

**MANNAR THIRUMALAI NAICKER COLLEGE**  
**PASUMALAI, MADURAI- 625 004**

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Re-accredited with 'A' Grade by NAAC)



**B.Sc., Maths with CA**  
**SYLLABUS AND REGULATIONS**

UNDER  
CHOICE BASED CREDIT SYSTEM (CBCS)  
**(For those who joined during 2018-2019 and after)**

### **Qualification for Admission**

Candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Government of Tamil Nadu with Mathematics as one of the subjects in Higher Secondary Education.

### **Duration of the Course**

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

### **Subject of Study**

Part I: Tamil

Part II: English

Part III:

1. Core Subjects
2. Allied Subjects
3. Electives

Part IV :

1. Non Major Electives
2. Skill Based Subjects
3. Environmental Studies
4. Value Education

Part V :

Extension activities

### **The scheme of Examination**

The components for continuous internal assessment are:

Two tests and their average --15 marks

Seminar /Group discussion --5 marks

Assignment --5 marks

Total --25 marks

**Pattern of the questions paper for the continuous Internal Assessment**

**(For Part I, Part II, Part III, NME & Skilled Paper in Part IV)**

The components for continuous internal assessment are:

**Part –A**

Six multiple choice questions (answer all) 6 x 01= 06 Marks

**Part –B**

Two questions (‘either .... or ‘type) 2 x 07=14 Marks

**Part –C**

One question out of two 1 x 10 =10 Marks

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Total		30 Marks
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Pattern of the question paper for the Summative Examinations:

**Note: Duration- 3 hours**

**Part –A**

Ten multiple choice questions 10 x 01 = 10 Marks  
 (No Unit shall be omitted; not more than two questions from each unit.)

**Part –B**

Five Paragraph questions (‘either .... or ‘type) 5 x 07 = 35 Marks  
 (One question from each Unit)

**Part –C**

Three Essay questions out of five 3 x 10 =30 Marks  
 (One question from each Unit)

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Total		75 Marks
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**The Scheme of Examination (Environmental Studies and Value Education)**

Two tests and their average		--15 marks
Project Report		<u>--10 marks*</u>
Total		<u>--25 marks</u>

\*\* The students as Individual or Group must visit a local area to document environmental assets – river / forest / grassland / hill / mountain – visit a local polluted site – urban / rural / industrial / agricultural – study of common plants, insects, birds – study of simple ecosystem – pond, river, hill slopes, etc.

**Question Paper Pattern**

**Pattern of the Question Paper for Environmental Studies & Value Education only) (Internal)**

**Part –A**

(Answer is not less than 150 words)

Four questions (‘either .... or ‘type) 4 x 05=20 Marks

**Part –B**

(Answer is not less than 400 words)

One question (‘either .... or ‘type) 1 x 10=10 Marks

	30 Marks
<b>Total</b>	30 Marks

**Pattern of the Question Paper for Environmental Studies & Value Education only) (External)**

**Part –A**

(Answer is not less than 150 words)

Five questions (either or type) 5 x 06 =30 Marks

(One question from each Unit)

**Part –B**

(Answer is not less than 400 words)

Three questions out of Five 3 x 15 = 45 Marks  
each unit (One question from each Unit)

	75 Marks
<b>Total</b>	75 Marks

**Minimum Marks for a Pass**

40% of the aggregate (Internal +Summative Examinations).

No separate pass minimum for the Internal Examinations.

27 marks out of 75 is the pass minimum for the Summative Examinations.

### **PROGRAM EDUCATIONAL OUTCOMES (PEO)**

**PEO1:** Acquire good knowledge in analytical, algebraic structures, applied mathematics and statistics.

**PEO2:** Work independently and collaboratively in mathematical projects.

**PEO3:** Empower to face the competitive exams, employability in MNC, Govt. Sectors, etc.

**PEO4:** Engage in lifelong learning through continuing education, environmental studies.

### **PROGRAM OUTCOMES**

**PO1:** Problem solving and analytic, reasoning

**PO2:** Modern tool usage and knowledge

**PO3:** Leadership readiness and Reflective thinking

**PO4:** Communication skills and Digital literacy

**PO5:** Moral and Ethical Reasoning

**PO6:** Cooperation and team work

**PO7:** Lifelong learning and research related skills

### **PROGRAMME SPECIFIC OUTCOMES**

**PSO1:** To enable the students to pursue further studies in advanced computer science and computational mathematics.

**PSO2:** To develop the skills to create software applications using a systematic approach

**PSO3:** To know the relationships between graph theory and networks and to provide the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems

**PSO4:** To evaluate indefinite integrals by basic integration formula and substitution rule and to enhance the ability to identify assess and interpret complex situations using mathematical Methods.

**B.Sc (Mathematics (CA))**

**Course Pattern**

Study Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	Total Hours	Total Credit	No.of courses	Total marks
Part – I Tamil	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Part –II English	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Part –III										
Core Subjects	6(4)	6(5)	5(5) 5(5)	5(5) 5(5)	5(5) 5(5) 6(5) 6(5)	5(5) 5(5) 6(5) 6(5)	76	69	14	1400
Elective Subjects					6(5)	6(5)	12	10	2	200
Allied Subjects	6(4)	4(3)	4(3)	6(4)			20	14	4	400
Allied Subjects (P)		2(1)	2(1)				4	2	2	200
<b>Allied Mathematics</b>										
<b>For B.Sc CS</b>	4(4)	4(4)	4(4)	4(4)		-	16	16	4	400
<b>For B.Sc IT</b>	4(4)	4(4)	4(4)	-		2(2)	14	14	4	400
<b>For B.Sc E&amp;C</b>	-	4(3)	-	6(4)		-	10	7	2	200
<b>For B.C.A</b>	4(4)	4(4)	-	-		-	8	8	2	200
<b>For B.Sc Chemistry</b>			4(4)	4(4)	6(4)	6(4)	20	16	4	400
Part-IV										
Skill Based Subject	2(2) 2(2)	2(2) 2(2)			2(2)	2(2)	12	12	6	600
Environmental Studies / Value Education	2(2)	2(2)					4	4	2	200
Non major elective			2(2)	2(2)			4	4	2	200
Part V										
Extension activities				0(1)			0	1	1	100
<b>Total</b>	<b>30 (20)</b>	<b>30 (21)</b>	<b>30 (22)</b>	<b>30 (23)</b>	<b>30 (27)</b>	<b>30 (27)</b>	<b>180</b>	<b>140</b>	<b>41</b>	<b>4100</b>

