilibrium of a particle on an inclined plane. (Chapter2: Section-2.1,2.2; Chapter3: Section-3.1,3.2)

UNIT-II:

Forces on a Rigid Body: Moment of a Force – General motion of a body – Equivalent systems of forces- Parallel Forces – Forces acting along a Triangle - A specific reduction of Forces: Reduction of coplanar forces into a force and couple – Problems involving frictional forces. (Chapter4: Section-4.1 to 4.5; Chapter5: Sections-5.1,5.2)

UNIT-III:

Work, Energy and Power: Work – Conservative field of force – Power -Rectilinear Motion under Varying Force: Simple Harmonic Motion - along a horizontal line – along a vertical line. (Chapter11:Section-11.1,11.2,11.3;Chapter12: Section-12.1,12.2,12.3)

UNIT – IV:

Projectiles: Forces on a projectile – Projectile projected on an inclined plane (Chapter13: Section-13.1, 13.2)

UNIT-V:

Central Orbits**:** General orbits – Central orbit – Conic as a centered orbit (Chapter16: Section-16.1 to 16.3)

Text Book

1.Duraipandian. P.,LaxmiDuraipandian and MuthamizhJayapragasm- Mechanics. 2007. S.Chand and company.

Reference Books

1. A. Ruina and R. Pratap, Introduction to Statics and Dynamics, , Oxford University Press, 2014.
2. S.L. Loney, The Elements of Statics and Dynamics, Cambridge University Press, 1904.
3. J.L. Meriam and L. G. Kraige, Engineering Mechanics: Statics, Seventh Edition,Wiley and sons Pvt ltd., New York, 2012.
4. J.L. Meriam, L. G. Kraige, and J.N. Bolton, Engineering Mechanics: Dynamics, 8th edn, Wiley and sons Pvt ltd., New York, 2015.
5. A. K. Dhiman, P.Dhinam and D. Kulshreshtha, Engineering Mechanics (Statics and Dynamics) ,McGraw Hill Education(India) Private Limited, New Delhi, 2015.

E-learning Sources

https://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Resultant, Component of a Force, Coplanar forces, like and unlike parallel forces, Equilibrium of a Particle, Limiting equilibrium of a particle on an inclined plane. conditions	K1 & K2
CO2	Define Moment of a force and Couple with examples. Define Parallel Forces and Forces acting along a Triangle, Solve problems on frictional forces	K2 & K3
CO3	Define work, energy, power, rectilinear motions under varying forces. Define Simple Harmonic Motion and find its Geometrical representation.	K3 & K4
CO4	Define Projectile, impulse, impact and laws of impact. Prove that the path of a projectile is a parabola. Find the direct and oblique impact of smooth elastic spheres	K5

CO5	Define central orbits, explain conic as centered orbits and solve problems related to central orbits	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Elective Courses Syllabus

Program: B.Sc. Mathematics				
Elective Course		**Course Code:**23UMAME01		**Course Title**: Numerical Methods with Applications
Semester V	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

1. To develop skills in solving problems using numerical techniques.
2. This course covers the techniques of Numerical Differentiation and Numerical Integration.
3. It also deals with solution of difference equations, Algebraic and Transcendental equations and Numerical solution of Ordinary differential equations of first order.

UNIT –I:

The Bisection Method - The Iteration method – The method of false position - Newton Raphson Method - Generalized Newton's Method - Ramanujan's Method - Muller's method. (Chapter 2: Sections 2.1 to 2.7)

UNIT –II:

Finite Difference - Forward Differences –Backward Differences - Central Differences - symbolic relations and separation of symbols - Newton's formulae for interpolation - Central Differences interpolation formulae - Gauss Central difference formulae - Stirling Formulae - Bessel's Formulae - Everett's formulae (Problems only). (Chapter 3: Sections 3.3(3.3.1 - 3.3.4), 3.6, 3.7(3.7.1 - 3.7.4))

UNIT-III :

Lagrange's Interpolation Formulae – Divided differences - Divided differences table - Newton's Divided Difference formulae - Inverse Interpolation. (Problems only) (Chapter 3: Sections 3.9.1, 3.11.1, 3.12)

UNIT – IV:

Numerical Differences - Maximum and minimum values of Tabulated function - Numerical Integration - Trapezoidal Rule - Simphson 1/3 Rule - Simphson 3/8 Rule - Boole's and Weddle's rule. (Problems only) (Chapter 5: Sections 5.2, 5.3, 5.4(5.4.1 - 5.4.4))

UNIT-V:

Direct method - Gauss elimination Method – Gauss Jordan Method - Modification of Gauss Method to compute the inverse - Method of Factorization - Iterative Methods - Gauss Jacobi method - Gauss seidel Method. (Problems only) (Chapter 6: Sections 6.3(6.3.2 - 6.3.4), 6.4)

TextBook

1. S.S. Sastry - Introductory methods of numerical Analysis 3rd Edition, Prentice Hall of India Private Ltd., New Delhi.

Reference Books

1. P. Kandasamy, K. Thilagavathy, K. Gunavathy - Numerical Methods, Third Revised Edition, S.Chand & Companyy Ltd., Ram Nagar, New Delhi

E-Learning Sources ://nptel.ac.in

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Compute the Solution of Algebraic and Transcendental equation using Bisection, Iteration, Method of false position and Newton Raphson Method.	K1
CO2	Solve Interpolation of Finite differences – Newton’s Forward, Central and Backward differences	K2 & K3
CO3	Solve Bessel’s formula – Stirling’s formula – Laplace – Everett’s formula.	K3 & K4
CO4	Obtain the Numerical differentiation and integration. Derive Trapezoidal and Simpson’s Rule.	K4 & K5
CO5	Derive and compute the solution of Taylor series, Picard’s	K6

	andEuler method and Runge–Kutta Methods.	

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs Mapping of COs with POs

	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

Program: B.Sc. Mathematics				
Major Elective	**Course Code:**21UMA5CE02		**Course Title**: Number Theory	
Semester V	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

1. To highlight the niceties and nuances in the world of numbers.
2. To prepare the students for coding through congruence.
3. Know about the basic concepts of number theory.
4. Get a complete grip of various concepts to present modern Mathematics in elementary terms.
5. Develop the skill of solving problems in number theory.

