DAYALBAGH EDUCATIONAL INSTITUTE
FACULTY OF SCIENCE
DEPARTMENT OF MATHEMATICS: 2018-19

Course Number	Course Title	Credits	End Sem. Exam.Exists	Theory/ Practical
MAH101	MATHEMATICS I COURSE	3.0	Yes	T
MAH102	MATHEMATICS II COURSE	3.0	Yes	T
MAW101	COMPUTER AIDED STATISTICAL TECH. I	2.0	No	P
MAM101	STATISTICS I	4.0	Yes	T
MAM102	DISCRETE MATHEMATICS	4.0	Yes	T
MAM103	SEMINAR & GROUP DISCUSSION	1.0	No	P
MAH251	MATHEMATICS I COURSE	3.0	Yes	T
MAH252	MATHEMATICS II COURSE	3.0	Yes	T
MAH231	MATHEMATICS I COURSE	3.0	Yes	T
MAH232	MATHEMATICS II COURSE	3.0	Yes	T
MAW201	COMPUTER AIDED STATISTICAL TECH. II	2.0	No	P
MAM201	ANALYSIS I (CALCULUS OF ONE VARIABLE)	4.0	Yes	T
MAM202	ALGEBRA I (GROUP & RINGS)	4.0	Yes	T
MAM203	SEMINAR & GROUP DISCUSSION	1.0	No	P
MAM301	ANALYSIS II(INTEGRATION&CONVERGENCE)	4.0	Yes	T
MAM302	ALGEBRA II (LINEAR ALGEBRA)	4.0	Yes	T
MAM303	OPERATIONS RESEARCH	4.0	Yes	T
MAM304	SEMINAR & GROUP DISCUSSION	1.0	No	P
MAM401	DIFFERENTIAL EQUATIONS I(O.D.EQNS.)	4.0	Yes	T
MAM402	STATISTICS II	4.0	Yes	T
MAM403	ANALYSIS III (VECTOR CALCULUS)	4.0	Yes	T
MAM404	SEMINAR & GROUP DISCUSSION	1.0	No	P
MAM407	FUNDAMENTALS OF GRAPH THEORY	4.0	Yes	T
MAM501	METRIC SPACES	4.0	Yes	T
MAM502	CURVES & SURFACES	4.0	Yes	T
MAM503	DIFFERENTIAL EQUATIONS II(P. D. E.)	4.0	Yes	T
MAM504	'C' & DATA STRUCTURES	4.0	Yes	T
MAM505	ALGEBRA III (SYLOW'S THMS.& I.P.S.)	4.0	Yes	T
MAM506	PROGRAMMING LAB I	2.0	Yes	P
MAM601	NUMBER THEORY	4.0	Yes	T
MAM602	COMPLEX ANALYSIS	4.0	Yes	T
MAM603	METHODS OF APPLIED MATHEMATICS	4.0	Yes	T
MAM604	NUMERICAL ANALYSIS	4.0	Yes	T
MAM605	TENSOR ANALYSIS	4.0	Yes	T
MAM606	PROGRAMMING LAB II	2.0	Yes	P

MAM701	MEASURE & INTEGRATION	4.0	Yes	T
MAM702	TOPOLOGY	4.0	Yes	T
MAM703	THEORY OF DIFFERENTIAL EQUATIONS	4.0	Yes	T
MAM704	ANALYTICAL MECHANICS	4.0	Yes	T
MAM705	RINGS & CANONICAL FORMS	4.0	Yes	T
MAM706	SOFTWARE LAB I	2.0	Yes	P
MAM707	COMPUTER SYSTEMS ARCHITECTURE	4.0	Yes	T
MAM708	DATABASE MANAGEMENT SYSTEMS	4.0	Yes	T
MAM801	OPTIMIZATION	4.0	Yes	T
MAM802	FIELD THEORY	4.0	Yes	T
MAM803	FUNCTIONAL ANALYSIS	4.0	Yes	T
MAM804	FLUID DYNAMICS	4.0	Yes	T
MAM805	STOCHASTIC PROC. & STAT. INFERENCE	4.0	Yes	T
MAM806	SOFTWARE LAB II	2.0	Yes	P
MAM807	INTERNET TECHNOLOGIES	4.0	Yes	T
MAM808	SOFTWARE ENGINEERING	4.0	Yes	T

MAM809	CRYPTOGRAPHY & SECURITY	4.0	Yes	T
MAM810	INTELLIGENT INFORMATION PROCESSING	4.0	Yes	T
MAM811	DESIGN & ANALYSIS OF ALGORITHMS	4.0	Yes	T
MAM812	GRAPH THEORY	4.0	Yes	T
MAM001	BASIC RES. METH., SC.COMPUT.& ANAL.	4.0	Yes	T
MAM002	PRE-DISSERTATION	4.0	No	P
MAM901	DISSERTATION	12.0	Yes	P
MAM902	MATHEMATICAL MODELLING	4.0	Yes	T
MAM903	INTRODUCTION TO RIEMANNIAN GEOMETRY	4.0	Yes	T
MAM904	FUZZY SETS & SYSTEMS	4.0	Yes	T
MAM905	COMPUTER NETWORKS	4.0	Yes	T
MAM906	COMPUTER GRAPHICS	4.0	Yes	T
MAM908	MATHEMATICAL THEORY OF ELASTICITY	4.0	Yes	T
MAM909	WAVELET TRANSFORMS	4.0	Yes	T
MAM910	TOPICS IN MATRICES& THEIR APPLICAT.	4.0	Yes	T
MAM912	AUTOMATA THEORY & FORMAL LANGUAGES	4.0	Yes	T
MAM913	THEORY OF DYNAMICAL SYSTEMS & CHAOS	4.0	Yes	T
MAM951	DISSERTATION I	8.0	Yes	P
MAM952	DISSERTATION II	16.0	Yes	P
MAM953	SELF STUDY COURSE	4.0	Yes	P
MAM954	ADV. SCIENTIFIC METHODOLOGY& ANALYSIS	4.0	Yes	T
MAM955	SPECIAL TOPICS IN MATHEMATICS	4.0	Yes	T
Courses offered to B.Tech. & M.Tech. Classes				
MAM181	ENGINEERING MATHEMATICS I	3.0	Yes	T
MAM281	ENGINEERING MATHEMATICS II	3.0	Yes	T
MAM381	ENGINEERING MATHEMATICS III	3.0	Yes	T
MAM481	ENGINEERING MATHEMATICS IV	3.0	Yes	T
MAM581	DISCRETE MATHEMATICS	3.0	Yes	T
MAM582	PROBABILITY & STATISTICS	3.0	Yes	T
MAM681	ADVANCED OPTIMIZATION TECHNIQUES	3.0	Yes	T
MAM881	ADVANCED ENGINEERING MATHEMATICS	3.0	Yes	T
PMA101	COMPUTATIONAL METHODS	4.0	Yes	T

CHOOSE ANY TWO (ONLY FOR M.SC. MATHEMATICS STUDENTS)
MAM804, MAM805 & MAM812

CHOOSE ANY TWO (ONLY FOR M.SC. MATHEMATICS STUDENTS)
MAM902, MAM903 & MAM904

CHOOSE ANY TWO (ONLY FOR M.SC. MATHEMATICS WITH SPECIALIZATION IN COMPUTER SCIENCE STUDENTS)
MAM809, MAM810, MAM811 & MAM812

CHOOSE ANY TWO (MATHEMATICS WITH SPECIALIZATION IN COMPUTER SCIENCE STUDENTS)
MAM704, MAM912, MAM904, MAM905

MAM581 IS FOR CS SPECIALIZATION STUDENTS
MAM582 IS FOR OTHER B.TECH. STUDENT
FROM APPLICABLE SESSION 2018-19

Course No.: MAH101, Course Title: MATHEMATICS I COURSE
Class: B.Sc., Status of Course: HALF COURSE, Approved since session: 1998-1999
Total Credits: 3, Periods(55 mts. each)/week:3(L-3-0+P/S-0), Min.pds./sem:39

UNIT 1: DISCRETE MATHEMATICS [8 pds]
(a) Mathematical Logic, Propositions, Connectives, well formed formulas, equivalence of formulas, tautological implications, elementary theory of inference for propositional calculus (b) Set theory notation, inclusion and equality of sets power set, operation on sets, set identities, ordered pair, integer, rational, irrational numbers, decimals and real numbers, inequalities, absolute value, intervals, properties of intervals. Relations, properties of binary relations in a set, equivalence relations, partitions, Functions Composition of functions, inverse, graphs of functions (c) Combinatories, Permutations, Combinations, Binomial Theorem.
UNIT 2: TRIGONOMETRY [8 pds]
(a) Trigonometrical ratio, directed angle and its measure, circular functions of angles, trigonometric ratio of some standard angles, fundamental trigonometric identities, addition formula, multiple angles, transformation of sum into product and vice versa.
UNIT 3: CO-ORDINATE GEOMETRY [8 pds]
Cartesian system of axis, distance between two points, section formula, equation of a line, angles between two lines, parallel and perpendicular lines, general idea of conic sections circle, ellipse, parabola and hyperbola.
UNIT 4: VECTORS, MATRICES AND DETERMINANTS [8 pds]
(a) Scalars and vectors, equality, addition of vectors, multiplication of a vector by scalar and vector (b) Matrices Special types of matrices, addition and multiplication of two matrices, properties of determinants products of two determinants, inverse of a matrix, application of matrices.
UNIT 5: LINEAR AND QUADRATIC EQUATIONS [7 pds]
(a) Introduction linear equation, quadratic equations.

SUGGESTED READINGS:-
Hobert E Forsey David & Walker: MATHEMATICS FOR ECONOMIC AND BUSINESS ANALYSIS
Frank S Budnick: APPLIED MATHEMATICS OF BUSINESS ECONOMIC AND THE SOCIAL SCIENCES

Course No.: MAH102, Course Title: MATHEMATICS II COURSE
Class: B.Sc., Status of Course: HALF COURSE, Approved since session: 1998-1999
Total Credits:3, Periods(55 mts. each)/week:3(L-3-0+P/S-0), Min.pds./sem:39

UNIT 1: DIFFERENTIAL CALCULUS [8 pds]
Introduction, functions and limits, derivatives, rules for differentiation of functions of one variables, applications, maxima and minima, preliminary considerations of optimization.
UNIT 2 [8 pds]
Derivatives of multi-variate functions, applications of functions of several variables, conditions for optimizing multivariate functions and applications.
UNIT 3: INTEGRAL CALCULUS [8 pds]
Introduction, integrals, sums and areas, rules of integration, applications of integration to business problem, definite integrals,
UNIT 4: LINEAR PROGRAMMING [8 pds]
Introduction, formulation of a LLP, graphic solution of LLP.
UNIT 5: INTRODUCTION TO PROBABILITY [7 pds]
Sample space, equally likely, mutually exclusive outcomes, definition of probability, total probabilities, addition rule, joint probabilities, multiplication rule, independent events, Baye's rule.

SUGGESTED READINGS:
Frank S Budnick: APPLIED MATHEMATICS FOR BUSINESS, ECONOMICS AND SOCIAL SCIENCES

Course No.: MAW101, Course Title: COMPUTER AIDED STATISTICAL TECH. I
Class: B.Sc., Status of Course: HALF COURSE, Approved since session: 2017-18
Total Credits:2, Periods(55 mts. each)/week:2(L-2-0+P/S-0), Min.pds./sem:26

Introduction to Computers, Introduction to MATLAB/SYSTAT/EXCEL.

Course No: MAM101, Course Title: STATISTICS I
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods (55 mts. each)/week: 4(L-4-0+P/S-0), Min.pds./sem: 52

UNIT 1
Measures of Dispersion, Range, Mean Deviation, Standard Deviation, Coefficient of Variation, Quartile Deviation, Moments, Measures of Skewness and Kurtosis.
UNIT 2
Important concepts of probability, Mathematical Probability, Statistical Probability, Axiomatic Approach to Probability, Addition Theorem of Probability, Conditional Probability, Multiplication Theorem of Probability, Independent Events, Multiplication Theorem of Probability for independent events, Pairwise Independent Events, Total Probability Rule, Bayes' Theorem.
UNIT 3
Random Variables: Discrete and Continuous, Probability mass function, Probability Density Function, Distribution Function for Discrete and Continuous Random Variables. Mathematical Expectation or Expected Value of a Random Variable, Expected Value of Function of Random Variable, Properties of Expectation, Mean, Variance and Covariance of a random variable, Means and Variances of Linear Combination of Random Variables.
UNIT 4
Discrete Probability Distributions: Probability Function and Properties of Bernaulli, Binomial, Poisson, Negative Binomial, Geometric and Hypergeometric distributions and their Moment Generating Functions.
UNIT 5
Continuous Probability Distributions: Probability Density Functions of Rectangular (Uniform) Distribution, Normal Distribution and their Moment Generating Functions.

