NETAJISUBHASUNIVERSITY, JAMSHEDPUR

Course of Study (2018-20)

M. Sc (Mathematics)

STRUCTURE OF THE M.Sc. (2 YEAR) PROGRAM IN MATHEMATICS

Note :- Each paper in each semester is 30 marks for Internal Exam and 70 marks for External Exam,

Total marks 100 for each paper (Overall marks 1600)

Year - I			
Semester I	**code no.**	**Semester II**	**code no.**
Real Analysis & Measure Theory	101	Topology	201
Complex Analysis	102	JAVA (theory &Practical)	202
Prob. & Statistics	103	Differential Geometry&Numerical Analysis	203
Group Theory& Higher Arithmetic	104	Discrete Mathematics & Graph Theory	204

Year - II			
Semester III	**code no.**	**Semester IV**	**code no.**
Functional Analysis	301	Operation Research	401
Ring & Field Theory	302	Elective I	402
Analytical Dynamics	303	Elective II	403
Differential Equation	304	Project (compulsory)	404

ELECTIVE PAPERS: - I **(any one of the following)**

1) Boundary layer theory (Specialization)
2) Difference Equation
3) Elasticity

ELECTIVE PAPERS :- II **(any one of the following)**

1) Integral Transformation (Specialization)
2) Mathematical modeling
3) Advance Computer Application (Lang. Python) (Specialization)

Python Scripting is one of the easy languages to learn and is widely used from individuals to big organizations such as Google. This Python training starts with basic syntax of Python and continues to small GUI programs. You will learn Python data types such as Tuples and Dictionaries, Looping, Functions and I/O handling. Python training will also give you an overview of Object Oriented Programming and Graphical application development. This course will explain some basics modules and their usage. At the end of the Python Scripting Training individuals will have the skills to grow in Web-Development, GUI Application Programming, Game Development and writing powerful script for System Administration.

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Prof.O.P.Sharma (Controller of Examinations)
Prof.S.Kakoli (Member)
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Prof. Alok Banga (Member)
Prof.D.Shome (Head Academics)
Prof. Ravi Shankar (Member)

Course Objectives:

- Comprehend Python's flexible function protocols.
- Comprehend Python's memory model.
- Comprehend Python's straight-forward object-oriented features.
- Comprehend Python's built-in data types: using them, and inheriting from them in classes you design.
- Comprehend Python's list comprehensions, decorators, iterators, generators, context managers.
- Comprehend Python's scheme for creating and using libraries and packages.

Python Benefits

Upon Completion of this Course, you will accomplish the following:-

- Understand flexible function protocols
- Memory model
- Straight-forward object-oriented features
- Built-in data types: using them, and inheriting from them in classes you design
- List comprehensions, decorators, iterators, generators, context managers
- Scheme for creating and using libraries and packages.

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Type of Question and Time allocation for University Exam

Full Marks: 70 **Time: 3 Hours**

Instruction:

- Question 1 will be compulsory

(Objective Multiple choice 10 questions) 10 X 1= 10

- Short answer type 5 questions (out of seven questions) 5 X 2 = 10
- Long answer type 5 questions (out of seven questions) 5 X 10= 50

Type of Question and Time allocation for Internal Exam

Full Marks: 30 **Time: 3 Hours**

Instruction:

- Question 1 will be compulsory

(Objective Multiple choice 5 questions) 5 X 1= 05

- Short answer type 2 questions (out of five questions) 5 X 2 = 10
- Long answer type 3 questions (out of five questions) 3 X 5 = 15

OR

Continues Internal Assessment (CIA) – 30 MARKS

1. Mid – Term Test (Subjective/Objective Type) 15 Marks
2. Assignment /Project/Posters/Quiz/Seminar 10 Marks
3. Classroom attendance & active participation with Leadership quality, good manners and articulation in routine class instruction delivers. 05 Marks

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First Year: Semester –I

Paper I: **REAL ANALYSIS &MEASURE THEORY** **Code no. : - 101**

Unit – I **REAL ANALYSIS**

Sequence and series of function: Uniform convergence of sequence and series of real function. Cauchy's General Principle of Uniform Convergence, Continuity of the sum of a series of function. Weiestrass'sM-test for Uniform Convergence.Term by term integration and differentiation.