UNIT-I: Divisibility

Introduction- Divisibility, Greatest Common Divisor, Euclid's Algorithm, Greatest Common Divisor via Euclid's Algorithm- Least Common Multiple- Representation of

Integers, Decimal Representation of Integers, Binary Representation of Integers(Chapter:2. Sections 2.1 to 2.4, Related Problems)

UNIT-II: Primes

Introduction-Primes, Prime counting function, prime number theorem, Test of primality by trial division – Sieve of Eratothenes, Canonocal Factorization, Fundamental theorem of arithmetic, Sieve of Eratothenes, Determining the canonical factorization of a natural number (Chapter3:. Sections-3.1 to 3.3, Related Problems)

UNIT-III: Congruences

Introduction-Congruences and Equivalence Relations, Equivalence Relations and Linear Congruences - Linear Diophantine Equations and the Chinese Remainder Theorem (Chapter4: Sections 4.1 to 4.4, Related Problems)

UNIT-IV: Congruences(continued)

PolinomialCongruences- Modular Arithmetic: Fermat's theorem – Wilson's Theorem and Fermat's Numbers – Pythagorean Equation(Chapter4: Sections 4.5 to 4.8, Related Problems).

UNIT-V:Arithmetic Functions

Introduction- Sigma function, Tau function, Dirichlet product – DirichletInverse, Moebius function, Euler's function, Euler's Theorem, An application of algebra (Chapter5: Sections 5.1 to 5.3, Related Problems)

Text Book

1.Neville Robinns,Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi2006.

Reference Books

1. David M. Burton, Elementary Number theory 6th Ed., Tata McGraw – Hill Edition, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000.

E-Learning Source

1. http://www2.math.uu.se/~lal/kompendier.pdf

Note: Questions to be taken only from the text books

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	**CO Statement**	**Knowledge Level**
CO1	Describe the Division Algorithm and the Diophantine Equation ax+by=c.	K1
CO2	To discuss The Fundamental Theorem of arithmetic, the sieve of Eratesthenes – The Goldbach conjecture.	K2 & K3
CO3	To describe Linear congruences – The little Fermat's theorem – Wilson's Theorem.	K3 & K4
CO4	Derive the Functions μ and □the Mobius inversion Formula	K5
CO5	Discuss Euler's Phi–Function and Euler's Theorem	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs Mapping of COs with POs

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

<table>
<tr><th colspan="5">B.Sc Mathematics</th></tr>
<tr><td colspan="2">Elective Cource</td><td colspan="2">Course Code:
23UMAME03</td><td>Course Title :
Mathematical Statistics</td></tr>
<tr><td>Semester</td><td>Hours/Week</td><td>Total Hours</td><td>Credits</td><td>Total Marks</td></tr>
<tr><td>VI</td><td>5</td><td>75</td><td>3</td><td>100</td></tr>
</table>

Course Objectives

1. To facilitate students to understand fundamentals of statistics.
2. To promote skill of applying statistical techniques in business.
3. To enable students to apply the statistical tools in analysis and interpretation of data.

UNIT – I

Random variables and Distribution functions:

Introduction– Distribution functions - Discrete random variable (One dimensional)-Probability mass function and Distribution function – Continuous Random variable (one dimensional) –Probability density function – Various Measures of Central tendency-Continuous distribution function-Problems. (Chapter5: Sections 5.1 to 5.4)

UNIT – II

Mathematical Expectation:

Introduction –Mathematical Expectation –Expected value of function of Random variable- Properties - Variance – Properties – Covariance. (Chapter6: Sections 6.1 to 6.6)

UNIT – III

Generating functions and Law of large numbers:

Moment Generating functions – Cumulants - Characteristic function – Properties – Problems (Chapter7: Sections 7.1 to 7.4)

UNIT – IV

Special Discrete Probability Distributions:

Introduction - Binomial, Poisson, Geometric distributions– Theorems (Statements only)- Properties and Problems. (Chapter8: Sections 8.1,8.4, 8.5, 8.7.

UNIT – V

Some Continuous Probability Distributions:

Normal distribution, Uniform distribution and Exponential distribution – Theorems (Statements only) -Properties and Problems. (Chapter9: Sections 9.1 to 9.3, 9.8)

TEXT BOOK:

1.Gupta S.C. and Kapoor V.K. Fundamentals of Mathematical Statistics.. [Twelfth Edition]. Sulthan Chand and Sons, New Delhi 2020.

REFERENCE BOOKS

1. Gupta S.C. and Kapoor V.K. Elements of Mathematical Statistics. [Third Edition]. Sulthan Chand and Sons, New Delhi.2001

2. Vittal, P.R. Mathematical Statistics. Margham Publications,Chennai.2020.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand basic knowledge about statistics and measures of central tendency.	K1 & K2
CO2	Promote skill for calculation of measures of dispersion	K3
CO3	Enable students to apply the statistical tools of correlation and regression analysis for interpretation of data.	K4
CO4	Gather information about index and construction of index number.	K5
CO5	Update knowledge of analysis of time series	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs Mapping of COs with POs

	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

Program: B.Sc. Mathematics		
Elective Course -II	**Course Code:** 23UMAME04	**Course Title:** DIFFERENCE EQUATIONS WITH APPLICATIONS

Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	3	100

Objectives of the Course:

- It is the study of difference operator and its application.
- Solving first order difference equations.
- Solving Difference equations using matrix form.

UNIT-I:

Difference operator - Summation – Generating functions and approximate summation. (Chapter 2: Sections 2.1 to 2.3)

UNIT-II:

First order equations - General results for linear equations - Solving linear equations. (Chapter 3: Sections 3.1 to 3.3)

UNIT-III:

Equations with variable coefficients – The z - transform. (Chapter 3: Sections 3.5 to 3.7)

UNIT–IV:

Initial value problems for linear systems – Stability of linear systems. (Chapter 4: Sections 4.1, 4.2

UNIT-V:

Phase plane Analysis for Linear Systems, Fundamenta Matrices and Floquet Theory. (Chapter 4: Sections 4.3, 4.4)

Recommended Text

1. W.G. Kelley and A.C. Peterson, “Difference Equations”, 2nd Edition, Academic Press, New York, 2001.

Reference Books

1. R.P. Agarwal, “Difference Equations and Inequalities”, 2nd Edition, Marcel Dekker, New York, 2000.

2. S.N. Elaydi, “An Introduction to Difference Equations”, 3rd Edition, Springer, India, 2008.

3. R. E. Mickens, “Difference Equations”, 3rd Edition, CRC Press, 2015.

CO Number	CO Statement	Knowledge Level
CO1	Understand Logic and properties.	K1
CO2	Derived Normal forms and The theory of inference for the statement calculus.	K1&K2
CO3	Describe The predicate calculus and Inference theory of the predicate calculus.	K2& K3
CO4	To solve the initial value problem for linear systems.	K4&K5
CO5	To solve the fundamental matrices.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

Program: B.Sc. Mathematics				
Elective Course -II		**Course Code:** 23UMAME05	**Course Title:** Discrete Mathematics	
Semester V	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems. Gain knowledge about the concept of Mathematical logic and algebraic structures. Know about Boolean algebra and its application to Sequential Machines. Make them to use in practical applications related to computer science.

