V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Reaccredited with 'A++' Grade (4th Cycle) by NAAC
VIRUDHUNAGAR
Quality Education with Wisdom and Values

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS
(with effect from Academic Year 2025 - 2026)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 13 UG Programmes (SF), 13 PG Programmes and 6 Ph.D. Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the University Grants Commission (UGC) &Tamil Nadu State Council for Higher Education (TANSCHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

The Departments of Commerce, English, History, Mathematics, Biochemistry and Tamil upgraded as Research Centres offer Ph.D. Programmes as per the norms and regulations of Madurai Kamaraj University, Madurai and do not come under the purview of CBCS.

A. CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose Courses from the prescribed Courses. The CBCS is followed as per the guidelines formulated by the UGC. The performance of students is evaluated based on the uniform grading system. Computation of the Cumulative Grade Point Average (CGPA) is made to ensure uniformity in evaluation system.

List of Programmes in which CBCS/Elective Course System is implemented

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UG PROGRAMMES

Arts & Humanities	:	History (E.M. & T.M.), English, Tamil
Physical & Life Sciences	:	Mathematics, Zoology, Chemistry, Physics, Biochemistry, Home Science - Nutrition and Dietetics, Costume Design and Fashion, Microbiology, Biotechnology, Computer Science, Information Technology, Data Science, Computer Applications and Computer Applications - Graphic Design
Commerce & Management	:	Commerce, Commerce (Computer Applications), Commerce (Professional Accounting), Business Administration

PG PROGRAMMES

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Physics, Chemistry, Biochemistry, Home Science - Nutrition and Dietetics, Biotechnology, Computer Science and Computer Applications (MCA) *
Commerce & Management	:	Commerce, Business Administration (MBA) *

* AICTE approved Programmes

OUTLINE OF CHOICE BASED CREDIT SYSTEM – UG

1. Core Courses
2. Elective Courses
    - Generic Elective Courses
    - Discipline Specific Elective Courses (DSEC)
    - Non Major Elective Courses (NMEC)
3. Skill Enhancement Courses (SEC)
4. Environmental Studies (EVS)
5. Value Education
6. Self Study Courses (Online)
7. Extra Credit Courses (Self Study Courses) (Optional)

List of Non Major Elective Courses (NME)
(2023-2024 onwards)

UG PROGRAMMES

Name of the Course	Course Code	Semester	Department
Introduction to Tourism	23UHIN11	I	History(EM)
Indian Constitution	23UHIN21	II	History(EM)
சுற்றுலா ஓர் அறிமுகம்	23UHIN11	I	History (TM)
இந்திய அரசியலமைப்பு	23UHIN21	II	History(TM)
Popular Literature and Culture	23UENN11	I	English
English for Professions	23UENN21	II	
பேச்சுக்கலைத்திறன்	23UTAN11	I	Tamil
பயன்முறைத் தமிழ்	23UTAN21	II	
Practical Banking Basic Accounting Principles	23UCON11 23UCON22	I II	Commerce (Aided)
Financial Literacy-I Financial Literacy -II	23UCON12 23UCON21	I II	Commerce (SF)
Self-Employment and Startup Business Fundamentals of Marketing	23UCCN11 23UCCN21	I II	Commerce CA (SF)

Women Protection Laws	23UCPN11	I	Commerce (Professional Accounting)
Basic Labour Laws	23UCPN21	II	
Basics of Event Management	23UBAN11	I	Business Administration
Business Management	23UBAN21	II	
Quantitative Aptitude I	23UMTN11	I	Mathematics
Quantitative Aptitude II	23UMTN21	II	
Physics for Everyday life -I	23UPHN11	I	Physics
Physics for Everyday life -II	23UPHN21	II	
Food Chemistry	23UCHN11	I	Chemistry
Drugs and Natural Products	23UCHN21	II	
Ornamental fish farming and Management	23UZYN11	I	Zoology
Biocomposting for Entrepreneurship	23UZYN21	II	
Foundations of Baking and Confectionery	23UHSN11	I	Home Science – Nutrition and Dietetics
Basic Nutrition and Dietetics	23UHSN21	II	
Nutrition and Health	23UBCN11	I	Biochemistry
Life Style Diseases	23UBCN21	II	
Social and Preventive Medicine	23UMBN11	I	Microbiology
Nutrition & Health Hygiene	23UMBN21	II	
Herbal Medicine	23UBON11	I	Biotechnology
Organic farming and Health Management	23UBON21	II	
Basics of Fashion	23UCFN11	I	Costume Design And Fashion
Interior Designing	23UCFN21	II	
Office Automation	23UCSN11	I	Computer Science
Introduction to Internet and HTML 5	23UCSN21	II	
Office Automation	23UITN11	I	Information Technology
Introduction to HTML	23UITN21	II	
Introduction to HTML	23UCAN11	I	Computer Applications
Fundamentals of Computers	23UCAN21	II	
Introduction to HTML	23UGDN11	I	Computer Applications - Graphic Design
Fundamentals of Computers	23UGDN21	II	
Organic Farming	23UBYN11	I	Botany
Nursery and Landscaping	23UBYN12		
Mushroom Cultivation	23UBYN21	II	
Medicinal Botany	23UBYN22		
Cadet Corps for Career Development I	23UNCN11	I	National Cadet Corps
Cadet Corps for Career Development II	23UNCN21	II	

B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

The core philosophy of Outcome Based Education rests in employing a student - centric learning approach to measure the performance of students, based on a set of pre-determined outcomes. The significant advantage of OBE is that it enables a revamp of the curriculum based on the learning outcomes, upgrade of academic resources, quality enhancement in research and integration of technology in the teaching–learning process. It also helps in bringing clarity among students as to what

is expected of them after completion of the Programme in general and the Course in particular. The OBE directs the teachers to channelise their teaching methodologies and evaluation strategies to attain the Programme Educational Objectives (PEOs) and fulfill the Vision and Mission of the Institution.

Vision of the Institution

The founding vision of the Institution is to impart Quality Education to the rural womenfolk and to empower them with knowledge and leadership quality.

Mission of the Institution

The mission of the Institution is to impart liberal education committed to quality and excellence. Its quest is to mould learners into globally competent individuals instilling in them life-oriented skills, personal integrity, leadership qualities and service mindedness.

B.1 Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes

It is imperative for the institution to set the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs), consistent with its Vision and Mission statements. The PEOs and the POs should be driven by the mission of the institution and should provide distinctive paths to achieve the stated goals. The PEOs for each Programme have to fulfill the Vision and Mission of the Department offering the Programme.

Vision

To impart intensive knowledge and skills to rural students through quality education and to provide an environment where students become competent users of Mathematics in other disciplines.

Mission

To empower the students with profound knowledge in Mathematics, logical reasoning and analytical skills, to induce their passion for research and lifelong learning with a focus on moral values and social ethics.

B.1.1 Programme Educational Objectives (PEOs)

PEOs are broad statements that describe the career and professional achievements that the programme is preparing the graduates to achieve within the first few years after graduation. PEOs are framed for each programme and should be consistent with the mission of the Institution.

Programme Educational Objectives (PEOs) of B.Sc.Mathematics Programme

The students will be able to

- become successful teachers in schools, Bank officers, government officials, Statisticians and IT professionals.
- apply mathematical skills in analyzing and solving problems in real life situations.
- upgrade themselves by pursuing higher education and engaging in social work to boost their morality.

Key Components of the Mission Statement	PEO1	PEO2	PEO3
chisel the creative and critical faculties through in-depth study of English literary texts	✓	✓	-
instill a fervour for research endeavours	✓	-	-
strengthen their linguistic competency for employability	✓	✓	✓
better living	-	-	✓

B.1.2 Programme Outcomes (POs)

POs shall be based on Graduate Attributes (GAs) of the programme. The GAs are the attributes expected of a graduate from a programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge, Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co-operation/ Team Work, Scientific Reasoning, Reflective Thinking, Information/ Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/ Reasoning, Leadership Qualities and Lifelong Learning.

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

1. apply effectively the acquired knowledge and skill in the field of Arts, Physical Science, Life Science, Computer Science, Commerce and Management for higher studies and employment. (*Disciplinary Knowledge*)
2. articulate innovative thoughts and ideas proficiently in both in spoken and written forms. (*Communication Skills)*
3. identify, formulate and solve problems in real life situations scientifically / systematically by adapting updated skills in using modern tools and techniques. (*Scientific Reasoning and Problem Solving)*

4. critically analyse, synthesize and evaluate data, theories and ideas to provide valid suggestions through assignments, case studies, Internship and projects for the fullfillment of the local, national and global developmental needs. (*Critical Thinking and Analytical Reasoning)*
5. use ICT in a variety of self-directed lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning)*
6. self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence)*
7. uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness)*

B.1.3 Programme Specific Outcomes (PSOs)

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each UG Programme**.** Programme Specific Outcomes denote what the students would be able to do at the time of graduation. They are Programme-specific and it is mandatory that each PO should be mapped to the respective PSO.

On completion of B.Sc. Mathematics Programme, the students will be able to

PO1-*Disciplinary Knowledge*

PSO1.a: apply the strong knowledge acquired in core and related areas of Mathematics and its applications to continue higher studies, research activities or for employment.

PSO 1.b: apply the concrete subject knowledge and skill obtained in mathematics and carrier oriented courses to appear for competitive examinations.

PO2–*Communication Skills*

PSO2: communicate efficaciously on complex mathematical concepts, theorems and models with mathematics community and with society at a large.

PO3–*Scientific Reasoning and Problem Solving*

PSO 3.a: implement logical reasoning and analytical skills in mathematics as foundation for advanced cases in other disciplines.

PSO3.b: formulate real life problems into mathematical model and apply mathematical techniques to find solutions to the problems.

PO4–*Critical Thinking and Analytical Reasoning*

PSO 4.a: consider the social, cultural, economic and environmental constraints, apply the mathematical knowledge and skills to arrive at optimal solutions**.**

PSO 4.b: analyse mathematical data using principles of mathematics, interpret the results and provide valid conclusions applicable to various sectors of the nation.

PO5–*Digital Literacy, Self-directed and Lifelong Learning*

PSO5: make use of e-resources and strive for self- directed lifelong learning in their field of interest to face career challenges.

