ANDHRA UNIVERSITY
COLLEGE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (FIRST SEMESTER)
AM-101: REAL ANALYSIS
(With effect from 2020-2021 Admitted Batch)
For pandemic year 2020-2021 exams only

Duration: 3 hours **Maximum Marks: 80**

(A total of FOUR questions are to be set. Among them the first question consists of 4 short answer questions covering the first 3 units. The remaining THREE questions are to be set as internal choice in first three units. Each question carries 20 marks and the first question is compulsory.)

Unit-I

Basic Topology: Finite, countable and uncountable sets, metric spaces, compact sets, perfect sets, connected sets.

Continuity: Limits of functions, continuous functions, continuity and compactness, continuity and connectedness, discontinuities, monotone functions, infinite limits and limits at infinity. (Chapters 2 and 4 of Ref.1).

Unit-II

The Riemann - Stieltjes integral: Linearity properties, integration by parts, change of variable, reduction to a Riemann integral, monotonically increasing integrators, Riemann's condition, comparison theorems, integrators of bounded variation, sufficient conditions for existence of R-S. integrals, necessary conditions for existence of R-S integrals, mean-value theorems for R-S integrals, integral as a function of interval, second fundamental theorem of integral calculus, second mean-value theorem for Riemann integrals. (Sections: 7.1 to 7.7 and 7.11 to 7.22 of Ref.2)

Unit-III

Multivariable Differential Calculus: Directional derivative, total derivative, Jacobian matrix, chain rule, mean-value theorem for differentiable functions, sufficient conditions for differentiability and for equality of mixed partial derivatives, Taylor's formula for real valued functions in n real variables. (Chapter 12 of Ref.2).

Text Books: (1) Principles of Mathematical Analysis by WALTER RUDIN (third edition) Mc.Graw Hill international edition, 1976.
(2) Mathematical Analysis by TOM.M.APOSTOL (Second Edition) Addison-Weslay publishing Company.

ANDHRA UNIVERSITY
COLLEGE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (FIRST SEMESTER)
AM 105: PROGRAMMING IN C
(With effect from 2020-2021 Admitted Batch)
For pandemic year 2020-2021 exams only

Duration: 3 hours **Maximum Marks: 80**

(A total of Four questions are to be set. Among them the first question consists of 4 short answer questions covering the first 3 units. The remaining Three questions are to be set as internal choice in first three units. Each question carries 20 marks and the first question is compulsory.)

Unit-I

Data types, Operators and Some statements: Identifiers and key words, Constants, C operators, Type conversion. Writing a Program in C: Variable declaration, Statements, Simple C Programs, Simple input statement, Simple output statement, Featutre of stdio.h. Control statements: Conditional expressions: If statement, if-else statement.

Unit-II

Switch statement, Loop statements: For loop, While loop, Do – while loop, Breaking control statements: Break statement, Continue statement, goto statement.

Unit-III

Functions and Program Structures: Introduction, Defining a function, Return statement, Types of Functions, Actual and formal arguments, Local Global variables. The scope of variables: Automatic Variables, Register Variables, Static Variables, External wariables, Recursive functions. Arrays: Array Notation, Array declaration, Array initialization, Processing with arrays, Arrays and functions, Multidimensional array, Character array.

Text books:

Programming in C by D.Ravichandran, New Age International, 1998 Chapters: 1, 2, 3,4,5,6, and 8.

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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS(FIRST SEMESTER)
AM 102: TECHNIQUES OF APPLIED MATHEMATICS-1
(With effect from 2020-2021 Admitted Batch)For pandemic year 2020-2021 exams only

Duration: 3 hours **Maximum Marks: 80**

(A total of FOUR questions are to be set. Among them the first question consists of 4 short answer questions covering the first 3 units. The remaining THREE questions are to be set as internal choice in first three units. Each question carries 20 marks and the first question is compulsory.)

Unit-I

Linear equations with variable coefficients, the Wronskian and linear independence, reduction of the order of a homogeneous equations, the non-homogeneous equations. Homogeneous equations with analytic coefficients.Linear equations with regular singular points, Euler's equations. (Chapter 3 (excluding section 8 & 9), chapter 4 (excluding sections 5, 7 & 8 of Text book 1.)

