SAKTHI COLLEGE OF ARTS AND SCIENCE FOR WOMEN, ODDANCHATRAM

(Recognized Under Section 2(f) and 12(B) of UGC Act 1956)

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

CURRICULUM FRAMEWORK AND SYLLABUS FOR

OUTCOME BASED EDUCATION IN

SYLLABUS FOR

M.Sc., MATHEMATICS

FRAMED BY

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL

UNDER

CHOICE BASED CREDIT SYSTEM

2015 - 2018

Regulations:

Objectives:

The Subjects of study are suitably designed to provide core knowledge and also to develop skills.

Mode:

Full - time Regular Programme.

Eligibility for Admission:

A candidate for admission into M.Sc. programme shall have studied B.Sc. Mathematics under 10+2+3 pattern of study.

Candidates who passed Bachelor's degree in Mathematics are eligible to apply.

Duration of study:

The course duration shall normally be two years spread over four semesters. The duration of each semester is minimum 90 working days and maximum 110 working days. The maximum duration to complete the course shall 5 years.

Medium:

The medium of instruction is English.

Number of Courses:

The total number of courses for the programme is 18 and that includes 14 hard core courses , 3 soft core courses, and 1 Project .

Passing minimum:

Passing Eligibility and Classification for the award of the Degree are as per the norms of the Choice Based Credit System(CBCS) and Introduction of Transfer of Credits.A candidate who obtains not less than 50% marks (30/60) in each paper in the summative examination and 50% marks (20/40) in each internal evaluation.

Minimum credits required to pass – 90

Assessment:

Evaluation of the candidates shall be through both Internal & External assessment. The ratio internal and external assessment should be 40:60

The Breakup of marks for internal assessment shall be as follows

Best score of two tests out of three tests	- 25
Speaking	- 05
Listening and Comprehension	- 05
Reading and Comprehension	- 05

Question Paper in External Examination carrying 60 marks will be in the format:

	Type	**No.of Questions to be answered**	**Marks**
PART A	Objective	24 questions, each carrying 1 mark- no choice	24 X 1 = 24
PART B	Paragraph About 1 to $1\frac{1}{2}$ Pages	4 questions out of 6, each carrying 3 marks	4 X 3 = 12
PART C	Essay Type About 3 pages	3 questions out of 5, each carrying 8 marks	3 X 8 = 24
		Total	60

Publication of Result:

	Examinations	**Publications of Results**
Odd Semester	I week of November	2nd week of January
Even Semester	III week of April	2nd week of June

COMMON STRUCTURE

Sem	Part	Subject code	Title of the Papers	Marks				Credits	Hrs / Week
				Internal		External			
				Max	Min	Max	Min		
I	Core	MMSC01	Linear Algebra	40	20	60	30	5	6
		MMSC02	Real Analysis	40	20	60	30	5	6
		MMSC03	Graph Thoery	40	20	60	30	5	6
		MMSC04	Object Oriented Programmimg with c++	40	20	60	30	5	6
	Elective	MMSE01	Number Theory	40	20	60	30	5	6
			TOTAL	**200**	**100**	**300**	**150**	**25**	**30**
II	Core	MMSC05	Differential Equation	40	20	60	30	5	6
		MMSC06	Topology	40	20	60	30	5	6
		MMSC07	Numerical Methods	40	20	60	30	5	6
		MMSC08	Probability Theory and Statistics	40	20	60	30	5	6
	Elective	MMSE02	Discrete Mathematics	40	20	60	30	5	6
			TOTAL	**200**	**100**	**300**	**200**	**25**	**30**
III	Core	MMSC09	Complex Analysis	40	20	60	30	5	6
		MMSC10	Functional Analysis	40	20	60	30	5	6
		MMSC11	Differential Geometry	40	20	60	30	5	6
		MMSC12	Operations Research	40	20	60	30	5	6
	Elective	MMSE03	Stochastic Process	40	20	60	30	5	6
			TOTAL	**200**	**100**	**300**	**200**	**25**	**30**
IV	Core	MMSC13	Fluid Dynamics	40	20	60	30	5	6
		MMSC14	Measure and Integration	40	20	60	30	5	6
	Project	MMSP1	Mathematical Model	40	20	60	30	5	18

TOTAL	**120**	**60**	**180**	**90**	**15**	**30**

Total No. of Credits in All Semester: 90

Semester : I **Core Paper 1** Hrs/Week : 6

Sub. Code : MMSC01 **LINEAR ALGEBRA** Credits : 5

Objectives:

1. *To give the students a thorough knowledge of the various aspects of linear Algebra*
2. *To train the students in problem-solving as a preparatory to NET/SLET*

UNIT I: Linear Transformations: Matrices:

Systems Of Linear Equations – Matrices And Elementary Row Operations – Row Reduced Echelon Matrices – Matrix Multiplication – Invertible Matrices. (Chapter 1 sec 1.1 to 1.6)

UNIT II: The Algebra Of Linear Transformations:

The Algebra Of Linear Transformations – Isomorphisms Of Vector Spaces – Representations Of Linear Transformation By Matrices – Linear Functionals (Chapter 3 sec 3.1 to 3.5)

UNIT III: The Algebra Of Polynomials And Determinant Functions:

The Algebra Of Polynomials – Lagrange Interpolation – Polynomial Ideals – The Prime Factorization Of A Polynomial, Commutative Rings – Determinant Functions – Permutations And The Uniqueness Of Determinants – Classical Adjoint Of A (Square) Matrix – Inverse Of An Invertible Matrix Using Determinants.(Chapter 4 sec 4.1 to 4.5, Chapter 5 sec 5.1 to 5.4)