**SEMESTER –I**

Subject code	Subjects	No. of Courses	Hours / week	Credits	Maximum Marks		
					Int.	Ext	Total
18UTAG11	பகுதி-Iதமிழ் தற்கால கவிதையும் உரைநடையும்	1	6	3	25	75	100
18UENG11	English-I: Exploring Language Through Literature-1	1	6	3	25	75	100
18UMCC11	<b>Part –III Core Subject</b> Differential Calculus	1	6	4	25	75	100
18UMCA11	<b>Part –III Allied Subject</b> Introduction to MS-Office Introduction to MS-Office - Lab	1 -	4 2	4 -	25	75	100
18UMCS11	<b>Part –IV Skill Subject</b> Numerical Aptitude	1	2	2	25	75	100
18UMCS12	Trigonometry	1	2	2	25	75	100
18UEVG11	<b>Part –IV Mandatory Subject</b> Environmental Studies	1	2	2	25	75	100
	<b>Total</b>	<b>7</b>	<b>30</b>	<b>20</b>	<b>175</b>	<b>525</b>	<b>700</b>

**SEMESTER – II**

Subject code	Subjects	No. of Courses	Hours / week	Credits	Maximum Marks		
					Int	Ext	Total
18UTAG21	பகுதி-I தமிழ் பக்தி இலக்கியமும் நாடகமும்	1	6	3	25	75	100
18UENG21	English-II: Exploring Language Through Literature-II	1	6	3	25	75	100
18UMCC21	<b>Part –III Core Subject</b> Theory of Equations and its applications	1	6	5	25	75	100
18UMCA21	<b>Part –III Allied Subject</b> Programming in C	1	4	3	25	75	100
18UMCAP1	Programming in C – Lab	1	2	1	40	60	100
18UMCS21	<b>Part –IV Skill Subject</b> Linux Operating System	1	2	2	25	75	100
18UMCSP1	Shell Programming Lab	1	2	2	40	60	100
18UVLG21	<b>Part –IV Mandatory Subject</b> Value Education	1	2	2	25	75	100
	<b>Total</b>	<b>8</b>	<b>30</b>	<b>21</b>	<b>230</b>	<b>570</b>	<b>800</b>



SEMESTER –III							
18UTAG31	<b>Part –I Tamil</b> காப்பிய இலக்கியமும் சிறுகதையும்	1	6	3	25	75	100
18UENG31	<b>Part –II English</b> Exploring Language Through Literature-III	1	6	3	25	75	100
18UMCC31	<b>Part –III Core Subjects</b> Integral Calculus	1	5	5	25	75	100
18UMCC32	Sequences and Series	1	5	5	25	75	100
18UMCA31	<b>Part-III Allied Subject</b> Programming in C ++	1	4	3	25	75	100
18UMCAP2	Programming in C ++ - Lab	1	2	1	40	60	100
18UMCN31	<b>Part –IV Non Major Elective</b> Arithmetic and Mental Ability - I	1	2	2	25	75	100
<b>Total</b>		<b>7</b>	<b>30</b>	<b>22</b>	<b>190</b>	<b>510</b>	<b>700</b>

SEMESTER- IV							
18UTAG41	<b>Part –I Tamil</b> பழந்தமிழ் இலக்கியமும் புதினமும்	1	6	3	25	75	100
18UENG41	<b>Part –II English</b> Exploring Language Through Literature-IV	1	6	3	25	75	100
18UMCC41	<b>Part –III Core Subjects</b> Analytical Geometry 3D and Vector Calculus	1	5	5	25	75	100
18UMCC42	Statistics - I	1	5	5	25	75	100
18UMCA41	<b>Part-III Allied Subject</b> Python Programming	1	6	4	25	75	100
18UMCN41	<b>Part –IV Non Major Elective</b> Arithmetic and Mental Ability - II	1	2	2	25	75	100
18UEAG40- 18UEAG49	<b>Part V- Extension Activities</b>	1	-	1	100	-	100
<b>Total</b>		<b>7</b>	<b>30</b>	<b>23</b>	<b>250</b>	<b>450</b>	<b>700</b>

**SEMESTER –V**

Course code	Name of the course	No. of Courses	Hours / week	Credits	Maximum Marks		
					Int	Ext	Total
	<b>Part –III Core Subject</b>						
18UMCC51	Real Analysis	1	5	5	25	75	100
18UMCC52	Modern Algebra	1	6	5	25	75	100
18UMCC53	Numerical Analysis	1	5	5	25	75	100
18UMCC54	Statistics II	1	6	5	25	75	100
18UMCE51	Differential Equations	<b>1</b>	<b>6</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
18UMCE52	Fuzzy sets						
18UMCE53	Web Programming						
18UMCS51	<b>Part IV Skill Subject</b> Laplace Transforms & Fourier Series	1	2	2	25	75	100
	<b>Total</b>	<b>6</b>	<b>30</b>	<b>27</b>	<b>150</b>	<b>450</b>	<b>600</b>

**SEMESTER –VI**

Course code	Name of the subject	No. of Courses	Hours / week	Credits	Maximum Marks		
					Int	Ext	Total
	<b>Part –III Core Subject</b>						
18UMCC61	Complex Analysis	1	5	5	25	75	100
18UMCC62	Linear Algebra	1	5	5	25	75	100
18UMCC63	Operations Research	1	6	5	25	75	100
18UMCPR1	Project & Viva-voce	1	6	5	40	60	100
18UMCE61	Graph Theory	<b>1</b>	<b>6</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
18UMCE62	Stochastic Process						
18UMCE63	Number Theory						
18UMCS61	<b>Part IV Skill Subject</b> Boolean Algebra & Logic	1	2	2	25	75	100
	<b>Total</b>	<b>6</b>	<b>30</b>	<b>27</b>	<b>165</b>	<b>435</b>	<b>600</b>



**MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)**  
**DEPARTMENT OF MATHEMATICS WITH CA**  
**(For those who joined in 2018-2019 and after)**

<b>Class</b>	<b>: B.Sc (Mathematics with CA)</b>	<b>Part III</b>	<b>: Core</b>
<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 05</b>
<b>Course Code</b>	<b>: 18UMCC51</b>	<b>Credits</b>	<b>: 05</b>

**REAL ANALYSIS**

**Course Outcomes:**

**On successful completion of the course, the learners will be able to:**

- CO 1:** Demonstrate the understanding of basic concepts of Real analysis. (K2)  
**CO 2:** Determine whether subsets of a metric space are open, closed, complete, connected and/or compact. (K3)  
**CO 3:** Examine whether a function on a metric space is continuous, discontinuous, or uniformly continuous. (K4)  
**CO 4:** Comprehend arguments developing the theory behind real analysis (K2)  
**CO 5:** Construct mathematical proofs of basic results in real analysis(K3)

**Unit – I**

Countable and uncountable sets –Holder’s and Minkowski’s inequalities – Metric space – open sets and closed sets.

**Unit –II**

Completeness – Cantor’s intersection theorem and Baire’s category theorem - Problems.

**Unit –III**

Continuity – Homeomorphism -- Uniform continuity. Theorems and problems.

**Unit –IV**

Connectedness –Connected subsets of  $\mathbb{R}$  - Connectedness and continuity – Intermediate value theorem.

**Unit –V**

Compactness– Compact subsets of  $\mathbb{R}$ - Heine Borel Theorem - Equivalent characterization of compactness- Finite intersection property- Totally Bounded metric space – sub sequence – sequentially compact metric space - problems.

**Text Book:**

1. Dr.S.Arumugam, Mr. A. Thangapandi Isaac, Dr. A. Somasundaram, Modern Analysis, Yes Dee Publishing Pvt Ltd.

Unit I - Chapter 1: Sections 1.3 -1.5, Chapter 2: Sections 2.2, 2.5, 2.8

Unit II - Chapter 3: Full

Unit III - Chapter 4: sections 4.2 -4.4

Unit IV - Chapter 5: Full

Unit V - Chapter 6: Sections 6.2 – 6.4

**Reference Books:**

1. Shanthi Narayan, Elements of Real Analysis, S.Chand and Company Ltd, New Delhi, Sixth Edition, Revised edition 1989.
2. Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Pvt. Ltd, New Delhi, 1970.
3. Goldberg .R – Methods of Real Analysis, Oxford and IBH Publishing Co., New Delhi.



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<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCC52</b>	<b>Credits</b>	<b>: 05</b>

**MODERN ALGEBRA**

**Course Outcome:**

**On successful completion of the course, the learners will be able to:**

**CO 1:** Demonstrate the basic concepts like sets, relations, definition of groups (K1)

**CO 2:** Explain the concepts of subgroups, cosets, isomorphism, rings (K2)

**CO 3:** Justify the results like isomorphism in various groups (K5)

**CO 4:** Apply the important theorems (K3)

**CO 5:** Examine the properties of various groups (K4)

**Unit –I**

Subgroups – Examples – Theorems on subgroups- Permutation groups – Cycles and transpositions – Even permutations – Theorems on Permutations -  $S_n$  and  $A_n$ - Cyclic groups- Definitions, Examples, Theorems

**Unit –II**

Order of an element – Generators – Number of generators of Cyclic groups - Cosets – Theorems on cosets, Lagrange’s theorem, problems using Lagrange’s Theorem – Euler’s, Fermat’s Theorems .

**Unit –III**

Normal subgroups – Theorems on Normal subgroups – Quotient group- Isomorphisms- Examples , theorems - Automorphism

**Unit –IV**

Homomorphisms – Types and examples – Theorems on Homomorphisms – Fundamental theorem of Homomorphism – Any infinite cyclic group is isomorphic to  $(\mathbb{Z}, +)$  – Any finite group is isomorphic to  $(\mathbb{Z}_n, +)$  – Cayley’s Theorem-Rings – Definition and examples .

**Unit- V**

Elementary properties – Isomorphism types of rings – Integral domains, Fields – Zero divisors – Theorems on Integral domains and Fields, Characteristic of a ring.

**Text Book:**

1. Dr.S.Arumugam and Isaac, **Modern Algebra**, Scitech Publication, Chennai, Reprint, June 2019.

Unit I - Section 3.4 to 3.6

Unit II - Section 3.7 to 3.8

Unit III - Section 3.9 to 3.10

Unit IV - Section 3.11, Section 4.1

Unit V - Section 4.2 to 4.5

**Reference Books:**

1. M.L Santiago, **Modern Algebra**, Tata MC Graw Hill Publication, New Delhi, 1988.
2. K.Sivasubramaniam, A.S.Kumaraswamy and K.Sitaraman, **Modern Algebra**, S.Chand and Company Ltd, New Delhi, 1979.
3. Basic Modern Algebra with Applications , **Adhikari**, Mahima Ranjan, **Adhikari**, Avishek, Springer,2014.

Percentage of change: 30%



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<b>Programme</b>	<b>: B. Sc (Mathematics with CA)</b>	<b>Part III</b>	<b>: Core</b>
<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 05</b>
<b>Subject Code</b>	<b>: 18UMCC53</b>	<b>Credits</b>	<b>: 05</b>

**NUMERICAL ANALYSIS**

**Course Outcomes:**

**On successful completion of the course, the learners will be able to:**

- CO 1:** Identify the approximate solutions to mathematical problems. (K1)  
**CO 2:** Understanding the roots of non-linear equations and solution of system of linear equations. (K2)  
**CO 3:** Evaluate the accuracy of common numerical methods. (K5)  
**CO 4:** Analyse the problems in finding the solutions for the problems involving numerical differentiation.(K4)  
**CO 5:** Apply numerical methods for various mathematical operations and tasks such as interpolation, integration. (K3)

**Unit – I**

Numerical solutions of Algebraic and Transcendental equations – Iteration method – Newton Raphson method – Solutions of Simultaneous linear equations- Gauss Elimination method – Gauss’ Jordan method – Iteration method – Gauss Jacobi method – Gauss Seidel method.