Fourier series: Fourier series expansion of a function relative to an orthonormal system. Bessel's inequality, point wiseconvergence of trigonometric Fourier series, Dirichlet's integral, Perseval's theorem, Riemann-Lebesgue theorem, Problems on finding trigonometric Fourier series representation of periodic functions.

R^nandFunction of several variables: Schwartz's theorem, Young's theorem, Taylor's theorem in R^n, extreme value of a function, related problems, invertible function, implicit functions, Jacobian of a transformation, implicit function theorem, trigonometric Fourier series representation of periodic functions, De'Morgans Theorem..

Reference Books:

1. Element of Real Analysis: Shanti Narayan &M.D.RaiSinghania
2. Advanced Real Analysis: K. K. Jha

Unit – II **MEASURE THEORY**

Measure theory: Outer measure, measurable sets through Caratheodory approach, arithmetical properties of measureable sets, two fundamental theorems and examples of uncountable sets of zero measure.
Measurable Functions: Closure of class of measurable function under all algebraic and limit operations, Littlewood's third principle trigonometric Fourier series representation of periodic functions.
Function bounded over a set of finite measure, condition of measurability, Lebesgue integral and its arithmetical properties, comparison with R-integral, bounded convergence theorem.

Reference Books:

1. Principle of Mathematical Analysis: Walter Rudin
2. Mathematical Analysis: Shanti Narayan/ D. Somasundaram
3. Measure theory: Gupta & Gupta

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Paper II: COMPLEX ANALYSIS **Code no. : - 102**

Spherical representation of extended complex plane, Analytic functions,Harmonicconjugates,Cauchy's integral theorem, Cauchy's integral formula, Morera's theorem, Liouvillies theorem, Taylor's theorem, Laurent's theorem, Rouche's theorem, fundamental theorem of algebra.

Power series: formula for radius of convergence of power series, absolute & uniform convergence theorem of power series, uniqueness theorem of power series, term by term integration and differentiation theorem.

zeros& poles, contour integration and problem, Schwartz lemma, Casorati-Weierstrass theorem and problems.

Conformal mapping: Conformal and bilinear mapping, necessary & sufficient condition for conformal mapping, mapping from half plane to circle, mapping from unit circle to unit circle and related problems.

Analytic continuation and application: Definition of analytic continuation and related problems, uniqueness theorem of analytic continuation, circle of convergence theorem, standard method analytic continuation and other theorems.

Reference Books:

1. Complex Variable: Churchill
2. Theory of Functions: Titch Marsh
3. Complex Analysis: J. B. Conway
4. Function of a Complex Variable: Goyal& Gupta

Paper III: PROBABILITY ANDSTATISTICS **Code no. : - 103**

Unit – I Probability & Statistics

Probability space, conditional probability, Bayes' theorem.Independence, Random variables, joint and conditional distributions, standard probability distributions and their properties (Discrete uniform, Binomial, Poisson, Normal).Expectation, conditional expectation, moments.Sampling distributions, Testing of hypotheses, standard parametric tests based on normal distributions; Correlation Coefficient, Rank Correlation coefficient, Simple linear regression.

Unit – II Applied Statistics

Statistical Quality control, Time series, Index Number, Analysis of Variance, Design of sample surveys, Vital Statistics.

Reference Books:

1. Introductory Probability & Statistical Application: P.L. Meyer
2. Fundamentals of Applied Statistics :S.C.Gupta, V.K.Kapoor

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Paper IV: GROUP THEORY & HIGHER ARITHMETIC Code no. : - 104

Unit – I Group Theory

Isomorphism and Homomorphism of Groups, IsomorphismTheorem.

Permutation group & simple group, two square theorem and quadratic reciprocity law via permutation group.

Conjugacy classes, normaliser, class equation of a finite group.

Direct products: Direct product of a finite number of groups, necessary & sufficient condition for the isomorphism between the product and the direct product of groups.

Group action orbit stabilizer theorem, Syllow theorem & application in proving non-simplicity for the isomorphism between the product and the direct product of groups.

Normal series, composition series and solvable groupscommutator, normal series and derived series of a group, composition series, Jordan-Holder theorem, solvable group.

Unit – II Higher Arithmetic

Linear, simultaneous linear and polynomial congruences, Chinese remainder theorem, arithmetical function, Euler's totient function, Mobius function, drvisor function, Mobius inversion formula, Dirichlet product, group structure. Some Diophantine equations, Fermet's& Wilson's Theorem.