UNIT IV: Characteristic Roots:

Characteristic Values – Annihilating Polynomials – Invariant Subspaces – Simultaneous Triangulation And Simultaneous Diagonalization.(Chapter 6 sec 6.1 to 6.5)

UNIT V: Direct Sum:

Direct Sum Decompositions – Invariant Direct Sums – The Primary Decomposition Theorem (Chapter 6 sec 6.6 to 6.8)

Text book:

1. Kenneth Hoffman & Ray Kunze , "Linear Algebra" 2nd edition Prentice – Hall of india private Limited, New Delhi 1975.

Reference books:

1. S. Kumerason, "Linear Algebra" Prentoice Hall of India Pvt Ltd New Delhi 2000.
2. V. Krishnamurthy – "Introduction to Linear aAlgebra", east West Press Ltd. 1985
3. A.R. Rao, P. Bhimashankaram, "Linear Algebra", McGraw- Hill International Book Company, New York 1996,
4. W. Curtis, "Linear Algebra", Springer Verlag. 1984.
5. I.N. Herstein, "Topics in Algebra", Wiley Eastern Ltd, New Delhi 1975.

Semester : I **Core Paper 2** Hrs/Week : 6

Sub. Code : MMSC02 **REAL ANALYSIS** Credits : 5

Objectives:

1. To give the students a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced learning in Pure Mathematics.

2. To train the students in problem-solving as a preparatory to NET/SLET.

Note: *The Question paper may contain problems to a maximum of 20%*

UNIT I: Basic Topology:

Finite, Countable And Uncountable Sets-Metric Spaces-Compact Sets-Perfect Sets- Connected set (chapter 2: 2.1 to 2.47)

UNIT II: Numerical Sequences And Series:

Convergent Sequences-Subsequences-Cauchy Sequences-Upper and Lower Limits-Some Special Sequences-Series-Series Of Non-Negative Terms-The Number 'e'.(chapter 3: 3.1 to 3.32)

UNIT III: Series and Continuity:

The Root and Ratio Tests-Power Series-Summation by parts-Absolute convergence-Addition and Multiplication of series-Rearrangements - Limits of Functions-Continuous functions-Continuity and Compactness-Continuity and Connectedness.(chapter 3:3.33 to 3.55) &(chapter 4,4.1 to 4.27)

UNIT IV: Differentiation:

The Derivative of a Real Function – Mean Value Theorems – The continuity of Derivatives – L'Hospital Rule – Derivatives of Higher Order – Taylor's Theorem (chapter 5:5.1 to 5.19)

UNIT V: The Riemann – Stieltjes Integral and Uniform Convergence:

Definition and Existence of the Integral – Properties of the Integral - Integration and Differentiation. (chapter 6:6.1 to 6.25)

Text Book:

1. Walter Rudin –"Principle of Mathematical Analysis" (Third Edition) , McGraw-Hill International Book Company, New York.

Reference Books:

1. Dr. S. Kumaresan- "Topology of Metric Spaces", Narosa Publications.
2. Tom Apostol-"Mathematical Analysis"-Addison Wesley Publishing Company London-1971.

Semester : I **Core Paper 3** Hrs/Week : 6

Sub. Code : MMSC03 **GRAPH THEORY** Credits : 5

Objectives:

1. *To give introduction to the basic concepts of graph theory*
2. *To give applications of Graph Theory in other disciplines*.

Review Chapter 1 of the text book (Not for examinations)

UNIT I: Paths and Circuits:

Isomorphism – Subgraphs – Walks,Paths,And Circuits –Connected Graphs – Disconnected Graphs And Components- Operations On Graphs (Chapter 2: 2.1, 2.2 2.4, 2.5, 2.7)

UNIT II: Trees and Fundamental Circuits:

Trees – Properties Of Trees – Pendant Vertices In A Tree – Distances And Centers In A Tree – Rooted And Binary Tree – On Counting Trees – Spanning Tree – Fundamental Circuits – Finding All Spanning Trees Of A Graph And also In Weighted Graphs (Chapter 3: 3.1 to 3.10)

UNIT III: Cut-Sets And Cut-Vertices:

Cut-Sets - Some Properties Of A Cut-Set – All Cut-Sets In a Graph – Fundamental Circuits and cut-sets –Connectivity and Separability –Network Flows- 1-Isomorphism -2-Isomorphism (Chapter4: 4.1 to4.8)

UNIT IV: Matrix Representation of a Graph:

Incidence Matrix - Sub Matrices - Circuit Matrix - Fundamental Circuit Matrix And Rank - An Application To Switching Network – Cut-Set Matrix - Relationship Among A_f ,B_f,And C_f- Path Matrix-Adjacency Matrix (Chapter 7, 7.1 to 7.9)

UNIT V: Coloring , Covering and Partitioning:

Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matchings – Covering – Four Colour Problem (chapter 8:8.1 to 8.6)

Text Book:

1. Narasingh Deo – "Graph theory with applications of Engineering and Computer Science", (Prentice Hall of India) Pvt., Ltd, New Delhi 2004.