**Unit – II**

Finite differences – Forward difference and backward differences – Finite differences – operators– properties – Shift operator – Inverse operator- Finding missing terms.

**Unit –III**

Interpolation - Newton’s forward and backward interpolation formulae – Gauss forward and backward interpolation – Sterling’s formula – Lagrange’s interpolation formula – Divided difference - Newton divided difference formula - Inverse interpolation using Lagrange’s method.

**Unit –IV**

Numerical differentiation – Newton’s forward and backward difference formula– Maximum and Minimum of the interpolating polynomial.

**Unit -V**

Numerical Integration – Newton Cote’s Quadrature formula – Trapezoidal Rule – Simpson’s one third rule – Simpson’s three eighthrule – Weddle’s rule.

**Text Book:**

1. Dr.S.Arumugam, ThangapandiIssac and A.Somasundaram, **Numerical Analysis**, New Gamma Publications, Palayamkottai, Edition 2015.

Unit I - Chapter 1: Section 1.0, 1.2, 1.6

Chapter 2: Section 2.0, 2.1, 2.4, 2.6, 2.7

Unit II - Chapter 3: Section 3.1, 3.2

Unit III - Chapter 4: Section 4.0 to 4.6

Unit IV - Chapter 5: Section 5.1, 5.2 & 5.4

Unit V - Chapter 6: Section 6.0 to 6.4

**Reference Books:**

1. Prasun Kr Nayak, **Numerical Analysis** (Theory and Application) , Second Edition, Asian Books Private Limited, New Delhi, 2012.
2. S.S Sastry, **Introductory Methods of Numerical Analysis**, Third Edition, Prentice Hall of India Pvt Ltd, New Delhi, 1998.
3. Venkatraman .M.L - Numerical methods in Science and Engineering National Publishing Company V Edition 1998





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<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 06</b>
<b>CourseCode</b>	<b>: 18UMCC54</b>	<b>Credits</b>	<b>: 05</b>

**STATISTICS II**

**Course Outcome:**

**On successful completion of the course, the learners will be able to:**

- CO 1:** Remember and understanding of statistics and data analysis (K1, K2)
- CO 2:** Apply various types of distribution (K3)
- CO 3:** Analyze statistical techniques to interpret the data. (K4)
- CO 4:** Evaluate problems on test of significance and probability functions. (K5)
- CO 5:** Create sampling development and scientific attitude through Statistics. (K6)

**Unit – I**

Theory of probability – Sample space – Probability function – Conditional probability – Boole’s inequality – Baye’s theorem – Problems.

**Unit – II**

Random variables – Distribution function – Discrete and Continuous random variables – Probability density function – Mathematical expectation(one dimensional only).

**Unit –III**

Moment generating function – Cumulants – Characteristic function- Theoretical distribution – Binomial – Poisson – Normal.

**Unit –IV**

Test of significance of large samples.

**Unit –V**

Test of significance of small samples – t-test, F-test and Chi-square test.

**Text Book:**

1. Dr.S.Arumugam and Isaac, **Statistics**, New Gamma Publications, Palayamkottai, Reprint 2012.

Unit I - Chapter 11

Unit II - Chapter 12: Section 12.1 to 12.4

Unit III - Chapter 12: Section 12.5- 12.6 & Chapter 13

Unit IV - Chapter 14

Unit V - Chapter 15, 16

**Reference Books:**

1. T. Sankara Narayanan and A.Mangaldoss, **Statistics and its Application**, Preist Publications, New Delhi, 1994.
2. R.S.N.Pillai and Bagavathi, **Practical Statistics**, ,S.Chand and Company Pvt Ltd, New Delhi, 1987.
3. Bhat B.R, Srivenkataramana T and RaoMadhava K.S.(1996): **Statistics: A Beginner s Text, Vol. I**, New Age International (P) Ltd.



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<b>Class</b>	<b>: B. Sc (Mathematics with CA)</b>	<b>Part III</b>	<b>: Elective</b>
<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 06</b>
<b>CourseCode</b>	<b>: 18UMCE51</b>	<b>Credits</b>	<b>: 05</b>

**DIFFERENTIAL EQUATIONS**

**Course Outcomes:**

**On successful completion of the course, the learners will be able to:**

**CO 1:** Identify linear, nonlinear, partial and ordinary differential equations. (K2)

**CO 2:** Apply different methods for solving differential equations. (K3)

**CO 3:** Evaluate ordinary and partial differential equation. (K5)

**CO 4:** Convert different forms into standard forms. (K4)

**CO 5:** Solve different types of differential equations. (K3)

**Unit –I**

Exact differential equations of first order but of higher degree – Equations solvable for  $y$  – Equations solvable for  $x$  – Clairaut's form – Equation that do not contain  $x, y$  explicitly, Equation homogeneous in  $x$  and  $y$ .

**Unit –II**

Linear Equations with constant coefficients and variable coefficients - Equations reducible to the linear homogeneous equations.

**Unit –III**

Simultaneous Linear differential equations – Linear Equations of the second order – Reduction to the normal form – Change of independent variables – Variation of parameters.

**Unit –IV**

Partial differential equation of the first order – Formation of PDEs – Elimination of arbitrary constants and functions - Derivation of partial differential equation – Lagrange method of solving linear equations.

**Unit – V**

Standard forms – Equations reducible to the standard forms – Charpit's method.

**Text Book:**

1. T.K.Manickavasagam Pillai and S.Narayanan, **Differential equations and its Applications**, S.Viswanathan Publication, Chennai, 2014.