Reference Books:

1. University Algebra: N. S. Gopala Krishna
2. A First Course in Abstract Algebra: J. B. Fraleigh
3. First Course in Group Theory: P. B. Bhattacharya
4. Introduction to Analytic Number Theory: T. M. Apostol

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First Year: Semester-II

Paper V: TOPOLOGY **Code no. : - 201**

Compacness in metric space, Ascoli's theorem.
C(X, R), WeierstrassApproximation theorem and Picard's theorem.

Topological spaces: Definition, examples, base, sub-base, first axiom space, second axiom space, Lindeloff space, comparison of topologies.

Compactness: Compact space, product space, Tychonoff's theorem, locally compactness.

Separation: T_1 – space, T_2 – space, normal & completely regular space, Uryshon's lemma, Tietze extension theorem, Uryshon'smetrizationtheor. Connectedness: connectedness & its properties.

Reference Books:
1. Introduction to Topology & Modern Analysis: G. F. Simmons
2. Topology: Munkres
3. Advanced Topology: K. K. Jha

PaperVI : JAVA (Theory &Practical) **Code no. : - 202**

Computer Basics: Input output units; Description of computer input units, input methods, computer output units. Computer Memory; Memory cells, memory organization, read only memory, serial access memory, magnetic hard disks, floppy disks drives, CD drives. Processors; Structure of instructions, description of a processor, idea of cache memory.
Java Evolution and Overview of Java Language: How Java differs from C and C++, Java and Internet, Java and World Wide Web, Introduction, Simple Java Program, More of Java, An Application with Two Classes, Java Program Structure, Java Tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style.
Constants, Variables, and Data Types: Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Values of Variables, Scope of Variables, Symbolic Constants, Type Casting, Getting Values of Variables, Standard Default Values.
Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evolution of Expressions, Precedence of Arithmetic Operators, Type Conversion in Expressions, Operator Precedence and Associativity, Mathematical Functions.
Decision Making and Branching: Introduction, Decision Making with if Statement, Simple If Statement, The if... else Statement, Nesting of if ... else Statements, The else if Ladder, The switch Statement, The? Operator.
Decision Making and Looping: Introduction, The while Statement, The do Statement, The for Statement, Jumps in Loops, Labelled Loops.

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Classes, Objects and Methods: Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance: Extending a. Class, Overriding Methods, final Variables and Methods, Final Classes, Finalizer Methods, Abstract Methods and Classes, Visibility Control.
Arrays, String and Vectors: Arrays, One-Dimensional Arrays, Creating an Array, Two- Dimensional Arrays, Strings, Vectors, Wrapper Classes.
Interfaces: Multiple Inheritance: Introduction, Defining Interfaces, Extending Interfaces, implementing Interfaces, Accessing Interface Variables.
Packages: Putting Classes Together: Introduction, Java API Packages, Using system Packages, Naming Conventions, Creating Packages, Accessing a Packages, Using a Package, Adding a Class to a Package, Hiding Classes.
Multithreaded Programming: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, and Synchronization.
Managing Errors and Exceptions: Introduction, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging.
Text Book:
1. E. Balagurusamy, Programming with Java, A Primer Second Edition, Tata McGraw Hill, New Delhi.
Reference Books:
1. H.M.Deitel&P.J.Deitel- JA V A- How to Program, 5th Edn, Pearson Education, New Delhi-2004.
2. P.Naughton and H. Schildt-JAVA: The Complete Reference, TMH, New Delhi 2005.
3. D.Jana- Java and Object Oriented Programming Paradigm, PHI, New Delhi-2005.

Paper VII: Differential Geometry **Code no. : - 203**

Unit – I Differential Geometry
Space curve: Curvature and torsion, Serret-Frenet formulae, helix uniqueness theorem for space curve, the circle of curvature, osculating sphere, locus of centre of curvature, spherical curvature, locus of centre of spherical curvature, Bertrand curve.Envelopes and developable: Envelop, the edge of regression developable associated with space curve and their properties. Curvilinear co-ordinates on a surface, fundamental magnitudes, direction on a surface.Curve on a surface: Parametric curves, curvature of normal section, Meusier's theorem, principal direction & principal curvature, line of curvature, theorem of Euler and Dupin, conjugate direction and asymptotic line.Equation of Gauss and Mainardi-Codazzi.Geodesics: Differential equation of geodesics via normal properties, geodesics on developable, curvature & torsion of a geodesics.