PO6–*Co-operation / Team Work and Multicultural Competence*

PSO6: work effectively as a member or leader of a diverse team in multidisciplinary environment and become entrepreneur and bring multicultural richness in Mathematics.

PO7–*Moral and Ethical Awareness*

PSO7 practice the code of ethics of mathematics community in their career.

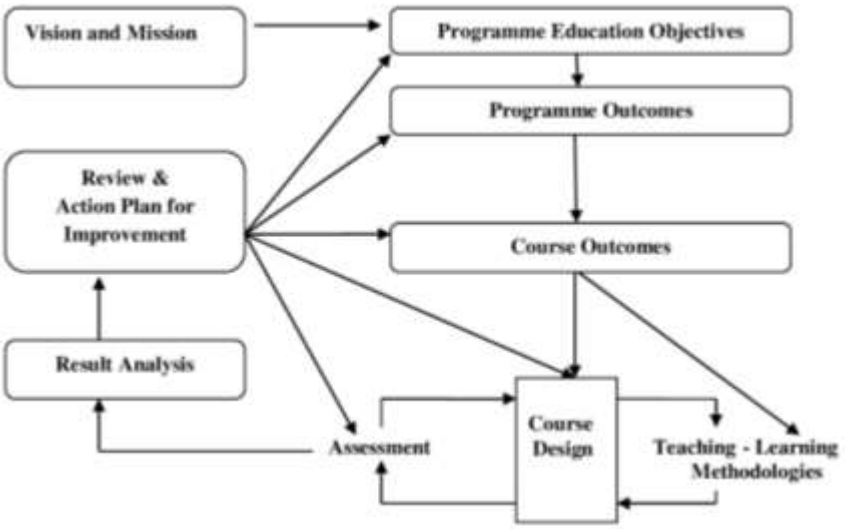
PO-PEO Mapping Matrix

Attainment of PEOs can be measured by a PO-PEO matrix. PEOs should evolve through constant feedback from alumnae, students, industry, management, *etc*. It is mandatory that each PEO should be mapped to at least one of the POs

PEOs / POs/PSOs	PEO1	PEO2	PEO3
PO1/PSO1.a	-	✓	✓
PO1/PSO1.b	✓	✓	✓
PO2/PSO2.a	✓	✓	-
PO2/PSO2.b	✓	✓	-
PO3/PSO3	-	✓	✓
PO4/PSO4.a	-	✓	✓
PO4/PSO4.b	✓	✓	-
PO5/PSO5	✓	✓	-
PO6/PSO6	-	✓	✓
PO7/PSO7	-	-	✓

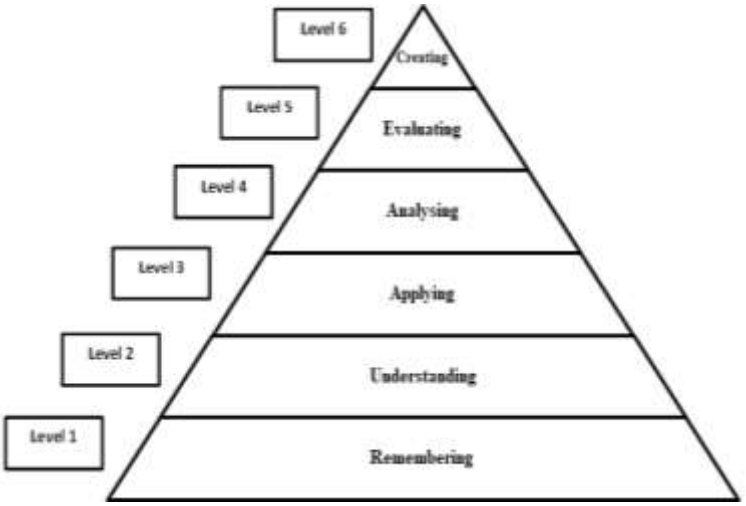
B.1.4 Course Outcomes (COs)

Course Outcomes are narrow statements restricted to the Course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after learning of Course contents. COs are measurable, attainable and manageable in number. COs contribute to attain POs in such a way that each CO addresses at least one of the POs and also each PO is reasonably addressed by adequate number of COs.



It is important to determine the methods of assessment. A comprehensive assessment strategy may be outlined using the revised Bloom's Taxonomy levels.

BLOOM'S TAXONOMY



CO – PO Mapping of Courses

After framing the CO statements, the COs framed for each Course is mapped with POs based on the relationship that exists between them. The COs which are not related to any of the POs is indicated with (-), signifying Nil. Measurement Mapping is based on Four Points Scale [High (H), Medium (M),

Low (L) and Nil (-)]. For calculating weighted percentage of contribution of each Course in the attainment of the respective POs, the weights assigned for H, M and L are 3, 2 and 1 respectively.

CO-PO/PSO Mapping Table (Course Articulation Matrix)

PO/PSOs / COs	PO1/ PSO1	PO2/ PSO2	PO3/ PSO3	PO4/ PSO4	PO5/ PSO5	PO6/ PSO6	PO7/ PSO7
CO1							
CO2							
CO3							
CO4							
CO5							

ELIGIBILITY FOR ADMISSION

The candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Tamil Nadu or any other equivalent examination accepted by the Academic Council with Mathematics as one of the subjects in Higher Secondary Course.

DURATION OF THE PROGRAMME

The candidates shall undergo the prescribed Programme of study for a period of three academic years (six semesters).

MEDIUM OF INSTRUCTION

English

COURSES OFFERED

Part I	:	Tamil/Hindi Course
Part II	:	English
Part III	:	Core Courses
		Elective Courses • Generic Elective Courses • Discipline Specific Elective Courses
		Self Study Course - online
Part IV	:	Skill Enhancement Courses (SEC)
		Elective Course (NMEC)
		Environmental Studies Value Education
		Field Project/Internship
		Self Study Course - online
Part V	:	National Service Scheme/ Physical Education/ Youth Red Cross Society/ Red Ribbon Club/ Science Forum/ Eco Club/ Library and Information Science/ Consumer Club/ Health and Fitness Club/ National Cadet Corps/ Rotaract Club

B.2 EVALUATION SCHEME

B.2.1.PART II

Components	Internal Assessment Marks	Summative Examination Marks	Total Marks
Theory	15	60	100
Practical	5	15	
Assignment	5	-	

Three Periodic Tests - Average of the best two will be considered

B.2.2.Part I & Part III – Core Courses, Elective Courses (Generic, DSEC)

Components	Internal Assessment Marks	External Examination Marks	Total Marks
Theory	25	75	**100**

INTERNAL ASSESSMENT
Distribution of Marks
Theory

Mode of Evaluation			Marks
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern Periodic for Tests **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 4	Multiple Choice	4	4	1	4
B	5 - 7	Internal Choice - Either… or Type	3	3	7	21
C	8 - 9	Internal Choice - Either… or Type	2	2	10	20
	Total					**45***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Question Pattern **Duration: 3 Hours**

Section	Q. No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 10	Multiple Choice	10	10	1	10
B	11 - 15	Internal Choice – Either ….or Type	5	5	7	35
C	16 - 18	Internal Choice – Either ……or Type	3	3	10	30
	Total					**75**

PROJECT

Assessment by Internal Examiner Only

Internal Assessment

Distribution of Marks

Mode of Evaluation	:	Marks
Project work and Report	:	60
Presentation and Viva –Voce	:	40
Total	:	100

B.2.3 PART IV - Skill Enhancement Courses, Non Major Elective Courses and Foundation Course

B.2.3.1 FOUNDATATION COURSE

INTERNAL ASSESSMENT
Distribution of Marks
Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K2 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15
B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Mode of Evaluation		Marks
Summative Examination	:	50
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Total	**:**	**75**

Question Pattern **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.3.2 Skill Enhancement Course - Entrepreneurial skills

INTERNAL ASSESSMENT ONLY

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	15
Assignment	:	5
Quiz	:	5
Model Examinations	:	60
Online Quiz(Multiple Choice Questions - K2 Level)	:	15
Total	**:**	**100**

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30**

*The total marks obtained in the Periodic Test will be calculated for 15 marks

Two Periodic Tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Two Quiz Tests - Better of the two will be considered

Question Pattern for Model Examination **Duration: 2 Hours**

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q. No.(1-5)	Internal Choice – Either Or Type	5	5	6	30
B Q. No.(6- 8)	Internal Choice – Either Or Type	3	3	10	30
Total					**60**

B.2.3.3 Skill Enhancement Courses/ Non Major Elective Courses

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K2 Level	:	5
Total		**:**	**25**

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

Mode of Evaluation		Marks
Practical Test*	:	30
Record & Performance	:	10
Total	**:**	**40**

*Average of the two Practical Tests will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15
B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

*The total marks obtained in the Periodic Test will be calculated for 15 marks

SUMMATIVE EXAMINATION

Mode of Evaluation		Marks
Summative Examination	:	50
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Total	**:**	**75**

Question Pattern **Duration: 2 Hours**

Section	Q.No.	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.4 PART IV- ENVIRONMENTAL STUDIES / VALUE EDUCATION

INTERNAL ASSESSMENT ONLY

Evaluation Pattern

Mode of Evaluation		**Marks**
Periodic Test	:	15
Assignment - K3 Level	:	10
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Poster Presentation - K3 Level		10
Report - K3 Level		10
Model Examination	:	30
Total	**:**	**100**

Three Assignment - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30***

Two Periodic tests - Better of the two will be considered

The total marks obtained in the Periodic test will be calculated for 15 marks

Question Pattern for Model Examination **Duration: 2 ½ Hours**

Section	**Q.No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 8	Internal Choice – Either… or Type	3	3	10	30
	Total					**60***

*The total marks obtained in the Model Examination will be calculated for 30 marks

B. 2. 5 PART IV- Internship / Industrial Training

- Internship / Industrial Training is mandatory for all the Students
- **Internship:** Students have to involve in a designated activity, working in an organization under the guidance of an identified mentor for a period of 15 days.
- **Industrial Training:** Student has to undertake in-plant training in industries individually or in group for a period of 15 days.
- Internship / Industrial Training must be done during the fourth semester holidays
- **Internal Assessment only.**