SUGGESTED READING:
MATHEMATICAL STATISTICS: Freund
PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS: Walpole & Myers
PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS: Sheldon Ross
BASIC STATISTICS FOR BUSINESS AND ECONOMICS: Lind Marchal Wathen
ESSENTIAL OF STATISTICS FOR BUSINESS AND ECONOMICS: Anderson, Sweeney, Williams
INTRODUCTION TO MATHEMATICAL STATISTICS: Hogg RV, Craig AL

Course: MAM102, Title: DISCRETE MATHEMATICS
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT1
Mathematical Logic: Propositions, Connectives, propositional formulae, truth tables, equivalence of formulas, tautological implications, normal forms: disjunctive and conjunctive; Theory of inference for propositional calculus; Predicate calculus: predicates, variables and quantifiers, free and bound variables, universe of discourse, nested quantifiers, rules of inference for predicate calculus. Proof methods.
UNIT2
Review of basic concepts in set theory: Russel's Paradox, Arbitrary Union, Arbitrary Intersection, Equivalence relation, Partition of a Set, Composition and inverse of a Function; Finite sets, Countable and uncountable sets, Axiom of choice, Partially Ordered Set, Ordered Set, Dictionary Order Relation, Upper Bound/ Lower Bound, Maximal/Minimal Element, Supremum, Infimum, Lattice, Zorn's Lemma, Well ordering principle.
UNIT3
Principles of Mathematical Induction, Division Algorithm, Prime Numbers, Euclid's lemma, Greatest Common Divisor, Euclidean Algorithm, Fundamental Theorem of Arithmetic, Congruence, Properties of Congruence, Integers Modulo n.
UNIT4
Combinatorics: Fundamental laws of counting, pigeonhole principle, permutations, combinations, binomial theorem, multinomial theorem, principle of exclusion and inclusion, derangements, permutations with forbidden positions.
UNIT5
Discrete numeric functions, Generating functions, Recurrence relations.

Course: MAM103, Title: SEMINAR & GROUP DISCUSSION
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits:1, Periods(55 mts. each)/week:2(L-0-0+P/S-2), Min.pds./sem:26
Seminar and Group Discussion based on MAM101 and MAM102 courses.

Course: MAH231/251, Title: MATHEMATICS I COURSE
Class: BSSc/BA/BCom, Status of Course: NF HALF COURSE, Approved since session: 1998-1999
Total Credits:3, Periods(55 mts. each)/week:3(L-3-0+P/S-0), Min.pds./sem:39

UNIT 1: DISCRETE MATHEMATICS [8 pds]
(a) Mathematical Logic, Propositions, Connectives, well formed formulas, equivalence of formulas, tautological implications, elementary theory of inference for propositional calculus (b) Set theory notation, inclusion and equality of sets power set, operation on sets, set identities, ordered pair, integer, rational, irrational numbers, decimals and real numbers, inequalities, absolute value, intervals, properties of intervals. Relations, properties of binary relations in a set, equivalence relations, partitions, Functions Composition of functions, inverse, graphs of functions (c) Combinatories, Permutations, Combinations, Binomial Theorem.
UNIT 2: TRIGONOMETRY [8 pds]
(a) Trigonometrical ratio, directed angle and its measure, circular functions of angles, trigonometric ratio of some standard angles, fundamental trigonometric identities, addition formula, multiple angles, transformation of sum into product and vice versa.
UNIT 3: CO-ORDINATE GEOMETRY [8 pds]
Cartesian system of axis, distance between two points, section formula, equation of a line, angles between two lines, parallel and perpendicular lines, general idea of conic sections circle, ellipse, parabola and hyperbola.
UNIT 4: VECTORS, MATRICES AND DETERMINANTS [8 pds]
(a) Scalars and vectors, equality, addition of vectors, multiplication of a vector by scalar and vector (b) Matrices Special types of matrices, addition and multiplication of two matrices, properties of determinants products of two determinants, inverse of a matrix, application of matrices.
UNIT 5: LINEAR AND QUADRATIC EQUATIONS [7 pds]
(a) Introduction linear equation, quadratic equations.

SUGGESTED READINGS:-
Hobert E Forsey David & Walker: MATHEMATICS FOR ECONOMIC AND BUSINESS ANALYSIS
Frank S Budnick: APPLIED MATHEMATICS OF BUSINESS ECONOMIC AND THE SOCIAL SCIENCES

Course: MAH232/252, Title: MATHEMATICS II COURSE
Class: B.S.Sc./B.A./B.Com., Status of Course: NF HALF COURSE, Approved since session: 1998-1999
Total Credits:3, Periods(55 mts. each)/week:3(L-3-0+P/S-0), Min.pds./sem:39

UNIT 1: DIFFERENTIAL CALCULUS [8 pds]
Introduction, functions and limits, derivatives, rules for differentiation of functions of one variables, applications, maxima and minima, preliminary considerations of optimization.
UNIT 2 [8 pds]
Derivatives of multi-variate functions, applications of functions of several variables, conditions for optimizing multivariate functions and applications.
UNIT 3: INTEGRAL CALCULUS [8 pds]
Introduction, integrals, sums and areas, rules of integration, applications of integration to business problem, definite integrals,
UNIT 4: LINEAR PROGRAMMING [8 pds]
Introduction, formulation of a LLP, graphic solution of LLP.
UNIT 5: INTRODUCTION TO PROBABILITY [7 pds]
Sample space, equally likely, mutually exclusive outcomes, definition of probability, total probabilities, addition rule, joint probabilities, multiplication rule, independent events, Baye's rule.

SUGGESTED READINGS:
Frank S Budnick: APPLIED MATHEMATICS FOR BUSINESS, ECONOMICS AND SOCIAL SCIENCES

Course: MAW201, Title: COMPUTER AIDED STATISTICAL TECH. II
Class: B.S.Sc./B.A./B.Com., Status of Course: NF HALF COURSE, Approved since session: 2017-18
Total Credits:2, Periods(55 mts. each)/week:2(L-2-0+P/S-0), Min.pds./sem:30

Laboratory based on the Course MAM 101, using SYSTAT/MATLAB/EXCEL.

Course No.: MAM201, Course Title: ANALYSIS I (CALCULUS OF ONE VARIABLE)
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Real Number System and the Completeness Property, Intervals, Open Sets as Union of Open Intervals, Closed Sets, Archimedean Property of Real Numbers, Rational Density Theorem, Irrational Density Theorem, Existence of n-th roots
UNIT 2
Sequences in R, Limit of a Sequence, Monotone Sequences, Cauchy Sequence, Convergence of Infinite Series, Alternating Series, Absolute Convergence, Conditional Convergence, Tests for Convergence of Series, Decimal, Binary and Ternary Representation of Real Numbers, Uncountability of Real Numbers.
UNIT 3
Limit of a Function, Continuous Function, Algebra of Continuous Functions, Types of Discontinuities, Limits at Infinity, Infinite Limits, Asymptotes, Bounded Function, Intermediate Value Theorem, Extreme Value Theorem.
UNIT 4
Derivative of a Real Function, Algebra of Differentiable Functions, Chain Rule, Implicit Differentiation, Slope of a Curve, Tangent, Vertical Tangent, Normal, Higher Order Derivative, Leibnitz Rule, Mean Value Theorem, Rolle's Theorem, Intermediate Value Theorem for Derivatives.
UNIT 5
Indeterminate Forms, Applications of Derivatives, Local Maxima Minima, Increasing and Decreasing Functions, Concavity, Point of Inflection, Graphing in Cartesian Coordinates, Polar Coordinates, Polar Equations, Graphing in Polar Coordinates.

SUGGESTED READING:
CALCULUS AND ANALYTICAL GEOMETRY: Thomas & Finney
PRINCIPLES OF MATHEMATICAL ANALYSIS: Rudin
INTRODUCTION TO REAL ANALYSIS: Bartle

Course No.: MAM202, Course Title: ALGEBRA I (GROUPS & RINGS)
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Group, Matrix groups-GL(n, R), SL(n, R),Order of an Element, Subgroup, Subgroup Generated by a Subset, Commutator Subgroup, Centre, Centralizer, Cyclic Group, Fundamental Theorem of Cyclic Groups.
UNIT 2
Permutation Group, Alternating Group, Cosets, Lagrange's Theorem, Normal Subgroup, Quotient Group, Internal Direct Product of Subgroups, External Direct Product of Groups.
UNIT 3
Group Homomorphism, Group Isomorphism, Inner Automorphism, Group Isomorphism Theorems, Group of Automorphisms, Cayley's Theorem, Aut (Z_n).
UNIT 4
Ring, Polynomial Ring as an Example of Rings, Subring, Integral Domain, Field, Characteristic, Ideal, Quotient Ring, Prime Ideal, Maximal Ideal.
UNIT 5
Ring Homomorphism, Ring Isomorphism, Ring Isomorphism Theorems, Subfield, Subfield Generated by a Subset, Prime Subfield, Field of Quotients.

SUGGESTED READING:
ABSTRACT ALGEBRA: D. S. Dummit and R. M. Foote
CONTEMPORARY ABSTRACT ALGEBRA: J. A. Gallian
TOPICS IN ALGEBRA: I. N. Herstein

Course No.: MAM203, Course Title: SEMINAR & GROUP DISCUSSION
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits: 1, Periods(55 mts. each)/week:2(L-0-0+P/S-2), Min.pds./sem:26
Seminar and Group Discussion based on MAM201 and MAM202 courses.

Course No.: MAM301, Course Title: ANALYSIS II(INTEGRATION&CONVERGENCE)
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods (55 mts. each)/week: 4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Riemann Integration: Partition of a Set, Step Function, Riemann Integral of a Step Function, Upper Riemann Integral, Lower Riemann Integral, Riemann Integral of a Bounded Function, Mean Value Theorem of Integral Calculus, Fundamental Theorem of Calculus.
UNIT 2
Techniques of Integration, Applications of Integration: Area, Volume, Surface Area, Length of an Arc, Improper Integrals.
UNIT 3
Power Series, Radius and interval of convergence, Circular, exponential functions etc as examples, Taylor's series, Uniform Convergence and Pointwise Convergence of Sequence of Functions, Cauchy Criterion for Uniform Convergence, Tests for Uniform Convergence.
UNIT 4
Uniform Convergence and Pointwise Convergence of Series of Functions, Weierstrass M test, Dini's theorem and other tests for Uniform convergence of series. Consequences of Uniform convergence of series and sequences.
UNIT 5
Geometric and algebraic explanation of Elementary Functions, Natural Logarithms, Exponential Function, Inverse Function, Trigonometric and Inverse-Trigonometric Function, Hyperbolic Functions, their Continuity & Derivatives, Beta and Gamma Functions.

SUGGESTED READING:
CALCULUS AND ANALYTICAL GEOMETRY: Thomas & Finney
Rudin W.: PRINCIPLES OF MATHEMATICAL ANALYSIS
Bartle: INTRODUCTION TO REAL ANALYSIS
TM Apostol: MATHEMATICAL ANALYSIS

Course No.: MAM302, Course Title: ALGEBRA II (LINEAR ALGEBRA)
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Vector Space, Subspaces, Sum of Subspaces, Linear Independence, Basis and Dimension, Co-ordinate, Change in Coordinates with Change in Basis.
UNIT 2
Linear Transformation, Isomorphism, Algebra of Linear Transformations, Rank and Nullity of a Linear Transformation, Rank and Nullity Theorem, Matrix Representation of a Linear Transformation, Composition of Linear Transformations and Matrix Multiplication.
UNIT 3
Elementary Matrices, The Row Space and Column Space, Rank of a Matrix, Change of Co-ordinate Matrix, Similarity of Matrices and Linear Transformation, Matrices in Block Form.
UNIT 4
Determinant of a Matrix over a Ring as a Map, Existence and Uniqueness of Determinant of matrices of order 2 and 3, Inverse of a Matrix, Determinant of Matrices in Block Form, Determinant of a Linear Transformation, Right Handed Co-ordinate System, Application to Area and Volume, Theory of System of Linear Equations, Equivalent Systems, Reduced Row Echelon Form, Gaussian Elimination.
UNIT 5
Dual Space and its Basis, Eigen Values and Eigen Vectors of a Linear Transformation and a Matrix, Eigen Space, Characteristic Polynomial, Characteristic Polynomial and Trace, Applications of Cayley-Hamilton Theorem.

SUGGESTED READING:
LINEAR ALGEBRA: K. Hoffman and R. Kunze
LINEAR ALGEBRA: S. H. Friedberg, A. J. Insel and L. E. Spence

Course No.: MAM303, Course Title: OPERATIONS RESEARCH
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Introduction to general linear programming problems, Geometrical and algebraic analysis of models/solutions. Definitions and Theorems, solution of LPP-graphical, simplex method.
UNIT 2
Two-phases of simplex, Big-M method. Concept of Duality: Weak Duality Theorem, Basic Duality Theorem, Fundamental Theorem on Duality, Complementary Slackness Theorem, Dual-simplex method.
UNIT 3
Post-optimality analysis: Variation in cost vector, resource vector, addition/deletion of constraints/variables. Transportation, Assignment and Travelling-salesman problems.
UNIT 4
Game Theory: Definitions, Maximin and Minimax principles, Two-person zero-sum game, Games with saddle point (Pure strategy), Games without saddle points (Mixed strategy), Graphical method, Dominance principle.
UNIT 5
Inventory Problem: Introduction, Economic Order Quantity, Deterministic inventory with no shortages: The basic EOQ model, EOQ with several production runs of unequal lengths, EOQ with fixed (finite) production (replenishment). Deterministic inventory with shortages, Stochastic inventory models.

[10 pds]

Course: MAM304, Title: SEMINAR & GROUP DISCUSSION
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 1, Periods(55 mts. each)/week:2(L-0-0+P/S-2), Min.pds./sem:26

Seminar and Group Discussion based on MAM301, MAM302 and MAM303 courses.