Reference Books:

1. F.Harary, "Graph Theory", Addition Wesley, 1969
2. C.L. Liu , "Elements of Discrete Mathematics", McGraw Hill Book Company, 2nd Edition,1986
3. R. Johnsonbaurgh, "Discrete Mathematics", 1989

4. L.R. Foulds, “Graph Theory Applications”, Narosa publishing House, 1993.
5. Bondy.J.A. & Murthy V.S.R- “Graph Theory with Applications”-Mac Millan Press Ltd,1976.

Semester : I **Core Paper 4** Hrs/Week : 6

Sub. Code : MMSC04 Credits : 5

OBJECT ORIENTED PROGRAMMING WITH C++

Objective:

1. *It explains all the common features and techniques for the C++ language.*
2. *The main purpose to learn object oriented programming C++, is to develope programs.*

UNIT I: Basic Concept of Object Oriented Programming:

Definitions – Object Oriented Programming – Basic Concepts of Object Oriented Programming - Benefits of OOP – Application of C++ - A simple C++ program – Structure of C++ program – Tokens – Expressions and control structures.

UNIT II: Functions in C++:

Introduction – The Main Function – Function Prototyping – Call by Reference – Return by Reference – Inline Function – Default arguments – Const. Arguments – Recursion – Function overloading – Friend and Virtual Functions – Math Library functions.

UNIT III: Constructors snd Destructors:

Introduction – Constructors – Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects – Copy Constructor – Dynamic Constructors – Constructing Two Dimensional Arrays – Const Objects – Destructors.

UNIT IV: Inheritance : Extending Classes:

Introduction – Defining Derived Clalsses – Single Inheritance – Making a Private Member Inheritable – Multi level Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual base classes – Abstract Classes – Constructors in Derived Classes – Member Classes: Nesting of Classes.

UNIT V: Pointers, Virtual Functions and Polymorphism:

Introduction – Pointers – Pointers to Objects – This Pointer – Pointers to Derived Classes – Virtual Functions – Pure Virtual Functions – Virtual Constructors and Destructors.

Text Book:

1. E. Balagurusamy “Object Oriented Programming with C++” , Tata McGraw Hill Education Pvt.Ltd. Fifth Edition.

Reference Books:

1. Ashok N Kamphane, “Object Oriented Programming with Ansi and Turbo C++” Pearson Education Publication.2003.
2. Robert Lafor, “Object Oriented Programming with C++” Sams Publication 4th Edition.

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Semester : I **Elective Paper** 1 Hrs/Week : 6

Sub. Code : MMSE01 **NUMBER THEORY** Credits : 5

Objectives:

1. *To expose the students to the charm, niceties and nuances in the world of numbers.*
2. *To highlight some of the applications of the theory of numbers.*

UNIT I: The Fundamental Theorem of Arithmetic:

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 Divisors Of More Than Two Numbers.(chapter 1, sec1.1 to 1.8)

UNIT II: Arithmetic Functions and Dirichlet Multiplication:

Introduction- The Möbius Function $\mu(N)$ - The Euler Totient Function ϕ (N)- A Relation Connecting μ And ϕ- A Product Formula For ϕ (N)-The Dirichlet Product Of Arithmetical Functions- Dirichlet Inverses And The Möbius Inversion Formula-The Mangoldt Function $\Lambda(N)$- Multiplicative Functions- Multiplicative Functions And Dirichlet Multiplication- The Inverse Of A Completely Multiplicative Function (Chapter 2, Sec 2.1 to 2.11)

UNIT III: Dirichlet Multiplication Functions:

Liouville's Function $\lambda(N)$-The Divisors Functions $\sigma_A(N)$- Generalized Convolution-Formal Power Series - Bell Series And Dirichlet Multiplication-Derivatives Of Arithmetical Functions- The Selberg Identity (Chapter 2, Sec 2.12 to 2.19)

UNIT IV: Averages of Arithmetical Functions:

Introduction- The Big Oh Notation- Asymptotic Equality Of Functions- Euler's Summation Formula- Some Elementary Asymptotic Formulas – The Average Order Of D(N) – The Average Order Of The Divisors Functions $\sigma_A(N)$- The Average Order Of $\Phi(N)$ – The Application To The Distribution Of Lattice Points Visible From The Origin – The Average Order Of M(N) And $\Lambda(N)$.(chapter 3, Sec 3.1 to 3.9)

UNIT V: Congruences:

The Partial Sums Of A Dirichlet Product – Application To M(N) And $\Lambda(N)$- Another Identity For The Partial Sums Of A Dirichlet Product –Introduction- Chebyshev's Functions $\Psi(X)$ And $\Theta(X)$- Definition And Basic Properties Of Congruence- Residue Classes And Complete Residue Systems-Linear Congruences- Reduced Residue Systems And The Euler–Fermat Theorem -

Polynomial Congruences Modulo P. Lagrange's Theorem – Application Of Lagrange's Theorem (chapter 3, Sec 3.10 to 3.12, chapter 4, Sec 4.1 and 4.2, chapter 5, Sec 5.1 to 5.6)

Text Book:

1. T.M.Apostol "Introduction to Analytic Number Theory" , Narosa Publications. 1998.

Reference Books:

1. S. B. Malik, "Basic Number Theory", Vikas publishing Pvt Ltd.
2. George E. Andrews, "Number Theory", Hindustan Publishing Corporation- 1984 Edition.

Semester : II **Core Paper 5** Hrs/Week : 6

Sub.Code : MMSC05 **DIFFERENTIAL EQUATIONS** Credits : 5

Objectives:

1. *To give an in depth knowledge of solving differential equations that we encounter frequently in various walks of life.*
2. *To introduce existence and uniqueness theorems in Differential equations.*

Review (Not for Examinations): Linear Differential Equations of the first order classification-initial and boundary value problems.