Unit I	-	Chapter 1: Section 6.1, 6.3 and Chapter 4: Section 1,2,3& 4
Unit II	-	Chapter 5: Section 4,5 & 6
Unit III	-	Chapter 6: Section 5,6 and Chapter 8: Section 1,2,3, & 4
Unit IV	-	Chapter 12: Section 1,2,3& 4
Unit V	-	Chapter 12: Section 5,6

**Reference Books:**

1. Dr. M.D. Raisinghania, **Advanced Differential Equations**, S.Chand and Company Pvt. Ltd, New Delhi, Reprint, 2012
2. Dr.S. Arumugam and Issac, **Differential equations and its Applications**, New Gamma Publications, Palayamkottai, 2011.
3. M.D.Raisinghania , Ordinary and Partial Differential Equations, S.Chand & Co



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<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCE52</b>	<b>Credits</b>	<b>: 05</b>

**FUZZY SETS**

**Course Outcomes:**

**On successful completion of the course, the learners will be able to:**

**CO 1:** Remember and understand the basic concepts of fuzziness. (K1, K2)

**CO 2:** Prepare concepts in projection and extension of the fuzzy numbers (K3)

**CO 3:** Conclude the properties of fuzzy relations and fuzzy sets (K4)

**CO 4:** Importance of the multi valued logics values and fuzzy logic values (K5)

**CO 5:** Compose applications of fuzzy sets and its logics. (K6)

**Unit – I**

Introduction – concept of fuzzy set – relation between fuzzy sets – operations on fuzzy sets – properties of the standard operations – numbers associated with a fuzzy set – crisp sets associated with fuzzy set – fuzzy sets associated with a given fuzzy set.

**Unit – II**

Crisp relation - fuzzy relations – operations on fuzzy relations -  $\alpha$ -cuts of a fuzzy relation – composition of fuzzy relation.

**Unit – III**

Projection of fuzzy relations - cylindric extension – cylindric closure – fuzzy relation on a domain.

**Unit – IV**

Compositions of Fuzzy Relations - Properties of the Min-Max Composition - Fuzzy Graphs - Special Fuzzy Relations.

**Unit – V**

Linguistic Variables - Fuzzy Logic - Classical Logics Revisited - Linguistic Truth Tables.

**Text Book:**

1. M. Ganesh, Introduction to fuzzy sets and fuzzy logic, PHI Learning Private Limited, New Delhi, 2009.

Unit 1: Chapter 6

Unit 2: 7.1 to 7.5

Unit 3: 7.6 to 7.9

2. H.-J. Zimmermann, Fuzzy Set Theory and Its Applications, Library of Congress Cataloguing-in-Publication Data, Fourth Edition.

Unit 4: Chapter 6: section 6.1 to 6.8

Unit 5: Chapter 9: section 9.1 to 9.3

**Reference Books:**

1. Klir.G, Yuan B.B. Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
2. Rajasekaran. S. Vijayalakshmi Pai. G.A. “Neural Networks, Fuzzy Logic and Genetic Algorithms”, Prentice Hall of India Private Limited, 2003.
3. George J. Klir and Tina .A Folger – Fuzzy sets, uncertainty and Informations – Prentice Hall of India, 2003, New Delhi.



**MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)**  
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**(For those who joined in 2018-2019 and after)**

<b>Class</b>	<b>: B.Sc. (Mathematics with CA)</b>	<b>Part III</b>	<b>: Elective</b>
<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCE53</b>	<b>Credits</b>	<b>: 05</b>

**WEB PROGRAMMING**

Course Outcome:

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

**CO1 :understand the concept of Internet.**

**CO2 :enrich the knowledge about HTML, Java Script and VBScript.**

**CO3 : know about the events used in Java script and VB script.**

**Unit-I** Introduction to the Internet: Computers in Business – Networking –Internet – Electronic Mail – Resource Sharing – Gopher – World Wide Web – Usenet – Telnet. Internet Technologies: Modem – Internet Addressing – Physical Connections – Telephone Lines. Internet Browsers: Internet Explorer – Netscape Navigator.

**Unit-II** Introduction to HTML: Designing a Home Page – History of HTML – HTML Generations – HTML Documents – Anchor Tag – Hyper Links. Head and Body Sections: Header Section – Title – Prologue – Links –Colorful Web Page – Comment Lines. Designing the Body Section: Heading Printing – Aligning the Headings – Horizontal Rule – Paragraph – Tab Settings – Images and Pictures. Ordered and Unordered Lists: Lists – Unordered Lists – Heading in a List – Ordered Lists –Nested Lists.

**Unit-III** Table Handling: Tables – Tables Creation in HTML –Width of the Table and Cells – Cells Spanning Multiple Rows/Columns – Coloring Cells – Column Specification. Frames: Frameset Definition – Frame Definition – Nested Framesets. Forms: Action Attribute – Method Attribute – Enctype attribute – Drop Down List.

**Unit-IV** JAVASCRIPT: Introduction – Language Elements – Objects of JavaScript – Other Objects – Arrays – Worked Examples.

**Unit-V** VBSCRIPT: Introduction – Embedding VBScript Code in an HTML Document – Comments – Variables – Operators – Procedures – Conditional Statements – Looping Constructs – Objects and VBScript – Cookies.

**Text Books:**

1. C.Xavier, World Wide Web Design with HTML, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2000.
2. N.P. Gopalan and J. Akilandeswari, Web Technology: A Developer's Perspective, PHI Learning Private Limited, Delhi, Second Edition, 2014.

**Text Book1:**

Unit I - Chapters 1,2 & 3 – Sections: 1.1 to 1.9, 2.1 to 2.4, 3.1 to 3.2

Unit II - Chapters 4, 5,6& 7–Sections: 4.1 to 4.6 , 5.1 to 5.6, 6.1 to 6.6, 7.1 to 7.5

Unit III- Chapters 8, 10, 12–Sections: 8.1 to 8.6, 10.1 to 10.3, 12.1 to 12.4

**Text Book2:**

Unit IV Chapter - 5 (Full)

Unit V Chapter – 6 (Full)

**Reference Books:**

1. Steven Holzner, HTML Black Book, Dream Tech Press, Tata McGraw Hill, New Delhi, 2001.
2. Ivan Bayross, HTML, JavaScript, DHTML and PHP, BPB Publications, New Delhi, 4th Revised Edition, 2005.