Unit-II

Series solutions, existence and uniqueness of solutions of 1st order equations, exact equations, Picard's method of successive approximations, existence & uniqueness of solution to systems. (Chapter 5 (excluding section 7) and chapter 6 (sections 1,3,5,6) of Text book 1.)

Unit-III

Calculus of variations : Euler's equations, functions of the form $\int_{x_0}^{x_1} F(x, y_1, y_2 \ldots y_n, y_1', y_2', \ldots y_n')dx$.Functional dependence on higher order derivatives, variational problems in parametric form and applications (Chapter VI of Text book.2).

Text books:

1. E.A. Coddington. An Introduction to ordinary differential equations, Prentice Hall of India Pvt. Ltd., New Delhi, 1987.
2. L. Elsgolts: Differential equations and calculus of variations, Mir Publishers, Moscow,
3. Barry Spain. Tensor Calculus-RadhaPublishing House, Calcutta.

103:- CLASSICAL MECHANICS

UNIT-1:-

Mechanics of particle, mechanics of a system of particles, constraints, generalized velocity generalized force and potential. D'Alembert's principle and lagranges equations. some applications of lagrangian formulations. Hamilton's principle, derivation of lagrange's equations from Hamilton's principle, extension of hamilton's principle to non-holonomics system, advantages of variational principle formulation, conservation theorems and symmetry properties.

UNIT-II

legendre transformations and the Hamilton equations of motion. cyclic coordinates and conservation theorems. Routh's procedure, derivation of Hamilton's equations from a variational principles. the principle of least action, the equations of canonical transformation. examples of canonical transformations.

UNIT-III

the Harmonic ossillators, the symplectic approach to canonical transformations, poisson and lagrange brackets and their invariance under canonical transformation. Jacobi's identity poisson's theorem equations of

Infinitesimal canonical transformation in the poisson's bracket formulation - Hamilton Jacobi equations for Hamilton's principal function - the harmonic oscillator problem as an example of the Hamilton - Jacobi method. the Hamilton - Jacobi equation for Hamilton's characteristic function.

Text books:—

1) classical mechanics by H. Goldstein, 2nd edition. Narosa Publishing House.

2) relevant topics from special relativity by W. Rindler, Oliver & Boyd. 1960.

104: DISCRETE MATHEMATICAL STRUCTURES

UNIT-I:-

Mathematical logic:- statements structures and notation, connectives, well formed formulas, tautologies. Equivalences, implications, normal forms- Disjunctive and conjunctive, principal disjunctive and conjunctive normal forms.

UNIT-II:-

Theory of inference:- Theory of inference for statement calculus, validity using truth tables rules of inference. Automatic theorem proving, predicate calculus: predicates, predicate formulas, quantifiers, free and bound variables, inference theory of predicate calculus.

UNIT-III

Relations and ordering:- Partially ordered relations, partially ordered sets, representation and associated terminology.

Lattices, lattices as partially ordered sets, some properties of lattices, lattices algebraic systems, sub-lattices, direct product and homomorphism some special lattices.

ANDHRA UNIVERSITY
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DEPARTMENT OF APPLIED MATHEMATICS

REVISED SYLLABUS
M.Sc. SECOND SEMESTER APPLIED MATHEMATICS
AM 204: ADVANCED NUMERICAL METHODS
(With effect from 2015-2016 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of seven questions are to be set and the student has to answer 5 (five) questions. All questions carry equal marks. The first question which is compulsory carries 16 marks. It consists of 4 short answer sub questions covering the entire syllabus. The remaining six questions each carrying 16 marks are to be set as suggested in the body of the syllabi.)