Mode of Evaluation		Marks
Onsite Learning/Survey	:	50
Report	:	25
Viva-Voce	:	25
Total		**100**

B.2.6 SELF STUDY COURSE

B.2.6 .1 PART III - Discipline Specific Quiz – Online

- Assessment by Internal Examiner only
- Question Bank is prepared by the Faculty Members of the Departments for all the Core and Elective Courses offered in all the Semesters.
- No. of Questions to be taken 700.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in VI Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
	:	**100**

Two Periodic Tests - Better of the two will be considered

B.2.6 .2 PART IV - Practice for Competitive Examinations – Online

Assessment by Internal Examiner only

- Question Bank prepared by the Faculty Members of the respective Departments will be followed.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in V Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Subject wise Allotment of Marks

Subject		Marks
Tamil	:	10
English	:	10
History	:	10
Mathematics	:	10
Current affairs	:	10
Commerce, Law & Economics	:	10
Physical Sciences	:	10
Life Sciences	:	15
Computer Science	:	5
Food and Nutrition	:	5
Sports and Games	:	5
Total	**:**	**100**

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25
Model Examination	:	75
Total	**:**	**100**

Two Periodic Tests - Better of the two will be considered

B.2.7. Part V – Extension Activities

INTERNAL ASSESSMENT ONLY

Distribution of Marks

Mode of Evaluation		Marks
Attendance	:	5
Performance	:	10
Report/Assignment/Project/Camp/Practical	:	10
Total	**:**	**25***

*The marks obtained will be calculated for 100 marks

B.2.8 EXTRA CREDIT COURSES (OPTIONAL)

2.8.1 Extra Credit Course offered by the Department.

Assessment by Internal Examiner Only (To be conducted along with the III Periodic Test)

Distribution of Marks

Mode of Evaluation		Marks
Quiz (Multiple Choice Questions)	:	25
Model Examination	:	75
Total	**:**	**100**

Question Pattern for Model Examination

Section	Types of Question	No. of Questions	No. of Questions to be answered	Marks for each Question	Total Marks
A Q.No.(1-5)	Internal Choice-Either or Type	5	5	7	35
B Q.No.(6-9)	Internal Choice-Either or Type	4	4	10	40
				Total	**75**

2.8.2 Extra credit Course offered by MOOC (Massive Open Online Course)

- The Courses shall be completed within the first V Semesters of the Programme.
- The allotment of credits is as follows **(Maximum of 10 credits)**

4weeks Course - 1 credit

8 weeks Course - 2 credits

12 weeks Course - 3 credits

ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study, lab work, *etc.*, and a minimum Pass marks in all the Courses.
  - No Pass minimum for Internal Assessment for all the Courses.
  - Pass minimum for External Examination is 27 marks out of 75 marks for Core Courses, Elective Courses (Generic Elective, DSEC Courses)
  - Pass minimum for External Examination is 18 marks out of 50 marks for Skill Enhancement Courses and Non Major Elective Courses (NMEC).
  - The aggregate minimum pass percentage is 40.
  - Pass minimum for External Practical Examination is 21 marks out of 60 marks.

- **Attendance**

a) The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.

b) The students who have only 60-75 days (66% - 84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.

c) The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.

d) The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.

- For Part V in UG Programmes, the students require 75 % of attendance to get a credit.
- For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

B.3 ASSESSMENT MANAGEMENT PLAN

An Assessment Management Plan that details the assessment strategy both at the Programme and the Course levels is prepared. The continuous assessment is implemented using an assessment rubric to interpret and grade students.

B.3.1 Assessment Process for CO Attainment

Assessment is one or more processes carried out by the institution that identify, collect and prepare data to evaluate the achievement of Course Outcomes and Programme Outcomes. Course Outcome is evaluated based on the performance of students in the Continuous Internal Assessments and in End Semester Examination of a Course. Target levels of attainment shall be fixed by the Course teacher and Heads of the respective departments.

Direct Assessment (Rubric based) - Conventional assessment tools such as Term Test, Assignment, Quiz and End Semester Summative Examination are used.

Indirect Assessment – Done through Course Exit Survey.

CO Assessment Rubrics

For the evaluation and assessment of COs and POs, rubrics are used. Internal assessment contributes 40% and End Semester assessment contributes 60% to the total attainment of a CO for the theory Courses. For the practical Courses, internal assessment contributes 50% and Semester assessment contributes 50% to the total attainment of a CO. Once the Course Outcome is measured, the PO can be measured using a CO-PO matrix.

CO Attainment

Direct CO Attainment

Course Outcomes of all Courses are assessed and the CO – wise marks obtained by all the students are recorded for all the assessment tools. The respective CO attainment level is evaluated based on set attainment rubrics.

Target Setting for Assessment Method

For setting up the target of internal assessment tools, 55% of the maximum mark is fixed as target. For setting up the target of End Semester Examination, the average mark of the class shall be set as target.

Formula for Attainment for each CO

Attainment = Percentage of students who have scored more than the target marks

$$\text{Percentage of Attainment} = \frac{\text{Number of Students who scored more than the Target}}{\text{Total Number of Students}} \times 100$$

Attainment Levels of Cos

Assessment Methods	**Attainment Levels**	
Internal Assessment	Level 1	50% of students scoring more than set target marks in Internal Assessment tools
	Level 2	55% of students scoring more than set target marks in Internal Assessment tools
	Level 3	60% of students scoring more than set target marks in internal Assessment tools
End Semester Summative Examination	Level 1	50% of students scoring more than average marks in End Semester Summative Examination
	Level 2	55% of students scoring more than average marks in End Semester Summative Examination
	Level 3	60% of students scoring more than average marks in End Semester Summative Examination

Indirect CO Attainment

At the end of each Course, an exit survey is conducted to collect the opinion of the students on attainment of Course Outcomes. A questionnaire is designed to reflect the views of the students about the Course Outcomes.

Overall CO Attainment= 75% of Direct CO Attainment + 25 % of Indirect CO Attainment

In each course, the level of attainment of each CO is compared with the predefined targets. If the target is not reached, the Course teacher takes necessary steps for the improvement to reach the target.

For continuous improvement, if the target is reached, the Course teacher can set the target as a value greater than the CO attainment of the previous year.

B.3.2 Assessment Process for Overall PO Attainment

With the help of CO - PO mapping, the PO attainment is calculated. PO assessment is done by giving 75% weightage to direct assessment and 25% weightage to indirect assessment. Direct

assessment is based on CO attainment, where 75% weightage is given to attainment through End Semester Examination and 25% weightage is given to attainment through Internal assessments. Indirect assessment is done through Graduate Exit Survey and participation of students in Co-curricular/ Extra-curricular activities.

PO Assessment Tools

Mode of Assessment	Assessment Tool	Description
Direct Attainment (Weightage -75%)	CO Assessment	This is computed from the calculated CO Attainment value for each Course
Indirect Attainment (Weightage - 25%)	Graduate Exit Survey 10%	At the end of the Programme, Graduate Exit Survey is collected from the graduates and it gives the opinion of the graduates on attainment of Programme Outcomes
	Co-curricular/ Extra-curricular activities 15%	For participation in Co-curricular/Extra-curricular activities during the period of their study.

Programme Articulation Matrix (PAM)

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Average Direct PO Attainment								
Direct PO Attainment in percentage								

Indirect Attainment of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Graduate Exit Survey							
Indirect PO Attainment							

Attainments of POs for all Courses

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Direct Attainment (Weightage - 75%)							
Indirect Attainment (Weightage - 25%)							
Overall PO Attainment							

Overall PO Attainment= 75% of Direct PO Attainment +
25% of Indirect PO Attainment (Graduate Exit Survey & Participation in Co- curricular and Extra curricular Activities)

Expected Level of Attainment for each of the Programme Outcomes

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PO Attainment

Graduation Batch	Overall PO Attainment (in percentage)	Whether Expected Level of PO is Achieved? (Yes/No)

B.3.3 Assessment Process for PEOs

The curriculum is designed so that all the Courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 5 years of completion of the Programme only through indirect methods.

Target for PEO Attainment

Assessment Criteria	Target (UG)	Target (PG)
Record of Employment	15% of the class strength	30% of the class strength
Progression to Higher Education	50% of the class strength	5% of the class strength
Record of Entrepreneurship	2% of the class strength	5% of the class strength

Attainment of PEOs

Assessment Criteria & Tool	Weightage
Record of Employment	10
Progression to Higher Education	20
Record of Entrepreneurship	10
Feedback from Alumnae	30
Feedback from Parents	10
Feedback from Employers	20
Total Attainment	**100**

$$\text{Percentage of PEO Attainment from Employment} = \frac{\text{Number of Students who have got Employment}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Higher Education} = \frac{\text{Number of Students who pursue Higher Education}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Entrepreneurship} = \frac{\text{Number of Students who have become Entrepreneurs}}{\text{Target}} \times 100$$

Expected Level of Attainment for each of the Programme Educational Objectives

POs	Level of Attainment
Attainment Value ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PEO Attainment

Graduation Batch	Overall PEO Attainment (in percentage)	Whether Expected Level of PEO is Achieved? (Yes/No)

C. PROCESS OF REDEFINING THE PROGRMME EDUCATIONAL OBJECTIVES

The college has always been involving the key stakeholders in collecting information and suggestions with regard to curriculum development and curriculum revision. Based on the information collected, the objectives of the Programme are defined, refined and are inscribed in the form of PEOs. The level of attainment of PEOs defined earlier will be analysed and will identify the need for redefining PEOs. Based on identified changes in terms of curriculum, regulations and PEOs, the administrative system like Board of Studies, Academic Council and Governing Body may recommend appropriate actions. As per the Outcome Based Education Framework implemented from the Academic Year 2020 - 2021, the following are the Programme Structure, the Programme Contents and the Course Contents of B.Sc. Mathematics Programme.