Course: MAM401, Title: DIFFERENTIAL EQUATIONS I(O.D.EQNS.)
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods (55 mts. each)/week: 4(L-4-0+P/S-0), Min.pds./sem: 52

UNIT 1
Equations of first order and first degree - exact equations. Elementary applications - Newton's law of cooling, orthogonal trajectories. Linear equations with constant coefficients, complementary function, auxilliary equation - distinct roots, repeated roots, imaginary or complex roots, particular integral-the operator D, methods of finding PI of variation of parameters.
UNIT 2
Equations of first order but not of first degree, simultaneous equations dx/P = dy/Q = dz/R, use of multipliers, total differential equations, necessary and sufficient conditions that an equation of the type P dx + Q dy + R dz be integrable, methods of solution.
UNIT 3
Solution in series, linear equations and power series, convergence of power series, ordinary and singular points, validity of the solutions near an ordinary point, solutions near an ordinary point, regular singular point, the indicial equation, form and validity of the solutions near a regular singluar point, indicial equations with difference of roots nonintegral, indicial equations with equal roots with difference of roots a positive integer, non-logarithmic and logarithmic cases.
UNIT 4
Bessel's equations, Legendre's equations, their recurrence relations, orthogonal properties and generating functions.
UNIT 5
Hypergeometric equation, Laguerre polynomial, Hermite polynomial and their properties.

SUGGESTED READINGS:
Braun M: DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS
ED Rainville& PE Bedient: ELEMENTARY DIFFERENTIAL EQUATIONS
Yoshida: DIFFERENTIAL EQUATIONS AND APPLICATION

Course: MAM402, Title: STATISTICS II
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Bivariate Distributions: Joint Probability Distribution, Joint Density Function, Joint Marginal Distributions, Joint Conditional Distributions, Statistical Independence, Simple Correlation, Karl Pearson Coefficient of Correlation, Spearmans Rank Correlation Coefficient, Linear Regression, Regression Coefficients, Properties of Regression Coefficients, Angle between Two Lines of Regression, Coefficient of Determination, Multiple and Partial Correlation Coefficient.
UNIT 2
Probability inequalities (Chebychev's Inequality, Morkov's, Jensen), Modes of Convergence, Weak and Strong Laws of Large Numbers, Bernaulli's Law of Large Numbers, Central Limit Theorem.
UNIT 3
Sampling: Introduction to Sampling: Reasons for Sampling, Reasons for taking a census, Frame, Random Versus Non Random Sampling. Random Sampling Techniques: Simple Random Sampling, Stratified Random Sampling, Systematic Sampling, Cluster or Area Sampling. Non-random Sampling: Convenience Sampling, Judgment Sampling, Quota Sampling, Snowball Sampling, Sampling Distributions: Statistic and Parameter, Sampling Distribution of Means, Sampling Distribution of Proportion, Sampling Distribution of Difference of Means, Sampling Distribution of Difference of Proportion.
UNIT 4
Hypothesis Testing- Null and Alternative Hypothesis, Level of Significance, One Tailed and Two Tailed Tests, Type I and Type II Errors, z-Test, t-Test, Chi-square test and F-test.
UNIT 5
Estimation: Point Estimation, Properties of Point Estimate, Interval Estimation. Estimating the Mean for single sample, Standard Error of Point Estimate, Estimating the Difference Between Two Means for Two Samples, Estimating the Proportion for single sample, Estimating the Difference Between Two Means for Two Samples, Estimating Population Variance, and Sample Size and working problems based on them.
SUGGESTED READING:
MATHEMATICAL STATISTICS: Freund
PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS: Walpole & Myers
PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS: Sheldon Ross
BASIC STATISTICS FOR BUSINESS AND ECONOMICS: Lind Marchal Wathen
ESSENTIAL OF STATISTICS FOR BUSINESS AND ECONOMICS: Anderson, Sweeney, Williams
INTRODUCTION TO MATHEMATICAL STATISTICS: Hogg RV, Craig AL

Course: MAM403, Title: ANALYSIS III(VECTOR CALCULUS)
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Sequences in R^n, Limit and Continuity of Maps from R^n to R, R to R^n and R^m to R^n, Related Sum and Product Theorems, Continuity of Composition, Curves in Plane and Space, Parametric Equations.
UNIT 2
Differentiation of Maps from R^n to R, R to R^n and R^m to R^n, Total Derivative, Partial Derivatives, Jacobian Matrix, Directional Derivative, Chain Rule.
UNIT 3

Mean Value Theorem, Taylor's Formula, Linear and Quadratic Approximation, Local Maxima, Local Minima, Lagrange Multipliers.
UNIT 4
Multiple Integrals: Double Integrals, Double Integrals as Volumes, Fubini's Theorem, Triple Integration, Change of Variable in Multiple Integrals.
UNIT 5
Line Integrals, Surface Integrals, Surface Area, Divergence and Curl Operations, Applications of Gauss Divergence Theorem and Stoke's Theorem.

SUGGESTED READING:
CALCULUS AND ANALYTICAL GEOMETRY: Thomas & Finney
PRINCIPLES OF MATHEMATICAL ANALYSIS: Rudin
INTRODUCTION TO REAL ANALYSIS: Bartle
MATHEMATICAL ANALYSIS: TM Apostol

Course: MAM404, Title: SEMINAR & GROUP DISCUSSION
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 1, Periods(55 mts. each)/week:2(L-0-0+P/S-2), Min.pds./sem:26

Seminar and Group Discussion based on MAM401, MAM402 and MAM403 courses.

Course: MAM407, Title: FUNDAMENTALS OF GRAPH THEORY
Class: B.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:1(L:4+T:0+P/S-0), Min.pds./sem:52

UNIT 1
Isomorphism, Paths, Cycles and Trails. Components, Cut edges, Cut Vertices, Bipartite Graphs, Euler graphs, Vertex degree and counting: Degree sum formula. Directed graphs: Vertex degrees, Euler digraph, Orientation and Tournaments, Acyclic.
UNIT 2
Trees: Properties, distance, Diameter, radius, Eccentricity, centre. Spanning trees and enumeration.
UNIT 3
Matching: Maximum Matchings, Hall's matching condition, Min-Max theorem. Introduction to independent sets and dominating sets, Maximum Bipartite matching. Connectivity: Edge and Vertex connectivity, Blocks, 2-connected graphs, Menger's theorems.
UNIT 4
Network flows: Ford Fulkerson labeling algorithm. Colourings: Definition and Upper Bounds, Chromatic polynomial.
UNIT 5
Planar Graphs: Embeddings, Dual graphs, Euler's formula, Statement and Examples of Kuratowski's and Tutte's theorems, five colour theorem. Hamiltonian graphs: Necessary and sufficient conditions.

SUGGESTED READING:
D.B. West: Introduction To Graph Theory, Prentice Hall, 2e.
R. Diestel, Graph Theory, Springer, 3e.

Course: MAM501, Title: METRIC SPACE
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:65

UNIT 1
Metric spaces – Definition and examples, Holder and Minkowski's inequalities, Open balls, Interior points and Interior of a set, Open sets, Closed sets, Diameter of a set, Distance between a point and a set, Distance between two sets.
UNIT 2
Convergent Sequences, Limit and Cluster points, Closure of a set, Cauchy sequences and Completeness, Examples of Complete Metric spaces, Bounded sets, Dense sets, Nowhere dense sets, Boundary of a set.
UNIT 3
Continuous functions, Characterizations of Continuous maps, Limit of a function, Uniform Continuity.
UNIT 4
Compact spaces and their properties, Equivalence of Compactness, Limit point Compactness and Sequential Compactness, Heine Borel Theorem, Continuous maps on compact spaces, Extreme Value Theorem, Uniform Continuity and compactness.
UNIT 5
Baire's Category Theorem, Cantor Intersection Theorem, Banach's Contraction Principle, Ascoli-Arzela Theorem, Inverse Function and Implicit Function theorem,Weirstrass Approximation Theorem.
SUGGESTED READING:
S Kumaresan : TOPOLGY OF METRIC SPACES
TM Apostol: MATHEMATICAL ANALYSIS
W Rudin: PRINCIPLES OF MATHEMATICS ANALYSIS

Course: MAM502, Title: CURVES AND SURFACES
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:65

UNIT 1
Curves in Space, Arc length, Velocity, Acceleration, Curvature and Torsion, Frenet-Serret formula, Osculating Plane, Normal Plane, Tangent Plane.
UNIT 2
Spherical Curves, Fundamental Theorem of Curves, Co-ordinate Patch, Surfaces, Parametric Curves, First Fundamental Form, Surface of Revolution, Ruled Surface.
UNIT 3
Normal Curvature, Geodesic Curvature, Gauss Formula, Christoffel Symbols, Second Fundamental Form.
UNIT 4
Orientability, Geodesics, Geodesics on a Surface of Revolution, Geodesics on Sphere, Geodesics on Cylinder.
UNIT 5
Weingarten Equations, Principal Directions, Principal Curvatures, Gaussian Curvature, Mean Curvature, Line of Curvature, Asymptotic Curve, Minimal Surface.

SUGGESTED READING:
DIFFERENTIAL GEOMETRY OF CURVES AND SURFACES: M. P. do Carmo
ELEMENTS OF DIFFERENTIAL GEOMETRY:Millman and Parker
ELEMENTARY DIFFERENTIAL GEOMETRY: Andrew Pressley

Course: MAM503, Title: DIFFERENTIAL EQUATIONS II(P.D.E.)
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:65

UNIT 1
Linear Partial Differential Equations: Lagrange's method, Working rule for solving Pp+Qq = R by Lagrange's method, geometrical description of Pp+Qq = R. Non-linear Partial Differential Equations of Order 1: Complete Integral, particular integral, singular integral and general integral. Standard form I: only p and q present, standard form II: z = px + qy + f(p,q), standard form III: only p q and z present, standard form IV: equations of the form $f_1(x,p) = f_2(y,p)$, Charpit method, Jacobi method. Cauchy's problem for first order PDE's.
UNIT 2
Second order PDE's, Classification of second order linear PDE's, Canonical forms for Hyperbolic, Parabolic and Elliptic equations.
UNIT 3
Elliptic Differential Equations- Derivation of Laplace equation, solution of Laplace equation in polar, cylindrical and spherical coordinates, separation of variable method, Neumann and Dirichlet problems.
UNIT 4
Parabolic Differential Equations- occurrence and derivation of Diffusion equation, boundary conditions, solution of Diffusion Equation in polar, cylindrical and spherical coordinates, boundary value problems.
UNIT 5
Hyperbolic Differential Equations- occurrence and derivation of Wave equation, Solution of wave equation in polar, cylindrical and spherical coordinates, D'Alembert's Solution, Vibrating String- Variable separable solution, boundary and initial value problems for two-dimensional wave equations- method of eigen function.

SUGGESTED READINGS:
K ShankaraRao: INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS
IN Sneddon: ELEMENTS OF PARTIAL DIFFERENTIAL EQUATIONS
F John: PARTIAL DIFFERENTIAL EQUATIONS

Course: MAM504, Title: 'C' & DATA STRUCTURES
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:65

UNIT 1 [13 pds]
Programming Fundamentals: Algorithms, Flow Charts. C Programming Language: Fundamentals, operators, expressions, Data Input and Output, Control Statements, functions, recursion.
UNIT 2 [13 pds]
C Programming Language: Arrays, pointers, structures and unions, data files
UNIT 3 [13 pds]
Data Structures: Introduction to Analysis of Algorithms, Arrays, Stacks, Queues, Static Implementations via Arrays, Linked Implementation involving Single Linking, Double Linking, and Circular Structures.
UNIT 4 [13 pds]
Trees: Binary Trees and their Applications; Searching Algorithms; Sorting: Internal sorting.
UNIT 5 [13 pds]
Symbol Tables: Binary Search Trees, Height Balanced Binary Trees, Hash Tables.

SUGGESTED READING:
Schildt HC: A REFERENCE MANUAL
Gottfried B: PROGRAMMING WITH C, SCHAUM'S OUTLINE SERIES
Weiss N: DATA STRUCTURES USING C
Dromey G: HOW TO SOLVE IT BY COMPUTERS
Horowitz E & Sahani S: AN INTRODUCTION TO DATA STRUCTURES USING PASCAL
Kernighan B & Richie D: C

Course No.: MAM505, Course Title: ALGEBRA III (SYLOW'S THMS.& I.P.S.)
Class: B.Sc. Honors, Status of Course: MAJOR COURSE, Approved since session:2017-18
Total Credits:4, Periods(55 mts. each)/week: 4(L-4;T-0; P-0), Min.pds./sem:52

UNIT 1
Conjugacy Class, Class Equation, Cauchy's theorem, Sylow's Theorems.
UNIT 2
Quaternion Group, Dihedral Group, Fundamental Theorem of Finite Abelian Groups, Classification of Groups of Orders 2p, pq, etc. where p and q are primes.
UNIT 3
Simple Groups, Tests for Nonsimplicity, Index Theorem, Simplicity of A_5.
UNIT 4
Inner Product Spaces, Orthogonal Sets, Orthonormal Basis, Cauchy-Schwarz's Inequality, Gram Schmidt Orthogonalization Process, Orthogonal Complement.
UNIT 5
Linear Operators on Finite Dimensional Inner Product Spaces:Adjoint of an Operator and its Matrix, Normal and Self-Adjoint Operators and Matrices, Unitary and Orthogonal Operators and their Matrices, Their Eigenvalues, Positive Definite Operators and Matrices.