Interpolation and Approximation: Lagrange interpolation, Hermite interpolation, Spline interpolation, Least squares approximation.
Numerical techniques for evaluating derivatives and integrals: Differentiation methods based on interpolation formulae, methods based on finite differences, extrapolation methods, partial differentiation. Numerical Integration methods based on interpolation formulae, Newton – Cote's methods, Trapezoidal and Simpsons formulae, Methods based on undetermined coefficients – Gauss Legendre, Gauss-Chebyshev integration methods, Lobatto integration, Composite integration methods – Trapezoidal rule, Simpsons rule and Romberg integration. (Chapter 4 and 5 of Text book 1)

(Three questions are to be set)

Numerical techniques for solving ordinary differential equations: Euler method, backward Euler method, Midpoint method. Single step methods: Taylor series method, Runge-Kutta methods. Multistep methods: Predictor-corrector method, Adams Bashforth method, Adams –Moultan method, Convergence and stability analysis of single – step methods. (Chapter 6 of Text book 1)

Numerical methods for solving elliptic partial differential equations: Difference methods, Dirichlet problem, Laplace and Poisson equations. (Chapter 1.1, 1.2, 4.1 to 4.2 of Text book 2).

(Three questions are to be set)

Text books:

1. Numerical method for Scientific and Engineering Computation, M.K Jain, S.R.K. Iyengar and R.K. Jain, 3rd edition, 1993, New Age International Pvt.Ltd.
2. Computational methods for partial differential equations by M.K. Jain, S.R.K Iyengar and R.K. Jain, New Age International Pvt. Ltd. (1993).

ANDHRA UNIVERSITY
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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (SECOND SEMESTER)
AM 202: TECHNIQUES OF APPLIED MATHEMATICS-II
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Partial differential equations: Equations of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$, Orthogonal trajectories, Pfaffian differential equations, 1st order partial differential equations; Charpit's method and some special methods. Jacobi's method. (Chapter 1 (excluding sections 7 & 8), Chapter-II (excluding section 14) of Text book 1).

Unit-II

Second order Partial differential equations with constant & variable coefficients, canonical forms, separation of variables method, Monge's method (Chapter III (excluding section 10) of Text book 1).

Unit-III

Laplace Transform definition, conditions for existence, properties, problems, inverse Laplace transforms, convolution theorem, applications of convolution theorems, solutions of ordinary, partial differential equations using Laplace transforms, applications of Laplace transforms for initial and boundary value problems .

(Chapters 1,2,3,5 of Text book 2)

Unit-IV

Fourier Transform definition, conditions for existence, properties, problems, inverse forier transforms, relation between Laplace and Fourier Transforms, Fourier sine transforms, Fourier Cosine transform, finite Fourier transforms, applications of convolution theorems, solutions of ordinary, partial differential equations using Fourier transforms (Chapters 6 and 8 (sections 8.1 & 8.2 only) of Text book 2)

Text books:

1. I.N. Sneddon, Elements of partial differential equations. Mc Graw Hill International student Edition, 1964.
2. A.R.Vasishtha & R.K.Gupta, Integral transforms, Krishna Prakashan Media (P) Ltd, Meerut, 2003.

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DEPARTMENT OF APPLIED MATHEMATICS

REVISED SYLLABUS
M.Sc. APPLIED MATHEMATICS (SECOND SEMESTER)
AM-206: Mathematical Methods
(With effect from 2020-2021 Admitted Batch)

Duration:3hours Maximum Marks: 80

(A total of five questions are to be set and the student has to answer all and the first question is compulsory. All questions carry equal marks. The first question consists of 4 short answer questions one question from each unit. The remaining four questions each carrying 16 marks are to be set as internal choice in each unit.)

Unit-I

Graph Theory: Graphs and Multigraphs, Subgraphs, Isomorphism and Homeomorphism, Paths, Connectivity, Traversable Multigraph, Labeled and Weighted Graphs, Complete, Regular and Bipartite Graphs, Trees, Planar Graphs. (Scope as in Sections 8.2 to 8.9 of chapter 8 of textbook 1).

Unit-II

Directed Graphs: Rooted Trees, Sequential Representation of Directed Graphs,Warshall's Algorithm, Shortest Path, Binary Trees, Complete and Extended Binary Trees, Representation of Binary Trees, Traversing Binary Trees and Binary Search Trees (Scope as in Sections 9.2 to 9.6 and 9.8 of chapter 9 and 10.1 to 10.6 of chapter 10 of textbook 1).