UNIT I: Homogeneous Linear Equations:

Introduction, Linear Differential Equations of Higher Order, Linear Dependence And Wronskian, Method of Variation of Parameters, Homogeneous Linear Equations With Constant Coefficients.

UNIT II: Second Order Linear Equations:

Solutions In Power Series, Second Order Linear Equations With Ordinary Points, Legendre Equation And Legendre Polynomial, Hermite Polynomial, Second Order Equations With Regular Singular Points, Bessel Equation.

UNIT III: Existence and Uniqueness Of Solutions:

Existence And Uniqueness of Solutions, Successive Approximations, Picard's Theorem, Non Uniqueness of Solutions, Continuation And Dependence On Initial Conditions, Existence of Solutions In The Large, Existence And Uniqueness of Solutions Of Systems.

UNIT IV: Boundary Value Problems:

Boundary Value Problems, Sturm-Liouville problem, Green's Functions, Non-Existence of Solutions, Picard's Theorem.

UNIT V: First Order Partial Differential Equations:

Statement (Without Proof) of The Existence of Solutions of Cauchy Problem For The First Order Partial Differential Equations, Cauchy Problem And Characteristics.

Text Books:

1. Deo and Raghavendra "Differential equations and stability theory" Tata McGraw Hill edition, (Chapter 3,sec 3.1 to 3.5).
2. Ian N. Sneddon "Elements of partial differential equations" McGraw Hill International Student Edition, (chapter 2 , sec 8, chapter 3 , sec 4,5,9, chapter 4 ,sec 5).

Reference Books:

1. Birkhoff &Rora, " Ordinary Differential Equations".
2. John .F, " Partial Differential Equations" (3^{rd} edition) Narosa 1979.

Semester : II | **Core Paper 6** | Hrs/Week : 6

Sub. Code : MMSC06 | **TOPOLOGY** | Credits : 5

Objectives:

1. *To generalize the concepts the students have learnt in Real Analysis*
2. *To train the students to develop analytical thinking*

UNIT I: Topological Spaces And Continuous Functions:

Topological spaces- Basis for a Topology- The order Topology- The Product Topology on X×Y- The subspace Topology – Closed sets and Limit points- Continuous Functions- The product Topology.

UNIT II: Metric Topology:

The Metric Topology- The Metric Topology (continued) Connectedness and Compactness: Connected Spaces- Connected Subspaces of the Real line- Components and Local Connectedness.

UNIT III: Compactness:

Compact Spaces- Compact subspaces of the Real Line- Limit Point Compactness- Local Compactness.

UNIT IV: Countability And Separation Axioms:

The Countability Axioms- The Separation Axioms- Normal Spaces- The Urysohn Lemma.

UNIT V: Extension Theorem:

The Urysohn Metrization Theorems- The Tietze Extension Theorem- The Tychonoff Theorems- The Stone-Cech Compactification.

Text Book:

1. "Topology A first course" by James. R. Munkres, Prentice Hall of India Pvt Ltd, New Delhi.

Reference Book:

1. G.F. Simmons "Introduction to Topology and Modern Analysis", Tata McGraw Hill edition.

Semester : II **Core Paper 7** Hrs/ Week : 6

Sub .Code : MMSC07 **NUMERICAL METHODS** Credits : 5

Objective

1. To introduce popular numerical methods to students from other departments.

Note: *no derivations, Problems only.*

UNIT I: Transcendental and Polynomial Equations:

Bisection Methods – Iteration Methods Based On First Degree Equation - Iteration Methods Based On Second Degree Equation - Iteration Methods- Finding Roots Of Polynomial Equations –Birge-Vieta Methods – Bairstow Methods – Graeffe's Roots Squaring Methods

UNIT II: System of Linear Algebraic Equations and Eigen Values Problem:

Direct Methods –Cramer Rule - Gauss-Elimination method and Gauss Jordan Elimination Method-Triangularization method- Cholesky Methods- Partition method – Iteration method-Jacobi method and Gauss-Seidel iteration method – Eigen values on Eigen vectors- methods for symmetric matrices- Jacobi,Given power methods

UNIT III: Interpolation:

Lagrange And Newton Interpolation-Higher Order Interpolation Methods -Newton Divided Difference Interpolation – Iterated Interpolation – Finite Difference Interpolation – Stirling's And Bessel Interpolation – Hermite Interpolation – Piecewise Interpolation

UNIT IV: Differentiation and Integration:

Numerical Differentiation Based On Interpolation And Finite Difference Operators – Richardson's Interpolation Methods – Numerical Integration – Newton-Cotes Methods – Tripezoidal And Simpson's Rule- Composite Integration Methods Using Tripezoidal And Simpson's Rules – Romberg Integration – Double Integration

UNIT V: Ordinary Differential Equations:

Euler Methods – Backward Euler – Midpoints Methods – Single Step Methods – Runge-Kutta Methods – Implicit Runge-Kutta Methods –Multistep Methods – Predictor – Corrector Methods.

Text Books:

1. M.K.Jain, S.R. Iyengar and R.K. Jain: "Numerical Methods for scientific and Engineering Computation". 3rd Ed. New Age International, New Delhi.
2. Kandasamy. P, Thilakavathy. K, Gunavathy. K , "Numerical Mehods", Reprint 2001, S. Chand & Co.Ltd, New Delhi.