SUGGESTED READING:
ALGEBRA: Michael Artin
ABSTRACT ALGEBRA: D. S. Dummit and R. M. Foote
LINEAR ALGEBRA: S. H. Friedberg, A. J. Insel and L. E. Spence
CONTEMPORARY ABSTRACT ALGEBRA: J. A. Gallian
TOPICS IN ALGEBRA: I. N. Herstein
LINEAR ALGEBRA: K. Hoffman and R. Kunze

Course No.: MAM506 , Course Title: PROGRAMMING LABORATORY I
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 2, Periods(55 mts. each)/week:5(L-0+T-0+P/S-5), Min.pds./sem:65

Laboratory based on the course: C AND DATA STRUCTURES (MAM 504).

Course No: MAM601, Course Title: NUMBER THEORY
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2013-14
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:65

UNIT 1 [13 pds]
Number Theoretic Functions-σ, τ, ϕ, Greatest Integer Function, Application to Calendar & Other Applications.
UNIT 2 [13 pds]
Complete Set of residues, Reduced Set of Residues, Linear Congruence, Chinese Remainder Theorem, Fermat's Little Theorem, Wilson's Theorem, Euler's Theorem, Applications.
UNIT 3 [13 pds]
Order of an element modulo n, Primitive Roots, Existence of Primitive Roots, Lagrange's Theorem, Primitive Roots of Primes, Primitive Roots for Composites, Theory of Indices.
UNIT 4 [13 pds]
Quadratic Residue for an Odd Prime, Quadratic Residue for a Power of an Odd Prime, Quadratic Residue for any Integer, Legendre symbol, Gauss' Lemma, Quadratic Reciprocity Law.
UNIT 5 [13 pds]
Pythagorean Triple, Fermat's Last Theorem for n=4, Lagrange's Four-Square Theorem, Finite Continued Fractions, Infinite Continued Fractions, Pell's Equation.

SUGGESTED READING:
David M. Burton: ELEMENTARY NUMBER THEORY, Universal Book Stall, New Delhi, 2002
Gareth A. Jones and J. Mary Jones, ELEMENTARY NUMBER THEORY, Springer-Verlag, London, 2005
I. Niven, H. S. Zuckerman, H. L. Montgomery: AN INTRODUCTION TO THE THEORY OF NUMBERS, John Wiley & Sons, New York, 1991

Course: MAM602, Title: COMPLEX ANALYSIS
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week: 4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Complex Numbers, Open and Closed sets in the complex plane, Limit and Continuity, Holomorphic functions, Complex power series, Analytic Continuation, Complex Power series.
UNIT 2
Elementary functions, paths, Integration along paths, Cauchy's theorem, Morera's theorem.
UNIT 3
Cauchy's Integral formula, Liouville's theorem, The fundamental theorem of Algebra, Cauchy's formula for derivatives, Taylor's Theorem, Zeros of holomorphic functions, The Identity theorem, The maximum modulus theorem, Schwarz's Lemma.
UNIT 4
Laurent's Theorem, Singularities, Calculation of Residues, Cauchy's Residue Theorem, Problems on Contour integration.
UNIT 5
Conformal mapping, Mobius transformations, Examples on building conformal mappings.

SUGGESTED READING:
Preistley HA: INTRODUCTION TO COMPLEX ANALYSIS
Ahlfors LV: COMPLEX ANALYSIS
Lang S: COMPLEX ANALYSIS
Choudhary B: THE ELEMENTS OF COMPLEX ANALYSIS
Churchill RV: COMPLEX ANALYSIS

Course No: MAM603, Course Title: METHODS OF APPLIED MATHEMATICS
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Laplace transform and its properties, Convolution Theorem. Laplace transform of derivatives and periodic functions. Error and complementary functions and their Laplace transforms.
UNIT 2
Inverse Laplace transforms, Application of Laplace transforms to the solution of ordinary and partial differential equations.
UNIT 3
Fourier series: an expansion theorem, Fourier sine series, cosine series, the one dimensional heat equation, surface temperature varying with time, heat conduction in a sphere, a simple wave equation, Laplace's equation in two dimensions
UNIT 4
Exponential Fourier transform, Fourier Sine and Cosine transforms and their applications in solving partial differential equations.
UNIT 5
Integral Equations: Conversion of Ordinary Differential Equations into Integral equations, Classification of Linear Integral Equations and Introductory methods of their solutions, Eigen functions of integral equations.

SUGGESTED READINGS:
RV Chruchill: OPERATIONAL MATHEMATICS
IN Sneddon: THE USE OF INTEGRAL TRANSFORMS
CJ Tranter: INTEGRAL TRANSFORMS
DV Widder: AN INTRODUCTION TO TRANSFORM THEORY
RM Rao& AS Bopardikar: WAVELET TRANSFORMS

Course: MAM604, Title: NUMERICAL ANALYSIS
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2002-03
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1 [13 pds]
Rounding off and truncation of numbers, Errors and propagation of errors in arithematic operations and function evaluation. Solution of Nonlinear equations, Concept of order of convergence and convergence properties. Horner's method of polynomial evaluation.
UNIT 2 [13 pds]
Direct and Iterative methods for solving system of Linear equations. Convergence and acceleration of iterative methods. System of non-linear equations.
UNIT 3 [13 pds]
Finite differences, Newton's forward and backward formula for interpolation, Gauss and Stirling's formula and Bessel's formula, Lagrange and Hermite Interpolation, Newton's Divided Differences interpolation.
UNIT 4 [13 pds]
Numerical Differentiation, Numerical Integration by Newton Cotes methods-Trapezoidal and Simpson's rules, Concept of condition number. Gershgorin’s theorem, Power method for computation of largest eigen value (in magnitude) and the corresponding eigen vector and its convergence. The QR method.
UNIT 5 [13 pds]
Numerical solution of Ordinary Differential Equations, Single step methods-Taylor's, Euler, Runge-Kutta methods and their stability. Multistep methods and strong stability. Introductory finite difference methods for solving partial differential equations.

SUGGESTED READING:
K Atkinson: AN INTRODUCTION TO NUMERICAL ANALYSIS
MK Jain et al.: NUMERICAL METHODS FOR SCIENTIFIC AND ENGINEERING COMPUTATION
SD Conte & Carl de Boor: ELEMENTARY NUMERICAL ANALYSIS

Course No.: MAM605 , Course Title: TENSOR ANALYSIS
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week: 4(L-4+T-0+P/S-0), Min.pds./sem:52

UNIT 1
Review of vectors, covectors, dual basis and relation between components in different coordinate systems, Multi linear map, Tensor on a vector space, types of tensors, order(rank), tensor space, components, Transformation Laws, identification between tensor space and space of multi linear maps.
UNIT 2
Multiplication of tensors, basis of tensor spaces, Einstein summation convention, trace (contraction), alternating and symmetric tensors, Mapping and covariant tensors, wedge product and its properties, Cartan's lemma.
UNIT 3
Tensor algebra, Riemannian space, Fundamental Tensor, Reciprocal metric Tensor, Associated covariant and contra variant vectors and tensors, Coordinate Hyper surface, Angle between two coordinate curves and two hyper surfaces.
UNIT 4
Christoffel symbols, covariant differentiation of tensors, covariant derivative of a vector and scalar, Curl and divergence of a vector, Divergence of covariant vector, Covariant derivative of covariant, contravariant and mixed tensor of rank two, covariant derivative of higher rank tensor.
UNIT 5
Riemannian– Christoffel tensor and Ricci tensor, covariant curvature tensor, Bianchi's identity.

SUGGESTED READINGS
AN INTRODUCTION TO DIFFERENTIABLE MANIFOLDS AND RIEMANNIAN GEOMETRY: W. M. Boothby
RIEMANNIAN MANIFOLDS: John M. Lee

Course No.: MAM606 , Course Title: PROGRAMMING LAB II
Class: B.Sc. Honours, Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 2, Periods(55 mts. each)/week:5(L-0+T-0+P/S-5), Min.pds./sem:65

MATLAB and Exercise based on MAM604- Numerical Analysis.

Course No.: MAM701, Course Title: MEASURE & INTEGRATION
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Lebesgue Outer Measure, its properties, Measurable sets and their properties, Borel sets and their measurability
UNIT 2
Construction of Lebesgue Measure, Measurable Sets and their Properties, Regularity, Measurable Functions and their Properties.
UNIT 3
Lebesgue Integration: Simple Function, Lebesgue integral of a Simple functions, bounded functions and Non-Negative measurable functions. Fatou's Lemma and Lebesgue Monotone Convergence Theorem.
UNIT 4
General Lebesgue Integration and its Properties, Lebesgue Dominated Convergence Theorem, Integration of Series.
UNIT 5
L^p Spaces: L^p space as a vector space and as a metric space, Holder and Minkowski'sinequalities forL^p space, Completeness of L^p spaces.

SUGGESTED READING:
HL Royden: REAL ANALYSIS
G.deBarra:MEASURE THEORY AND INTEGRATION

Course: MAM702, Title: TOPOLOGY
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1 [10 pds]
Topology, Interior points, Exterior points, Boundary points and limit points of a set, Derived set, Interior and closure of a set, Dense Sets, Alternate methods of defining topology on a set, Basis, Sub-basis, Real Line, Sorgenfrey Line.
UNIT 2 [10 pds]
Subspace Topology, Metric topology, Metrizability, Sequence Lemma, Continuous Map, Open Map, Closed Map, Projection Map, Homeomorphism.
UNIT 3 [10 pds]
Product space, Quotient space, Quotient map, Separable space, First and Second countable spaces.
UNIT 4 [10 pds]
T_1, T_2, Regular, T_3, Completely Regular, $T_{3½}$, Normal and T_4spaces;Compact spaces.
UNIT 5 [10 pds]
Connected spaces, Components, Path connected spaces, Path components, Applications of Connectedness.

SUGGESTED READING:
TOPOLOGY-A FIRST COURSE: J. R. Munkres
GENERAL TOPOLOGY: J. L. Kelley, Van Nostrand, New York 1955
BASIC TOPOLOGY: M. A. Armstrong

Course: MAM703, Title: THEORY OF DIFFERENTIAL EQUATIONS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Elementary Concepts about Differential Equations, Lipschitz condition, Gronwall inequality, Existence and Uniqueness of solutions for scalar and systems of equations.
UNIT 2
Linear Differential Equations with Variable Coefficents, Linear Dependence and Independence of Solutions, Concept of Wronskian, Oscillatory and Non-oscillatory Behaviour of Solutions of Second Order Linear Differential Equations, Non-Homogenous Equations, Strum-Liouville Boundary Value Problem, Green's Function.
UNIT 3
Fundamental matrix, Non-homogenous Linear Equations, Linear Systems with constant coefficients, Linear Systems with Periodic Coefficients.
UNIT 4
Stability of Linear Systems, Behaviour of solutions of Linear Differential Equations.
Unit 5
Stability of Nonlinear Differential Equations, Applications of Poincare Bendixon Theorem, Introductory Methods of Solution of Linear Integral Equations.

Course: MAM704, Title: ANALYTICAL MECHANICS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Calculus of Variations: Euler-Lagrange equation, Functionals of the form $\int F(x, y_1, y_2, \ldots, y_n, y_1', \ldots, y_n')\, dx$, Functionals dependent on higher order derivatives, Functionals dependent on the functions of several independent variables, Variational methods for boundary value problems in ordinary differential equations.
UNIT 2
Generalised co-ordinates. Generalised velocities. Vertual work and genralised forces. Lagrange's equations for a holonomic system. Case of conservative forces. Generalised components of momentum and impulse. Lagrange's equation for impulsive forces. Kinetic energy as a quadratic function of velocities. Equilibrium configuration for conservative holonomic dynamical system. Theory of small oscillations of conservative holonomic dynamical system.
UNIT 3
Variational methods. The Brachistochrone problem. Hamilton's principle. The principle of least action. Distinction between Hamilton's principal and principal of least action.
UNIT 4
Hamilton's equations--the Hamiltonian and the canonical equatios of motion. The passage from the Hamiltonian to the Lagrangian. The Hamilton--Jacobi equation and its complete integral. Phase space. Poisson brackets. Liouville's theorem.
UNIT 5
Motion about a fixed point-Euler's dynamical equations. Motion under no forces about-rotating axes.

Course: MAM705, Title: RINGS & CANONONICAL FORMS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Polynomial Rings, Roots of a Polynomial, Division Algorithm, Irreducibility of a Polynomial, Mod p Irreducibility Test, Eisenstein Criterion, Irreducibility of *p*th Cyclotomic Polynomial
UNIT II
Quadratic Integer Rings, Euclidean Domain, Principle Ideal Domain, Unique Factorization Domain.
UNIT III
Geometric and Algebraic Multiplicity, Direct Sum of Subspaces, Direct Sum of Eigenspaces, Diagonalizability of Matrices and Linear Operators.
UNIT IV
Minimal Polynomial, Invariant Subspaces, Conductor, Minimal Polynomial & Diagonalizability, Minimal Polynomial &Triangulability, Cyclic Subspace, Cayley-Hamilton Theorem, Companion Matrix.
UNIT V
Generalized Eigenspace, Cycle of Generalized Eigenvectors, Direct Sum of Generalized Eigenspaces, Jordan Form, Rational Form.

