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., Mathematics

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 CBSE Board with Mathematics as one of the subjects in Higher Secondary Education.

Duration of the Course

The students shall undergo the prescribed B.Sc(Mathematics) 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

Extension activities

The scheme of Examination

The components for continuous internal assessment are:

Two	tests and their average	15 marks
Semi	nar /Group discussion	5 marks
Assig	gnment	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 (answ	ver all)	6 x01= 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
	Total	30 Marks

Pattern of the question paper for the Summative Examinations:

Note: Duration- 3 hours		
Part –A		
Ten multiple choice questions	10 x01	= 10 Marks
(No Unit shall be omitted; not more than two questions f	rom each ur	nit.)
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)		
Total		75 Marks

The Scheme of Examination (Environmental Studies and Value Education)

Two tests and their average	15 marks
Project Report	10 marks*
Total	25 marks

** 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
	Total	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)		
,	Total	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 understand the basic rules of logic, including the role of axioms or assumptions

- **PSO2:** To recognize connections between different branches of mathematics and appreciate the connections between theory and applications.
- **PSO3:** To enable the students to gain knowledge in basic Mathematics.
- **PSO4:** To provide sufficient knowledge on computer skills through MS office, C, C++ and Java Programming and many innovative and modern subjects in Mathematics.

Study Component	Ι	II	III	IV	V	VI	Total	Total	No.of	Total
	Sem	Sem	Sem	Sem	Sem	Sem	Hours	Credit	course	marks
Part – I	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Tamil										
Part –II	6(3)	6(3)	6(3)	6(3)			24	12	4	400
English										
Part –III										
Core subjects	6(4)	6(5)	5(5)	5(5)	5(5)	5(5)	76	69	14	1400
			5(5)	5(5)	5(5)	5(5)				
					6(5)	6(5)				
					6(5)	6(5)				
Allied Subject-I	4(4)	4(3)	4(4)	4(3)			16	14	4	400
Allied Subject-I	2(0)	2(1)	2(0)	2(1)			8	2	2	200
(P)										
Allied Subject-II					6(5)	6(5)	12	10	2	200
Allied Subject -									1	100
II (P)										
Part-IV										
Allied	6(4)	6(4)	4(4)	4(4)			20	16	4	400
Mathematics										
Skill Based	2(2)	2(2)			2(2)	2(2)	12	12	6	600
Subjects	2(2)	2(2)								
Environment	2(2)	2(2)					4	4	2	200
studies / value										
education										
Non Major			2(2)	2(2)			4	4	2	200
Elective										
Part V										
Extension				0(1)			0	1	1	100
Activities										
Total	30	30	30	30	30	30	180	140	42	4200
	(20)	(21)	(22)	(23)	(27)	(27)				

B.Sc (Mathematics) (Those who joined in 2018-2019 and after) Table: 1: Course pattern

Subject code	Subjects	No. of	Hours	Credita	Maximum Marks		
Subject code	subjects		/ week	Creatis	Int.	Ext	Total
	Part –I Tamil Subject						
18UTAG11	Tamil –I:	1	6	3	25	75	100
	தற்கால கவிதையும் உரைநடையும்						
	Part –II English Subject						
18UENG11	Exploring Language Through Literature-	1	6	3	25	75	100
	Ι						
	Part –III Core Subject	1	6	4	25	75	100
18UMTC11	Differential Calculus	1	0	4	23	15	100
	Part –III Allied Subject	1	4	4	25	75	100
18UPHA11	Allied Physics –I Mechanics, Properties	1	4	4	25	15	100
	of Matter and Relativity		2				
18UPHAP1	Allied Physics Practical - I	-	2	-	-	-	-
	Part –IV Skill Subject	1	2	2	25	75	100
18UMTS11	Numerical Aptitude	1	2	2	23	15	100
18UMTS12	Trigonometry	1	2	2	25	75	100
	Part –IV Mandatory Subject	1	2	2	25	75	100
18UEVG11	Environmental Studies	1	2	2	23	15	100
	Total	7	30	20	175	525	700

SEMESTER -I

SEMESTER – II

Subject code	Systianta	No. of	Hours	Cradita	Maximum Marks		
	Subjects	Courses	/ week	Creatis	Int	Ext	Total
18UTAG21	Part –I Tamil Subject Tamil –II: பக்தி இலக்கியமும் நாடகமும்	1	6	3	25	75	100
18UENG21	Part –II English Subject Exploring Language Through Literature- II	1	6	3	25	75	100
18UMTC21	Part –III Core SubjectTheory of Equations and its applications	1	6	5	25	75	100
18UPHA21	Part –III Allied Subject Allied Physics –II Thermal Physics and Sound		4	3	25	75	100
18UPHAP1	Allied Physics Practical - I	1	2	1	40	60	100
18UMTS21	Part –IV Skill Subject MS Office	1	2	2	25	75	100
18UMTSP1	MS Office Lab	1	2	2	40	60	100
18UVLG21	Part –IV Mandatory Subject Value Education	1	2	2	25	75	100
	Total	8	30	21	230	570	800