UNIT – I:

Mathematical logic - Statements and Notations - Connectives - Negation - Conjunction - Disjunction – Statement formulas and truth table - Conditional and Bi-conditional - Well formed formulas - Tautologies. Chapter 1(sections 1.1, 1.2.1 to 1.2.4, 1.2.6 to 1.2.8)

UNIT – II:

Normal forms - Disjunctive Normal forms - Conjunctive Normal forms - Principal Disjunctive Normal forms - Principal conjunctive Normal forms - Ordering and Uniqueness of normal forms - Validity using truth tables - Rules of inference. Chapter 1 (sections 1.3.1 to 1.3.5, 1.4.1, 1.4.2)

UNIT – III:

The Predicate calculus - Predicates - The Statement function, Variables and quantifiers - Predicate formulas – Free and bound variables - The Universe of discourse –

inference theory of the predicate calculus - Valid formulas and Equivalence - Some valid formulas over finite Universes - Special valid formulas involving quantifiers - Theory of inference for the Predicate calculus. Chapter 1 (sections 1.5.1 to 1.5.5)

UNIT – IV:

Relations and Ordering - Relations - Properties of Binary relations in a set - Partial ordering - Partially ordered set: Representation and Associated terminology - Functions: Definition and Introduction - Composition of functions - Inverse functions - Natural Numbers: Peano axioms and Mathematical induction. Chapter 2 (sections 2.3.1, 2.3.2, 2.3.8, 2.3.9, 2.4.1 to 2.4.3, 2.5.1)

UNIT – V:

Lattices as partially ordered sets: Definition and examples - Some properties of Lattices – Sub lattices, Direct product and Homomorphism – Boolean algebra: Definition and examples - Sub Algebra, Direct product and Homomorphism. Chapter 4 (sections 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.2.2)

Text Book

J.P. Trembly, R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, Tata McGraw Hill, 2001.

Reference Books

1. Dr. M.K. Sen and Dr. B.C. Charraborthy, Introduction to
Discrete Mathematics, Arunabha Sen Books & allied Pvt.
Ltd, 8/1, Chintamoni Das Lane, Kolkatta - 700 009.
2. Kenneth H.Rosen, Discrete Mathematics and Its Applications, Fourth Edition.

E–Learning Sources

1. https://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-042j-mathematics-for-computer-science-fall-2005
2. www.crectirupati.com>default>files
3. www.mafy.lut.fi>Lectures>Lecture2
4. Faculty.atu.edu>mfinan>main2

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand Logic and properties.	K1
CO2	Derived Normal forms and The theory of inference for the statement calculus.	K1&K2
CO3	Describe The predicate calculus and Inference theory of the predicate calculus.	K2& K3
CO4	Define and illustrate the Relations and ordering.	K4&K5
CO5	Describe Lattices as partially ordered sets.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs Mapping of COs with POs

	POs						PSOs		
	1	2	2	3	3	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	2	2	1	1	3	3	2
CLO5	3	2	2	2	1	1	3	3	2

<table>
<tr><td colspan="5">Program: B.Sc. Mathematics</td></tr>
<tr><td colspan="2">Elective Course –II</td><td colspan="2">Course Code:
23UMAME06</td><td>Course Title:
GRAPH THEORY WITH APPLICATIONS</td></tr>
<tr><td>Semester
VI</td><td>Hours/Week
5</td><td>Total Hours
75</td><td>Credits
3</td><td>Total Marks
100</td></tr>
</table>

- To introduce the concepts of Graphs.
- To provide a sound knowledge on Trees and Spanning Trees
- To gain knowledge about Matrices of Graphs and Digraphs

Unit I :

Introduction, Paths and Circuits:

Introduction- Finite and Infinite graphs-Applications of Graphs- Incidence and degree-Isolated vertex, Pendent vertex and Null graph-Isomorphism- Subgraphs -Walks, Paths and circuits-Connected Graphs-Disconnected Graphs and Components. (Chapter1: Sections 1.1 to 1.5 & Chapter2: Sections 2.1,2.2, 2.4&2.5)

Unit II:

Paths and Circuits:

Euler graphs- Operations on Graphs-More on Euler graphs-Hamiltonian paths and Circuits

Trees and Fundamental Circuits:

Trees-Some properties on Trees-Pendent vertices in a Tree-Distance and Canters in a Tree- Spanning Trees. (Chapter2: Sections 2.6 to 2.9 & Chapter3: Sections 3.1 to 3.4, 3.7)

Unit III:

Matrix Representation of Graphs:

Incidence Matrix- Submatrices of A(G)-Circuit Matrix-Fundamental Circuit Matrix and Rank of B- Path Matrix-Adjacency Matrix. (Chapter7: Sections 7.1 to 7.9)

Unit IV:

Colouring, Covering and Partitioning:

Chromatic Number-Chromatic Partitioning-Chromatic Polynomial- Matchings – Coverings. (Chapter8: Sections 8.1 to 8.5)

Unit V:

Directed Graphs:

Definition-Some types of Digraphs-Directed Paths and Connectedness- Euler Digraphs-Trees with Directed Edges. (Chapter9: Sections 9.1, 9.4 to 9.6)

Recommended Text:

1.Narsingh Deo. [Fifth Edition] ,Graph Theory with Applications to Engineering &Computer Science , Prentice Hall of India, New Delhi . 1974 .

Reference Books:

1.Frank Harary. Graph Theory , Narosa Publishing House, Pvt.Ltd., New Delhi. 2001.

2. Arumugam, S. and Ramachandran, S. Invitation to Graph Theory. Scitech Publications, Chennai.2001.

3. S.P.Rajagopalan and R.Sattanatthan,Graph Theory, Margham Publications, Chennai.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the concepts of Graph, Sub graph , Walks and Paths.	K1
CO2	Discuss about Eulerian graphs, Hamiltonian Paths and Trees.	K1&K2
CO3	Give Matrix Representations of Graphs	K2& K3
CO4	Know about Chromatic number and Chromatic Polynomial	K4&K5
CO5	Describe about digraph, Euler digraphs	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	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

SKILL ENHANCEMENT COURSE

<table>
<tr><th colspan="5">Program: B.Sc. Mathematics</th></tr>
<tr><td colspan="2">B.Sc. Mathematics
SKILL ENHANCEMENT COURSE
(Non Major Elective)</td><td colspan="1">Course Code: 23UMA1S01</td><td colspan="2">Course Title:
MATHEMATICS FOR COMPETITIVE EXAMINATION – I</td></tr>
<tr><td>Semester
I</td><td>Hours/Week
2</td><td>Total Hours
30</td><td>Credits
2</td><td>Total Marks
100</td></tr>
</table>

UNIT-I

Number System. Page No(3-50)

UNIT-II

H.C.F and L.C.M of numbers. Page No(51-68)

UNIT-III

Decimal Fractions. Page No(69-94)

UNIT-IV

Simplifications. Page No(95-113)

UNIT-V

Average. Page No(206-239)

TEXT BOOK:

1.R. S.Aggarwal, Quantitative Aptitude – For Competitive Examinations (Fully Solved) , S.Chand& Company Pvt.Ltd, Reprint 2017.