Reference Book:

1.Gerald, Curtis and Wheatley, Patrick.O: “Applied Numerical Analysis”, Fifth Edition, Addison-Wesley.

Semester : II **Core Paper 8** Hrs/Week : 6

Sub.Code : MMSC08 **PROBABILITY THEORY AND STATISTICS** Credit : 5

Objectives:

The Objective of the Probability Theory and statistics is to decide non- deterministic aspects from various possibilities and studying various distributions and Estimations.

UNIT I: Theory Of Probability:

Axiomatic approach to the Theory of Proibability, conditional probability – Total probability and Baye's theorem – Independent events. The concept of Random variables - The distribution and Density Function – Marginal Distributions – Conditional Distributions – Functions Of Multidimensional Random Variable And Their Probability Distributions.

UNIT II: Moment Generating Function:

Expectation – Moments – Markov Inequality, Chebyshev Inequality – Lapunov Inequality, Moment Generating Function – Probability Generating Function – Characteristic Functions, The Uniform Distribution – The Normal Distribution – Exponential Distribution – Gamma And Beta Distributions – Cauchy Distribution – Bivariate Normal Distribution – Correlation – Regression – Partial And Multiple Correlation.

UNIT III: Distributions:

Concept of Stochastic Convergence (convergence in probability –convergence in distribution) – Demoivre – Laplace Theorem Lindberg – Levy Theorem The Chi- Square Distribution – Students 'T' Distribution – F-Distribution.

UNIT IV: Estimation:

Concepts of Point and Interval Estimation – Consistent Estimates – The Lindberg The Best Estimates – Sufficient Estimates – Properties Of Estimates – The Maximum Likelihood Estimates.

UNIT V: Classifications:

Oneway, Two way classification – The Principles of Randomisation, Replication, Local Control and sensitivity – Completely Randomised Design, Randomised Block design – Latin square designs.

Text Book:

1. P.R.Vital ,"Mathematical Statistics", MARGHAM publications, Edition 2012.

Reference Book:

1. S.C. Gupta & V.K. Kapoor, Sultan Chand and sons, "Fundamentals of Mathematical Statistics", Educational Publishers, New Delhi.

Semester : II **ELECTIVE 2** Hrs/Week : 6

Sub. Code : MMSE02 **DISCRETE MATHEMATICS** Credit : 5

Objective:

The Objective of Discerte Mathematics is to study the mathematical logic and verifily statement with Truth Table.

The Automata theory deals with the grammars and machine. Convertion of formal languages to machine language.

UNIT I: Mathematical Logic:

Introduction – Statements And Notation – Connectives : Negation, Conjunction – Disjunction – Statement Formulas And Truth Tables – Conditional And Biconditional – Well Formed Formulas – Tautotogies – Equivalance of Formulas – Duality Law – Tautological Implications – Formulas With Distinct Truth Tables – Funtionally Complete Sets of Connectives – Other Connectives – Normal Farms: Disjunctive Normal Forms – Conjunctive Normal Forms – Principal Disjunctive Normal Forms – Principal Conjunctive Normal Forms.

UNIT II: The Theory of Inference for the Statement Calculus:

Validity Using Truth Tables – Rules of Inference – Consistency of Premises And Indirect Method of Proof – The Predicate Calculus: predicates – The Statement Functions, Variables And Quantifiers – Predicate Formulas – Free And Bound Variables – The Universe of Discourse. Inference Theory of The Predicate Calculus : Valid Formulas And equivalences – Some Valid Formulas Over Finite Universes – Special Valid Formulas Involving Quantities – Theory of Inference For The Predicate Calculus – Formulas Involving More Than One Quantifier

UNIT III: Lattices and Boolean Algebra:

Introduction: Lattices as Partially Ordered Sets – Definition and Examples – Some Properties of Lattices – Lattices as Algebraic Systems , Sublattices, Direct Product and Homomorphism – Some Special Lattices – Boolean Algebra: Definition and Example Subalgebra, Direct Product and Homomorphism – Boolean Functions: Boolean Forms and Free Boolean Algebras – Values of Boolean Expressions and Boolean Functions, Represntation and Minimization of Boolean Functions: Representation of Boolean Functions – Minimization of Boolean Functions.

UNIT IV: Grammars and Languages:

Introduction – Alphabet – Words, Free Semigroup – Freemonoid – Languages – Operations On Languages – Phrase Structure Grammar – Content Sensitive Grammar – Context Free Grammar – Regular Grammar – Examples – Languages Generated By Grammar – Phrase Structure

Language – Content Sensitive Language – Content Free Language – Regular Language – Relation Between Grammars And Languages.

UNIT V: Finite State Automata (FSA):

Definitions – Acceptance of Word, String By Automata – Finite State Language – Examples – Digramative representation of FSA – Non-Deterministic Finite State Automata (NDFSA) – Definition – Examples – Robin And Scott Theorem – Digramtic Reprentation – Conversion of NDFSA to DFSA – Chomsky And Miller Theorem – Relation Between Regular Language And Finite State Automation – Pushdown Automata (PDA): Formal Definitions – Language Accepted By PDA.

Text books:

1. J.P. Tremblay and R. Manohar, "Discrete Mathematical structures with applications to computer science", Tata McGraw Hill Publishing company Ltd New Delhi Edition 1997.
2. Rani Siromoney "Formal Languages and Automata" ,CLS publication 1979.