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<b>Semester</b>	<b>: V</b>	<b>Hours</b>	<b>: 02</b>
<b>Course Code</b>	<b>: 18UMCS51</b>	<b>Credits</b>	<b>: 02</b>

**LAPLACE TRANSFORMS AND FOURIER SERIES**

**Course Outcome:**

**On successful completion of the course, the learners will be able to**

**CO 1:** Learn Laplace transforms and understanding its inverse. (K1, K2)

**CO 2:** Apply Laplace Transform to solve ordinary differential equation. (K3)

**CO 3:** Solve problems in inverse Laplace transform. (K3)

**CO 4:** Examine the Laplace transform in periodic function. (K4)

**CO 5:** Evaluate the Fourier series and half range Fourier series.(K5)

**Unit –I**

Laplace Transforms –Definitions – Sufficient conditions for the existence of the Laplace transform – Laplace transform of periodic functions – Some general Theorems – Problems – Evaluation of integrals.

**Unit –II**

The Inverse Laplace Transforms – Problems –Results.

**Unit –III**

Solving ordinary differential equations with constant coefficients and variable coefficients – Simultaneous linear equations using Laplace Transforms – Solving certain equation involving integrals using Laplace Transforms.

**Unit –IV**

Fourier series –Trigonometric series – Even and Odd functions.

**Unit – V**

Half range Fourier series – Extension to intervals of length  $2\pi$ .

**Text Book :**

1. S.Narayanan and T.K.Manicka Vasagam Pillay, **Differential equations and its Applications**, S.Viswanathan Publications, Chennai, 2006.
2. Dr.S. Arumugam and Issac, **Sequence & Series And Fourier Series**, New Gamma Publishing House, Palayamkottai, 2006.

Unit I (Book 1) - Chapter 9: Section 1 to 5

Unit II (Book 1) - Chapter 9: Section 6 to 7

Unit III (Book 1) - Chapter 9: Section 8 to 11

Unit IV (Book 2) - Chapter 6: Pg.No: 1 to 16

Unit V (Book 2) - Chapter 6: Pg.No: 17 to 20

**Reference Books:**

1. Dr. M.D. Raisinghania, **Advanced Differential Equations**, S.Chand and Company PVT.LTD, New Delhi, Reprint, 2012.
2. George yankovsky, **Differential and Integral Calculus (Volume II)**, MIR Publishers, Moscow, 1974.
3. Ray Hanna J., - **Fourier Series, Transforms and Boundary Value Problems**, Dover Publications, New York, 2008.



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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 05</b>
<b>Course Code</b>	<b>: 18UMCC61</b>	<b>Credits</b>	<b>: 05</b>

**COMPLEX ANALYSIS**

**Course Outcome:**

**On successful completion of the course, the learners will be able to:**

- CO 1:** List the basic concepts of analytic function and harmonic functions. (K1)
- CO 2:** Express analytic property, conformal mapping and identify singularities. (K2, K3)
- CO 3:** Examine the basic properties of singularities, convergence of power series. (K4)
- CO 4:** Choose the Cauchy's integral formula or integral theorem. (K5)
- CO 5:** Reduce the complex integration with the help of integral formula. (K6)

**Unit – I**

Continuous functions – Differentiability – Cauchy-Riemann Equations – Alternative forms of Cauchy-Riemann equations – Analytic functions – Harmonic functions – Milne-Thompson method.

**Unit – II**

Conformal mapping definition and examples – Elementary transformations: translation, rotations, magnification, inversion – Bilinear Transformation – cross ratio – Fixed points.

**Unit – III**

Exact equation – Cauchy's Theorem – Connected region – Cauchy's Integral formula – Maximum modulus theorem – Higher derivatives.

**Unit – IV**

Taylor's series – Maclaurin's series – Laurent's series – Zeros – Singularities – types of singularities – meromorphic function.

**Unit – V**

Residues – Cauchy’s residue theorem – Evaluation of definite integrals of standard types – Jordan’s lemma (without proof).

**Text Book:**

1. S. Arumugam, A. Thangapandi Isaac and A. Somasundaram, Complex Analysis, Scitech publications, 2019.

Unit – I: Chapter 2: Section 2.4 to section 2.9

Unit – II: Chapter 3: Section 3.0 to section 3.4

Unit – III: Chapter 6: Section 6.2 to

Unit – IV: Chapter 7

Unit – V: Chapter 8

**Reference Books:**

1. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, New Delhi. 2000.
2. L.V Ahlfors, Complex Analysis, McGraw Hill Co., New York, 1988.
3. Ponnuswamy .S – “Foundations of Complex Analysis”, Narosa Publication House, New Delhi, II edition 2005.



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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 05</b>
<b>Course Code</b>	<b>: 18UMCC62</b>	<b>Credits</b>	<b>: 05</b>

**LINEAR ALGEBRA**

**Course Outcome:**

**On successful completion of the course, the learners will be able to:**

- CO 1:** Exhibit vector space, inner product space, span of a set and understand the fundamental theorem of homomorphism (K1,K2)
- CO 2:** Characterize vector spaces and matrices. (K3)
- CO 3:** Apply properties of matrices and vector space (K3)
- CO 4:** Analyze orthogonality and bilinear forms (K4)
- CO 5:** Reduce quadratic form into diagonal form. (K6)

**Unit –I**

Vector Spaces – Definition and examples – Subspaces – Linear Transformation – Fundamental theorem of Homomorphism.

**Unit –II**

Span of a set – Linear independence – Basis and Dimension – Rank and Nullity – Matrix and Linear Transformations.

**Unit-III**

Inner Product Spaces – Definition and examples – Orthogonality – Orthogonal complement.