Reference Books:

1. Quantitative Aptitude ‘’by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To solve H.C.F & L.C.M of numbers and averages.	K1
CO2	Solve the problems based on Numbers and ages.	K2
CO3	Solve the problems based onPercentage - Profit & Loss.	K3& K4
CO4	Solve the problems based onTime & Work - Time & Distance.	K5
CO5	Solve the problems based onArea - Volume & Surface area.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

<table>
<tr><th colspan="5">Program: B.Sc. Mathematics</th></tr>
<tr><td colspan="2">B.Sc. Mathematics
SKILL ENHANCEMENT COURSE</td><td>Course Code: 23UMA2S02</td><td colspan="2">Course Title:
MATHEMATICS FOR COMPETITIVE EXAMINATION – II</td></tr>
<tr><td>Semester
II</td><td>Hours/Week
2</td><td>Total Hours
30</td><td>Credits
2</td><td>Total Marks
100</td></tr>
</table>

Objective of the Course:

- Understanding the concepts of chain rule.
- Applying the concept of time and distance.
- Analyzing the problem on trains with solved examples.

UNIT-I

Problems on Numbers. Page No(240-263)

UNIT-II

Problems on Ages. Page No(264-277)

UNIT-III

Surds and Indices. Page No(278-296)

UNIT-IV

Logarithms. Page No(297-307)

UNIT-V

Percentage. Page No(308-320)

TEXT BOOK:

R. S.Aggarwal, Quantitative Aptitude – For Competitive Examinations (Fully Solved) S.Chand& Company Pvt.Ltd, Reprint 2017.

Reference Books:

1. Quantitative Aptitude ‘’by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain in detail about Profit & Loss and Ratio & Proportion..	K1
CO2	Explain Partnership and Chain Rule.	K2
CO3	Explain Time & Work and Pipes & Cistern..	K3& K4
CO4	Explain Time & Distance and Problems on Trains.	K5
CO5	Explain Boats & Streams and Alligation or Mixture..	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

B.Sc. Mathematics SKILL ENHANCEMENT COURSE	**Course Code:** 23UMA3S04	**Course Title:** MATHEMATICS FOR COMPETITIVE EXAMINATION – III

Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	2	30	2	100

UNIT-I

Profit and Loss. Page No(374-425)

UNIT-II

Ratio and Proportion. Page No(426-475)

UNIT-III

Time and Work. Page No(526-561)

UNIT-IV

Time and Distance. Page No(562-599)

UNIT-V

Boats and Streams . Page No(600-611)

TEXT BOOK:

R. S.Aggarwal, Quantitative Aptitude – For Competitive Examinations (Fully Solved) , S.Chand& Company Pvt.Ltd, Reprint 2017.

Reference Books:

1. Quantitative Aptitude ‘’by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain in detail about Simple Interest and Compound Interest..	K1

CO2	Explain Logarithms and Area	K2
CO3	Explain Volume & Surface Areas and Races & Games of Skill.	K3& K4
CO4	Explain Calendar and Clocks.	K5
CO5	Explain Stocks & Shares.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

B.Sc. Mathematics SKILL ENHANCEMENT COURSE	Course Code: 23UMA4S06	Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION – IV

Semester	Hours/Week	Total Hours	Credits	Total Marks
IV	2	30	2	100

Remembering the Permutation and Combinations.

- **Understanding the concept of Banker's Discount.**
- **Analysing the concepts of Odd Man Out and Series.**

UNIT-I

Simple Interest. Page No(641-662)

UNIT-II

Compound Interest. Page No(663-687)

UNIT-III

True Discount. Page No(861-865)

UNIT-IV

Bankers Discount. Page No(866-869)

UNIT-V

Odd Man Out and Series. Page No(877-883)

TEXT BOOK:

R. S.Aggarwal, Quantitative Aptitude – For Competitive Examinations (Fully Solved) , S.Chand& Company Pvt.Ltd, Reprint 2017.

Reference Books:

1. Quantitative Aptitude ''by Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi (2005

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To solve H.C.F & L.C.M of numbers and averages.	K1

CO2	Solve the problems based on Numbers and ages.	K2
CO3	Solve the problems based onPercentage - Profit & Loss.	K3& K4
CO4	Solve the problems based onTime & Work - Time & Distance.	K5
CO5	Solve the problems based onArea - Volume & Surface area.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / **CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

B.Sc. Mathematics SKILL ENHANCEMENT COURSE	**Course Code:** 23UMA2S03	**Course Title:** COMPUTATIONAL MATHEMATICS

Semester	Hours/Week	Total Hours	Credits	Total Marks
II	2	30	2	100

- **Understand and use the structure of C++ programme, to solve different Numerical Methods.**

UNIT-I

Algebraic and Transcendental Equations: Bisection method- Method of false position-Method of successive approximation- Newton-Raphson's method-Secant Method-Graeff's root squaring method.

UNIT-II

System of Linear Algebraic Equations: Direct method- Iterative method-Eigen value problems.

UNIT-III

C++ Program for Bisection method-C++ Program for Method of false position- C++ Program for Method of successive approximation-C++ Program for Newton-Raphson's method.

UNIT-IV

C++ Program for Secant Method-C++ Program for Graeff's root squaring method-C++ Program for Gauss elimination method-C++ Program for Gauss Jordan method.

UNIT-V

C++ Program for Jacobian method-C++ Program for Gauss Seidal method-C++ Program for Largest eigen value by power method.

TEXT BOOK:

1.R.M. Somasundaram and R.M. Chandrasekaran, "Numerical Methods with C++ Programming", Prentice Hall India Pvt. Ltd., New Delhi, 2005.