Reference book:

1. Seymour Lipschutz and Marc Lars Lipson, "Schaums outlines discrete mathematics" – Tata McGraw Hill Publication New Delhi 2nd Edition 1999.

Semester : III **Core Paper 9** Hrs/week : 6

Sub. Code : MMSC09 **COMPLEX ANALYSIS** Credits : 5

Objectives:

1. *To explain the various intrinsic concepts and theories of Complex Analysis.*
2. *To study the concept of Analyticity, Complex Integration and Infinite Products in depth.*

UNIT I: Introduction To The Concept Of Analytic Functions:

Limits and Continuity – Analytic Functions – Polynomials – Rational Functions – Sequences - Series –Uniform Convergence.(Chapter 2, Sec1, 1.1 to 1.4 and Sec 2. 2.1 to 2.3)

UNIT II: Some Special Function:

Power Series – Abel's Limit Theorem – Exponential Function – Trigonometric Function- The Periodicity – The Logarithm.(Chapter 2, Sec 2,2.4 ,2.5 and Sec 3. 3.1 to 3.4)

UNIT III: Conformality:

Arcs And Closed Curves – Analytic Function In Regions – Conformal Mapping – Length And Area – Linear Group – Cross Ratio- Symmetry – Elementary Riemann Surfaces.(Chapter 3,Sec 2.2.1 to 2.4, Sec 3.3.1 to 3.3, Sec 4. 4.3)

UNIT IV: Fundamental Theorems:

Line Integrals – Rectifiable Arcs – Line Integrals As Functions Of Arcs – Cauchy's Theorem For Rectangle- Cauchy's Theorem In A Disc- The Index Of A Point With Respect To A Closed Curve – The Integral Formula –Higher Derivatives – Removable – Singularities – Taylor's Theorem – Zeros And Poles- Local Mapping- The Maximum Principle. (Chapter 4, Sec 1.1 to 1.5, Sec 2, 2.1 to 2.3, Sec 3.3.1 to 3.4)

UNIT V: Calculus Of Residues:

The Residue Theorem – The Argument principle – Evaluation of Definite Integrals- Weierstrass's Theorem –The Taylor Series – The Laurent Series- Partial Fractions (Chapter 4, Sec 5.1-5.3, Chapter 5, Sec 1: 1.1 to 1.3)

Text book:

1. Lars V.Ahlfors " An Introduction to the theory of Analytic function of one variable", 3rd Edition, McGraw Hill Book Company.

Reference Books:

1. John B. Conway "Function of one Complex Variable" 2nd Edition,Springers International Students Edition.
2. Ponnusamy. S, "Function of Complex Analysis", Narosa Publishing House, New Delhi.

Semester : III **Core Paper 10** Hrs/week : 6

Sub. Code : MMSC10 **FUNCTIONAL ANALYSIS** Credits : 5

Objectives:

1. To study the three structure theorems of Functional Analysis viz., Hahn – Banach theorem, open mapping theorem and uniform boundedness principle.

2. To introduce Hilbert spaces and operator theory leading to the spectral theory of operators on a Hilbert Spaces.

UNIT I: Banach Spaces:

Definition and Some Examples, Continuous Linear Transformation, The Hahn-Banach Theorem, (Chapter 9: sec 46 to 48)

UNIT II: Natural Imbedding:

The Natural Imbedding of N In N**, The Open Mapping Theorem, The Closed Graph Theorem, Uniform Boundedness Principle, Conjugate of an Operator.(Chapter 9, sec 49 to 51)

UNIT III: Hilbert Spaces:

The Definition and Some Simple Properties, Orthogonal Complements, Orthonormal Sets, The Conjugate Space H*.(Chapter 10, sec 52 to 55)

UNIT IV: Operators:

The Adjoint of an Operator, Self-Adjoint Operators, Normal And Unitary Operators, Projections. (chapter 10, sec 56 to 59).

UNIT V: Algebric Banach Spaces:

General Preminaries on Banach Algebras – Definition and Examples – Regular and Singular Elements – Topological Divisors of Zero – The Spectrum – The Formula for The Spectral Radius – The Radical and Semi Simplicity.(chapter 12, sec 64 to 69).

Text Book:

1. G.F. Simmons “Introduction to Topology and Modern Analysis”, Tata McGraw Hill, Edition 2004.

Reference Books:

1. M. Thamban Nair, “Functional Analysis”, Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi 2002.
2. B.V. Limaye, “Functional Analysis”, Wiley Eastern, New Delhi 1981.

Semester : III **Core paper 11** Hrs/ Week : 6

Sub. Code : MMSC11 **DIFFERENTIAL GEOMETRY** Credits : 5

Objective

1. *To explain briefly the various intrinsic concepts and theories of Differential Geometry*
2. *To enlighten the students with many applications of this subject.*

UNIT I: The Theory Of The Space Curve:

Analytical Representation –Arc Length, Tangent – Oscillating Plane – Torsion – Formulae For Frenet Contact. (Chapter 1, sec 1.1 – 1.7)

UNIT II: Natural Equations :

Natural Equations – Helices – General Solution Of Natural Equations – Evolutes And Involutes – Imaginary Curves – Ovals (Chapter 1, sec 1.8 -1.13)

UNIT III: Analytical Representation:

Analytical Representation – First Fundamental Theorem – Normal, Tangent Plane – Developadle Surfaces – Second Fundamental Form – Meusrier's Theorem – Euler's Theorem.(Chapter 2, sec 2.1 – 2.6)

UNIT IV: Geometrical Interpretations:

Dupin's Indicatrix – Some Surfaces – A Geometrical Interpretations Of Asymptotic And Curvcature Lines Conjugate Directions – Triply Orthogonal System Of Surfaces.(chapter 2, sec 2.7 – 2.11)

UNIT V: The Second Fundamental Form Of Fundamental Theorem Of Surface Theory:

Gauss – The Equations Of Gauss – Weingarten – The Theorem Of Gauss And The Equations Of Codazzi Curvilinear Coordinates In Space – Some Of Applications Of The Gauss And The Codazzi Equations – The Fundamental Theorem Of Surface Theory. (Chapter 3, sec 3.1 – 3.6).