SEMESTER –III											
Subject	Subjects	No. of H		Hours		Credits		Maximum Ma			:ks
code	Subjects	Co	urses	/ we	week		Int	F	Ext	Total	
18UTAG31	Part –I Tamil காப்பிய இலக்கியமும் சிவககையம்	1		6		3		25	7	5	100
18UENG31	Part –II English Exploring Language Through Literature-III	1		6		3		25	7	5	100
18UMTC31 18UMTC32	Part –III Core Subject Integral Calculus Sequences and Series	1 1		5 5		5 5		25 25	7	5 5	100 100
18UPHA31	Part –III Allied Subject Allied Physics –III Electricity and Electronics Allied Physics	1		4		4		25	7	5	100
100111112	Practical - II	-		2							
18UMTN31	Part –IV NME Mathematics for Competitive Examination - I	1	2		2		25	7	5	100	
	Total	6		30		22		150) 4	50	600
SEMESTER	IV										
Subject Code	Title of the Paper		No.o: Cour	f ·ses	Ho /W	ours /eek	Cre	dits	Max Int	imum Ext	Marks Total
18UTAG41	Part – I Tamil பழந்தமிழ் இலக்கியமும் புதினமும்		1		6		3		25	75	100
18UENG41	Part –II English Exploring Language Through Literature-IV		1		6		3		25	75	100
18UMTC41	Part –III Core Subject Analytical geometry 3D and Vector calculus		1		5		5		25	75	100
18UMTC42	Statistics - I		1		5		5		25	75	100
18UPHA41	Part –III Allied Subject Allied Physics- IV Optics, Spectroscopy and Mod Physics	lern	1		4		3		25	75	100
18UPHAP2	Allied Physics Practical -II		1		2		1		40	60	100
18UMTN41	Part –IV Non Major Elective Mathematics for Competitive Examination - II		1		2		2		25	75	100
18UEAG40- 18UEAG49	Part V- Extension Activities		1		-		1		100	-	100

SEMESTER –V											
Course	Name of the course	No. of	Hours /	Credit	Maximum Marks						
code		Courses	week	S	Int	Ext	Total				
	Part –III Core Subject										
18UMTC51	Real Analysis	1	5	5	25	75	100				
18UMTC52	Modern Algebra	1	6	5	25	75	100				
18UMTC53	Statistics II	1	6	5	25	75	100				
18UMTA51	Programming in C	1	5	5	25	75	100				
18UMTE51	Differential Equations	1	6	5	25	75	100				
18UMTE52	Fuzzy sets										
18UMTE53	Astronomy										
18UMTS51	Part IV Skill Subject Laplace Transforms & Fourier Series	1	2	2	25	75	100				
	Total	6	30	27	150	450	600				

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Total 8

290 510 800

SEMESTER -- VI

Course ande	Nome of the subject	No. of	Hours /	Credita	Maximum Marks				
Course code	Ivalle of the subject	Courses	week	Creatis	Int	Ext	Total		
	Part –III Core Subject								
18UMTC61	Complex Analysis	1	5	5	25	75	100		
18UMTC62	Linear Algebra	1	6	5	25	75	100		
18UMTPR1	Project & Viva-voce	1	6	5	40	60	100		
18UMTA61	Operations Research	1	5	5	25	75	100		
18UMTE61	Graph Theory								
18UMTE62	Stochastic Process	1	6	5	25	75	100		
18UMTE63	Number Theory								
18UMTS61	Part IVSkill Subject	1	2	2	25	75	100		
	Programming in C++	1	2	2	23	15	100		
	Total	6	30	27	165	435	600		



Course Outcomes:

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

Class : B.Sc (Mathematics) Semester : V Course Code : 18UMTC51

Part III	: Core
Hours	: 05
Credits	: 05

REAL ANALYSIS

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

- **CO1:** demonstrate the understanding of basic concepts of Real analysis. (K2)
- CO2: determine whether subsets of a metric space are open, closed, complete, connected and/or compact. (K3)
- **CO3:** examine whether a function on a metric space is continuous, discontinuous, or uniformly continuous. (K4)
- **CO4:** comprehend arguments developing the theory behind real analysis (K2)
- **CO5:** 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 R - Connectedness and continuity – Intermediate value theorem.