Reference Book

1. Pallab Ghosh, "Numerical Methods with Computer Programs in C++", Prentice Hall India Pvt. Ltd., New Delhi, 2009.
2. T. Veerarajan and T. Ramachandran, "Numerical Methods with Programs in C", Second Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2006.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the roots of algebraic equations using different methods like, Newton-Raphson method, Secant Method etc.	K1
CO2	Solve system of algebraic equations using direct and iterative methods..	K2
CO3	To write C++ Program to compute roots of algebraic equations using Bisection method, Newton-Raphson method etc.	K3& K4
CO4	To write C++ Program to compute roots of algebraic equations using Secant method, Gauss Jordan method etc.	K5
CO5	To write C++ Program to solve the system of algebraic equations using the Jacobian method, Gauss Seidal method.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S

CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

<table>
<tr><th colspan="5">Program: B.Sc. Mathematics</th></tr>
<tr><td>B.Sc. Mathematics
SKILL ENHANCEMENT COURSE</td><td colspan="2">Course Code:
23UMASE04</td><td colspan="2">Course Title: Statistics with Excel Programming</td></tr>
<tr><td>Semester
III</td><td>Hours/Week
1</td><td>Total Hours
15</td><td>Credits
1</td><td>Total Marks
100</td></tr>
</table>

UNIT-I

Distribution of data- Characteristics of data- Frequency distribution- Procedure for Constructing a Frequency Distribution- Using Excel to Construct a Frequency Distribution- Relative FrequencyDistribution-Cumulative Frequency Distribution. (Chpater-2: Pages 58to 70)

UNIT-II

Histograms-Relative Frequency Histogram-Normal Distribution-Common Distribution Shapes-Skewness-Using XLSTAT for Histograms-Graphs-Using Excel to Construct a Scatterplot- Correlation Coefficient. (Chapter-2: Pages 70 to 81)

UNIT-III

Time-Series Graph-Dotplots-Using XLSTAT for Stemplots-Bar Graphs-Using Excel to Create Bar Graphs-Pareto Charts-Pie Charts-Using Excel to Create Pie Charts-Frequency Polygon-Using Excel to Create Frequency Polygons. (Chapter-2: Pages 81 to 98)

UNIT-IV

Descriptive statistics-Measures of Center-Mean-Using Excel to Calculate the Mean-Median-Using Excel to Find the Median. (Chapter-3: Pages 110 to 114)

UNIT-V

Mode-Using Excel to Find the Mode-Midrange-Using Excel to Calculate the Midrange-Weighted Mean-Using Excel for Descriptive Statistics. (Chapter-3: Pages 114 to 125)

TEXT BOOK:

1.Mario F. Triola,“Elementary Statistics Using Excel”,Fifth Edition,Pearson New International Edition, 2014. (Chapter 2 and 3).

Reference Book

1. E. Balagurusamy, “Computer Oriented Statistical and Numerical Methods”, Macmillan Publishers India Limited, 2000.
2. V. K. Rohatgi, A. M. E. Saleh, “An introduction to probability and statistics”, John Wiley & Sons, 2015.
3. B. Held, B. Moriarty&T. Richardson, “Microsoft Excel Functions andFormulas”, Stylus Publishing, LLC, 2019.
4. N. J. Salkind, “Excel statistics: A quick guide”, Sage Publications, 2015.
5. J. Schmuller, “Statistical analysis with Excel for dummies”, John wiley & sons, 2013.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To solve H.C.F & L.C.M of numbers and averages.	K1
CO2	Solve the problems based on Numbers and ages.	K2
CO3	Solve the problems based onPercentage - Profit & Loss.	K3& K4
CO4	Solve the problems based onTime & Work - Time & Distance.	K5
CO5	Solve the problems based onArea - Volume & Surface area.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

B.Sc. Mathematics SKILL ENHANCEMENT COURSE	**Course Code**23UMASE07	**Course Title: LaTeX-PRACTICAL**		
SemesterIV	**Hours/Week** 2	**Total Hours** 30	**Credits** 2	**Total Marks** 100

- **To enable the Students to Prepare Research Articles in LaTeX format.**

1. Creation of a Document with different Alignments(Left, Right, Center, Justify).
2. Typing a Letter for Appling a job.
3. Creation of Own Bio-Data.
4. Creating a Table Structure.
5. Typing a Mathematical Expression involving Differentiation, Integration and Trigonometry.
6. Typing a Mathematical Expression using all Expressions and Inequalities.
7. Creation of an Article using LaTeX.
8. Inserting Picture in a LaTeX.
9. Preparing a question paper in LaTeX Format.
10. Creation of Power Point Presentation in LaTeX.

TEXT BOOK:

David F Griffiths and Desmond J. Higham, Learning LaTex, SIAM(Society for Industrial and Applied Mathematics) Publishers, Phidelphia, 1996

Reference Book

1. Nambudiripad, K.B.M., 2014. LaTeX for beginners. Narosa Publishing House private limited, New Delhi.
2. Martin J. Erickson and Donald Bindner, A student's Guide to the Study, Practice and Tools of Modern Mathematics, CRC Press, Boca Raton, FL, 2011.
3. L. Lamport, LATEX: A Document Preparation System, User's Guide and Reference Manual, Addison-Wesley, Newyork,Second edition, 1994.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Make different Alignments in a document and an Application for a job	K1
CO2	Generate Bio-Data and Table Structures.	K2
CO3	Create Mathematical Statements using LaTeX.	K3& K4
CO4	Prepare Articles and Inserting Pictures.	K5
CO5	Prepare Question paper and PowerPoint presentation in LaTeX format.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S

CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

<table>
<tr><td colspan="5">Program: B.Sc. Mathematics</td></tr>
<tr><td colspan="2">Professional Competency Skill</td><td colspan="2">Course Code: 23UMAPC01</td><td>Course Title: Statistics with R Programming- Practical</td></tr>
<tr><td>Semester
VI</td><td>Hours/Week
2</td><td>Total Hours
30</td><td>Credits
2</td><td>Total Marks
100</td></tr>
</table>

Course Objectives

1. To learn the problems solving techniques for measures of central tendency.
2. To enable to students prepare themselves for binomial, normal and poisson distributions.

LIST OF EXPERIMENTS

1. Calculation of measures of central tendency
2. Calculation of measures of dispersion
3. Graphical display of data
4. Analyzing data using tables
5. Expectations of discrete and continuous random variable
6. Binomial, Normal and Poisson Distributions
7. One sample t-test
8. Independent sample t-test
9. Dependent sample t-test
10. One-way Between-Groups ANOVA
11. Unplanned and planned comparisons
12. Two-way Between-Groups ANOVA

13. Chi-square test of independence
14. Bi-variate correlation
15. Partial correlation
16. Rank Correlation
17. Linear regression

Reference Books

1. Mark Gardener, Beginning R – The Statistical Programming Language, Wiley Publications, 2015.
2. W. John Braun and Duncan J. Murdoch, A First Course in Statistical Programming withR, Cambridge University Press, 2007.