Unit-III

Group codes: The communication Model and Basic Notions of Error Correction, Generation of Codes by Using Parity checks, Error Recovery in Group Codes (3.7.1, 3.7.2 and 3.7.3 of Chapter 3 of Textbook 2)

Theory of Recursion: Recursive Functions, Sets and Predicates, Primitive Recursive functions, Partial Recursive and Ackerman's Functions (scope and treatment as in Section 2.6.1 of Textbook 2)

Unit-IV

Integral equations, Differentiation of a function under an integral sign, Relation between differential and integral equation, Solution of non-homogeneous Volterra's integral equation of second kind by the methods of successive substitution and successive approximation, Solution of Fredholm's integral equation by the methods of successive substitution and successive approximation, Reciprocal functions, Volterra's solution of Fredholm's equation. (Chapters 1 & 2 of Text book 3)

Text books:

1. Discrete Mathematics, Schaum's outline series, second edition, by Seymour Lipschutz and Marc Lipson Tata Mc Graw-Hill.
2. Discrete Mathematical structures with Applications to Computer Science by J.P.Tremblay and R.Manohar Tata Mc Graw-Hill Edition.
3. Shanti Swarup- Integral equations, Krishna Prakashan Media (P) Ltd, Meerut, 2003.

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DEPARTMENT OF APPLIED MATHEMATICS

REVISED SYLLABUS
M.Sc. APPLIED MATHEMATICS (SECOND SEMESTER)
AM 203: Elements of Elasticity and Fluid Dynamics
(With effect from 2020-2021 Admitted Batch)

Duration: 3hrs. **Max.Marks:80**

(A total of five questions are to be set and the student has to answer all questions and the first question is compulsory. All questions carry equal marks. The first question consists of 4 short answer sub questions covering the entire syllabus. The remaining four questions each carrying 16 marks are to be set as internal choice in each unit.)

Unit-I

Analysis of strain, deformation, affine deformation, infinitesimal affine deformation, geometrical interpretation of the components of strain, strain quadric of Cauchy, principal directions, invariants, general infinitesimal deformation, Examples of strain, equations of compatibility, finite deformations. (Chapter 1 of Text book 1)

Unit-II

Analysis of stress, body and surface forces, stress tensor, equations of equilibrium, transformation of coordinates, stress quadric of Cauchy, Mohr's diagram, examples of stress, Hook's law, Generalized Hook's law, Homogeneous isotropic media. (Chapter 2 and chapter 3(sections 20,21 & 22) only of Text book 1)

Unit-III

Kinematics of fluids, real and ideal fluids, velocity of fluid at a point, streamlines and path lines, velocity potential, velocity vector, local and particle rates of change, equation of continuity, Acceleration of fluid, conditions at a rigid boundary, General analysis of fluid motion. (Chapter 2 of Text book 2)

Unit-IV

Equation of motion of a fluid, pressure at a point in a fluid at rest and in a moving fluid, conditions at a boundary of two in viscid immiscible fluids, Euler's equations of motion, Bernoulli's equation. Discussion of the case of steady motion under conservative body forces, Some potential theorems, Flows involving axial symmetry. Impulsive motion. Vortex motion, Kelvin's circulation theorem. Some further aspects of vertex motion. (Chapter 3 of Text book 2)

Text books:

1. Mathematical theory of Elasticity, by I.S.SOKOLNIKOFF
   2nd edition; Tata Mc Graw Hill-New Delhi
2. Text book of Fluid Dynamics by F.Chorlton, CBS publishers and distributors, New Delhi.

AM 201 : COMPLEX ANALYSIS

UNIT-I :-

functions of a complex variable

Analytic functions and harmonic functions, cauchy Riemann equations, and sufficient conditions

UNIT-II :- complex integration

contour Integration, cauchy-gourset theorem Antiderivatives, Integral representation for Analytic functions theorem of morera and liouville and some Applications.