**Unit –IV**

Theory of Matrices –Algebra of Matrices –Types –Inverse-Elementary Transformation-Rank of a Matrix– Simultaneous Linear equations – Characteristic equation and Cayley Hamilton theorem – Eigen values and Eigen Vectors.

**Unit – V**

Bilinear forms – Matrix of a Bilinear form – Quadratic forms – Reduction to Quadratic forms.

**Text Book:**

1. Dr.S.Arumugam and Issac A.T, **Modern Algebra**, Scitech Publications, Chennai, Reprint July 2014.

Unit I - Chapter 5: Section 5.0 to 5.3

Unit II - Chapter 5: Section 5.4 to 5.8

Unit III - Chapter 6: Section 6.0 to 6.3

Unit IV - Chapter 7: Section 7.0 to 7.8

Unit V - Chapter 8: Section 8.0 to 8.2

**Reference Books:**

1. Leadership Project Committee, University of Bombay, **Text book of Algebra**, Tata McGraw Hill Publication, New Delhi, 1985.
2. V.Krishnamurthy, V.P.Mainra & J.L.Arora, **An Introduction to Linear Algebra**, Affiliated East – West press Pvt Ltd, New Delhi, 1990.
3. Manicavasagam Pillai .T.K and others – **Modern Algebra**, S. Viswanathan Publishers, Chennai 1993.



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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCC63</b>	<b>Credits</b>	<b>: 05</b>

**OPERATIONS RESEARCH**

**Course Outcome:**

**On successful completion of the course, the learners will be able to:**

**CO 1: Illustrate linear problem, special forms and game theory. (K2)**

**CO 2: Evaluate game theory and linear problems. (K5)**

**CO 3: Compare different types of methods in solving linear problem. (K4)**

**CO 4: Solve linear programming problem. (K3)**

**CO 5: Design real life problem into a linear problem. (K6)**

**Unit –I**

Linear Programming Problem – Formulation of LPP. Mathematical form – Solution by Graphical Method, The Simplex method and Method of penalty (Big M Method only).

**Unit –II**

Duality – Dual simplex method- Problems.

**Unit –III**

Transportation problem – Mathematical form – Initial solutions by all methods – MODI method for both balanced and unbalanced TP- The assignment problems.

**Unit –IV**

Sequencing –Replacement problem.

**Unit –V**

Game theory – Two person zero sum game – saddle point – Game with saddle point – Solution of game by using formula, graphical method, method of dominance and LPP method.

**Text Book:**

1. Kanti Swarup , P.K. Gupta and Man Mohan, **Operations Research** , Sultan Chand and Sons Publications, New Delhi, Reprint 2006.

Unit I - Chapter 2 Section 2.1, 2.2  
Chapter 3 Section 3.1 to 3.5  
Chapter 4 Section 4.1 to 4.4

Unit II - Chapter 5: Section 5.1 to 5.4 and 5.7

Unit III - Chapter 10: Section 10.1 to 10.5, 10.8 to 10.11 and 10.14

Chapter 11: Section 11.1 to 11.4

Unit IV - Chapter 12: Section 12.1 to 12.5

Chapter 18: Section 18.1 to 18.3

Unit V - Chapter 17: Section 17.1 to 17.7

**Reference Books:**

1. Dr.S.Arumugam and ISAAC, **Topics in Operations Research -Linear Programming**, New Gamma Publishing House, Palayamkottai, June 2012.
2. P.R.Vital and V.Malini, **Operations Research**, Margham Publications, Chennai, 2002.
3. Hamdy A. Taha, - **Operations Research, An Introduction**, 8<sup>th</sup> Ed., Prentice – Hall India, 2006.





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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCPR1</b>	<b>Credits</b>	<b>: 05</b>

**PROJECT AND VIVA**

**Course Description**

The Project is conducted by the following Course Pattern.

**Internal**

Presentation	}	<b>40</b>
Submission		

**External**

Project Report	}	<b>60</b>
Viva Voce		

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<b>Total</b>	<b>- 100</b>
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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCE61</b>	<b>Credits</b>	<b>: 05</b>

**GRAPH THEORY**

**Course Outcomes**

**On successful completion of the course, the learners will be able to:**

- CO 1:** Demonstrate the basic concepts of graph theory. (K2)
- CO 2:** Develop mathematical proofs in graph theory. (K3)
- CO 3:** Examine types of graph and finding its index. (K4)
- CO 4:** Present various graph models. (K5)
- CO 5:** Build mathematical models using graph theory. (K6)

**Unit –I**

Graphs- Degrees – Sub graphs, Isomorphism, Ramsey numbers – Independent sets and Coverings –Matrices of graphs - Operation on graphs.

**Unit –II**

Degree sequences – Graphic sequences- Walks, Trials and Paths – Connectedness and Components – Blocks- Connectivity.

**Unit –III**

Eulerian graphs – Hamiltonian graphs – Trees – Characterization of trees – Centre of a tree – Matching – Matching in bipartite graphs.

**Unit –IV**

Planar graph and properties – Characterization of Planar graphs – Thickness – Crossing numbers and Outer planarity.

**Unit –V**

Chromatic number and Chromatic index – Five colour theorem and Four colour theorem - Chromatic polynomial.

**Text Book:**

1. Dr.S.Arumugam and S.Ramachandran, Invitation to Graph Theory, Scitech Publication, Chennai, 2015.

Unit I - Chapter 2: Section 2.1 to 2.6 &2.8 to 2.9

Unit II - Chapter 3, 4

Unit III - Chapter 5, 6 &7

Unit IV - Chapter 8

Unit V - Chapter 9

**Reference Books:**

1. Harry, Graph Theory, Narosa Publishing House, New Delhi, 2001.
2. S.K.Yadav, Elements of Graph Theory, Ane Books Private Ltd, New Delhi, 2010.
3. Narasingh Deo – Graph theory with application to engineering and computer science, Prentice – Hall of India pvt. Ltd., New Delhi.