Allied UG Subjects

ELECTIVE/ALLIED MATHEMATICS

Program: B.Sc. Mathematics		
Allied Mathematics	**Course Code: 23UMA1A01**	**Course Title:** Allied Mathematics – I

B.Sc.PHY/CHE				
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	6	75	5	100

Course Objectives

1. To acquire knowledge about the rank of a matrix, characteristic roots and characteristic vectors.
2. To gain knowledge about the various concepts on matrices.
3. Promote problem solving ability in differential equations.

UNIT I: MATRICES

Definition of characteristics Equation of a matrix – characteristics roots of a matrix – Eigen values and the corresponding Eigen vectors of matrix – cayley Hamilton theorem (statement only) – Verification of Cayley Hamilton theorem – problems. (Chapter 5 , Pages: 5.50-5.73).

UNIT II: FINITE DIFFERENCES

Finite differences – Newton’s forward and backward formula for interpolation – Lagrange’s formula – Interpolation of missing values. (Chapter 7, Pages: 7.1-7.29).

UNIT III: RADIUS OF CURVATURE

Formula of radius of curvature in Cartesian coordinates-parametric coordinates and polar coordinates (no proof for formulae) – problems only. (Chapter 11Pages: 11.1-11.19 & 11.22-11.33).

UNIT IV: ORDINARY DIFFERENTIAL EQUATIONS

Ordinary Differential Equation – second order differential equation with consant co-efficient – Particular integrals of the form $e^{ax}v$, where v is of the form x , x^2 ’sinax ,cosax. (Chapter 23, Pages: 23.1-23.28).

UNIT V: PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Lagrange’s linear partial differential equations Pp+Qq=R -problems only. (Chapter 26, Pages;26.1-26.14 & 26.44-26.56).

Text Book

Dr. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai-17, Reprint 2012.

Reference Books

1. S.G. Venkatachalapathi**,** Allied Mathematics, Margham Publications, Chennai-17, Reprint 2011.
2. P.R.Vittal, V. Maline, Calculus, Margham Publications, Chennai-17, Reprint 2012.
3. P. Duraipandian, Dr. S. Udayabaskaran, Allied Maths, Volume –1, Muhil Publishers Chennai- 28, Reprint 1999.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge about the rank of a matrix, characteristic roots and characteristic vectors.	K1
CO2	Solve algebraic and transcendental equations by Numerical methods.	K2
CO3	Solve the problem of radius of curvature in Cartesian coordinates, parametric coordinates and polar coordinates	K3 & K4
CO4	recall the concepts of second order differential equations and acquire knowledge to find the particular integral for different types of functions.	K4 & K5
CO5	Analyse the different types of solutions for partial differential equations.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Creat

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S

CO3	M	S	M	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Mathematics		
Allied Mathematics B.Sc.PHY/CHE	**Course Code:** **23UMA2A02**	**Course Title:** Allied Mathematics – II

Semester	Hours/Week	Total Hours	Credits	Total Marks
II	6	75	5	100

Course Objectives

1. To acquire knowledge about the Integral calculus and Laplace transform.
2. Understand the method of doing problems using the above concepts.
3. Acquire knowledge in theory of equations
4. Acquire the knowledge in vector differentiation.

UNIT I: DEFINITE INTEGARAL

Definite integrals Simple properties of definite integrals – Bernoulli’s formula – Integration by parts-Simple problems-Reduction formula for $\int_0^{\frac{\pi}{2}} \sin^n x dx$, $\int_0^{\frac{\pi}{2}} \cos^n x dx$, $\int_0^{\infty} e^{-x} x^n dx$ -simple problems. (Chapter 15& 16 , Pages 15.54-15.75& 16.1-16.9).

UNIT II: THEORY OF EQUATION

Imaginary and irrational roots – Reciprocal equation – diminish the root of equations – Removal of terms – Descartes’ rule of signs. (Chapter 6, pages: 6.19-6.25, 6.30-6.37,6.49-6.60).

UNIT III: LAPLACE AND INVERSE LAPLACE TRANSFORMS

Laplace Transforms – Definition-laplace transform of standard functions – Elementary theorems – problems – Inverse Laplce Transforms – Standard formula – problems. (Chapter 27, Pages: 27.1-27.19, 27.23-27.38).

UNIT IV: VECTOR DIFFERENTIATION

Vector Differentiation – Limit of a vector function – Continuity and derivative of vector function – Gradient – Directional Derivative of Scalar Point Functions – Equation of Tangent Plane and Normal Line to a level surface – Problems only.

(Chapter 28, Pages: 1-20).

UNIT V: VECTOR DIFFERENTIATION (Continuation)

Vector Point Function: Divergence and Curl of a vector point function – Solenoidal and irrotational functions – vector identities – Laplacian operator

(Chapter 28, Page no. 22-33, 35-50).

Text Book

1. Dr. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai-17, Reprint 2012.

Reference Books

1. S.G. Venkatachalapathi**,** Allied Mathematics, Margham Publications, Chennai-17, Reprint 2011.
2. Vector Analysis, Dr. P.R. Vittal, Margham Publications, Chennai-17, Reprint 2006.
3. Vector Analysis, P. Duraipandian and Laxmi Duraipandian, Emerald Publishers, Reprint 2003.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Grasp the concept of multiple integrals and its evaluations.	K1
CO2	Understand the relation between the roots and coefficients, symmetric functions of the roots, reciprocal equation and solve the related problems.	K2
CO3	Learn the Laplace and Inverse Laplace transform of elementary functions and study its applications.	K3 & K4
CO4	To solve Vector Differentiation, Limit of a vector function, Continuity and derivative of vector function.	K5
CO5	Analyse the different types of Vector Point Function.	K5 & K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	M	S	S	S	S
CO3	M	S	M	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

<table>
<tr><th colspan="5">Allied Mathematics (I-B.Sc- Physics & Chemistry)</th></tr>
<tr><td colspan="2">Allied Mathematics
B.Sc.PHY/CHE</td><td>**Course code**
23UMA2AP01</td><td colspan="2">**Course title: Allied Mathematics Practical**</td></tr>
<tr><td>**Semester**
II</td><td>**Hours/Week**
2</td><td>**Total Hours**
30</td><td>**Credits**
2</td><td>**Total Marks**
100</td></tr>
</table>

COURSE OBJECTIVE

1. Acquire knowledge about Matrices and Cayley-Hamilton Theorem.
2. Acquire knowledge about Finite Difference Newtons Interpolation.
3. Understand the concepts of Partial Differential Equations.
4. Acquire knowledge about Integration.
5. Acquire knowledge about Theory of Equations.
6. Understand the concepts of Laplace Transforms and Inverse Laplace Transforms.
7. Understand the concepts of Vector Differentiation.