SUGGESTED READING:
ALGEBRA: Michael Artin
ABSTRACT ALGEBRA: D. S. Dummit and R. M. Foote
CONTEMPORARY ABSTRACT ALGEBRA: J. A. Gallian
TOPICS IN ALGEBRA: I. N. Herstein
LINEAR ALGEBRA: S. H. Friedberg, A. J. Insel and L. E. Spence

Course: MAM706, Title: SOFTWARE LAB. I
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 2, Periods(55 mts. each)/week:4(L-0-0+P/S-4), Min.pds./sem:52

The course will introduce and involve practical sessions on:
1. (Common to all students) Concepts of Object Oriented Programming with Java: Classes, Objects, Methods, Inheritance, Interfaces, Exceptions, Packages and Java Package Library.
2. (Common to all students) MATLAB exercises based on models developed in MAM704.
3. MATLAB exercises based on models developed in MAM903.
4. Java Applets and Java Swing.

Course No. MAM707, Course Title: COMPUTER SYSTEMS ARCHITECTURE
Class: M.Sc., Status of the Course: MAJOR, Approved Since Session: 2009-10
Credits: 4, Periods (55 mts.) per week:4(L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Number Systems, Radix Conversion, Fixed and Floating point Arithmetic, Logic Gates, Boolean Algebra, Combinational Logic, Minimization, Implementation Examples- arithmetic/logic circuits. Sequential logic, flips-flops, finite state machines, registers, counters.
UNIT 2
General Purpose Machine, History, Programming–Architecture–Logic design Viewpoints, Machine Classifications, Instruction Formats, Computer Instruction Sets (Data Movement, ALU, Branch Instructions) Addressing Modes, Simple RISC Computers (SRC), Formal Description using Register Transfer Notation (RTN) Data path, Control Path.
UNIT 3
Processor Design, register transfers, single bus SRC microarchitecture, Data Path Implementation, Logic Design, Control Sequences, Control Unit, Clocks, Timing, multi-bus microarchitecture, exceptions.
UNIT 4
Pipelining, microprogramming, examples of CISC/RISC processors.
UNIT 5
Memory system design, RAM Structure, SRAM, DRAM, ROM, Memory hierarchy, cache design, cache policies. I/O Programmed, I/O Interrupts, DMA, Error Control, Peripheral Devices.

SUGGESTED READING:
Heuring & Jordan: COMPUTER SYSTEMS ARCHITECTURE
R.P. Jain: DIGITAL ELECTRONICS
M. Mano: DIGITAL ELECTRONICS AND COMPUTER DESIGN

Course No. MAM708, Course Title: DATABASE MANAGEMENT SYSTEMS
Class: M.Sc Status of the Course: MAJOR, Approved Since Session: 2009-10
Credits: 4, Periods (55 mts.) per week:4(L:3 + T:1 + P:0), Min. periods per semester: 52

UNIT 1
Basic concepts: databases, database systems, data models, schemas, database systems architecture, data independence, database languages and interfaces, DBMS System Environment, classification, record storage and primary file organisation, index structures.
UNIT 2
Introduction to Microsoft Access for Windows 98/Microsoft SQL Server, Table creation, forms, data entry, creating and printing reports.
UNIT 3
Relational mode: Domains, relations, keys, relational algebra, calculus; SQL: data definition, queires, update statements, views; relational support for queries with MS Access/MS SQL Server.
UNIT 4
Database design: ER modelling, normalisation, relations and relaional algebra with MS Access/MS SQL Server.
UNIT 5
System implementation: transaction processing systems, concurrency, recovery, security, integrity, distributed databases, client-server architectures.

SUGGESTED READING:
CN Prague & MR Irwin: ACCESS FOR WINDOWS 95 BIBLE, 3/e, Comdex Publ.
Date CJ: AN INTRODUCTION TO DATABASE SYSTEMS, 6/e, Addison Wesley.
Elmasri & Navathe: FUNDAMENTALS OF DATABASE SYSTEMS, 3/e. Addison Wesley.
Soren V: SQL AND RELATIONAL DATABASE, Galgotia.
Kroenke DM: DATABASE PROCESSING: FUNDAMENTALS, DESIGN AND IMPLEMENTATION, Maxwell Publication.

Course: MAM801, Title: OPTIMIZATION
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods (55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem: 52

UNIT 1
Queueing Theory: Introduction, Definitions and Notations, Classification of Queueing Models, Distribution of Arrivals (The Poisson Process): Pure Birth Process, Distribution of Inter Arrival Times, Distribution of Departures (Pure Death Process), Distribution of Service Time, Solution of Queueing Models, Poisson Queues- (M/M/1): (∞/FIFO), (M/M/1):(N/FIFO), (M/M/C): (∞/FIFO), (M/M/C): (N/FIFO).
UNIT 2
Non-Linear Programming Problem (NLPP): Introduction, Maxima and minima of functions of several variables and their solutions, Quadratic forms, Concave and convex functions, Unconstrained and constrained optimization.
UNIT 3
Constrained NLPP: Lagrange's method, Kuhn-Tucker conditions, Graphical Method, Concept of Quadratic programming, Frank-Wolfe method. Unconstrained NLPP: Fibonacci and Golden section search, Steepest Descent Method, Conjugate metric method.
UNIT 4
Dynamic Programming: Multistage decision processes, Concept of sub-optimality, Principle of optimality, Calculus method of solution, Tabular method of solution, LPP as a case of dynamic programming.
UNIT 5
Integer programming: Gomory method for pure and mixed LPP, All pure and mixed integer programming, Algorithm and solution of numerical problems, Branch and bound method.

Course: MAM802, Title: FIELD THEORY
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:5(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Extension of a Field, Finite Extension, Algebraic Extension, Simple Extension, Algebraic Number, Transcendental Number. Applications.
UNIT 2
Roots of a Polynomial in an Extension Field, Separability of Polynomials, Splitting Field, Separable Extension, Cyclotomic Extension.
UNIT 3
Finite Fields, Structure of Finite Fields, Extension of a Finite Field, Classification of Finite Fields, Finite Fields as Simple Extensions and their Degree.
UNIT 4
Group of Automorphisms of a Field, Fixed Field, Galois Group, FrobeniusAutomorphism, Roots of Unity, Fundamental Theorem of Galois Theory, Subfields of a Finite Field.
UNIT 5
Solvable Group, Normal Series, Radical Extension, Solvability of Polynomials by Radicals, Casus Irreducibilis.

SUGGESTED READING
ALGEBRA: Michael Artin
ABSTRACT ALGEBRA: D. S. Dummit and R. M. Foote
GALOIS THEORY: Joseph Rotman
CONTEMPORARY ABSTRACT ALGEBRA: J. A. Gallian

Course: MAM803, Title: FUNCTIONAL ANALYSIS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week: 4(L-4-0+P/S-0), Min.pds./sem: 52

UNIT 1
Normed Linear Space, Banach Space, Finite Dimensional Normed Linear Space, Compactness and Finite Dimension, Continuity of a Linear Map, Norm of a Continuous Linear Map, Isometric Isomorphism.
UNIT 2
Dual Space, Natural Embedding of a Normed Linear Space in its second Dual Space, Weak Topology, Principle Conjugate of an Operator.
UNIT 3
Hahn-Banach theorem, Open Mapping Theorem, Closed Graph Theorem, Uniform Boundedness principle.
UNIT 4
Hilbert space, Schwarz's inequality, orthogonal complement of a set, orthonormal set, complete orthonormal set, Bessel's inequality, Fourier's expansion, Parseval's equation, Gram Schmidt orthogonalisation process, Dual and second Dual of Hilbert space.
UNIT 5
Adjoint of an Operator, Self Adjoint Operators, Normal Operators, Unitary Operators, Projection on a Linear Space, Banach Space and Hilbert Space, Spectral Theorem.

Course: MAM804, Title: FLUID DYNAMICS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-2018
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem: 52

UNIT 1
The Equation of Continuity in Cartesian, Polar and Spherical coordinates, Boundary Surface, Eulerian and Lagrangian forms of equation of continuity. Symmetrical form of equation of continuity, Equation of Motion, Pressure equation, Lagrangian equation of motion, Helmholtz vorticity equation, Cauchy’s integral.
UNIT 2 [10 pds]
Viscosity, The Navier-Stokes equations of motion, Euler's Equation, Bernoulli's Equation, steady motion between parallel planes, steady flow through a cylindrical pipe, steady flow between concentric rotating cylinders.
UNIT 3 [10 pds]
Meaning of two-dimensional flow, velocity potential and Stream function, Complex potential for irrotational, incompressible flow, complex potentials for line source, sinks and doublets, two dimensional image systems, circle theorem, the theorem of Blasius.
UNIT 4 [10 pds]
Vortex filaments, complex potential due to a vortex of strength +k, motion due to m vortices, two vortex filaments, image of vortex w.r.t. a plane, image of vortex w.r.t. a cylinder, complex potential due to vortex doublet, vortex sheet, infinite single row of vortices of equal strength, two infinite rows of vortices, Karman's vortex sheet.
UNIT 5 [10 pds]
Non dimensional numbers, Prandtl's boundary layer theory, Karman's integral equation.

Course No.: MAM805, Course Title: STOCHASTIC PROC. & STAT. INFERENCE
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1: STOCHASTIC PROCESSES
Stationary processes, Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, Markov processes in continuous time, Poisson process, birth and death process.
UNIT 2: THEORY OF ESTIMATION
Point Estimation, Criterion of unbiasedness, Consistency, sufficiency, Cramer-Rao inequality, Uniformly minimum variance unbiased estimators, Methods of estimation: maximum likelihood moments, minimum chi-square, least square, confidence interval estimation.
UNIT 3: TESTING OF HYPOTHESIS
Basic concepts, types of errors, critical region, power function, most powerful and uniformly most powerful tests, likelihood ratio test, Wald's sequential probability ratio test.
UNIT 4: RELIABILITY THEORY
Definition, Failure, Data Analysis, Hazard, Models, System Reliability Series, Parallel and Mixed Configurations.
UNIT 5: DESIGN OF EXPERIMENTS
Basic principles of experimental design, randomization structure and analysis of completely randomized, randomized block and Latin-square designs. Factorial experiments. Analysis of 2^n factorial experiments in randomized blocks.

Course: MAM806, Title: SOFTWARE LAB II
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 2, Periods(55 mts. each)/week:4(L-0-0+P/S-4), Min.pds./sem:52

For all students: MATLAB exercises on MAM801- Optimization.
For students of M.Sc. Mathematics with Specialization in Computer Applications only: Exercises based on MAM807-Internet Technologies.

Course: MAM807, Title: INTERNET TECHNOLOGIES
Class: M.Sc. Status of the course: MAJOR, Approved from session: 2009-10
Credits: 4, Periods (55 mts. each) per week:4(L:3 + T:1 + P/S:0), Min.pds./sem:52

UNIT 1
Introduction to WWW, HTML Document Markup: HTML, DHTML, Web Browsers; Authoring Tools: Microsoft Front Page, Web site security, firewalls, configuration, proxy servers.
UNIT 2
Dynamic HTML: Cascading Style Sheets, Object Model and Collections, Event Model, Filters and Transitions, Data binding with Tabular Data Control.
UNIT 3
Client side scripting using Javascript. Javascript programming constructs: Control structures, functions, arrays, objects, forms, object based programming, event handlers.
UNIT 4
Javascript object library, DOM, Forms links, anchors, image maps, cookies.
UNIT 5
Server side scripting with PHP: Language Constructs, Control structures, functions, arrays, objects and classes, Handling file uploads, Using remote files, Connection handling, Persistent Database Connections, PHP Function Library, Database connectivity using MySQL.

SUGGESTED READING:
Dietel, Dietel & Nieto: INTERNET AND WORLD WIDE WEB, AWL, India
J. Jaworski: MASTERING JAVASCRIPT AND JSCRIPT, BPB Publications
D. Goodman: JAVA SCRIPT BIBLE, IDG Publ.
I. Byross: HTML, DHTML, JAVA SCRIPT, PERL. BPB Publ.
R. Darnell: HTML 4.0 UNLEASHED, Techmedia
T Converse, J Park: PHP and MySQL Bible, Wiley.

Course No. MAM808, Course Title: SOFTWARE ENGINEERING
Class: M.Sc. Status of the Course: MAJOR, Approved Since Session: 2009-10
Credits: 4, Periods (55 mts.) per week: 4(L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Introduction: Software and Software Engineering, Phases in Software Engineering, Software Engineering Life-Cycle Paradigms; Software: its Nature and Qualities. Software Engineering Principles.
UNIT 2
Software Project Management: The Software Management Process; Software Measurement: Function Points and Code Size Estimation, Software Cost Estimation - COCOMO and Putnam models; Staffing and Personnel Planning; Team Structure; Risk Management - an overview; Software Configuration Management; Quality Assurance Planning; Project Monitoring Planning; Case Study.
UNIT 3
Software Requirements Specification: Analysis principles, Structured Analysis: Modelling Tools, Structured Analysis Methodology - Classical and Modern; Requirements Specification: Characteristics, and Components; Case Study.
UNIT 4
System Design: Objectives, Principles, Modular Design, Structured Design - Structure Charts, Transform Analysis, Transaction Analysis, Design Heuristics; Module Specification; Detailed Design; Case Study.
UNIT 5
Coding: Structured Programming, Programming Style; Validation; Verification: Static Analysis (Reviews and Inspections), Testing - Goals, Theoretical Foundations, Testing in the Small, Testing in the Large; Metrics: Metrics in Requirements Analysis and Design, Complexity Metrics-Halstead's Theory, and Cyclomatic Complexity.