Text Book:

1. Dirk J. Struik: "Lectures on Classical Differential Geometry" (second edition), Addison Wesley Publishing company.

Reference Book:

1. Willmore, TJ.: "An Introduction to Differential Geometry", Delhi Oxford University Press, Bombay, Calcutta, Madras.

Semester : III **Core paper 12** Hrs/Week : 6

Sub. Code : MMSC12 **OPERATIONS RESEARCH** Credits : 5

Objectives:

The Objective of Operations Research is to minimize the cost and maximize the Profit so as to get best result amoung various aspects.

UNIT I: Operations Research – An Overview:

Origin and Development of O.R - Nature and Features of O.R - Modelling in Operation Research- General Solution Methods for O.R models- Scientific Method in O.R.- Methodology of Operation Research- Applications of O.R - Opportunities and ShortComings of Operation Research. Linear Programming Problem :Introduction- Mathematical Formulation Of The Problem. Duality In Linear Programming: Introduction- General Primal- Dual Pair- Formulating A Dual Problem- Primal Dual Pair In Matrix Form- Duality Theorems- Complementary Slackness Theorems- Duality And Simplex Method - Dual Simplex Method.

UNIT II: Integer Programming:

Introduction- Gomory's all-I.P.P. Method- Construction of Gomory's Constraints- Fractional Cut Method – All Integers- Fractional Cut Method – Mixed Integer- Branch And Bound Method – Application Of Integer Programming.

UNIT III: Sequencing Problem:

Introduction – Problem Of Sequencing- Basic Terms Used In Sequencing- Processing N Jobs Through Two Machines- Processing N Jobs Through K Machines- Processing 2 Jobs Through K Machines- Maintenance Crew Scheduling.

UNIT IV: Dynamic Programming:

Introduction- The Recursive Equation Approach- Characteristics of Dynamic programming- Dynamic Programming algorithm- Solution of Discrete D.P.P- Some applications- Solution of L.P.P. By dynamic Programming.

UNIT V: Network Scheduling by PERT/CPM:

Introduction- Network and Basic Components- Logical Sequencing- Rules of network Construction- Critical path analysis- Probability Considerations in PERT- Distinction Between PERT and CPM. Resource Analysis in Network Scheduling: Introduction- Project Cost- Time Cost Optimazation Algorithm- Linear Programming Formulation- Updating- Resource Allocation And scheduling.

Text Book:

1. Kanti Swarup, P.K. Gupta, Man mohan- "Operation Research", Sultan Chand & Sons,Educational Publishers Since Edition 1950.

Reference Books :

1. V.Sundaresan,K.S.Subramanian,K.Ganesan-"Operations Research",New Revised edition, A.R.Publications,Srikali.
2. Hamdy.A.Taha- "Operations Research, an Introduction", 5th edition & 6th & 7th edition,Prentice Hall of India,New Delhi 1995.

Semester : III **ELECTIVE 3** Hrs/Week : 6

Sub code : MMSE03 **STOCHASTIC PROCESS** Credits : 5

Objective:

1. *To understanding the stochastic models for many real life probalistic situations.*
2. *To learn the well known models like birth – death and queueing to reorient the knowledge of stochastic analysis.*

UNIT I: Basic Definitions:

Introduction – Specification of Stochastic Process.

UNIT II: Sequence Of Chains:

Markov Chain – Definition and Examples – Higher Transition Probabilities – Generalization of Independent – Bernoulli Trails – Sequence of Chain – Dependent Trails.

UNIT III: Classification of States:

Classification of States and Chains- Determination of Higher Transition Probabilities- Stability of a Markov System- Graph Theoretic approach.

UNIT IV: Birth and Death Distribution Process:

Poisson Process- Poisson Process and Related Distributions- Generalisation of Poisson Process- Birth and Death Process.

UNIT V: Renewal Process:

Renawal process- Renewal process in continuous Time- Renewal Equation- Stopping Time- Wald's Equation- Renewal Theorems- Delayed and Equilibrium Renewal Process- Residual and Excess lifetimes.

Text Book:

1. J.Medhi "Stochastic process", Second edition- New Age International Publishers. (Chapter 2, 3,4and 6)

Reference Books:

1. Samuel Karlin and Howard M. Taylor, "A First Course in stochastic process", second edition, academic Press. 1975
2. Samuel Karlin and Howard M. Taylor, "A second course in stochastic process", Academic Press, 1981.
3. Narayan Bhat, U, "Elements of Applied Stochastic Processes", Second Edition John Wiley & Sons, New York.
4. Feller, "An Tntroduction to Probability theory and its applications", Volume 1. Third edition, John Wiley & Sons, New York.