UNIT I: MATRICES:

1. Find Eigen Values and Eigen Vectors of the Matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

2. Find Eigen Values and Eigen Vectors of the Matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

3. Find Eigen Values and Eigen Vectors of the Matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 3 \\ 0 & 0 & 2 \end{bmatrix}$

4. Find the Characteristic equation of the matrix A=$\begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ and verify that its satisfied by A. Also find A^{-1}

5. Verify Cayley Hamilton theorem for matrix A=$\begin{bmatrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{bmatrix}$ and hence find A^{-1}

UNIT II FINITE DIFFERENCE & NEWTONS INTERPOLATION

1. Using Newtons Forward interpolation formula, and the given table values

x	1.1	1.3	1.5	1.7	1.9
y	0.21	0.69	1.25	1.89	2.61

Obtain the values of y when x=1.4

2. Using an appropriate formula for interpolation estimate the number of students who obtained marks between 40 and 45 from the following table.

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

3. The population of the certain town (as obtained from census data) is shown in the following data table.

Year	1921	1931	1941	1951	1961

Population (in thousand)	19.96	39.65	58.81	77.21	94.61

Estimate the population in the year 1963.

4. Using Newton’s interpolation formula find the number of factories earning less than RS.65,000 as profits from the following data.

Profits (RS.000)	30-40	40-50	50-60	60-70	70-80
No. of factories	34	43	56	39	29

5. Use Newton’s formula to find y when x=142, given.

X	140	150	160	170	180
Y	3.685	4.854	6.302	8.076	10.225

UNIT III: RADIUS OF CURVATURE

1. Find the radius of curvature at $x = y = \frac{3a}{2}$ to the curve $x^3 + y^3 = 3axy$.
2. Prove that the radius of curvature at the point $x = 3acos\theta - acos3\theta,\quad y = 3asin\theta - asin3\theta$ is $3asin\theta$.
3. Prove that the radius of curvature at the point $(acos^3\theta, asin^3\theta)$ on the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ is $3a\, sin\theta\, cos\theta$
4. Find the radius of curvature at the any point on the curve $r^n = a^n \cos n\theta$
5. Find the radius of curvature at the point $\left(\frac{a}{4}, \frac{a}{4}\right)$ at the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$

UNIT IV: SECOND ORDER DIFFERENTIAL EQUATIONS

1. Solve $(D^2 – 2D + 5)\, y = e^{2x} \sin x$
2. Solve $(D^2 + 3D + 2)\, y = e^{2x} + x^2 + \sin x$
3. Solve $(D^2 + 4)\, y = x \sin x$
4. Solve $(D^2 – 4D - 12)\, y = \sin x \sin 2x$
5. Solve $(D^2 – 3D + 2)\, y = xe^{3x} + \sin 2x$

UNIT V: PARTIAL DIFFERENTIAL EQUATIONS

1. Form the partial differential equation by eliminating the arbitrary function from

$$f(x + y + z\,,\;\; xyz) = 0$$

2. Form the partial differential equation by eliminating the arbitrary function from $z = f_1(y + 2x) + f_2(y - 3x)$.

3. Solve $(mz - ny)p + (nx - lz)q = ly - mx$.

4. Solve $(y - z)p + (z - x)q = x - y$.

5. Solve $(3z - 4y)p + (4x - 2z)q = 2y - 3x$.

UNIT VI: INTEGRATION

1. Evaluate $\int_0^{\pi} \frac{x \sin x}{1+cos^2 x}\, dx$
2. Evaluate $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x}\, dx$
3. Evaluate $\int_0^{1} \frac{\log(1+x)}{1+x^2}\, dx$
4. Reduction formula for $\int \sin^n x \, dx$
5. Reduction formula for $\int \cos^n x \, dx$

UNIT VII: THEORY OF EQUATIONS

1. Given that $-2 + \sqrt{-7}$ is a root of the equation $x^4 + 2x^2 - 16x + 77 = 0$ Solve it completely.
2. Solve the equation $x^4 - 5x^3 + 4x^2 + 8x - 8 = 0$ given that $1 - \sqrt{5}$ is a root.
3. Solve that equation $4x^4 - 20x^3 + 33x^2 - 20x + 4 = 0$
4. Solve $6x^5 + 11x^4 - 33x^3 - 33x^2 + 11x + 6 = 0$
5. Find the equation whose roots are the roots of the equation $x^4 - x^3 - 10x^2 + 4x + 24 = 0$ increased by 2 and hence solve the equation.

UNIT VIII: LAPLACE TRANSFORMS and INVERSE LAPLACE TRANSFORMS

1. Find $L\left[\frac{cos3t - cos2t}{t}\right]$
2. Find $L\left[\frac{e^{3t} - e^{-2t}}{t}\right]$
3. Find $L^{-1}\left[\frac{7s-1}{(s+1)(s+2)(s+3)}\right]$
4. Find $L^{-1}\left[\frac{s^2}{(s^2+4)(s^2+9)}\right]$
5. Find $L^{-1}\left[log\left(\frac{s^2+9}{s^2+1}\right)\right]$

UNIT IX: VECTOR DIFFERENTIATION

1. If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = |\vec{r}|$ prove that i) $\nabla r = \frac{1}{r}\vec{r}$ ii) $\nabla r^n = nr^{n-2}\vec{r}$
2. Find the directional derivative of $xyz - xy^2z^3$ at the point $(1,2,-1)$ in the direction of the vector $\vec{i} - \vec{j} - 3\vec{k}$.
3. Find the angle between the normal to the surface $xy - z^2 = 0$ at the point $(1,4,-2)$ and $(-3,-3,3)$.
4. Show that the surface $5x^2 - 2y - 9x = 0$ and $4x^2y + z^3 - 4 = 0$ are orthogonal at $(1,-1,\ 2)$.
5. Find the equation of Tangent plane and Normal line to the surface $xyz = 4$ at $(1,2,2)$

UNIT X: IRROTATIONAL and SOLENOIDAL

1. Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)\vec{i} + (3xz + 2xy)\vec{j} + (3xy - 2xz + 2z)\vec{k}$ is irrotational and solenoidal.
2. A field $\vec{F}$ is of the form $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$. show that $\vec{F}$ is conservative field and find a function ϕ such that $\vec{F} = \nabla\phi$.
3. If $\vec{v} = \vec{w} \times \vec{r}$ prove that $\vec{w} = \frac{1}{2} curl\vec{v}$ when $\vec{w}$ is a constant vector and $\vec{r}$ is the position vector of a point.
4. Prove that $\nabla[\nabla r^n] = n(n+1)r^{n-2}$.
5. Show that $\nabla^2 f(r) = \frac{d^2f}{dr^2} + \frac{2}{r}\frac{df}{dr}$.