Unit –V

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

Text Book:

- 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

- 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.



Class : B.Sc (Mathematics) Semester : V Course Code :18UMTC52

Part III	: Core
Hours	:06
Credits	: 05

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

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

 $\begin{array}{l} Homomorphisms-Types \ and \ examples-Theorems \ on \ Homomorphisms-Fundamental \\ theorem \ of \ Homomorphism-Any \ infinite \ cyclic \ group \ is \ isomorphic \ to \ (Z, +) - Any \ finite \\ group \ is \ isomorphic \ to \ (Z_n, +) - Cayley's \ Theorem-Rings-Definition \ and \ examples \ . \end{array}$

Unit- V

Academic Council Meeting Held on 21.10.2019

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**, MahimaRanjan, **Adhikari**, Avishek, Springer, 2014.

Percentage of change: 30%



Course Outcomes:

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

Class : B. Sc (Mathematics) Semester : V Course Code : 18UMTC53

Part III: CoreHours: 06Credits: 05

STATISTICS II

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

- 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.
- Bhat B.R, Srivenkataramana T and Rao Madhava K.S.(1996): Statistics: A Beginner s Text, Vol. I, New Age International (P) Ltd.



Class	: B.Sc (Mathematics)	Part III	: Allied
Semester	: V	Hours	: 05
Course Co	de: 18UMTA51	Credits	: 05

PROGRAMMING IN C

Course Outcomes:

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

CO 1: Identify appropriate program concepts. (K1)

CO 2: Explain the concept of programming and pseudo codes (K2)

CO 3: Analyze problems, identify subtasks and implement them as functions/procedures. (K4)

CO 4: Implement variables and looping techniques. (K5)

CO 5: Apply branching statement and iteration techniques to solve application programs. (K3)

Unit 1: Programming Fundamentals – program development life cycle – algorithm – flow chart – pseudo code

Unit 2: C character set – identifiers and keywords – declaration statement – data types – type quantifiers and type modifiers – difference between declaration and definition– variables and constants - structure of a C program – Executing a C program.

Unit 3: Expressions – Simple Expressions and compound expressions – classification of operators – combined precedence of all operators – reading strigs – printing strings.

Unit 4: Statement – classification of statements – branching statements: if statement, if-else statement, nested if statement, nested if-else statements, switch statement, jump statement, goto statement, break statement, return statement

Unit 5: Iteration statement: counter-controlled loops, for statement, while statement, do-while statement, sentinel –controlled loops – nested loops- break and continue statements

Text book:

1. Anita Goel and Ajay Mittal, Computer fundamentals and programming in C, 2nd Edition, Pearson publication.

Unit 1: section 2.12 to 2.17 Unit 2: section 3.4 to 3.13 (excluding 3.10) Unit 3: section 4.1 to 4.8 Unit 4: section 5.1 to 5.4 Unit 5: section 5.5 full.

- 1. E.Balagurusamy, Programming in ANSI C, sixth Edition, Tata McGraw Hill Publishing Company, Uttar Pradesh, 2005.
- 2. Byron Gottfried, Programming with C, Tata McGraw Hill, New Delhi, 2011
- 3. Yashavant Kanethkar, Let us C, BPB Publications, New Delhi, Jan 2010.



Class : B.Sc (Mathematics) Semester : V Course Code: 18UMTE51 Part III: ElectiveHours: 06Credits: 05

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

- 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



Class : B.Sc (Mathematics) Semester : V Course Code : 18UMTE52

Part III: ElectiveHours: 06Credits: 05

FUZZY SETS

Course Outcomes:

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

CO1: 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 - α -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.

Academic Council Meeting Held on 21.10.2019

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

- 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.
- George J. Klir and Tina .A Folger Fuzzy sets, uncertainty and Informations Prentice Hall of India, 2003, New Delhi.



Class : B.Sc. (Mathematics) Semester : V Course Code: 18UMTE53

Part III	: Elective
Hours	:06
Credits	: 05

ASTRONOMY

Course Outcome:

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

CO 1: Remember the daily and long-term motion of planets and others. (K1)

CO 2: Apply mathematical concepts in studying space objects. (K3)

CO 3: Analyze the concepts of the spherical, horizontal systems. (K4)

CO 4: Evaluate the Meridian system. (K5)

CO 5: Create the interest about astronomy. (K6)

UNIT I:

Sphere and related theorem – great circles and small circles- Axis and poles of a circle-Distance between two points on a sphere- angle between two circles – secondaries –Angular, radius or spherical radius – Related theorems (without proof)- Spherical figures – spherical triangle –polar triangle –Related theorems(without proof)- some properties of spherical triangles (without proof) – colunar and antipodal triangles – Examples.