UNIT-III :-

series :-

Uniform convergence of series, Taylor and laurent series representations, singularities, Zeros and poles, Applications of taylor and laurent series.

Residue theory :-

Residue theorem, calculus of residues, evaluation of Improper real integral, Indented contour integrals, Integration with branch point. Rouche's theorem.

UNIT-IV :-

conformal mapping :-

Basic properities of conformal mapping, Bi-linear transformations, mappings involving elementary functions.

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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (THIRD SEMESTER)
AM-301: MEASURE THEORY
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Lebesgue Measure: Introduction, Outer measure, Measurable sets and Lebesgue measure, A nonmeasurable set, Measurable functions, Littlewood's three principles.

Unit-II

The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure. The integral of a nonnegative function. The general Lebesgue integral, Convergence in measure. (Cahpters 3 and 4 of the Text book).

Unit-III

Differentiation and Integration: Differentiation of Monotone functions, Functions of bounded variation, Differentiation of an integral, Absolute continuity, Convex functions.

Unit-IV

The classical Banach Spaces: The Lp spaces, The Holder and Minkowski inequalities, Convergence and completeness, Bounded linear functionals on the L_p spaces.

Text Book: Real Analysis, H.L. Royden – Macmillan publishing Comp.

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DEPARTMENT OF APPLIED MATHEMATICS
M.Sc. APPLIED MATHEMATICS (THIRD SEMESTER)
AM -302 : TECHNIQUES OF APPLIED MATHEMATICS-III
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-1

Difference Calculus : Basics of difference calculus, General theory of difference equations, first order difference equations explained through examples, steady-state and stability, linear homogeneous equations with constant coefficients, non-homogeneous equations; method of undertermined coefficients, limiting behavior of solutions, non-linear equations transformable to linear equations. (Chapter 2 – section 2.1 to 2.6 of Text book 1) **(Two questions are to be set)**

Unit-II

System of linear difference equations, basic theory, autonomous systems, Jordan form, linear periodic systems. (Chapter 3-Section 3.1 to 3.4 of Text book 1) **(One question is to be set)**

Z-transform methods, definition with examples, properties of Z-tranforms, inverse Z-transforms, solution to difference equations by Z-transform method. (Chapter 6-Section 6.1, 6.2.1-6.2.2 of Text book 1) **(One question is to be set)**

Unit-III

Partial differential equations – Modelling; vibrating string, one-dimensional wave equation, separation of variables, D'Alember's solution of the wave equation, one-dimensional heat flow, heat flow in an infinite bar, two-dimensional wave equation, rectangular membrane, Laplacian in polar coordinates. (Chapter 11 – Section 11.2 to 11.9 of Text book 2) **(One question is to be set)**

Unit-IV

Strum-Liouville problem, orthogonality of eigen functions, construction of Green's function, using Green's function to solve boundary value problems. (Chapter 9 and 10 of Text book 3)

Text books:

1. An introduction to difference equations by Saber Elaydi, Springer Publisher, Third Edition.
2. Advanced Engineering Mathematics by Erwin Kreyszig, 5th Edition, New Age International (P) Limited Publishers.
3. Elements of ordinary differential equations and special functions by A. Chakrabarti, New Age International Publishers, revised second edition.

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M.Sc. APPLIED MATHEMATICS (THIRD SEMESTER)

AM -303 : PROGRAMMING LANGUAGE -- C++

(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Basic concept of Object-Oriented Programming(OOP), benefits of OOP, beginning with C++, tokens, expression and control structures (Sec 1.5,1.6 in Chapter 1, Sec 2.1-2.8 in Chapter 2 and Sec 3.1-3.25 in Chapter 3)

Unit-II

Functions in C++, the main function, function prototyping, call by reference, infinite functions, default arguments, constant arguments, recursion function overloading, fiend and virtual functions, math library functions, class, a C++ program with class, nesting of member functions, Arrays within a class, static data members, arrays of objects, cost member functions, pointers to members, local classes (Sec 4.1-4.12 in Chapter 4 and Sec 5.1-5.19 in Chapter 5).