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VIRUDHUNAGAR

Quality Education with Wisdom and Values

BACHELOROF SCIENCE MATHEMATICS (2014)

Outcome Based Education with Choice Based Credit System

Programme Structure-Allotment of Hours and Credits

For those who join in the Academic Year 2023-2024

Components	Semester						Total Number of Hours (Credits)
	I	II	III	IV	V	VI	
Part I : Tamil /Hindi	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24 (12)
Part II : English	6 (3)	6(3)	6 (3)	6 (3)	-	-	24 (12)
Part III : Core Courses, Elective Courses & Self Study Course							
Core Course	4 (4)	4 (4)	4(4)	4 (4)	6 (6)	6(5)	28(27)
Core Course	4 (4)	4 (4)	4(4)	4(4)	6 (6)	6(5)	28 (27)
Core Course	-	-	-	-	5 (4)	6(4)	11(8)
Core Course Practical	-	-	-	-	-	-	-
Core Course Project	-	-	-	-	1 (1)	-	1 (1)
Elective Course (DSEC)	-	-	-	-	5(3)	5 (3)	10 (6)
Elective Course (DSEC)	-	-	-	-	5(3)	5 (3)	10(6)
Elective Course I (Allied)	4 (3)	4 (3)	-	-	-	-	8(6)
Elective Course I Practical I(Allied)	2(1)	2(1)	-	-	-	-	4(2)
Elective Course II(Allied)	-	-	6 (4)	5 (4)	-	-	11(8)
Elective Course II Practical II(Allied)	-	-	-	-	-	-	-
Self Study Course	-	-	-	-	-	0 (1)	0 (1)
Part IV : Skill Enhancement Courses, Elective Courses, Environmental Studies, Value Education, Self Study Course &Internship/ Industrial Training							
SEC	2 (2)	-	1 (1)	2 (2)	-	-	5(5)
SEC	-	2 (2)	2 (2)	2 (2)	-	2 (2)	8 (8)
Elective Course(NME)	2 (2)	2 (2)	-	-	-	-	4 (4)
Value Education	-	-	-	-	2 (2)	-	2 (2)
Environmental Studies	-	-	1 (0)	1 (2)	-	-	2 (2)
Self Study Course	-	-	-	-	0 (1)	-	0 (1)
Internship/ Industrial Training	-	-	-	-	0 (1)	-	0 (1)
Part V : Extension Activities	-	-	-		-	0 (1)	0 (1)
Total	**30 (22)**	**30 (22)**	**30(21)**	**30(24)**	**30(27)**	**30(24)**	**180 (140)**
Extra Credit Course (Self Study Course)	-	-	-	-	0(2)	-	0(2)

DSEC: Discipline Specific Elective Course; SEC– Skill Enhancement Course

NMEC: Non Major Elective Course

PROGRAMME CONTENT
SEMESTER V

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	Part III	Core Course -9	Abstract Algebra	23UMTC51	6	6	3	25	75	100
2.		Core Course -10	Real Analysis	23UMTC52	6	6	3	25	75	100
3.		Core Course-11	Mathematical Modelling	23UMTC53	5	4	3	25	75	100
4.		Core Course - 12	Project	23UMTC54PR	1	1	-	100	-	100
5.		Elective Course	Numerical Methods with Applications/ Combinatorial Mathematics	23UMTE51/ 23UMTE52	5	3	3	25	75	100
6.		Elective Course	Graph Theory and Applications / Stochastic Processes	23UMTE53 / 23UMTE54	5	3	3	25	75	100
7.	Part IV		Value Education	23UGVE51	2	2	2	100	-	100
8.		Self Study Course	Practice for Competitive Examinations-Online	23UGCE51	-	1	-	100	-	100
9.		Internship/ Industrial Training	Internship	23UMTI51	-	1	-	100	-	100
Total					**30**	**27**				**900**
10.		Extra Credit Course	Visualizing Data through SAGEMATH	23UMTO51	-	2	3	100	-	100

PROGRAMME CONTENT

SEMESTER VI

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	Part III	Core Course-12	Linear Algebra	23UMTC61	6	5	3	25	75	100
2.		Core Course-13	Complex Analysis	23UMTC62	6	5	3	25	75	100
3.		Core Course-14	Mechanics	23UMTC63	6	4	3	25	75	100
4.		Elective Course	Statistical Methods / Number Theory and Cryptography	23UMTE61/ 23UMTE62	5	3	3	25	75	100
5.		Elective Course	Operations Research / Discrete Mathematics	23UMTE63/ 23UMTE64	5	3	3	25	75	100
6.		Self Study Course	Discipline Specific Quiz - Online	23UMTQ61	-	1	-	100	-	100
7.	Part IV	SEC-7	Mathematics for Competitive Examinations	23UMTS61	2	2	2	25	75	100
8.	Part V		Extension Activities		-	1	-	100	-	100
Total					**30**	**24**				**800**

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Semester V	**ABSTRACT ALGEBRA**	Hours/Week:6	
Core Course-9		Credits:6	
Course Code **23UMTC51**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the notion of group theory and ring theory. [K1]

CO2: explain the fundamental concepts of different types of groups and some classes of rings and characterize its properties. [K2]

CO3: understand the abstract algebraic structures and prove lemmas and theorems [K2]

CO4: apply the properties of groups and rings to solve problems related to algebraic structures. [K3]

CO5: use abstract algebraic concepts and structures to prove theorems and resolve illustrative examples. [K3]

UNIT I Introduction to groups- Subgroups- cyclic groups and properties of cyclic groups- Lagrange's Theorem-A counting principle – Examples. (18 Hours)

UNITI I Normal subgroups and Quotient group- Homomorphism- Automorphism -Examples. (18 Hours)

UNIT III Cayley's Theorem-Permutation groups – Examples. (18 Hours)

UNIT IV Definition and examples of ring- Some special classes of rings- homomorphism of rings-Ideals and quotient rings- More ideals and quotient rings. (18 Hours)

UNIT V: The field of quotients of an integral domain-Euclidean Rings - The particular Euclidean Ring – Examples. (18 Hours)

TEXT BOOK:

Herstein I.N, (2006), *Topis in Algebra*, Wiley Eastern Ltd, 2nd Edition.

REFERENCE BOOKS:

1. John B. Fraleigh, (2002).*A First Course in Abstract Algebra*, 7th Ed., Pearson,

2. Artin.M, (2011). *Abstract Algebra*, 2nd Ed., Pearson,

3. Joseph A Gallian, (1999).*Contemporary Abstract Algebra*, 4th Ed., Narosa.

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

Course Code 23UMTC51	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	2	1	1	2	1	1
CO2	3	3	3	2	2	2	2	2	1	1
CO3	3	3	3	2	2	2	2	3	1	1
CO4	3	3	3	3	3	3	3	3	1	1
CO5	3	3	3	3	3	3	3	3	2	2

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari
Head of the Department

Dr.P.Geetha
Course Designer

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Semester V	**REAL ANALYSIS**	Hours/Week:6	
Core Course-10		Credits:6	
Course Code **23UMTC52**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: define continuous function, Connectedness, Completeness, Compactness on metric spaces, measure, Riemann integral, and the point wise and uniform convergence of sequence of functions. [K1]

CO2: understand the basic concepts of Continuous and Discontinuous functions, open and closed sets, Connectedness, Completeness, Compactness on metric spaces with examples.[K2]

CO3: explain the concepts of calculus and the sequence and series of functions to derive results. [K2]

CO4: apply the logical arguments for proving characterization, equivalence criterions in real analysis. [K3].

CO5: utilize various results to find the behavior of continuous function, Connectedness, Completeness, Compactness on a metric spaces. [K3]

UNIT I

Open sets– Closed sets–Discontinuous function on R^1. (18 Hours)

UNIT II

More about open sets-Connected sets-Bounded sets and totally bounded sets- Complete metric spaces. (18 Hours)

UNIT III

Compact metric spaces-Continuous functions on a compact metric space-Continuity of inverse functions-Uniform continuity**.** (18 Hours)

UNIT IV

Sets of measure zero- Definition of the Riemann integral- Existence of the Riemann integral- Properties of Riemann integral. (18 Hours)

UNIT V

Derivatives-Rolle's theorem-The law of the mean-Fundamental theorems of calculus.

(18 Hours)

TEXT BOOK

Richard R. Goldberg (1st January 2020). *Methods of Real Analysis*, (John Wiley & sons, 2nd edition) (Indian edition –Oxford and IBH Publishing Co, New Delhi,)

REFERENCE BOOKS

1. Walter Rudin, (1st July 2017).*Principles of Mathematical Analysis*, Tata McGraw Hill Education, Third edition.
2. Tom Apostal M, (1974), *Mathematical Analysis*, Publishing House, 2nd edition Addison-Wesley publishing company, New Delhi, Narosa.

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

Course Code 23UMTC52	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	3	2	2	1	1	-
CO2	3	3	2	2	3	2	2	1	1	-
CO3	3	3	2	2	3	2	2	1	1	-
CO4	3	3	2	2	3	2	2	1	1	-
CO5	3	3	2	2	3	2	2	1	1	-

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari — **Head of the Department**

Dr.R.P.Aditya — **Course Designer**

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Semester V	**MATHEMATICAL MODELLING**	Hours/Week:5	
Core Course-11		Credits:4	
Course Code **23UMTC53**		Internal 25	External 75

COURSE OUTCOMES

CO 1: define the simple situations and the characteristics of Linear, non-linear Growth and Decay Models and compartmental models. [K1]

CO 2: explain model using differential equations in-terms of linear growth and Decay models. [K2]

CO 3: understand ordinary differential equations of first order, various models for Epidemics and Medicine. [K2]

CO 4: apply analytical techniques to solve difference equations. [K3]

CO 5: use difference equations for different mathematical models in real life situation. [K3]

UNIT I

Mathematical Modelling: Simple situations requiring mathematical modelling, characteristics of mathematical models. (15 Hours)

UNIT II

Mathematical modelling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models. (15 Hours)

UNIT III

Mathematical Modelling, through system of Ordinary differential equations of first order: Prey-predator models, Compartment 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. (15 Hours)

UNIT IV Introduction to difference equations. (15 Hours)

UNIT V Mathematical Modelling through difference equations: Harrod Model, cob web model application to Actuarial Science. (15 Hours)

TEXT BOOK:

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

REFERENCE BOOKS:

1. Bimalk. Mishra and Dipak K.Satpathi, (1 Januuary 2009) *Mathematical Modeling*, Ane Books Pvt. Ltd.

2. Sandip Banerjee, (2017) *Mathematical Modeling Models, Analysis and Applications*, CRC Press, Taylor & Francis group.

3. Jonas Hall & Thomas ,*Mathematical Modeling applications with Geogebra* Ligefjard, John Wiley & Sons.

4.Mark M. Meerschaert: (2007).*Mathematical Modeling*, Elsevier Publ.