UNIT II:

Relation between the sides and angles of a spherical triangle- Five parts formula – functions of half an angle- functions of half a side- Delambre's analogies and Napier's analogies- Right angled spherical triangle (without proof) – Theorem.

UNIT III:

Napier's rules – Spherical coordinates – Relation between spherical and rectangular coordinates (without proof) – General proof of the cosine formula- small variations –Formulae in plane trigonometry – Worked Examples (1-6).

UNIT IV:

Celestial sphere – Diurnal motion, Celestial axis and equator – cardinal points- First point of Aries and First point of Libra- Equinoxes and Solstices – Colures – Celestial Coordinates – Horizontal system – equatorial system.

UNIT V:

Meridian system – Ecliptic system – Different systems of co –ordinates in the same figure – Conversion of coordinates (without proof) – The relation between Right Ascension and Longitude of the sun –Trace the Changes in the coordinates of the sun in the course of a year – The longitude of the sun on the day – Worked Examples (1-4 problems only).

Text Book:

"Astronomy for Degree Students" by Kumaravelu and Susila Kumaravelu 1996, Reprint 2006.

Unit I: Chapter 1: Sections 1 to 19.

Unit II: Chapter 1: Sections 20 to31 (31 without proof).

- Unit III: Chapter 1: Section 32 to 38(34 without proof)
- Unit IV: Chapter 2: Sections 40 to 61.
- Unit V: Chapter 2: Sections 62 to 68 (65 without proof)

- 1. M.L.KHANNA, Spherical Astronomy Prakash printers, 1973.
- 2. George O Abell Exploration of the Universe (Second Edition)
- 3. G V Ramachandran, Text Book of Astronomy, Mission Press, Palayamkottai, 1965



Class : B.Sc (Mathematics) Semester : V Course Code: 18UMTS51

Part IV	: Skill
Hours	:02
Credits	:02

LAPLACE TRANSFORMS AND FOURIER SERIES

Course Outcome:

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

CO1: Learn Laplace transforms and understanding its inverse. (K1, K2)

CO2: Apply Laplace Transform to solve ordinary differential equation. (K3)

CO3: Solve problems in inverse Laplace transform. (K3)

CO4: Examine the Laplace transform in periodic function. (K4)

CO5: 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 cosine series and Fourier sine series.

Text Books:

- 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 14
Unit V (Book 2)	-	Chapter 6: Pg.No: 15 to 20

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



Class : B.Sc (Mathematics) Semester : VI Course Code: 18UMTC61

Part III	: Core
Hours	: 05
Credits	: 05

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**

) int – 11

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

Unit – III

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 definition integrals ofstandard 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 6.4

Unit – IV: Chapter 7

Unit – V: Chapter 8

- 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.



Class : B.Sc (Mathematics) Semester : VI Course Code : 18UMTC62

Part III	: Core
Hours	:06
Credits	: 05

LINEAR ALGEBRA

Course Outcome:

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

- **CO1:** Exhibit vector space, inner product space, span of a set and understand the fundamental theorem of homomorphism (K1, K2)
- **CO2:** Characterize vector spaces and matrices. (K3)

CO3: Apply properties of matrices and vector space (K3)

CO4: Analyze orthogonality and bilinear forms (K4)

CO5: 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:

- 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

- Leadership Project Committee, University of Bombay, Text book of Algebra, Tata McGraw Hill Publication, New Delhi, 1985.
- 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.



Class : B.Sc (Mathematics) Semester : VI Course Code : 18UMTPR1 Part III: CoreHours: 06Credits: 05

PROJECT AND VIVA

Course Description

The Project is conducted by the following Course Pattern.

Internal

Tota	al		- 100
Viva	a Voce	J	60
Proj	ect Report)	
External			
Sub	mission	}	40
Pres	entation)	



Class : B.Sc (Mathematics) Semester : VI Course Code: 18UMTA61

Part III	: Allied
Hours	: 05
Credits	: 05

OPERATIONS RESEARCH

Course Outcome:

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

CO1: Illustrate linear problem, special forms and game theory. (K2)

CO2: Evaluate game theory and linear problems. (K5)

CO3: Compare different types of methods in solving linear problem. (K4)

CO4: Solve linear programming problem. (K3)

CO5: 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

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.

Unit –V

Sequencing –Replacement problem.