Unit-III

Constructors, multiple constructers in class, copy constructors, constructing two-dimensional arrays, destructors, operator overloading, over loading unary, binary operators and using friends, manipulation of strings using operators, type conversions(Sec 6.1-6.11 in Chapter 6 and Sec 7.1-7.9 in Chapter 7)

Unit-IV

Inheritance: Extending Classes, single and multiple inheritance, Hierarchical inheritance, pointers, pointers to objects, pointers to derived classes, virtual functions, virtual constructors and destructors, managing console I/O operations, C++ streams, C++ stream classes, unformatted il/O operations, formatted console I/O operations (Sec 8.1-8.7 in Chapter 8, Sec 9.1-9.8 in Chapter 9 and Sec 10.1-10.5 in Chapter 10)

Text Books:

Object oriented programming with C++, E. Balagurusamy, 6th edition, 2015, McGraw Hill.

Reference Books:

Programming with C++, D. Ravichandran, Tata Mc GrawHill, Second Edition.

Mastering C++, K R Venugopal, Rajkumar, T. Ravishankar, Tata Mc GrawHill.

Data structures using C and C++, YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, PHI.

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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (THIRD SEMESTER)
AM 304(A): BOUNDARY VALUE PROBLEMS-I
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

UNIT - I

Elementary Topology on Metric spaces: Mappings on metric spaces, Existence and uniqueness theorem via the principle of contraction. Continuation of solutions, Dependence of solutions on initial conditions and on parameters. General theory for linear first order system of equations, solution space, The non-homogeneous equation. **(Chapter 2 of text book l)**

UNIT - II

General theory for linear first order system of equations, solution space, The non-homogeneous equation. The nth order linear homogeneous equation. The nth order non-homogeneous equation, The adjoint vector equation, The adjoint nth order equation, The relationship between scalar and vector adjoints. Linear equation with constant coefficients, Real distinct eigenvalues, The general solution. Direct solutions, Real solutions associated with complex eigenvalues. **(Chapter 3 and Chapter 4, Section: 4.1, 4.2, 4.3, of text book l)**

UNIT - III

The two point boundary value problem: The two point homogeneous boundary value problem, the adjoint boundary value problem, The non-homogeneous boundary value problem and Green's matrix. The nth order boundary value problem, The nth order adjoint boundary value problem, the nth order non-homogeneous boundary value problems and Green's function. Self-adjoint boundary value problem
(Chapter 6 of text book l)

UNIT - IV

Linear Control System: Controllability, Observability, Controllability and Polynomials, linear feed back, state observers, Relization of constant systems.
(Chapter 4 of text book 2)

Text books:

1. Theory of Ordinary differential equations, Randal H.Cole Appleton-Century-Crafts, New York (1968)
2. Introduction to Mathematical Control Theory, S.Barnett, R.G.Camaron, Clarendon Press, 1985.

Reference book: Theory of Ordinary differential equations by E.A. Coddington and Normal Levinson, Tata Mcgraw Hill Inc., New York (1980)

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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (THIRD SEMESTER)
ELECTIVE: 305(B) OPTIMIZATION TECHNIQUES-I
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Linear Programming an its Applications: Formulation of L.P. problems, slack and surplus variables, convex sets, simplex method, artificial variables techniques, big M-method, degeneracy, revised simplex method. (Chapter I (expect 1,3),Chapter II. Chapter III, Chapter IV of unit 2 and Appendix – A of Unit-6 of text book 1)

Unit-II

Duality in linear programming, the dual simplex method, Integer linear programming, Gomory's cutting plane method, branch and bound method (Chapter V, Chapter VI and Chapter VIII of unit –2 of text book 1)

Unit-III

Assignment models, Hungarian method, the traveling salesman problem, transportation models, methods for initial basic feasible solutions, MODI method, degeneracy in transportation problems. (Chapter IX, Chapter X, of unit 2 of text book1)

Unit-IV

Dynamic programming, concepts of dynamic programming, Bellman's principle of optimality, simple models, Non-linear programming-unconstrained optimization-decent methods-gradient of a function, steepest decent method, conjugate gradient method, Quasi-Newton method

(7.1 to 7.9 of Chapter VII of unit 5 of text book 1, part of Chapter 6 of text book 2)

Text book: 1. S.D. Sharma, Operations Research, Kedarnath Ramnath & Company.
2. Optimization Theory and Applications by S. S. Rao, Wiley Eastern Limited, second edition.