5.Edward A. Bender: ,(2002). *An introduction to mathematical Modeling*, CRC Press

6. Walter J.(2000) Meyer, *Concepts of Mathematical Model*ing, Dover Publ.

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

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UMTC53	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	2	2	3	2	2	1	1	-
CO2	3	3	2	2	3	2	2	1	1	-
CO3	3	3	2	2	3	2	2	1	1	-
CO4	3	3	2	2	3	2	1	1	1	-
CO5	3	3	2	2	3	2	1	1	1	-

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari — **Head of the Department**

Dr.M.Uma Maheswari — **Course Designer**

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Semester V	**PROJECT**	Hours/Week:1	
Core Course-11		Credits : 1	
Course Code **23UMTC54PR**		Internal 100	External -

COURSE OUTCOMES

On completion of the practical, the students will be able to

CO1: understand the concepts to select projects in Mathematics and related fields. [K2]

CO2: understand the technical skills in finding the solutions to the problems [K2]

CO3: apply the theoretical knowledge to model the real life problem to calculate the required parameters [K3]

CO4: apply the theoretical results and communicate academic knowledge orally. [K3]

CO5: demonstrate the project through viva-voce to meet the challenges at higher education level/society level. [K3]

Students are expected to select a project in the field of Mathematics and related interdisciplinary fields. Two students can do one project. Minimum pages for project report should be 20 pages. Two typed copies of the report on the completed project will be submitted to the Controller of Examination through the Head of the department in the month of November during V semester. Evaluation will be done internally.

Project work & Report - 60 marks

Presentation & Viva-voce - 40 marks

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UMTC54PR	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	3	3	3	2	2	2	2	1
CO2	3	3	3	3	3	2	3	2	2	1
CO3	3	3	3	3	3	3	3	2	2	1
CO4	3	3	3	3	3	3	3	2	2	1
CO5	3	3	3	3	3	2	3	2	2	1

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari
Head of the Department

Dr.M.C.Maheswari
Course Designer

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B.Sc. MATHEMATICS

(for those who join in 2023-2024)

Semester V	**NUMERICAL METHODS WITH APPLICATIONS**	Hours/Week:5	
Elective Course		Credits:3	
Course Code **23UMTE51**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, students will able to

CO1: define the fundamental concepts in numerical Methods. [K1]

CO2: explain the various numerical methods in finding the solution of numerical problems. [K2]

CO3: identify the appropriate numerical method to solve various type of problems. [K2]

CO4: apply the numerical methods to obtain appropriate solutions to mathematical problems [K3]

CO5: apply the numerical techniques to find the solution of numerical problems arising real life situations. [K3]

UNIT I

Introduction-The Bisection Method – Method of Succesive Approximations or the Iteration Method – The Method of False Position(Regula Falsi Method) – Newton's Iteration method or Newton– Raphson method.

Introduction-Gauss Elimination Method – Gauss Jordan Method –Computation of the Inverse of a matrix using Gauss's elimination method – Iterative Methods. (15 hours)

UNIT II

Introduction-First Differences – Higher differences – Difference Tables –To express any value of y in terms of initial value y_0 and the differences - Backward differences-To express any value of y in terms of y_n and the backward differences- Central difference Notation – Properties of the operator Δ – Differences of a polynomial – Factorial Polynomials – The Operator E - Relation between the operators E and Δ – Relation between the operators D and Δ - Other Difference Operators - Relation between the operators.

(15 hours)

UNIT III

Introduction- Linear interpolation – Gregory-Newton Forward Interpolation Formula – Gregory-Newton Backward Interpolation Formula – Equidistant terms with one or more missing values.

Central Difference Tables-Central Difference Interpolation Formulae – Gauss's forward interpolation formula – Gauss's Backward Interpolation Formula – Stirling's Formula.

Divided Differences- Properties of Divided Differences-Newton's interpolation formula for unequal intervals-Lagrange's Interpolation formula. (15 hours)

UNIT IV

Introduction- Newton's forward difference formula to compute the derivatives - Newton's backward difference formula to compute the Derivatives - Derivatives using Stirling's formula – Maxima and Minima of a tabulated function. (15 hours)

UNIT V

Numerical Integration - The Trapezoidal Rule - Truncation error in the Trapezoidal formula - Romberg's method - Simpson's Rule - Truncation error in Simpson's formula – Practical Applications of Simpson's rule. (15 hours)

TEXT BOOK

Venkataraman. M.K. (2013), *Numerical Methods in Science and Engineering*, The National Publishing Co., 5th Edition.

REFERENCE BOOKS

1. P.Kandasamy, K.Thilagavathy, K.Gunavathy. (Reprint 2002) *Numerical Method*, S.Chand and company Ltd., New Delhi.

2. M.K.Jain, S.R.K.Iyankar, R.K.Jain, *Numerical Methods for Scientific and Engineering Computations* Sixth Edition,New Age International (P) Ltd.,Publishers New Delhi.

Web Resources

https://nm.mathforcollege.com/textbook-numerical -methods-with-applications/

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UMTE51	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	3	3	3	3	3	2	2	2
CO2	3	3	3	3	3	3	3	2	2	2
CO3	3	3	3	3	3	3	2	2	2	1
CO4	3	3	3	2	3	3	3	2	2	1
CO5	3	3	3	3	3	3	3	2	2	1

Dr.M.C.Maheswari

Head of the Department

Dr.S.Kohila

Course Designer

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Quality Education with Wisdom and Values

B.Sc. MATHEMATICS

(for those who join in 2023-2024)

Semester V	**COMBINATORIAL MATHEMATICS**	Hours/Week:5	
Elective Course		Credits:3	
Course Code **23UMTE52**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the fundamental concepts of combinatorics. [K1]

CO2: understand the elementary counting techniques by the sum and product rules, permutations, combinations and pigeonhole principle. [K2]

CO3: explain the concepts of permutations, combinations and recurrence relations [K2]

CO4: Apply combinatorial principles and techniques to solve counting problems.[K3]

CO5: use combinations, arrangements and generation functions to solve problems arising in real life situations. [K3]

UNIT I

Permutations and Combinations: Introduction - The rules of sum and product – Permutations - Combinations – Distributions of distinct objects - Distributions of non-distinct objects – Stirling's formula. (15 Hours)

UNIT II

Generating Functions: Introduction - Generating functions for combinations – Enumerators for permutations - Distributions of distinct objects into non distinct cells – Partitions of integers – The Ferrers Graph (15Hours)

UNIT III

Recurrence Relations: Introduction - Linear recurrence relations with constant coefficients – Solution by the technique of generating functions - Recurrence relations with two indices.

(15 Hours)

UNIT IV

The Principle of Inclusion and Exclusion: Introduction - The principle of inclusion and exclusion – The general formula – Derangements – Permutations with restrictions on relative positions – The Rook polynomials. (15 Hours)

UNIT V

Polya's Theory of Counting: Introduction - Sets, relations and groups - Equivalence classes under permutation Group - Equivalence classes of functions – Weights and inventories of functions – Polya's fundamental theorem – Generalization of Polya's theorem. (15Hours)

TEXT BOOK

C.L.Liu, (1968), Introduction to Combinatorial Mathematics, McGraw Hill,

REFERENCE BOOKS

1. Richard A. Brualdi, 2010. *Introductory Combinatorics*, V Edition, China Machine Press.

2. Alan Tucker, 2012. *Applied Combinatorics*, VI Edition, John Wiley & Sons Inc.

Course Code 23UMTE52	PO1		PO2	PO3	PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	2	2	1	2	1
CO2	3	3	2	2	2	2	1	2	1
CO3	3	3	2	2	2	2	1	2	1
CO4	3	3	2	2	2	2	1	2	1
CO5	3	3	-	2	2	2	1	2	1

Strong (3) Medium (2) Low (1)

Dr.M.C.Maheswari — **Head of the Department**

Dr.P. Sooriyakala — **Course Designer**

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B.Sc. MATHEMATICS
(for those who join in 2023-2024)

Semester V	**GRAPH THEORY AND APPLICATIONS**	Hours/Week:5	
Elective Course		Credits:3	
Course Code **23UMTE53**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic concepts in Graph Theory. [K1]

CO2: explain the concept of Connectedness, Eulerian, Hamiltonian, Trees, Matchings, Planarity and Colouring in graphs. [K2]

CO3: understand the graph using the concepts of various parameters and their applications in Graph Theory. [K2]

CO4: develop a graph theoretical model for a real life situations. [K3]

CO5: apply the appropriate theories, principles and concepts relevant to Graph Theory. [K3]

UNIT I

Graphs – Subgraphs – Isomorphism and degrees – Walks and connected graphs – Cycles in graphs – Cut vertices and cut edges. (15 Hours)

UNIT II

Eulerian graphs – Fleury's algorithm – Hamiltonian graphs – Weighted graphs (15 Hours)

UNIT III

Bipartite graphs – Marriage problem – Trees – Connector problem. Matrix representations – Vector spaces associated with graphs – Cycle space – Cut-Set space. (15 Hours)

UNIT IV

Planar graphs – Euler formula – Platonic solids – Dual of a plane graph – Characterization of planar graphs. (15 Hours)

UNIT V Vertex colouring – Edge colouring – An algorithm for vertex colouring – Directed graphs. (15 Hours)

TEXT BOOK

S. A. Choudum.(2000).*A First course in Graph Theory*, Macmillan Publishers India Pvt Ltd,

REFERENCE BOOKS

1.F. Harary.(2001). *Graph Theory*, Narosa Publishing Company.

2.NarsinghDeo, (1997) *Graph Theory with applications to Engineering &Computer Science*, Prentice Hall of India ,New Delhi.