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 Chapter17: Section 17.1 to 17.7
- Unit V Chapter 12: Section 12.1 to 12.5

Chapter 18: Section 18.1 to 18.3

- 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, 8th Ed., Prentice Hall India, 2006.



Class : B.Sc (Mathematics) Semester : VI Course Code : 18UMTE61

Part III: ElectiveHours: 06Credits: 05

GRAPH THEORY

Course Outcomes

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

CO1: Demonstrate the basic concepts of graph theory. (K2)

CO2: Develop mathematical proofs in graph theory. (K3)

CO3: Examine types of graph and finding its index. (K4)

CO4: Present various graph models. (K5)

CO5: 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:

 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

- 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.
- Narasingh Deo Graph theory with application to engineering and computer science, Prentice – Hall of india pvt. Ltd., New Delhi.



Class : B.Sc (Mathematics) Semester : VI Course Code: 18UMTE62 Part III: ElectiveHours: 06Credits: 05

STOCHASTIC PROCESS

Course Outcomes: On successful completion of the course, the learners will be able to CO1: List the definition of Markov chain and random walk.(K2) CO2: Illustrate Stochastic Process, Markov Process. (K3) CO3: Evaluate the transition probability matrices. (K4) CO4: Justify the type of Markov Chain. (K5) CO5: 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:

1. 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%



Class: B.Sc (Mathematics)Semester: VICourse Code: 18UMTE63

Part III: ElectiveHours: 06Credits: 05

NUMBER THEORY

Course Outcomes:

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

CO1: Explain the basic concepts of numbers (K2)

CO2: Solve congruence and number problems. (K3)

CO3: Apply theoretical concepts in number theory (K3)

CO4: Examine the divisibility using several methods (K4)

CO5: 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-special divisibility test - linear congruences.

Unit-IV

Fermat's Factorization method – The Little theorem -Wilson's theorem

Unit-V

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

Academic Council Meeting Held on 21.10.2019

Text Book:

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

Unit-I	: Chapter 1: Sec 1.3		
	Chapter 2: Sec 2.1, 2.2.		
Unit-II	: Chapter 3: Sec 3.1 to 3.3		
Unit-III	: Chapter 4: Sec 4.2 to 4.4		
Unit-IV	: Chapter 5: Sec 5.2 to 5.4		
Unit-V	: Chapter 6: Sec 6.1 to 6.3		

Reference Books:

 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.



Class	: B.Sc (Mathematics)	Part IV	: Skill
Semester	: VI	Hours	:02
Course Code:	18UMTS61	Credits	:02

Programming in C++

Course Outcomes:

At the end of the course the students can able to

CO1: Demonstrate how C++ improves C with object-oriented features. (**K2**)

- CO2: Write inline functions for efficiency and performance. (K3)
- CO3: Make use of constructors and member functions. (K3)
- CO4: Differentiate Overload functions and operators in C++. (K4)
- CO5: Design C++ classes for code reuse. (K5)

Unit - I

Objects Oriented Programming - Structure of C++ program – Basic data type – User defined data type -Derived data type.

Unit - II

Operators in C++ - Control structures - Functions - Inline functions - Default arguments – Function overloading.

Unit - III

Class- Creating objects – Accessing class members- Defining member function - Static data members- Static member function.

Unit - IV

Friend function – Constructors – Destructors – Operator overloading – Rules for operator overloading.

Unit - V

Inheritance – Defining Derived classes – Single inheritance – Multilevel inheritance – Multiple Inheritance – Hierarchical in heritance - Hybrid Inheritance.

Text Book:

 E. Balagurusamy, Programming with C++, Tata McGraw Hill, New Delhi, Fifth Edition, 2011.

Unit I	-	Chapter 1: Section	: 1.5
		Chapter 2: Section	: 2.6
		Chapter 3: Sections	: 3.2 -3.6, 3.8.
Unit II	-	Chapter 3: Sections	: 3.14, 3.15, 3.25
		Chapter 4: Section	: 4.2, 4.6, 4.7, 4.10
Unit III	-	Chapter 5: Sections	: 5.3, 5.4, 5.11, 5.12
Unit IV	-	Chapter 5: Sections	: 5.15
		Chapter 6: Sections	: 6.2, 6.11
		Chapter 7: Sections	: 7.2, 7.8
Unit V	-	Chapter 8: Sections	: 8.2, 8.3, 8.5, 8.6, 8.7, 8.8

- Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley, New York, 1999.
- Robert Lafore, Object-Oriented Programming in Microsoft C++, Galgotia Publications, New Delhi, 2000.
- D.Ravichandran, Programming with C++, Tata McGraw Hill Education (India) Private Limited, New Delhi, Sixth Reprint, 2005.