Reference Books:
1. Differential Geometry: C. E. Weatherburn
2. Riemannian Geometry: C. E. Weatherburn

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Unit – II **Numerical Analysis**

Solution of linear equations: Direct methods - Gauss elimination, Gauss-Jordan elimination, LU decomposition. Iterative methods - Jacobi, Gauss-Siedel.
The algebraic eigenvalue problem: Jacobi's method, Given's method, House-holder's method, Power method. Ordinary differential equations: Euler's method, Single-step methods, Runge-Kutta's method, multi-step methods.Approximation: Different types of approximation, least square polynomial ap-proximation.

Reference Books: **1.Numerical Analysis :Lalji Prasad**

PaperVIII: **DISCRETE MATHEMATICS& GRAPH THEORY** **Code no. : - 204**

Unit – I **Discrete Mathematics**

Partially order sets, lattices, geometrical lattices, distributive lattices, modular lattice, complemented lattice.Algebric Structures, Matrix Algebra.

Mathematical Logic, Boolean algebra, Boolean expression, application to switching circuits.
Tree, Formal Language and Automata.

Unit – II **Graph theory**

Degree sum theorem, Eulerian graph and its properties, Hamiltonian graph, trees, planarity of graphs, Euler's theorem on planar graph and application, chromatic number and five colour theorem, marriage theorem, transversal version of marriage theorem, directed graph, Kruskal's algorithm, Dijkastra's algorithm.
Pigeon hole principle, principle of inclusion & exclusion, derangement.

Reference Books:

1. Lattice: K. K. Jha
2. Discrete Mathematics: K. D. Joshi
3. Automata theory-Discrete Mathematics: Tremby&Manohar
4. Discrete Mathematics :S.K.Chakraborty&B.K.Sarkar
5. Graph Theory: R. J. Wilson

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Second Year: Semester -III

Paper IX: FUNCTIONAL ANALYSIS **Code no. : - 301**

Cauchy's, Minskowski's and Holder's inequalities, normed linear space, Banach space, definition and examples including classic Banach space, sub-space and Quotient space.
Continuous linear maps, $B(N,N^1)$: Dual (conjugate) space of 'N', natural embedding theorem, dual of R_n and I_p operator and its conjugate Riesz lemma.
Hahn-Banach theorem and consequences, open mapping theorem and projection on Banach space, closed graph theorem and uniform boundedness principle.
Hilbert's Space: Definition and examples, Schwartz inequalities, orthogonal completeness characterization, Gram-Schmidt orthogonalization.
Dual of H, Reisz representation theorem, reflexivity.
Adjoint of an operator, self adjoint operator, unitary and normal operator.
Perpendicular projection, invariance, reducibility, orthogonal projection theorem.

Refence Books:
1. Function Analysis: J, N, Sharma & A. R. Vashishtha
2. Elements of Functional Study: SoboreveLusternic

Paper X: RING & FIELD THEORY **Code no. : - 302**

Unit – I Ring Theory

Factorization in integral domain: Concept of divisibility in integral domain, GCD & LCM of two non-zero elements in an integral domain, irreducible and prime elements in an integral domain, relation between prime and irreducible elements, definition and examples of Euclidean domain, principal ideal domain and unique factorization domain, relation between Euclidean domain, principal ideal domain and unique factorization domain, the integral domain Z[I] and K[X] K field properties of Euclidean domain, principal ideal domain and unique factorization domain, Einstein criteria of irreducibility, Gauss's lemma.Definition of field and extension of a field.

Unit – II Field Theory

Extension of a field, finite extension and infinite extension, algebraic extension and transcendental extension, properties of algebraic extension, relation between algebraic and finite extension, splitting field of a polynomial over a field, normal extension, characterization of finite normal extension, separable extension and properties of a separable extension, perfect field and characterization of perfect field, primitive element theorem, finite field and their existence.