Web Resources:

1. https://d3gt.com/
- Learn Graph Theory Interactively
2. https://www.mathsisfun.com/graph/index.html
3 .https://brilliant.org/courses/graph-theory-intro/
4 .http://mathworld.wolfram.com/GraphTheory.
5 .https://www.javatpoint.com/graph-theory - Graph Theory Tutorial

Course Code 23UMTE53	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	2	2	2	2	2	1
CO2	3	3	3	2	2	2	2	2	2	1
CO3	3	3	3	3	3	3	3	2	2	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	3	3	3	3	3	3	2	2	2

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari
Head of the Department

Dr. P. Getchial Pon Packiavathi
Course Designer

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B.Sc. MATHEMATICS

(for those who join in 2023-2024)

Semester V	**STOCHASTIC PROCESSES**	Hours/Week: 5	
Elective Course		Credits:3	
Course Code **23UMTE54**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the random variables, Stochastic Process, Markov chains and Markov Process. [K1]

CO2: understand the concepts of Generating functions, Markov chain and Poisson Process.[K2]

CO3: explain the properties of Markov chain, Poison Process, birth-death and renewal process. [K2]

CO4: apply the concepts gained in random variables, Markov process to find transition matrix, transition matrix, transition probabilities and stability Markov systems. [K3]

CO5: develop the concepts of Markov process with discrete state spaces and derive the form of the distribution of the inter-arrival times. [K3]

UNIT I

Generating Functions: Introduction - Probability Generating Functions: Mean and Variance –Sum of (a fixed number of) random variables –Sum of a random number of Discrete Random Variables(Stochastic Sum) –Generating Function of Bivariate Distribution –Stochastic Processes: An introduction -Specification of Stochastic Process. (15 Hours)

UNIT II

Definition and Examples - Transition Matrix –Order of a Markov Chain – Markov Chains as Graphs – Higher Transition Probabilities – Generalization of Independent Bernoulli Trails: Sequence of Chain - Dependent Trails - Markov – Bernoulli Chain Correlated Randomwalk. (15 Hours)

UNIT III

Stability of a Markov System –Computation of the Equilibrium Probabilities –Graph theoretic Approach –Markov Chain with Denumerable Number of States –Reducible Chains –Finite Reducible

Chains with a Single Closed Class – Chain with one single class of Persistent Non-null Aperiodic States -Absorbing Markov Chains (15 Hours)

UNIT IV

Poisson Process: Introduction - Postulates of Poisson Process - Properties of Poisson Process – Poisson Process and Related Distributions – Inter arrival Time – Further Interesting Properties of Poisson Process. (15 Hours)

UNIT V

Generalizations of Poisson Process: Poisson Process in Higher Dimensions – Poisson Cluster Process – Pure Birth Process: Yule - Furry Process – Birth-Immigration Process – Time dependent Poisson Processes – Random Variation of the Parameter λ – Renewal Process –Birth and Death Process – Particular Cases (15 Hours)

TEXT BOOK

Medhi, J.(Third Edition, Reprint 2013). *Stochastic Processes,* New Delhi: New Age International Publishers.

REFERENCE BOOKS

1. Basu, K.(2003). *Introduction to Stochastic Process*, Narosa Publishing House, New Delhi.
2. Goswami and Rao, B. V. (2011). *A Course in Applied Stochastic Processes,* Hindustan Book Agency, New Delhi.
3. G. Grimmett, G and Stirzaker, D.(2001). *Probability and Random Processes*, 3rd Ed., Oxford University Press, New York.

Course Code 23UMTE54	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
	PSO 1.a	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	3	3	3	2	2	2	2	2
CO2	3	3	3	3	3	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	2
CO4	3	3	3	2	3	3	3	2	2	2
CO5	3	3	3	3	3	3	3	2	2	2

Strong (3) Medium (2) Low (1)

Dr.M.C.Maheswari — **Head of the Department**

Mrs.P.Getchial Pon Packiavathi — **Course Designer**

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B.Sc. MATHEMATICS
(for those who join in 2023-2024)

Semester V	**INTERNSHIP**	Hours/Week:	
PART IV		Credit: 1	
Course Code **23UMTI51**		Internal 100	External -

COURSE OUTCOMES

On completion of the Internship/Field Project, students will be able to

CO1: relate their theoretical insights with hands-on experience. [K2]

CO2: develop technical skills to their respective field of study. [K3]

CO3: demonstrate the attributes such as observational skills, team spirit and inter personal skills built through site visits. [K3]

CO4: exhibit the written communication skills acquired through internship/field project. [K3]

CO5: analyze the observations and results and communicate their academic and technological knowledge appropriately oral means. [K4]

Guidelines/ Regulations:

- Each student must go for Internship training in a reputed Industry / Company / Organization/ Educational Institution.
- Students should produce the completion certificate after the completion of Internship period.
- A report of 10-15 pages must be submitted by each student after the completion of the Internship period.
- Internal Viva-voce examination will be conducted.
- Students with diverse disabilities must complete a 10 day internship programme at their preferred places.

Course Code 23UMTI51	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	3	3	2	2	2	1
CO2	3	3	3	3	2	2	1
CO3	3	3	3	3	2	2	3
CO4	3	3	3	3	2	2	1
CO5	3	3	3	3	2	2	1

Dr.M.C.Maheswari
Head of the Department

Dr.M.C.Maheswari
Course Designer

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B.Sc. MATHEMATICS
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Semester V	**Visualizing Data through SAGEMATH**	Hours/Week: -	
Extra Credit Course		Credits:2	
Course Code **23UMTO51**		Internal 100	External -

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: gain knowledge on Computational Mathematics using SageMath. [K1]

CO2: understand the fundamental concepts in SageMath**.** [K2]

CO3: identify the usage of SageMath in abstract and applied Mathematics. [K2]

CO4: apply algorithms to solve problems numerically, algebraically and graphically. [K3]

CO5: analyse the problems in Algebra, Analysis and Differential Equations using SageMath. [K4]

UNIT I

Elementary functions and Usual Constants-Online help and Automatic Completion-Python variables-Symbolic variables –First Graphics

UNIT II

Symbolic Expressions-Transforming Expressions-Usual - Mathematical Expressions-Assumptions-Some Pitfalls –Explicit Solving-Equations with no explicit solution.

UNIT III

Sums-Limits-Sequences- Power Series Expansions-Series- Derivatives-Partial Derivatives-

Integrals

UNIT IV

Solving Linear Systems-Vector Computations-Matrix Computations-Reduction of a Square Matrix.

UNIT V

Graphical Representation of a Function-Parametric Curve-Curve in Polar Coordinates-Curve defined by an implicit equation.

TEXT BOOK

Computational Mathematics with SageMath by Paul Zimmermann and others, 2018.

REFERENCE BOOKS

1. Gregory V. Bard ; Sage for Undergraduates(online version)

2. Craig Finch; Sage Biginner's Guide; PACKT Publishing(Open Source)

Website and e-Learning Source

1.https://onlinecourses.nptel.ac.in/noc21_ma29/preview

2.https://mosullivan.sdsu.edu/Teaching/sdsu-sage-tutorial/sageprog.html

Course Code 23UMTO51	PO1		PO2		PO3	PO4	PO5	PO6	PO7	PO8
	PSO 1.a	PSO 1.b	PSO 2. a	PSO 2.b	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3	1	3	3	1	-	3	3	1	-
CO2	3	2	3	1	2	2	3	3	1	-
CO3	3	2	3	1	2	2	3	3	1	-
CO4	3	1	2	3	2	2	2	3	1	-
CO5	3	1	1	2	3	3	2	3	1	-

Strong (3) Medium (2) Low (1)

Dr.M.C. Maheswari
Head of the Department

Dr.R.P.Aditya
Course Designer

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B.Sc. MATHEMATICS
(for those who join in 2023-2024)

Semester VI	**LINEAR ALGEBRA**	Hours/Week: 6	
Core Course-12		Credits:5	
Course Code **23UMTC61**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course, students will be able to

CO1: define the concepts in vector spaces, inner product spaces and theory of matrices. [K1]

CO2: explain the fundamental concepts of Linear Algebra. [K2]

CO3: explain the concepts of Linear Dependence, Linear Independence, Bases and Dimension, Linear Transformations, their Matrix representation and the dual spaces [K2]

CO4: make use of properties of vector spaces, linear transformations, inner product spaces and matrices to solve variety of problems. [K3]

CO5: find the dimension, rank, nullity, matrices from a linear transformation and inner product of a vector space. [K3]

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. (18 Hours)

UNIT II

Linear Dependence and Linear Independence – Bases and Dimensions (18 Hours)

UNIT III

Linear Transformations, Null spaces and Ranges – The Matrix Representation of a Linear Transformation –Invertibility and Isomorphisms – Dual spaces (18 Hours)

UNIT IV

Eigenvalues and Eigenvectors, Diagonalizability – Invariant Subspaces and the Cayley–

Hamilton Theorem (18 Hours)

UNIT V

Inner Products and Norms – The Gram Schmidt Orthogonalization Process and Orthogonal Complements (18 Hours)

TEXT BOOK

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

REFERENCE BOOKS

1. I.N.Herstein, (2006.)*Topics in Algebra*, Wiley EasternLtd. Second Edition, N.S.Gopalakrishnan, *University Algebra*, New Age International Publications, Wiley Eastern Ltd.
2. John B.Fraleigh, *First course in Algebra*, Addison Wesley.
3. David C. Lay.(2007). *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint.
4. S. Lang,(2005) .*Introduction to Linear Algebra*, 2nd Ed.,Springer.
5. Gilbert Strang.(2007). *Linear Algebra and its Applications*, Thomson.
6. S. Kumaresan, (2004) Linear Algebra: A Geometric Approach, Prentice-Hall of India Ltd.