SUGGESTED READING:
Jalote, P., AN INTEGRATED APPROACH TO SOFTWARE ENGINEERING, NAROSA.
Pressman, R.S., SOFTWARE ENGINEERING: A PRACTITIONER'S APPROACH, MCGRAW HILL.
Somerville, I., SOFTWARE ENGINEERING, ADDISON WESELEY.

Course No.: MAM809, Course Title: CRYPTOGRAPHY AND SECURITY
Class: M.Sc, Status of the course: Major, Approved from session: 2009-10
Credits: 4, Periods (55 mts. each) per week:4(L:4 + T:0 + P/S:0), Min. periods/Sem.:52

UNIT 1
Private Key Cryptosystems: classical techniques, modern techniques, algorithms like DES, IDEA, RC5, Blowfish, etc, confidentiality using Conventional Encryption.
UNIT 2
Introduction to Number Theory: modular arithmetic, Fermat's and Euler's theorem, primality testing, Chinese remainder theorem, discrete logarithms; Basics of Finite fields.
UNIT 3
Public Key Encryption and Hash Functions: principles of public key cryptosystems, Diffie-Hellman key exchange, RSA, introduction to elliptic curve cryptography.
UNIT 4
Message Authentication and Hash function: MD5, SHa-1, HMAC etc.; Digital Signature and authentication protocols: Digital signature, DSS, Authentication protocols;
UNIT 5
Differential and Linear cryptanalysis; existing cryptosystems and their security. Cryptanalysis of existing systems. Zero-knowledge protocols, One-way functions. Advanced protocols for different applications, e.g. e-cheque, e-cash etc. Network and System level security issues.

SUGGESTED READING:
William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersy.
Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
Bruce Schiener, "Applied Cryptography".

Course No.: MAM810, Course Title: INTELLIGENT INFORMATION PROCESSING
Class: M.Sc. Status of the Course: Major, Approved Since Session: 2009-10
Credits: 04, Periods (55 mts.) per week:4(L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Soft Computing: neural networks, fuzzy logic, evolutionary computation, applications of soft computing technologies, simulation software.
UNIT 2
Pattern recognition, Bayesian Techniques, Bayes Theorem, Bayes classifier, neural network implementations, supervised learning with expectation maximization.
UNIT 3
Data Mining, models, methodologies, and processes. The KDD process. Generic tasks. Broad themes (search, induction, querying, approximation, and compression). Application areas.
UNIT 4 & UNIT 5
Special Topics (Invited lectures): Intelligent Software Agents, Multi-objective Evolutionary Optimization, Applications (Networks), Applications (Imaging), Hybrid Soft Computing Systems

SUGGESTED READINGS:
Material available from web sites.

Course No. MAM811, Course Title: DESIGN & ANALYSIS OF ALGORITHMS
Class: M.Sc. Status of the Course: Major, Approved Since Session: 2012-13
Credits: 04, Periods (55 mts.) per week:4(L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Introduction: Algorithms, analysis of algorithms, Growth of Functions, Master Theorem. Sorting and order Statistics: Heap sort, Quick sort, Sorting in Linear time, Medians and Order Statistics.
UNIT 2
Advanced Data Structures: Red-Black Trees, Augmenting Data Structures. B-Trees, Binomial Heaps, Fibonacci Heaps, Data Structure for Disjoint Sets.
UNIT 3
Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithms, Amortized Analysis.
UNIT 4
Graph Algorithms: Elementary Graphs Algorithms, Minimum Spanning Trees, Single-source Shortest Paths, All-Pairs Shortest Paths, Maximum Flow, Travelling Salesman Problem.
UNIT 5
Selected Topics: Randomized Algorithms, String Matching, NP Completeness, Approximation Algorithms.

SUGGESTED READING:
Cormen, Leiserson, Rivest : "Introduction to Algorithms", PHI.
Basse, S., "Computer Algorithms: Introduction to Design & Analysis", Addison Wesley.
Horowitz & Sahani, "Fundamental of Computer Algorithms", Galgotia.

Course No.: MAM812, Course Title: GRAPH THEORY
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week: 4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Matrix representation of a graph, Isomorphism, Paths, Cycles and Trails. Components, Cut edges, Cut Vertices, Bipartite Graphs, Euler graphs, Vertex degree and counting: Degree sum formula. Directed graphs: Vertex degrees, Euler digraph, Orientation and Tournaments, Acyclic.
UNIT 2
Trees: Properties, distance, Diameter, radius, Eccentricity, centre. Spanning trees and enumeration, Cayley's formula. Minimum Spanning tree: Kruskal's and Prim's algorithms. Shortest paths: Dijkstra's and Floyd's algorithms, Breadth first search and depth first search. Intree, outtree and Euler digraphs.
UNIT 3
Matching: Maximum Matchings, Hall's matching condition, Min-Max theorem. Introduction to independent sets and dominating sets, Maximum Bipartite matching. Augmenting path algorithm. Connectivity: Edge and Vertex connectivity, Blocks, 2-connected graphs, Menger's theorems.
UNIT 4
Network flows: Ford Fulkerson labelling algorithm. Colourings: Definition and Upper Bounds, Color critical graphs, Chromatic number, Chromatic polynomial, Introduction to Chordal graphs.
UNIT 5
Planar Graphs: Embeddings, Dual graphs, Euler's formula, Statement and Examples of Kuratowski's and Tutte's theorems, five colour theorem, Surfaces of higher genus. Hamiltonian graphs: Necessary and sufficient conditions.

SUGGESTED READING:
Deo N: GRAPH THEORY WITH APPLICATIONS TO ENGINEERING AND COMPUTER SCIENCE
Harary F: GRAPH THEORY
Watson Wilkins: GRAPHS
Krishnamurthy V: COMBINATORICS : THEORY AND APPLICATIONS
Liu CL: DISCRETE MATHEMATICS
Liu CL: INTRODUCTION TO COMBINATORICS
Brualdi R: INTRODUCTORY COMBINATORICS
Douglas B. West: INTRODUCTION TO GRAPH THEORY, Second Edition, Pearson
G. Agnarsson & R. Greenlaw, GRAPH THEORY: MODELLING, APPLICATIONS AND ALGORITHMS, Pearson Education

Course No.: MAM001, Title: BASIC RES. METH., SC.COMPUT. & ANAL.
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2013-2014
Total Credits:4

UNIT 1: INTRODUCTION
Meaning of research, types of research, research process, problem formulation and techniques, literature review. Research design, principles and types of experimental designs, controls in an experiment, types of controls.
UNIT 2: MEASUREMENT & DATA COLLECTION
Measurement & Scaling: Measurement in research, scales of measurement, sources of errors, tests of sound measurement, development of measurement tools, scaling, scale construction techniques. Methods of data collection: observation, interviews, questionnaire, rating scales, content analysis, case study, schedules.
UNIT 3: ANALYSIS
Quantitative analysis, Errors in Quantitative analysis- random and systematic errors, handling systematic errors, presentation of results, Quality Control and Quality Assurance, Figures of merit-accuracy, precision, limit of detection, limit of quantification, method of standard additions, internal and external standards, comparison of analytical methods.
UNIT 4: INTERPRETATION & REPORTING
Interpretation, techniques of Interpretation, precautions in Interpretation. Report writing: synopsis, project/dissertation report, abstract; reading and writing a research paper.
UNIT 5: SEARCH, REASONING & IPR
Part A: Patents, copyrights, trademarks, trade secrets, IPR. Ethical, legal and social issues associated with research. Research and the Internet: World Wide Web, search engines, search strategy, subject categories, specialized databases.
Part B: Mathematical and Logical Reasoning.

SUGGESTED READINGS:
Kothari C.R. & Gaurav Garg : RESEARCH METHODOLOGY-METHODS AND TECHNIQUES, 3RD Edition, New Age International
Chawla D. and Neena Sondhi : RESEARCH METHODOLOGY CONCEPTS AND CASES, Vikas Publishing House Pvt. Ltd.
Agarwal A.K.: MODERN APPROACH TO LOGICAL REASONING, 2012, S. Chand & Co. Delhi
R. Panneerselvam : RESEARCH METHODOLOGY, PHI, 2004

Course Number: MAM002, Title: PRE-DISSERTATION
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits:4

1. Preparation of Bibliography
2. Summaries of Related Studies, and
3. Preparation of Synopsis of the Research Project.

Course: MAM901, Title: DISSERTATION
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits:12
Dissertation on any given topic. Every Candidate will submit Dissertation before 30 November every year.

Course No.: MAM902, Course Title: MATHEMATICAL MODELLING
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1: INTRODUCTION [11 pds]
Mathematical Modelling Process, Types of Models, Modelling with Discrete Dynamical systems: Modelling change with Difference Equations, approximating change with Difference Equations, Systems of Difference Equations.
UNIT 2: POPULATION MODELS [11 pds]
Single Species, Non-age Structured Population Models, Two Species Population Models.
UNIT 3: EPIDEMIC MODELS [10 pds]
Deterministic models without removals, a simple deterministic model, SIS model, SIS model with specific rate of infection as a function of time, SIS models with constant number of carriers, general deterministic models with removal, approximate solution, asymptotic behaviour of the solution, general deterministic model with immigration-steady state solution.
UNIT 4: PROBABILISTIC MODELLING [10 pds]
Models in Genetics, Genetic Matrices, Hardy-Weinberg Law, Correlation between Genetic composition of Siblings, Genotype and Phenotype ratios, Models for genetic improvements-Selection and Mutation.
UNIT 5: OPTIMIZATION MODELS [10 pds]
Role of optimization model in biology and medicine, finding optimal classification schemes, survival of systems, medical diagnosis problem, optimization models for blood testing and patient care, models for optimal control of water pollution, optimal air pollution control models, control models for solid waste disposal.

SUGGESTED READING:
JN Kapur: MATHEMATICAL MODELLING IN BIOLOGY AND MEDICINE
IA Rubinow: INTRODUCTIONS TO MATHEMATICAL BIOLOGY
Giordano, Weir & Fox: A FIRST COURSE IN MATHEMATICAL MODELLING

Course: MAM903, Title: INTRODUCTION TO RIEMANNIAN GEOMETRY
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods (55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Topological Manifold and its Properties such as Local Path Connectedness, Local Compactness etc., Topological Manifold with Boundary, Paracompactness.
UNIT 2
Differentiable Manifolds, Induced Topology on a Manifold, Real Projective Space, Grassman Manifolds, Partition of Unity.
UNIT 3
Differentiable Functions on Manifold, Differentiable Functions between manifolds, Diffeomorphisms, Tangent Space, Differential, Basis Theorem, Inverse Function Theorem for Manifolds.
UNIT 4
Immersion, Submersion, Submanifolds, Vector Field, Lie Bracket, Linear Connection.
UNIT 5
Riemannian Structure, Riemannian Connection, Riemannian Manifold, Exponential Map, Normal Coordinates.

Suggested Reading:
AN INTRODUCTION TO DIFFERENTIABLE MANIFOLDS AND RIEMANNIAN GEOMETRY: William M. Boothby
DIFFERENTIABLE MANIFOLDS: C. Brickell
A COURSE IN DIFFERENTIAL GEOMETRY AND LIE GROUPS: S. Kumaresan
RIEMANNIAN MANIFOLDS (AN INTRODUCTION TO CURVATURE): John M. Lee

Course: MAM904, Title: FUZZY SETS & SYSTEMS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1 [11 pds]
Fuzzy Sets, Convex fuzzy set & Basic theorems, Basic Concepts, Fuzzy Set Operations, Properties Of Fuzzy Sets, Alpha Cuts, Extension Principle, Features Of Membership Functions, Fuzzification, Membership Value Assignments: Intuition, Inference.
UNIT 2 [11 pds]
Fuzzy Arithmetic. Fuzzy Numbers, Fuzzy Operations On Fuzzy Numbers, Interval Analysis In Arithmetic, Fuzzy Vectors. Defuzzification & Arithmetic operations on fuzzy numbers.
UNIT 3 [10 pds]
Fuzzy Relations. Crisp Vs Fuzzy Relations, Operations On Fuzzy Relations, Properties Of Fuzzy Relations, Fuzzy Cartesian Product And Compositions, Fuzzy Tolerance And Equivalence Relations, Fuzzy Ordering Relations, Fuzzy Compatibility.
UNIT 4 [10 pds]
Fuzzy Logic. Bivalued And Multivalued Logic, Fuzzy Tautologies, Implication And Composition Operations, Decomposition of canonical form and canonical form, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inferencing from Various Propositions.
UNIT 5 [10 pds]
Applications. Fuzzy Expert Systems, Fuzzy Systems, Aggregation of fuzzy rules & graphical method of inference, Fuzzy Controllers.