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**STOCHASTIC PROCESS**

**Course Outcomes:**

**On successful completion of the course, the learners will be able to:**

**CO 1:** list the definition of Markov chain and random walk. (K2)

**CO 2:** illustrate Stochastic Process, Markov Process. (K3)

**CO 3:** evaluate the transition probability matrices. (K4)

**CO 4:** justify the type of Markov Chain. (K5)

**CO 5:** model the concepts and theorems for real life problems (K6)

**Unit –I**

Stochastic Processes – types – Stationary Processes –examples - Ergodicity

**Unit –II**

Discrete Time Markov Chain – Transition Probabilities – Chapman – Kolmogorov equation – Classification of States – Limit Theorems for Markov Chains.

**Unit –III**

Stationary Distribution – Special Chains and Foster Type Theorems – Theorems Regarding Finite Markov Chains – Methods of Evaluation of the n-step Transition Probability

**Unit –IV**

Random walks- Types – Sequential Analysis – Wald’s Equation and Wald’s Identity- Fluctuation Theory.

**Unit- V**

Continuous Time Discrete State Markov Process – Transition Function – Kolmogorov Differential Difference Equation- Birth and death Process – Yule’s Process

**Text Book:**

Introduction to Stochastic Processes, **A.K.BASU**, Narosa Publishing House, New Delhi

Unit I: Section 1.1-1.3

Unit II: Section 2.1-2.4

Unit III: Section 2.5-2.8

Unit IV: Section 3.1-3.4

Unit V : Section 6.1-6.6

**Reference Books:**

1. Stochastic Process, **J.Medhi** ,Wiley Eastern Company ,New Delhi,1987.
2. Basic Stochastic Processes, **Zdzistaw Brzeniak and Tomasz Zastawniak**, Springer International Edition, New Delhi, 1999.
3. Essentials of Stochastic Processes, **Rick Durrett**, Springer ,1999.

Percentage of change : 100%



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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 06</b>
<b>Course Code</b>	<b>: 18UMCE63</b>	<b>Credits</b>	<b>: 05</b>

**NUMBER THEORY**

**Course Outcomes:**

**On successful completion of the course, the learners will be able to:**

- CO 1:** Explain the basic concepts of numbers (K2)
- CO 2:** Solve congruence and number problems. (K3)
- CO 3:** Apply theoretical concepts in number theory (K3)
- CO 4:** Examine the divisibility using several methods (K4)
- CO 5:** Construct mathematical proofs of basic results in number theory (K3)

**Unit I :**

Early Number theory- The division Algorithm-The g.c.d-The Euclidean algorithm

**Unit-II**

The fundamental Theorem of arithmetic- The sieve of Eratosthenes –The Goldbach Conjecture

**Unit-III**

Basic properties of Congruences-Binary and decimal Representations of Integers- linear congruences- The Chinese remainder theorem

**Unit-IV**

Fermat’s Little theorem and pseudo primes-Wilson’s theorem

**Unit-V**

The sum and number of divisors-The mobious inversion formula- The greatest integer function

**Text Book:**

1. Elementary Number Theory by David M.Burton ,TATA Mc Graw-Hill Ltd Edition : 6th edition

Unit-I : Chapter 2.1 to 2.4

Unit-II : Chapter 3.1 to 3.3

Unit-III : Chapter 4.2 to 4.4

Unit-IV : Chapter 5.2 to 5.3

Unit-V : Chapter 6.1 to 6.3

**Reference Books:**

1. An Introduction to Theory of Numbers: Niven and Zuckermann Publishers Wiley Eastern Ltd Edition / Year: 13rd Edition / 1972.
2. Introduction to Analytic Number Theory by “ Tom .M.Apostal”
3. Elements of Number Theory by Kumaravelu and Sucila Kumaravelu, 2002.



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<b>Semester</b>	<b>: VI</b>	<b>Hours</b>	<b>: 02</b>
<b>Subject Code</b>	<b>: 18UMCS61</b>	<b>Credits</b>	<b>: 02</b>

**BOOLEAN ALGEBRA & LOGIC**

**Course Outcome:**

**On successful completion of the course, the learners will be able to**

**CO1:** Understand the logical statements using the concept of propositions (K1)

**CO2:** Analyse the logical statements using laws of propositions needed for computing skill (K4)

**CO3:** Classify the lattice structure using its properties (K2)

**CO4:** Determine the correlation between Boolean expressions. (K4)

**CO5:** Apply the different methods to simplify Boolean expressions.(K3)

**Unit –I**

**Logic:** Logic and Propositional Calculus - Statements, Basic Logical operations -Truth values of compound Statements - Propositions and Truth tables.

**Unit –II**

Tautologies and Contradictions - Logical equivalence - Negation, De Morgan's Laws - Algebra of Propositions – Conditional and Biconditional Statements.

**Unit –III**

Arguments, Arguments and Statements – Logical Implications – Quantifiers, Negation of Quantified Statements.

**Unit –IV**

**Boolean Algebra:** Basic definitions and theorems – Lattices - Sum-of-products forms.

**Unit – V**

Minimal Boolean Expressions, Prime Implicants – Logic Gates – Logic Circuits - Truth Tables – Karnaugh maps – Minimal AND-OR circuits.



**Text Book:**

1. Seymour Lipschutz, Marcs Lars Lipson, **Discrete Mathematics**, Schaum's series, McGraw-Hill International Editions, Second Edition, Chennai, 1999.  
Unit I - Chapter 4: Section 4.1 – 4.4  
Unit II - Chapter 4: Section 4.5 – 4.8  
Unit III - Chapter 4: Section 4.9 – 4.12  
Unit IV - Chapter 15: Section 15.1 – 15.8  
Unit V - Chapter 15: Section 15.9 – 15.12

**Reference Books:**

1. M.K. Venkataraman, N.Sridharan, N.Chandrasekaran, **Discrete Mathematics**, The National Publishing Company, Chennai, 2000.
2. K.Chandrasekhara Rao, **Discrete Mathematics**, Narosa Publishing House, Chennai, 2012.
3. Veerarajan .T – Discrete mathematics – Tata McGraw Hill – (2009)