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

Course Code 23UMTC61	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	3	2	2	1	1	-
CO2	3	3	2	2	3	2	2	1	-	-
CO3	3	3	2	2	3	2	2	1	-	-
CO4	3	3	2	2	3	2	2	1	1	-
CO5	3	3	2	2	3	2	2	1	1	-

Strong (3) Medium (2) Low (1)

Dr.M.C.Maheswari
Head of the Department

Ms. J. Ashwini
Course Designer

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B.Sc. MATHEMATICS

(for those who join in 2023-2024)

Semester VI	**COMPLEX ANALYSIS**	Hours/Week: 6	
Core Course- 13		Credits: 5	
Course Code **23UMTC62**		Internal 25	External 75

COURSE OUTCOMES

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

CO 1: Define the basic concepts of analytic functions, conformal mapping, definite integrals, power series, residues and poles. [K1]

CO 2: Explain the concept of Conformal mappings and mappings by linear transformations and linear fractional transformations.[K2].

CO 3: Explain about the integrations of functions over simply and multiply connected domains and to derive the Cauchy integral formula, Liouvlle's theorem, Fundamental theorem of Algebra and Maximum Module Principle. [K2]

CO 4: Apply the results and theorems in complex analysis to other discipline. [K3]

CO 5: Find the nature of singularities, to find the residue of a given function at a given singular point, to Explain about zeros and poles and to evaluate real improper integrals [K3]

UNITI

Functions of a Complex variable –Limits –Theorem on limits –Continuity – Derivatives – Differentiation formulae – Cauchy Riemann equation – conditions for differentiability – Polar coordinates– Analytic functions– Harmonic functions. (18 Hours)

UNITII

Mappings – Mapping by exponential function – Linear transformation – The transformation w= $\frac{1}{z}$– Mappings by $\frac{1}{z}$ – Linear fractional transformations (bilinear)

(18 Hours)

UNIT III

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. (18 Hours)

UNIT IV

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. (18 Hours)

UNIT V

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).

(18 Hours)

TEXT BOOK

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

REFERENCE BOOKS

1. Theodore W. Gamelan. (2008).*Complex Analysis*, Springer Verlag.
2. Joseph Bak and Donald J. Newman. (1997). *Complex Analysis*, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York.
3. Richard A. Silverman.((1972). *Introductory Complex Analysis*. Dover Publications.
4. S. Ponnusamy and H. Silverman (2006). *Complex variables with applications*, Birkhauser.

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

Course Code 23UMTC62	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	2	1	2	2	1	1
CO2	3	3	2	3	3	2	2	3	1	1
CO3	3	3	3	3	3	2	2	3	1	1
CO4	3	3	3	3	3	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	2	2

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari — **Head of the Department**

Dr.M.C.Maheswari — **Course Designer**

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B.Sc. MATHEMATICS
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Semester VI	**MECHANICS**	Hours/Week:6	
Core Course- 14		Credits:4	
Course Code **23UMTC63**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, students will able to

CO 1: define resultant, component of a force, coplanar forces, like and unlike parallel forces, equilibrium of a particle, limiting equilibrium of a particle on an inclined plane. [K1]

CO 2: understand the moment of a force, couple parallel forces, forces acting along frictional forces. [K2]

CO 3: explain work, energy, power, rectilinear motions under varying forces, simple harmonic motion and its geometrical representation. [K2]

CO 4: apply the concepts of projectile, direct and oblique impact of smooth elastic spheres arising in real life situations. [K3]

CO 5: solve the problems related to central orbits, conic as centered orbits. [K3]

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. (18 Hours)

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. (18 Hours)

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. (18 Hours)

UNIT IV Projectiles: Forces on a projectile – Projectile projected on an inclined plane. (18 Hours)

UNIT V Central Orbits**:** General orbits – Central orbit – Conic as a centered orbit (18 Hours)

TEXT BOOKS

1. Ruina, Pratap, (2014), *Introduction to Statics and Dynamics*, Oxford University Press.
2. S.L.Loney, (1904), *The Elements of Statics and Dynamics*, Cambridge University Press.

REFERENCE BOOKS

1. J.L. Meriam and L.G. Kraige,(2012), *Engineering Mechanics: Statics*, Seventh Edition, Wiley and sons Pvt ltd., New York.
2. J.L. Meriam, L. G. Kraige, and J.N. Bolton, (2015). *Engineering Mechanics: Dynamics*, 8thedn, Wiley and sons Pvt ltd., New York.
3. A. K. Dhiman, P.Dhinam and D. Kulshreshtha, (2015).*Engineering Mechanics* (Statics and Dynamics), McGraw Hill Education (India) Private Limited, New Delhi.

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

Course Code 23UMTC63	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	2	2	3	2	2	1	1	-
CO2	3	3	2	2	3	2	2	1	-	-
CO3	3	3	2	2	3	2	2	1	-	-
CO4	3	3	2	2	3	2	2	1	1	-
CO5	3	3	2	2	3	2	2	1	1	-

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari
Head of the Department

Dr.M.Uma Maheswari
Course Designer

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Semester VI	**STATISTICAL METHODS**	Hours/Week: 5	
ELECTIVE COURSE		Credits: 3	
Course Code **23UMTE61**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define the basic concepts in statistics. [K1]

CO2: understand the scope and necessity of Statistics. [K2]

CO3: explain various statistical methods and techniques in solving problems. [K2]

CO4: apply attributes, correlation and regression to draw conclusion for a given data. [K3]

CO5: apply statistical methods to solve the real life problems. [K3]

UNIT I

Arithmetic Mean – Properties of Arithmetic Mean - Merits and Demerits of Arithmetic Mean - Weighted Mean – Median - Derivation of Median Formula - Merits and Demerits of Median – Mode - Derivation of Mode Formula - Merits and Demerits of Mode - Geometric Mean - Merits and Demerits of Geometric Mean - Harmonic Mean - Merits and Demerits of Harmonic Mean - Selection of an Average - Partition Values.

Measures of Dispersion – Range - Quartile Deviation - Mean Deviation - Standard Deviation (σ) and Root Mean Square Deviation (s) - Relation between (σ) and s - Different Formulae for Calculating Variance - Coefficient of Dispersion - Coefficient of Variation (15 Hours)

UNIT II

Moments – Relation Between Moments About Mean in Terms of Moments About Any Point and Vice Versa - Effect of Change of Origin and Scale on Moments – Sheppard's Correction for Moments - Charlier's Checks - Pearson's β and γ Coefficients - Factorial Moments - Absolute Moments – Skewness - Kurtosis. (15 Hours)

UNIT III

Curve Fitting - Fitting of a Straight Line - Fitting of a Second Degree Parabola - Fitting of a Polynomial of k^{th} Degree - Change of Origin - Most Plausible Solution of a System of linear Equations - Conversion of Data to Linear Form - Selection of Type of Curve to be Fitted (15 Hours)

UNIT IV

Karl Pearson Coefficient of Correlation – Limits for Correlation Coefficient - Assumptions Underlying Karl Pearson's Correlation Coefficient - Rank Correlation - Tied Ranks - Repeated Ranks (Continued) - Limits for Rank Correlation Coefficient – Regression - Lines of Regression - Regression Curves - Regression Coefficients - Properties of Regression Coefficients - Angle Between Two Lines of Regression. (15 Hours)

UNIT V

Introduction – Notations – Dichotomy – Classes and Class Frequencies - Order of Classes and Class Frequencies - Relation between Class Frequencies – Class Symbols as Operators – Consistency of Data – Conditions for Consistency of Data – Independence of Attributes – Criterion of Independence – Symbols $(AB)_0$ and δ – Association of Attributes – Yule's Coefficient of Association – Coefficient of Colligation. (15 Hours)

TEXT BOOK

S.C.Gupta & V.K.Kapoor (Reprint 2002), Fundamentals of Mathematical Statistics, Tenth Revised Edition, Sultan Chand & sons Educational Publishers, New Delhi.

REFERENCE BOOKS

1. Bansilal and Arora (1989). *New Mathematical Statistics*, Satya Prakashan, New Delhi.

2. Kapoor, J.N. &Saxena, H.C. (1976). *Mathematical Statistics*, Sultan Chand and Sons Pvt. Ltd, New Delhi.

WEB RESOURCES

1. Statistics e-labs - http://home.ubalt.edu/ntsbarsh/STAT-DATA/javastat.htm

2. Statistical Analysis Lab - https://onlinestatbook.com/stat_analysis/index.html

3. https://www.w3schools.com/statistics/index.php - Interactive Statistics Tutorial

4. https://www.open.edu/openlearn/pluginfile.php/1061809/mod_resource/content/4/Medical %20statistics%20PDF.pdf – Medical Statistics

Course Code 23UMTE61	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	3	2	2	2	1	-
CO2	3	3	3	3	3	2	3	2	1	-
CO3	3	3	3	3	3	3	3	2	1	-
CO4	3	3	2	3	3	2	3	2	1	-
CO5	3	3	2	3	3	2	3	2	1	-

Dr.M.C.Maheswari — Ms.J.Ashwini

Head of the Department — **Course Designer**

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Quality Education with Wisdom and Values

B.Sc. MATHEMATICS

(for those who join in 2023-2024)

Semester VI	**NUMBER THEORY AND CRYPTOGRAPHY**	Hours/Week: 5	
Elective Course		Credits: 3	
Course Code **23UMTE62**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: define several basic concepts in Number Theory. [K1]

CO2: understand the context of theory of numbers to encrypt and decrypt a message using public key cryptography. [K2]

CO3: explain results using arithmetical functions, congruences, various transformations for encryption and decryption. [K2]

CO4: apply the various concepts related to theory of numbers. [K3]

CO5: use the results in number theory in various real life situations. [K3]

UNIT I

Introduction – Divisibility - Greatest common divisor - Prime numbers - The fundamental theorem of arithmetic - The series of reciprocals of the primes - The Euclidean algorithm - The greatest common divisor of more than two numbers (15 Hours)

The Mobius function $\mu(n)$ - The Euler totient function $\varphi(n)$ - A relation connecting φ and μ - A product formula for $\varphi(n)$-The Dirichlet product of arithmetical functions. (15 Hours)

UNIT II

Multiplicative functions - Multiplicative functions and Dirichlet multiplication - The inverse of a completely multiplicative function- Liouville's function $\lambda(n)$ -The divisor functions $\sigma_\alpha(n)$ - Generalized convolutions -Formal power series - The Bell series of an arithmetical function - Bell series and Dirichlet multiplication -Derivatives of arithmetical functions - The Selberg identity. (15 Hours)

UNIT III

Definition and basic properties of congruences - Residue classes and complete residue systems - Linear congruences - Reduced residue systems and the Euler-Fermat theorem -Polynomial congruences modulo p - Langrange's theorem - Applications of Lagrange's theorem - Simultaneous linear congruences, The Chinese remainder theorem. (15 Hours)

UNIT IV

Some simple crypto systems – Enciphering matrices. (15 Hours)

UNIT V

The idea of public key Cryptography- RSA - Discrete log (the index- calculus algorithm is excluded) - Knapsack. (15 Hours)

TEXT BOOKS

1. Tom M.Apostol, (Eighth Reprint 1998). *Introduction to Analytic Number Theory*, Narosa Publishing House, New Delhi, Springer International Student Edition.
2. Neal Koblitz, (Second edition, fourth Indian reprint 2010). *A Course in Number Theory and Cryptography*, Springer International Edition.