SUGGESTED READING
J Klir & Bo Yuan: FUZZY SETS AND FUZZY LOGIC T J Ross: FUZZY LOGIC WITH ENGINEERING APPLICATIONS

Course No. MAM905, Course Title: COMPUTER NETWORKS
Class: M.Sc. Status of the Course: Major, Approved Since Session: 2009-10
Credits: 04, Periods (55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Introduction to computer networks, internet, telephone network. Network edge, core, access and physical media. Transmission media: twisted pair, coaxial cables, optical fiber, terrestrial and satellite microwave radio. Concepts of data transmission, delay and loss, protocol layers and service models.
UNIT 2
Application Layer: Principles of application layer, Web, HTTP, FTP, Email (SMTP), DNS, etc. Socket programming with TCP/UDP, client-server implementation, simple web server implementation.
UNIT 3
Transport Layer: Transport layer services, multiplexing/demultiplexing, UDP. Principles of reliable data transfer (stop and wait, sliding window: go-back-N, selective repeat.). TCP: Connection management, segment structure, flow control, RTT estimation. Congestion control: Causes and approaches to control, TCP congestion control. Numerical examples.
UNIT 4
Network Layer: Network service models, routing principles (distance vector, link state), hierarchical routing, IP, fragmentation, ICMP, routing in the Internet (RIP, OSPF, BGP), IPv6.
UNIT 5
Link Layer & Security: services, error detection and correction, multiple access protocols, LAN, ARP, ethernet, bridging, wireless LAN. Security issues in networks, tunneling VPNs, IPSec.

SUGGESTED READING:
Kurose JF, Ross KW: a top down approach featuring the inernet, pearson educaton, 2nd edition, 2002
Peterson LL, Davie B: COMPUTER NETWORKS; A SYSTEMS APPROACH, MORGAN-KAUFMANN
Stallings William: Local Networks; An Introduction, Macmillan Pub. Co.

Course No. MAM906, Course Title: COMPUTER GRAPHICS
Class: M.Sc. Status of the Course: Major, Approved Since Session: 2009-10
Credits: 04, Periods (55 mts.) per week: 04 (L:4 + T:0 + P:0), Min. periods per semester: 52

UNIT 1
Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; RGB color model, direct coding, lookup table; Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.;
UNIT 2
Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.
UNIT 3
2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems;
Transformation of points, lines , parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.
UNIT 4
3D transformation & viewing: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.
UNIT 5
Curves: Curve representation, surfaces , designs , Bezier curves , B-spline curves.
Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, scan-line algorithm; Hidden line elimination

SUGGESTED READING:
Hearn, Baker – " Computer Graphics (C version 2nd Ed.)" – Pearson education
Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
D. F. Rogers, J. A. Adams – " Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

Course: MAM908, Title: MATHEMATICAL THEORY OF ELASTICITY
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1 [11 pds]
Analysis of strain, general theory of strain, analysis of stress.
UNIT 2 [11 pds]
Elasticity of solid bodies, equilibrium of isotopic elastic solids.
UNIT 3 [10 pds]
Transmission of force, two-dimensional Elastic systems.
UNIT 4 [10 pds]
Torsion problem, flexure of a beam.
UNIT 5 [10 pds]
Equilibrium of a thin rod bent in one plane, elastic waves.

SUGGESTED READING:
Timoshenko & Goddier: THEORY OF ELASTICITY
Maise G E: CONTINUM MECHANICS
AEH Love: A TREATISE ON MATHEMATICAL THEORY OF ELASTICITY

Course: MAM909, Title: WAVELET TRANSFORMS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2001-02
Total Credits:4, Periods(55 mts. each)/week:4(L:0+T:0+P/S-0), Min.pds./sem:52

UNIT 1
Continuous Wavelet Transforms-continuous time wavelets, definition of CWT, CWT as a correlation, CWT as an operator, inverse CWT.
UNIT 2
Discrete Wavelet Transforms-approximations of vectors in nested linear vector subspaces, example of an MRA, basis for detailed subspaces and HAR wavelet.
UNIT 3
MRA, Orthonormal Wavelets-formal definition of an MRA, construction of a general orthonormal MRA, a wavelet basis for MRA, digital filtering interpretation.
UNIT 4
Wavelet Transforms and Data compression-transform coding, DTWT for image compression, audio compression.
UNIT 5
Applications of Wavelet Transforms to Partial Differential Equations-Galerkin solution of PDE.

SUGGESTED READING:
RM Rao & AS Bopardikar: WAVELET TRANSFORMS
Burrus, Gopinath, & Guo: AN INTRODUCTION TO WAVELETS AND WAVELET TRANSFORMS

Course: MAM910, Title: TOPICS IN MATRICES& THEIR APPLICAT.
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 2002-03
Total Credits:4, Periods(55 mts. each)/week:5(L:5+T:0+P/S-0), Min.pds./sem:65

UNIT 1
Invariant subspaces, Eigen systems, decompositions and transformation representations. Similarity transformations, Jordan form, Unitary matrices and unitary similarity, Schur and diagonal forms.
Unit 2
Schur form and decompositions, Normal matrices, Properties of Normal Matrices, Eigen system of Normal Matrices, Singular value decomposition, Pseudoinverse.
Unit 3
Estimates for the eigen values, Spectral radius of Spectral and radial matrices, Estimates for similar values of a matrix, Spectral norm, Concept of the Condition Number, Spectral condition number, Estimates for spectral Condition number.
Unit 4
Numerical solution of a system of linear equations, System of Nonlinear Equations, Newton Method, General Iterative Method, their derivation and convergence.
Unit 5
Classification of second order linear partial differential equations, numerical methods for the heat equation in two dimensions. Numerical methods for the solution of the Laplace and the Wave equations in two dimensions.

SUGGESTED READINGS:
GH Golub & CFV Loan: MATRIX COMPUTATIONS, The John Hopkins University Press
B Noble & JW Daniel: APPLIED LINEAR ALGEBRA, Prentice - Hall.
MK Jain: NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS, Wiley Eastern Ltd.

Course: MAM912, Title: AUTOMATA THEORY & FORMAL LANGUAGES
Class: M.Sc., Status of Course: Major, Approved since session: 2009-10
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1
Regular languages, Finite Automata, Nondeterminism, Equivalence of NFAs and DFAs, Regular Expressions, Equivalence with Finite Automata, Nonregular Languages
UNIT 2
Context free grammars, Chomsky normal form, Pushdown automata, equivalence, non-context-free languages
UNIT 3
Turing Machines, Turing Machines as Language Acceptors, Multitape Turing Machines, Nondeterministic Turing Machines, Enumerators, Decidable Languages
UNIT 4
The Church-Turing Thesis, The Halting Problem, Universal Turing Machines, Reducibility, Rice's Theorem, Basics of Recursive function theory
UNIT 5
Measuring Complexity, The Class P, The Class NP, NP Completeness, Introduction to Space Complexity

SUGGESTED READING:
Michael Sipser, Introduction to the Theory of Computation.
Thomas A Sudkamp, Languages and Machines

Course: MAM913, Title: THEORY OF DYNAMICAL SYSTEMS & CHAOS
Class: M.Sc., Status of Course: MAJOR COURSE, Approved since session: 1998-1999
Total Credits:4, Periods(55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

UNIT 1 [12 pds]
Introduction & Overview: History, examples of chaotic behaviour, dynamical systems, attractors, preliminaries from calculus, elementary definitions, hyperbolicity, sensitive dependence on initial conditions, delay coordinates.
UNIT 2 [10 pds]
One Dimensional Maps: Piecewise linear one dimensional maps, the logistic map, general discussion of smooth one dimensional maps, examples of application of one dimensional maps to chaotic system sof higher dimensionality.
UNIT 3 [10 pds]
Strange Attractors and Fractal Dimension. The box dimension, the generalized Baker map, measure and spectrum of D_q dimensions, dimension spectrum of the generalized Baker map, pointwisde dimension, embedding.
UNIT 4 [10 pds]
Dynamical Properties of chaotic systems. Symbolic dynamics, topological conjugacy, chaos, structural stability, Sarkovskii's Theorem, Schwarzian derivative, bifurcation theory, maps of the circle, Morse-Smale diffeomorphisms,
UNIT 5 [10 pds]
Additional Topics, Homoclinic points & bifurcations, the period doubling route to chaos, kneading theory, geanealogy of periodic points, fractal basin boundaries, final state sensitivity, structure of fractal basin boundaries, chaotic scattering.
SUGGESTED READING
Edward Ott: CHAOS IN DYNAMICAL SYSTEMS Michael Barnsley: FRACTALS EVERYWHERE
Robert L Devaney: INTRODUCTION TO CHAOTIC DYNAMICAL SYSTEMS

Course: MAM951, Title: DISSERTATION I
Class: M.Phil., Status of Course: MAJOR COURSE, Approved since session: 2007-08
Total Credits: 8

Dissertation on any given topic.

Course: MAM952, Title: DISSERTATION II
Class: M.Phil., Status of Course: MAJOR COURSE, Approved since session: 2007-08
Total Credits: 16

Dissertation on any given topic.

Course: MAM953, Title: SELF STUDY COURSE
Class: M.Phil., Status of Course: MAJOR COURSE, Approved since session: 2007-08
Total Credits: 4

Self Study Course.

Course No.: MAM954, Course Title: ADV. SCIENTIFIC METHODOLOGY& ANALYSIS
Class: M.Phil., Status of Course: Major Course, Approved since session: 2013-14
Total Credits: 4, Periods(55 mts. each)/week:4(L-4+T-0+P/S-0), Min.pds./sem.:52
[SAME AS PHM954]
UNIT 1
Part A: Introduction, matrix-vector approach (MATLAB), vectors and plotting, vectorization of scalar computations, evaluation of functions, scaling and superposition, approximations and error, floating point numbers, properties of floating point systems, machine precision, subnormals and underflow, floating point arithmetic, condition number, stability, writing MATLAB functions, examples.
Part B: Mathematical and Logical Reasoning to Cover Part I of UGC NET Syllabus. Literature review, report writing and ethics in research.
UNIT 2
The polynomial interpolation problem, Vandermonde approach, special and general case, piecewise interpolation – Hermit, cubic and spline, nested multiplication, Newton representation, properties, accuracy, MATLAB implementations.
UNIT 3
Newton-Cotes integration and implementation, error, composite rules, Composite quadrature, adaptive quadrature, Gauss quadrature, MATLAB implementation examples.
UNIT 4
Matrix computations, simple i-j recipes, band and block structures, matrix-vector multiplications, matrix-matrix multiplications, errors and norms, recursive matrix operations, distributed memory matrix multiplication, discrete Fourier transform, fast Fourier transform, Introduction to MPI.
UNIT 5
Triangular problems, banded problems, full problems, stability, error, sensitivity, QR and Cholesky factorizations, system of linear equations, LU decomposition.

SUGGESTED READINGS:
Michael Heath, Scientific Computing: An Introductory Survey, McGraw Hill.
CF Van Loan, Introduction to Scientific Computing: A Matrix-Vector Approach Using MATLAB, 2nd Edition.

Course: MAM955, Title: SPECIAL TOPICS IN MATHEMATICS
Class: M.Phil., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 4, Periods (55 mts. each)/week: 4(L:4+T:0+P/S-0), Min.pds./sem:52

UNIT 1
Spectral radius, spread, singular values. Properties of Normal Matrices, Schur's Theorem, Diagonalizability of Normal and Self-adjoint Operators, The singular value decomposition and the pseudoinverse.
UNIT 2
Bilinear Forms: Matrix Representation, Diagonalizability of a Bilinear Form, Quadratic Forms and their Reduction.
UNIT 3
Rigid Motion, Translation, Rotation, Reflection, Orthogonal Operators on R^2 and R^3.
UNIT 4
Classical Linear Groups: Algebraic and Topological Structures on Matrix Groups, Dimension as a Vector Space, Topological Properties.
UNIT 5
Partial Differential Equations of Second Order: Introduction, Equation Reducible to Linear Form, Equation Integrable by Lagrange's method, solution of Equations under given Geometrical conditions, Monge's Method to solve $Rr+Ss+Tt+U(rt-s^2)=V$, Canonical Forms, Special Forms of II order Equation.

SUGGESTED READING:
ALGEBRA: Michael Artin
LINEAR ALGEBRA: S. H. Friedberg, A. J. Insel and
L.E. Spence

Course: MAM956, Title: STOCHASTIC PROC. & STAT. INFERENCE
Class: M.Phil., Status of Course: MAJOR COURSE, Approved since session: 2010-11
Total Credits: 4, Periods (55 mts. each)/week:4(L-4-0+P/S-0), Min.pds./sem:52

Syllabus same as MAM905.

Course: MAM181, Title: ENGINEERING MATHEMATICS I
Class: B. Tech., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 3, Periods (55 mts. each)/week:3(L-3-0+P/S-0), Min pds./sem:39

UNIT 1
Linear independence of vectors, Rank of a matrix, Solution of system of linear simultaneous equations, Characteristics roots and vectors, Cayley-Hamilton theorem.
UNIT 2
Functions of one variable: $\epsilon - \delta$ definition of limit and its applications, Mean value theorems, indeterminate forms, successive differentiation, Liebnitz theorem.
UNIT 3
Functions of several variables: Limit of real valued functions of several variables, Partial, directional and total derivative, Euler's theorem, Taylor Series(in one and two variables), Maxima and Minima, Jacobians.
UNIT 4
Limit of vector valued functions of one variable, Differentiation and Integration of vector valued functions, arc length, Double and Triple Integrals and their applications to area and volume.
UNIT 5
Gradient, Divergence and curl. Line and Surface Integrals, Gauss, Green's and Stroke's Theorem (without proof). Simple Applications.