Reference book: Linear Programming by G. Hadley, Oxford, IBH publishing Co

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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (FOURTH SEMESTER)
AM-401: FUNCTIONAL ANALYSIS
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Topological spaces: Elementary concepts, open bases and open subbases, weak topologies, function algebras Co (X, R) and Co (X, C), compact spaces, product spaces, Tychonoff's theorem, separation concepts.

Unit-II

Banach spaces: Definition and some examples, continuous linear transformations, the Hahn-Banach theorem, the natural imbedding of N in N**, the open mapping theorem, the conjugate of an operator. (Sections 16 to 23, 26, 27 and Chapter 9 of text book)

Unit-III

Hilbert spaces: Definition and some simple properties, orthogonal complements, orthonormal sets, the conjugate space H*, the adjoint of an operator, self-adjoint operators, normal and unitary operators, projections.

Unit-IV

Finite-Dimensional Spectral Theory: Matrices, determinants and the spectrum of an operator, the spectral theorem, a survey of the situation. (Chapters 10 and 11 of text book)

Text Book: G.F.Simmons – Mc Graw Hill, Introduction to Topology and Modern Analysis.

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DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (FOURTH SEMESTER)
AM 402: STATISTICAL METHODS
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

1. **Random variables, distribution functions, Mathematical expectation and Generating functions:**

One and two dimensional random variables (Discrete and Continuous), Distribution functions, joint and conditional distribution functions, probability mass function, probability density function, Transformation of Random variables.
Mathematical expectation, Moments of a distribution function, moment generating functions, characteristic functions and their properties, Chebychev inequality, probability generating functions. (Chapter 5, Chapter 6 except section 6.7 and Chapter 7-Sections 7.1, 7.2, 7.3, 7.5 and 7.9)

Unit-II

2. **Probability Distributions:**

Discrete Distributions-Binomial, Poisson and geometric distributions and their properties with applications. (Sections 8.1-8.5 and 8.7 of Chapter8)
Continuous distributions – Gamma, Beta, Cauchy, Normal distributions and their properties with applications (Sections 9.1, 9.2, 9.5, 9.6,9.7 and 9.12 of chapter 9)

Unit-III

3. **Correlation and Regression:**

Correlation, Karl Pearson's coefficient of correlation, Calculation of correlation coefficient for Bivariate frequency distribution, Spearman's rank correlation coefficient. Linear regression- regression coefficients and their properties, angle between regression lines, standard error of estimate, curvilinear regression, Sampling and Large sample Tests. (Chapter 10 and Chapter 11,14)

Unit-IV

4. **Exact Sampling Distributions:**

Exact sampling distributions, χ^2 , t, F distributions and their applications. (Chapter 15 up to 15.6.4 and Chapter 16 up to 16.6 except 16.4)

TEXT BOOK: Fundamentals of Mathematical Statistics-S.C.Gupta and V.K.Kapoor, 11 edition Sultan Chand and Sons, New Delhi

REFERENCE: An introduction to probability theory and mathematical statistics – V.K.Rohatgi Wiley Eastern Ltd, New Delhi

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ANDHRA UNIVERSITY
COLLEGE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED MATHEMATICS

M.Sc. APPLIED MATHEMATICS (FOURTH SEMESTER)
AM 403: THEORY OF AUTOMATA AND FORMAL LANGUAGES
(With effect from 2020-2021 Admitted Batches)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

The Theory of Automata: Definition of an automata, Description of a Finite Automation, Transition Systems, Properties of Transition Functions, Acceptability of a string by a finite Automation, Non Deterministic finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore models, Minimization of Finite Automaton.

Unit-II

Formal Languages: Basic definitions and examples, Chomsky classification of Languages, Languages and their relation, Languages and Automaton. Regular sets and Regular Grammars: regular expressions, Finite Automata and regular expressions, Pumping lemma for Regular sets, Application of Pumping lemma.