REFERENCE BOOKS

1. Ivan Niven, Herbert S. Zuckerman and Hugh L.Montgomery, (2008). (Fifth edition), *An Introduction to the Theory of Numbers,* John Wiley & sons.
2. Richard A.Mollin, (2006). *An introduction to cryptography*, Chapman and Hall / CRC, Second Edition.

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

Course Code 23UMTE62	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	3	3	2	3	3	1
CO2	3	3	3	2	3	3	2	3	3	1
CO3	3	3	3	2	3	3	2	3	3	1
CO4	3	3	3	2	3	3	2	3	3	1
CO5	3	3	3	2	3	3	2	3	3	1

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari
Head of the Department

Dr.M.Uma Maheswari
Course Designer

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B.Sc. MATHEMATICS
(for those who join in 2023-2024)

Semester VI	**OPERATIONS RESEARCH**	Hours/Week:5	
Elective Course		Credits:3	
Course Code **23UMTE63**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, students will able to

CO1: define the basic concepts in simplex method, assignment problem, transportation problems. [K1]

CO2: explain the fundamental concepts in sequencing and replacement and game theory concept to solve linear programming problems [K2]

CO3: classify the algorithms of optimization techniques to solve contextual problems [K2]

CO4: apply the graphical methods waiting line problems using single-channel and multi-channel models and apply them to solve real-world problems. [K3]

CO5: apply the project network diagrams and CPM/PERT techniques for project management and scheduling and obtain the optimal solutions to problems in real life situations. [K3]

UNIT I

Linear programming - Problem formulation, graphical solution, simplex method, artificial variables techniques, Big-M method. (15 Hours)

UNIT II

Transportation problem - Formulation, optimal solution, unbalanced transportation problem, Degeneracy; Assignment problem, formulation, optimal solution, variants of Assignment problem. (15 Hours)

UNIT III

Sequencing - Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines.

Replacement - Introduction: Replacement of items that deteriorate with time, when money value is not considered, replacement of items when money value is considered. (15 Hours)

UNIT IV

Theory of Games - Introduction – Terminology, Solution of games with saddle points and without saddle points, 2×2 games, dominance principle, m X 2 & 2 X n games, Graphical method.

(15 Hours)

UNIT V

Waiting Lines - Introduction, Terminology, Single Channel, Poisson arrivals and exponential service times with infinite population and finite population models, Multichannel, Poisson arrivals and exponential service times with infinite population

Network - Project Network diagram – CPM and PERT computations. (15 Hours)

TEXT BOOK

1. Sundaresan V, Ganapathy Subramaian K.S and Ganesan.K,(2002). *Resource Management Techniques*, A.R Publications, (Unit I to Unit IV)

2. Gupta, *Operations Research*, (2020), Krishna Prakashan India (P), Meerut Publications.

3. Sharma.S.D, *Operations Research*, Kedar Nath Ram Nath &Co. (Unit V)

REFERENCE BOOKS

1. Gupta P.K. and Hira D.S.,(2014) *Problems in Operations Research* - S.Chand & Co.,

2. Kanti Swaroop, Gupta P.K and Manmohan, (2014), *Problems in Operations Research*, Sultan Chand & Sons.

Web Resources

1. https://www.linearprogramming.info/Solve a Linear Programming model with OpenSolver- Excel Add-in that solves optimization models.

2. https://realpython.com/linear-programming-python/ Linear Programming With Python

3. https://www.princeton.edu/~rvdb/LPbook/101

Course Code 23UMTE63	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	3	3	3	3	2	3	2
CO2	3	3	3	3	3	3	3	3	2	2
CO3	3	3	3	3	3	3	2	3	2	2
CO4	3	3	3	2	3	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	2

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari — **Head of the Department**

Dr.S.Kohila — **Course Designer**

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B.Sc. MATHEMATICS
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Semester VI	**DISCRETE MATHEMATICS**	Hours/Week: 5	
Elective Course		Credits:3	
Course Code **23UMTE64**		Internal 25	External 75

COURSE OUTCOMES

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

CO 1: define the basic concepts in propositional logic, Combinatorics and Lattices & Boolean Algebra. [K1]

CO 2: understand the mathematical concepts in predicate logic. [K2]

CO 3: apply the concepts of Propositional Logic, Lattices & Boolean Algebra, BNF- Finite state Machine [K2]

CO 4: Solve problems in Input output strings, Combinatorics, Predicate Logic. [K3]

CO 5: apply the concepts of truth table techniques, predicate formulas and formal languages. [K3]

UNIT I

Propositional Logic: Definition, Connectives, Statements & Notation, Truth Values, Tautology and contradiction, Statement Formulae & Truth Tables, Well-formed Formulae, Equivalence of Formulae, Duality Law, Tautological Implications, normal forms Examples. (15 Hours)

UNIT II

Theory of inference, Truth table technique, Rules of inference, Indirect method of proof, Predicate Logic: Definition of Predicates; Statement functions, Variables, Quantifiers, Predicate Formulae, Free & Bound Variables; Valid Formulae& Equivalences, The Universe of Discourse Examples.

(15 Hours)

UNIT III

Lattices - Properties of lattices - Lattice as Algebraic System-Sub lattices- lattice Homomorphism- Special Lattices - Boolean Algebra- sub algebra- Boolean Expression and Boolean functions-expression of a Boolean function in canonical form. (15 Hours)

UNIT IV

Permutations and Combinations, Pascal's identity, Permutation with repetition, The Pigeonhole Principle, Generalisation of Pigeonhole principle, Principles of Inclusion-Exclusion Principle.

(15 Hours)

UNIT V

Introduction- Phrase -Structure Grammar- Types - BNF- Finite state Machine - Input output strings- Finite state Automata. (15 Hours)

TEXT BOOK

T.Veerarajan, (2017), *Discrete Mathematics*, McGraw Hill Education.

REFERENCE BOOKS

1. Tremblay and Manohar, (1997), *Discrete Mathematical Structures* with application to Computer Science, (Tata McGraw Hill, New Delhi).

2.Venkataraman M.K. and others, (2000) - *Discrete mathematics*, The National Publishing Company.

Web Resources

https://www.javatpoint.com/discrete-mathematics-tutorial - Discrete mathematics Tutorial

https://www.khanacademy.org/computing/computer-science/algorithms/intro-to-algorithms/v/discrete-mathematics

Course Code 23UMTE64	PO1		PO2	PO3		PO4		PO5	PO6	PO7
	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	3	3	2	2	2	2	2	2	1
CO2	3	3	3	2	2	2	2	2	2	1
CO3	3	3	3	3	3	3	3	2	1	2
CO4	3	3	3	3	3	3	3	2	1	2
CO5	3	3	3	3	3	3	3	2	1	2

Strong (3) Medium(2) Low(1)

Dr.M.C.Maheswari — **Head of the Department**

Dr. M.Uma Maheswari — **Course Designer**

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B.Sc. MATHEMATICS

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Semester VI	**MATHEMATICS FOR COMPETITIVE EXAMINATIONS**	Hours/Week: 2	
SEC- 7		Credits: 2	
Course Code **23UMTS61**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: retrieve the basic concepts in arithmetic problems. [K1]

CO2: understand the application of Mathematics in real life. [K1]

CO3: Understand in Time and work short cuts, Problems on numbers reasoning. [K2]

CO4: explain the shortcut methods of finding solutions to problems. [K2]

CO5: apply the analytical reasoning, non-verbal reasoning and computational skills in solving problems. [K3]

UNIT I

Problems on numbers - Problems on Ages (6 Hours)

UNIT II

Surds and Indices-Problems on Trains. (6 Hours)

UNIT III

Calendar –Clocks- Permutations and Combinations (6 Hours)

UNIT IV

Verbal Reasoning: Analogy - Coding and decoding - Directions and Distance- Blood relation. (6 Hours)

UNIT V

Analytical Reasoning: Data sufficiency. Non – Verbal Reasoning: Analogy, Classification and series (6 Hours)

TEXT BOOKS

1. R.S.Aggarwal, (2007). *Quantitative Aptitude,* S.Chand & Company Ltd.,Ram Nagar, New Delhi.
2. R.S.Aggarwal, (2009).*A Modern Approach to Verbal and Non-Verbal Reasoning,* S.Chand and company Ltd, Reprint

REFERENCE BOOKS

1. U. Mohan Rao, (2016), *Quantitative Aptitude for Competitive Examinations*, Scitech publications.
2. Dr.M.Manoharan, Dr.C.Elango and Prof K.L.Eswaran, (Reprint 2013), *BusinessMathematics*, Palani paramount Publications.

Web Resources: https://tamilnaducareerservices.tn.gov.in

Course Code	**PO1**		**PO2**	**PO3**		**PO4**		**PO5**	**PO6**	**PO7**
23UMTS61	**PSO 1.a**	**PSO 1.b**	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4.b**	**PSO 5**	**PSO 6**	**PSO 7**
CO1	3	3	2	2	2	2	2	3	2	1
CO2	3	3	3	2	2	2	2	3	2	1
CO3	3	3	3	3	3	3	3	3	2	2
CO4	3	3	3	3	3	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	2	2

Dr.M.C.Maheswari
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Dr. P.Sooriyakala
Course Designer