Semester : IV **Core Paper 13** Hrs/week : 6

Sub. Code : MMSC13 **FLUID DYNAMICS** Credits : 5

Objectives:

It is a subject of almost all fields of engineering, astrophysics, biomedicine, metrology. Basic concept of fluid dynamics are delt with in this paper.

UNIT I: Equation of Motion:

Introductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density –Pressure. Differentiation Following The Fluid – Equation of Continuity – Boundary Conditions (Kinematical and physical) - Rate of Change of Linear Momentum – Equation of Motion of an Inviscid Fluid.

UNIT II: Basic Theorem:

Euler's Momentum Theorem - Conservative Forces - Bernoulli's Theorem In Steady Motion – Energy Equation for Inviscid Fluid – Circulation – Kelvin's Theorem – Vortex Motion – Helmholtz Equation.

UNIT III: Two Dimensional Motion:

Two-dimensional Motion* – Two-Dimensional Functions – Complex Potential -Basic Singularities – Source, Vortex and Doublet. Circle theorem - Flow Past a Circular Cylinder With Circulation – Conformal Transformation – Blasius's Theorem – Lift Force.

UNIT IV: Viscous Flow:

Viscous Flow – Navier Stokes Equations – Vorticity And Circulation In a Viscous Fluid – Steady Flow Through an Arbitrary Cylinder Under Pressure – Steady Couette Flow Between Cylinders In Relative Motion – Steady Flow Between Parallel Planes.

UNIT V: The Laminar Boundary Layer:

The Laminar Boundary Layer In Incompressible Flow - Boundary Layer Concept – Boundary Layer Equations. Displacement Thickness – Momentum Thickness – Kinetic Energy Thickness – Integral Equation of Boundary Layer – Flow Parallel to Semi-Infinite Flat Plate – Blasius's Equation and Its Solution in Series.

Text Books:

1. L.M.Milne Thomson, " Theoretical Hydro dynamics", Macmillan Company, Vedition, 1968. (For Units I and II)

   Unit I Chapter 1, Sec1.0 to 1.3, Chapter 3,Sec 3.10 to 3.40 (omit sections 3.32)

   Unit II Chapter 3, Sec 3.41 to 3.53 (omit sections 3.44).

2. N.Curle and H.J.Davies, "Modern Fluid Dynamics" – Vol. I, D.Van nostrand Company Ltd, London, 1968. (For Units III, IV and V)

Unit III Chapter 3, Sec 3.1 to 3.7 (omit 3.4 & 3.5.3)

Unit IV Chapter 5, Sec 5.1 to 5.3 (omit 5.3.4 and 5.3.5)

Unit V Chapter 6, Sec 6.1 to 6.3 (omit 6.2.2 and 6.3.2 to 6.3.5)

Reference Books:

1. F.Chorlton, "Text book of Fluid Dynamics" , CBS Publishers and distributors, New Delhi-32,1998.
2. M.D.Raisinghawia, " Fluid Dynamics", S.Chand and Company Ltd, New Delhi - 55, 1995.

Semester : IV **Core Paper 14** Hrs/week : 6

Sub. Code : MMSC14 **MEASURE AND INTEGRATION** Credits : 5

Objectives

1. *To generalize the concepts of integration using measures.*
2. *To develop the concept of analysis in abstract situations.*

UNIT I: Lebesgue Measure:

Lebesgue Outer Measure - Measurable Sets – Regularity – Measurable Functions

UNIT II: Borel and Lebegue Measure:

Borel And Lebesgue Measurability – Integration Of Non-Negative Functions – General Integral.

UNIT III: R-S Integral:

Integration Of Series – Riemann And Lebesgue Integral – Measures And Outer Measures- Extension Of A Measure – Uniqueness Of Extension.

UNIT IV: Measure Spaces:

Completion Of A Measure – Measure Spaces – Integration With Respect To A Measure – L^p Spaces – Completeness.

UNIT V: Signed Measure:

Signed Measure And The Hahn Decomposition – The Jordan Decomposition – Radon-Nikodym Theorem- Measurability In A Product Space – The Product Measure And Fubini's Theorem.

Text Book:

1. De Barra.G. , "Measure and integration" – Wiley Eastern Limited 1991 Edition

Reference Books:

1. P.R. Halmos, "Measure Theory", D.Van Nostrand Company, Inc. Princeton, N.J., 1950
2. Walter Rudin, "Real and Complex Analysis", McGraw Hill Publishing Co.Ltd, New Delhi,10^{th} Reprint ,1986.
3. H.L.Royden "Real Analysis", Prentice Hall of India 2001 edition.

Semester: IV **Project - Mathematical Model** Hrs/week : 18

Sub. Code: MMSP1 Credit : 5

RULES AND REGULATION OF THE PROJECT

1.The Project Area / Title must be any one of the following

(i). Pure Mathematics

(ii). Applied Mathematics

(iii). Mathematical Application in Real Time Activities.

1. Student Allotment Method will be Decided by the Department Faculities (In October 2nd Week)
2. They are Four Project Common Meet (In Front of All Faculty) Power Point Presentation

(i). First Meet – December 1st Week.

Work Done – Topic and Area will be Decided (20 Marks)

(ii). Second Meet – Junuary 1st Week.

Work Done – 25% Work (30 Marks)

(iii). Third Meet – February 1st Week.

Work Done – 50% Work (30 Marks)

(iv). Fourth Meet – March 1st Week.

Work Done – 90% Work (50 Marks)

3. Project Record Submision - Third Week of March (20 Marks)

Internal Total - 150

External Total - 150