Unit-III

Context-free Languages: Context-free languages and derivation trees. Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal forms for Context-free Grammars.

Unit-IV

Turing Machines: Turing Machine model, Representation of Turing Machines, Languages Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machines and other modifications, Halting Problems of Turing Machines, unsolvable problems, the post correspondence problem.

Text book: Theory of Computer Science (Automata, Languages and Computation) Chapters: 2,3,4,5.1 to 5.4 and 7.1 to7.5 ,7.9.3 By K.L.P. Mishra, N. Chandrasekharan, PHI, Second edition

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M.SC. APPLIED MATHEMATICS (FOURTH SEMESTER)
ELECTIVE: AM 404(A): BOUNDARY VALUE PROBLEMS-II
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Stability of linear and weakly non-linear systems, continuous dependence and stability properties of linear, non-linear and weakly non-linear systems. Two dimensional systems. (chapter III of text book-1)

Unit-II

Stability by Liapunov second method, Autonomous systems, quadratic forms, Krasovski's Method. Construction of Liapunov functions for linear systems with constant coefficients. Selection of total energy function as a Liapunov Function, Stability based on first approximation (Chapter V of text book-1)

Unit-III

Mathematical Models in Population Dynamics: Introduction, single species Models, Two species Lotka volterra Models, Multi species Models. (chapter VI of text book-1)
Analysis and Methods of non-linear differential equations, Existence theorem, extremal solutions, upper and lower solutions. Existence via upper and lower solutions.(Sec. 6.1-6.4 in Chapter VI of text book-2)

Unit-IV

Bihari's inequality, Application of Bihari's integral inequality. Non-linear variation of parameters formula Alekseev's formula. (Sec. 6.6-6.7 in Chapter VI of text book-2)
Oscillations of second order equation, sturms comparison theorems, Elementary linear Oscillations, comparison theorem of Hille-Winter. (Chapter VIII of text book-2)

Text Books:

1. M.Rama Mohan Rao, Ordinary Differential equations, Theory methods and applications, Affiliated East-West Press Pvt.Ltd., New Delhi. (1980).
2. V.Lakshmikantam, S.G.Deo and V.Raghavendra, Text book of ordinary differential equations (second edition) Tata Mc Graw Hill, New Delhi. (1997).

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M.Sc. APPLIED MATHEMATICS (FOURTH SEMESTER)
AM 405(B): OPTIMIZATION TECHNIQUES-II
(With effect from 2020-2021 Admitted Batch)

Duration: 3 hours **Maximum Marks: 80**

(A total of five questions are to be set. Among them the first question consists of 4 short answer questions one from each unit. The remaining four questions are to be set as internal choice in each unit. Each question carries 16 marks and the first question is compulsory.)

Unit-I

Game Theory, Solution of Games with and without saddle points, minimax / maximini principle, principle of Dominance, matrix method for (m X n) Games without saddle point, algebraic method. **(Chapter 1 of Unit 4(except 1.22)**

Jog Sequencing: Processing of n-jobs through 2/3/m^{machines} **(Chapter 6 of unit 4)**

Unit-II

Inventory, classification inventory models, EOQ models with and without shortages, multi item deterministic models, dynamic demand Models.
(Chapter 2 of unit 4 (2.1 to 2.17))

Unit-III

Replacement Models: Replacement of items that deteriates with time, individual replacement. Group replacement policies, recruitment and production problem. Equipment and renewal problem systems reliability. **(Chapter 4 of unit 4)**
Queuing theory: distribution in queuing systems, poison process. Classification and solutions of Queuing model, models 1-4 **(Chapter 5 of unit 4) (5.1 to 5.15)**

Unit-IV

Network analysis, PERT/ CPM Techniques network diagram representation time estimates and critical path in net work analysis, uses of PERT / CPM Techniques
(Chapter 7 of unit 4)

Text book: Operations Research by S.D.Sarma (12 th Edition), Kedarnath Ramnath and company.

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