SUGGESTED READINGS:
THOMAS & FINNEY :CALCULUS AND ANALYTICAL GEOMETRY
E KREYSZIG : ADVANCED ENGINEERING MATHEMATICS
B S GREWAL: ENGINEERINGMATHEMATICS

Course: MAM281, Title: ENGINEERING MATHEMATICS II
Class: B. Tech., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 3, Periods (55 mts. each)/week:3(L-3-0+P/S-0), Min pds./sem:39

UNIT 1: DIFFERENTIAL EQUATIONS
Equations of first order and first degree, Linear equations with constant coefficients, Equations of first order but not of first degree, Singular solutions, Orthogonal trajectories.
UNIT 2: TOTAL DIFFERENTIAL EQUATIONS
Simultaneous and Total Differential Equations: Necessary and Sufficient conditions for integrability of the total differential equations, Solution by inspection, Regarding one variable as constant, Homogenous Total Differential Equations, Method of Auxiliary Equations.
UNIT 3: DIFFERENTIAL EQUATIONS OF SECOND ORDER
Ordinary Linear Differential Equations of Second Order: When one integral belonging to C.F. is known, Method of Removal of the first derivative, Transformation of the equations by changing the independent variable, Method of variation of parameters.
UNIT 4: PARTIAL DIFFERENTIAL EQUATIONS
Elementary partial differential equations of first order, Homogenous and non-homogenous partial differential equations with constant coefficents, Solution for wave, heat conduction and transmission equations.
UNIT 5: FOURIER SERIES
Dirichlet's conditions, Half range series, Harmonic analysis.

SUGGESTED READINGS:
Ray and Sharma : Differential Equations Gorakh Prasad: Text Book of Differential Calculus
Chadda GC, Dwivedi D S and Tripathi S M: : Text Book of Differential Calculus
Raddick and Millar: Advanced Mathematics for Engineers.

Course: MAM381, Title: ENGINEERING MATHEMATICS III
Class: B. Tech., Status of Course: MAJOR COURSE, Approved since session: 2009-10
Total Credits: 3, Periods (55 mts. each)/week:3(L-3-0+P/S-0), Min pds./sem:39

UNIT 1: LAPLACE TRANSFORMS
Standard Forms, Shifting and Convolution Theorems, Transforms of derivatives. Inverse Laplace Transforms, Laplace transforms of error function, Heavyside Direct Delta Functions, Applications of Laplace Transforms.
UNIT 2: FOURIER TRANSFORMS
Finite and Infinite Fourier Transforms, Fourier Integral Theorem, Inversion Theorem, Applications of Fourier Transforms.
UNIT 3: COMPLEX ANALYSIS
Analytic Function, Cuachy-Reimann Equation, Conjugate harmonic functions.
UNIT 4: COMPLEX ANALYSIS
Integration, Cauchy's Theorem, Cauchy's Inegral Formulae, Taylor's and Lautent's expansions, Zeros and poles.
UNIT 5: COMPLEX ANALYSIS
Residues, Cauchy Residues Theorem, Simple problems in contour integration.

SUGGESTED READINGS:
MD Raisinghania: INTEGRAL TRANSFORMS
Schaum's Series: LAPLACE TRANSFORM
Schaum's Series: COMPLEX VARIABLES

Course No.: MAM481, Course Title: ENGINEERING MATHEMATICS IV
Class: B.Tech., Status of Course: Major Course, Approved since session: 2017-18
Total Credits: 3, Periods(55mts. each)/week:3), Min.pds./sem: 39

UNIT 1: ALGEBRAIC AND TRANSCENDENTAL EQUATION
Numerical solution, Method of bisection, Newton-Raphson Iteration, Acceleration of Convergence by Aitken Triangle Square Process.
UNIT 2: LINEAR SIMULTANEOUS ALGEBRAIC EQUATION
Solution by Cholesky's, Jacobi's and Gauss-Seidal methods. Largest Eigen Value and corresponding Eigen Vector. Relaxation Techniques.
UNIT 3: INTERPOLATION
Difference Table. Forward, Backward, Central and Shift operators. Gregory-Newton, Sterling, Everett's and Bessel's Formulea. Lagrange's formula. Inverse interpolation.
UNIT 4: NUMERICAL DIFFERENTIATION AND INTEGRATION
Newton-Cotes Formula. Gaussien Quadrature Formula, Extension of trapizoidal and Simpsons rule to multiple integrals.
UNIT 5: ORDINARY DIFFERENTIAL EQUATIONS &PARTIAL DIFFERENTIAL EQUATIONS
Numerical Solution, Methods of Taylor, Picard, Euler, Range-Kutta, Adams-Bashforth and Milne's method. Simultaneous differential equations.
Numerical Solution. Laplace and one dimensional heat conduction equation.

SUGGESTED READINGS:
SS Sastry: NUMERICAL ANALYSIS
Conte DeBoor: NUMERICAL ANALYSIS
Hildebrand: NUMERICAL ANALYSIS
RG Stantom: NUMERICAL METHODS FOR SCIENTISTS AND ENGINEERS

Course No.: MAM581, Course Title: DISCRETE MATHEMATICS
Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 3, Periods (55mts. each)/week: 3, Min pds./sem: 39

UNIT 1
Mathematical Logic: Propositions, Connectives, Propositional formulae, Truth Tables, Well formed formulas, Tautologies, Equivalence Formulas; Duality Law: Normal forms: Disjunctive and Conjunctive; Tautological implications: Validity of the arguments, Theory of Inference; Predicate Calculus: Predicates, Variables and Quantifiers, Free and Bounded Variables, Inverse of Discourses.
UNIT 2
Set Theory: Review of basic concepts, Relations, Equivalence relations, Partitions and Equivalence classes, compatibility relations, Partial ordering, Partial Ordering set; Functions: Composition, Inverse, Characteristic functions of a set, Binary and n-ary operations; Natural numbers: Mathematical Induction, Cardinality.
UNIT 3
Groupoid, Monoid, Semigroups, Groups, Subgroups, Normal subgroups, Homomorphism, Cyclic groups, Permutation groups; Lattice: Lattices as posets, some special Lattices, Boolean Algebra; Rings and Fields.
UNIT 4
Combinatorics: Fundamental laws of Counting, Permutations, Combinations, Binomial Theorem, Principle of Exclusion and Inclusion.
UNIT 5
Discrete Numeric Functions, Recurrence relations, Generating functions.
SUGGESTED READINGS:
JP Tremblay, R Manohar: DISCRETE MATHEMATICAL STRUCTURES WITH APPLICATIONS TO COMPUTER SCIENCE, McGraw Hill Publication
CL Lee: DISCRETE MATHEMATICS
Kolman, Busby, Ross: DISCRETE MATHEMATICAL STRUCTURES, Prentice Hall Publication

Course No.: MAM582, Course Title: PROBABILITY AND STATISTICS
Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2017-18
Total Credits: 3, Periods (55mts. each)/week: 3, Min pds./sem: 39
[Applicable from session 2018-19]

UNIT 1
Conditional Probability, Baye's Theorem; Measure of central Tendency and dispersion in terms of moments. Mathematical expectations.
UNIT 2
Random Variables: Discrete and continuous, Probability mass/ density function, cumulative mass/ density function. Binomial, Poisson and Normal distributions and their applications.
UNIT-3
Sampling distribution, central limit theorem, Estimation; Point and internal estimation using z and t distribution.
UNIT-4
Two types of error, confidence and significance level (small and large samples). Testing of Hypothesis based on means proportions. X^2 – test as the test of independence and goodness of fit. Test based on variance; F-distribution; one way ANOVA.
UNIT- 5
Curve fitting (Method of least square) correlation analysis. Linear regression analysis.

SUGGESTED READING:
Walpole, R.E., Mayers, R.L., Myers, S.L., and Ye K., 'Probability and Statistics for engineers and scientists', Pearson Education.
Johnson, R.A., Probability and statistics for Engineers, PHI.
Kapoor and Saxena, Mathematical Statistics, S. Chand.

Course: MAM681, Title: ADVANCED OPTIMIZATION TECHNIQUES
Class: B.Sc. Engg., Status of Course: MAJOR COURSE, Approved since session: 2001-02
Total Credits:3, Periods(55 mts. each)/week:3(L:3-0+P:0+S:0), Min.pds./sem:39

UNIT 1 [8 pds]
Introduction to mathematical programming problems and models, Geometry and Analysis of models/solutions. Convex polyhedron, Concave and conve functions, Related theorems, Linear Models and representations, Definitions and Theorems, solution of l.p.p. graphical, simplex, two-phases of simplex, Big-M method.

UNIT 2 [8 pds]
Revised Simplex method, Concept of Duality, Theorems, Dual-simplex, Post-Optimality analysis, Decomposition principle, Transportation Problems. Optimal Solution.

UNIT 3 [8 pds]
Non-linear programming problems: Single and multi variable optimization problems (with and without constraints)-Definitions and related theorems. Lagrange's method, Kuhn-Tucker conditions. Unimodel function, Fibonacci and Golden section search, Steepest descent method, Conjugate metric method, variable metric method, Frank-Wolfe method, Kelly’s cutting plane method.

UNIT 4 [8 pds]
Dynamic Programming: Multistage decision processes, Concept of sub-optimality, Principle optimality, Calculus method of solution, Tabular method of solution, L.p.p. as a case of Dynamic programming.

UNIT 5 [7 pds]
Quadratic Programming.

SUGGESTED READINGS:
G Hadley: LINEAR PROGRAMMING
SI Gass: LINEAR PROGRAMMING
SS Rao: OPTIMIZATION TECHNIQUES
NS Kambo: MATHEMATICAL PROGRAMMING TECHNIQUES

Course: MAM881, Title: ADVANCED ENGINEERING MATHEMATICS
Class: B.Sc. Engg., Status of Course: MAJOR COURSE, Approved since session: 2002-03
Total Credits:3, Periods(55 mts. each)/week:3(L-3-0+P/S-0), Min.pds./sem:39

UNIT 1: ADVANCED STATISTICS [8 pds]
Theory of Point estimation, properties of a good estimator, methods of estimation, method of maximum likelihood estimate, metho of moments.
UNIT 2 [8 pds]
Theory of testing of hypotheses, Null and alternate hypotheses, Simple and composite hypotheses, Errors of the 1st and 2nd kind. Critical region, Most powerful C.R.
UNIT 3 [8 pds]
(a) Test of significance based on large samples {Test of single and double mean} (b) Test of significance based on small samples. Test of significance based on chi-square and F-distributions.
UNIT 4: OPTIMIZATION TECHNIQUES [8 pds]
Convex sets and lpp, Graphical method. Simplex method. Degeneracy. Duality in lpp. Application of lpp. in transportation and assignment problems. Linear programming models for CPM & PERT.
UNIT 5: RELIABILITY TECHNIQUES [7 pds]
Definition of a system. Types of systems. Reliability of the system with hazard rate.

SUGGESTED READINGS:
Rao SS: OPTIMIZATION TECHNIQUES
Sivazban & Sinfel: OPTIMIZATION TECHNIQUES IN OPERATION RESEARCH
Papoulis A: PROBABILITY, RANDOM VARIABLES & STOCHASTIC PROCESSES
Bazovsky I: RELIABILITY THEORY AND PRACTICE
Calabro SR: RELIABILITY PRINCIPLES AND PRACTICES
Bryant: STATISTICAL ANALYSIS

Course: PMA101, Title: COMPUTATIONAL METHODS
Class: M. Tech, Status of Course: Major Course, Approved since session: 2009-10
Total Credits:4, Periods(55 mts. each)/week:4(L-3+T-1+P-0+S-0), Min pds./sem: 52

UNIT 1: PARTIAL EQUATIONS OF SECOND ORDER
Equation that can be integrated by inspection, equation reducible to linear form, equation integrable by Lagrange's method, solution of equation under given geometrical conditions, Monge's method to solve the equation of the type $Rr+Ss+Tt=v$ and $Rr+Ss+Tt+U(rt-s^2)=v,$ canonical forms.
UNIT 2: TRANSFORMS
Standard forms, Shifting and convolution theorems, Transforms of derivatives, inverse Laplace transforms, Applications to the solution of linear and simultaneous differential equations, Finite and infinite Fourier transforms, Applications to boundary value problems.
UNIT 3: INTEGRAL EQUATIONS
Conversion of ordinary differential equations into integral equation, classification of linear integral equation and methods of their solution using Laplace transforms.
UNIT 4: STATISTICS
Correlation and Regression, Binomial, Poisson and Normal distributions. Theory of testing of Hypothesis: Null and alternate hypotheses, simple and composite hypotheses, Type I & Type II errors, Critical region, Most powerful Critical region, Analysis of Variance.
UNIT 5: LINEAR PROGRAMMING
Graphical Method, Simplex method.

SUGGESTED READINGS:
Raddick & Miller: ADVANCED MATHEMATICS FOR ENGINEERS
C J Tranter: INTEGRAL TRANSFORMS IN MATHEMATICAL PHYSICS
B S Grewal: HIGHER ENGINEERING MATHEMATICS
S S Rao: OPTIMIZATION TECHNIQUES
R P Kanwal: LINEAR INTEGRAL EQUATIONS
Peter Collins: DIFFERENTIAL & INTEGRAL EQUATIONS

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