TEXT BOOK:

1. Dr.P.R .Vittal ,Allied Mathematics, Margham publication, Chennai-17, Reprint 2012

REFERENCE BOOK:

1. S.G.Venkatachalapathi, Allied Mathematics, Margham publication, Chennai-17, Reprint 2011.

Program: B.Sc. Mathematics		
Allied Mathematics B.Sc.CS/IT/BCA/AI&DS	**Course Code:** **23UMA1EG01**	**Course Title:** Discrete Mathematics – I

Semester	Hours/Week	Total Hours	Credits	Total Marks
I	6	75	5	100

Course Objectives

- Mathematical Logic
- Truth Table
- Relations and Ordering

UNIT-I:

Mathematical Logic: Statement and Notation - Connectives –Negation – Conjunction – Disjunction-Statement Formulas and Truth Tables – Conditional and Biconditional – Well-formed Formulas – Tautologies Chapter: 1 (Section: 1.1, 1.2(1.2.1 to 1.2.8)

UNIT-II:

Normal Forms: Disjunctive Normal Forms – Conjunctive Normal Forms –Principal Disjunctive Normal Forms –Principal Conjunctive Normal Forms –Ordering and Uniqueness of Normal Forms- The theory of inference for the statement calculus: Validity Using Truth Tables - Rules of Inference – Consistency of Premises and Indirect Method of Proof. Chapter-1 (section: 1.3, 1.3.1 to 1.3.5 & 1.4, 1.4.1 to 1.4.3)

UNIT-III:

The Predicate Calculus: Predicates – The Statement Function, Variables, and Quantifiers – Predicate Formulas – Free and Bound Variables – The Universe of Discourse.

Inference theory of the predicate calculus: Valid Formulas and Equivalences – Some Valid Formulas Over Finite Universes – Special Valid Formulas Involving Quantifiers – Theory of Inference for the Predicate Calculus – Formulas Involving More Than One Quantifiers. Chapter-1 (section: 1.5, 1.5.1 to 1.5.5 &1.6.1 to1.6.5)

UNIT – IV:

Set Theory: Notation – Inclusion and Equality of Sets – The Power Set – Some Operations on Sets –Venn Diagrams – Some Basic Set Identities – The Principle of Specification – Ordered Pairs and n-tuples – Cartesian Products.

Chapter-2(section: 2.1.1 to 2.1.9)

UNIT-V:

Relation and ordering: Relations – Properties of Binary Relations in a Set – Relation Matrix and the Graph of a Relation – Partition and Covering of a Set – Functions: Definition and Introduction – Composition of Function – Inverse Function – Binary and n-ary Operations – Characteristic Function of a Set – Hashing Functions-Peano Axioms and Mathematical Introduction – Cardinality**.**

Chapter- 2 (section: 2.3.1 to 2.3.4 & 2.4.1 to 2.5.2)

Text Book

J.P. Trembly, R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, Tata McGraw Hill, 2001.

Reference Books

1. Discrete Mathematics – Dr.S.P.Rajagopalan and Dr.R.Sattanathan
2. Discrete Mathematics – Dr.G.Balaji
3. Discrete Mathematics and its applications – Kenneth.H.Rosen.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Mathematical Logics and few examples.	K1
CO2	Define Normal Forms and The theory of inference for the statement calculus.	K2
CO3	Describe The Predicate Calculus and Inference theory of the predicate calculus	K3 & K4
CO4	Define Some Basic Set Identities, and Cartesian products	K5
CO5	Describe Relation and ordering and Functions	K5 & K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5

CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	2	3

Program: B.Sc. Mathematics				
Allied Mathematics B.Sc.CS/IT/BCA/AI&DS	**Course Code:** **23UMA2EG02**	**Course Title:** Discrete Mathematics – II		
Semester I	**Hours/Week** 6	**Total Hours** 75	**Credits** 2	**Total Marks** 100

Course Objectives

To gain knowledge about the concept of Mathematical logic and algebraic structures. Know about Boolean algebra and its application to Sequential Machines. Make them to use in practical applications related to computer science.

UNIT-I:

Algebraic Systems: Examples and General Properties-Definition and Examples-Some Simple Algebraic Systems and General Properties.Semigroups and Monoids: Definitions and Examples- Homomorphism of Semigroups and Monoids-Sub semigroups and Sub monoidsGrammars and languages:Discuss of Grammars-Formal definition of a Language-Notion of Syntax Analysis (Chapter-3: Sections 3.1 to 3.3)

UNIT-II:

Groups: Definitions and Examples-Subgroups and homomorphisms- Cosets and Language’s Theorem-Normal Subgroups-Algebraic systems with Two Binary operations-The application of the residue arithmetic to computers: Introduction to number system-residue arithmetic. (Chapter 3: Sections 3.5(3.5.1 - 3.6.2)

UNIT-III:

Latex and Boolean algebra:Lattices as partially ordered sets-definition and examples-some properties of lattices-lattices as algebraic system-sublattices, Direct product, and homomorphism-some special lattices -Boolean algebra- definition and examples-subalgebra, direct product, and homomorphism. (Chapter 4: Sections 4.1.1 to 4.2.2)

UNIT –IV: UNIT – IV:

Boolean function-Boolean forms and free Boolean algebras-values of Boolean expressions and Boolean functions- **Representation and minimization of Boolean functions:** representation of Boolean functions-minimization of Boolean functions (Chapter 4: Sections 4.3.1 to 4.4.2)

UNIT-V: Graph theory: Basic concepts of graph theory-basic definitions-paths, reachability and connectedness-matrix representation of graphs-trees-storage representation and manipulation of graphs-Trees: their representation and operations-List: structures and graphs (Chapter 5: Sections 5.1.1 to 5.2.2)

Text Book

1.J.P. Trembly, R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, Tata McGraw Hill, 2001.

Reference Books

1. Discrete Mathematics – Dr.S.P.Rajagopalan and Dr.R.Sattanathan
2. Discrete Mathematics – Dr.G.Balaji
3. Discrete Mathematics and its applications – Kenneth.H.Rosen.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Algebraic system - definitions and example	K1
CO2	Define Groups and The application of the residue arithmetic to computers	K2
CO3	Define Latex and Boolean algebra and problems	K3 & K4
CO4	Define Boolean functions and examples	K5
CO5	Define graph theory and some basic definitions	K5 & K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	3	2	3
CO5	2	3	3	3	3