Reference Books:
1. University Algebra: N. S. Gopalakrishna
2. Advanced Course in Modern Algebra: Goyal& G

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Paper XI: Analytical Dynamics — Code no. : - 303

Motion in two dimensions: Motion of C. G. and motion about C. G., K. E. slipping of road, motion of sphere on inclined plane when rolling and sliding are combined, motion of circular disk on a plane and related problems.
Moving axes: Velocity and acceleration in two dimensional motion when the axes are moving, velocity and acceleration in three dimensions when the axes are moving, velocity and acceleration in three dimensional motion in polar form, angular velocity referred to moving axes and Euler's geometrical equation.
Equation of motion and its application in three dimensions: General equation of motion, Euler's equation of motion, momentum of rigid body, moments about instantaneous axes, K. E. of rigid body and related problems.
Lagrange's equation of motion of small oscillation: Generalized co-ordinates, constraints classification of mechanical systems, Lagrange's equation of motion, principle of energy, small oscillation, normal co-ordinates
Hamilton's canonical equation, Routh's equation: Canonical variables Hamiltonian, Hamilton's canonical equation, equation from Lagrange's equation of motion, cyclic co-ordinate, Routh's equation of motion.

Reference Books:
1. Rigid Dynamics: P. P. Gupta & G. S. Malik.
2. Dynamics Part-II: A. S. Ramsay
3. Rigid Dynamics : J.N.Sharma

Paper XII: DIFFERENTIAL EQUATION — Code no. : - 303

Laplace transform, transform of elementary function, transform of derivative, inverse transform, convolution theorem, application of ordinary and partial differential equation
Fourier transform, sine and cosine transform, inverse Fourier transform, application to ordinary and partial differential equation.Series solution of general homogeneous linear second order equation, singular points, the method of Frobenius.
Linear system, linear algebra applied to ordinary differential equation, Eigen value problem, fundamental matrix solution, introduction to stability problem.
Green function, Strum-Liouville boundary value problem, Eigen value problem.

Classification of second order partial differential equation, reduction to canonical forms.

Wave equation, one dimensional solution by separation of variable, D' Alembert's solution of wave equation.
Heat equation, one dimensional heat flow in infinity bar, solution by Fourier series, solution by Fourier integral and transform

Reference Books:
1. Integral Transform: A. R. Vashishtha
2. Differential Equation & their application: Martin Braun
3. Elements of ODE & Special Function: A. Chakraborty
4. Advanced Differential Equation: M. D. Raisinghania

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Second Year: Semester-IV

Paper XIII: OPERATION RESEARCH **Code no. : - 401**

Game theory: Two person zero-sum games, games with mixed strategies, graphical solution, solution by linear programming.Inventory Control.Queuing Theory.Known demand, probabilistic demand, deterministic model and probabilistic model without lead time.
Project planning and control with PERT-CPM: Rules of network construction, time calculation in networks, critical path method, PERT, PERT calculations, advantages of network (PERT/CPM), difference between CP and PERT
Integer programming: Branch and bound technique, Gomory's cutting plane method.
Models in operation research: Different models, their construction and general method of solution.
Non-Linear programming: One and multivariable unconstrained optimization, Kuhn-Tucker conditions for constrained optimization, quadratic programming, Wolfe's and Beale's method.

Reference Books:
1. Operation Research: R. K. Gupta.
2. Introduction to Operation Research: F. S. Hillier & G. L. Lieberman.
3. Operation Research: A. M. Natrajan, P. Balaguruswami, A. Tamilarasi.
4. Operation Research: KantiSwaroop, P. K. Gupta & Man Mohan.
5. Operation Research: S. D. Sharma,

Paper XIV : Elective I **Code no. : - 402**

Select any one from bellow three

1) BOUNDARY LAYER THEORY (Specialization)

1. Derivation of Navier-Stokes equation of motion for a viscous flow, Poiseuille flow through a pipe, plane Couette flow, stagnation point, flow between two concentric rotating cylinders, flow near rotating disk, slow motion, limiting case of large small viscosity, linearization of the Navier-stokes equation by method of Stokes and Oseen.
2. Boundary layer concept, boundary layer thickness, displacement thickness, derivation of boundary layer equation for flow along a plane and curved wall, Raynold's principle of similarity, similar solutions, boundary layer along a flat plate, a wedge, a circular cylinder and in a convergent channel. A xi-symmetric boundary layer on a body of revolution, boundary layer growth for impulsive start of motion & for uniformly accelerated motion.
3. The momentum equation for the boundary layer and its application to the flow past a flat place at zero incidence.
4. Idea of transition from laminar to turbulent flow, derivation of Orr-Sommerfield stability equation, effect of boundary layer formation on a flow, methods of controlling boundary layer, Asymptotic suction profile.

Reference Books:
1. Boundary Layer Theory: H. Schlichting
2. Modern Development in Fluid Dynamics. Vol-I & II: S. Goldstain

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2) DIFFERENCE EQUATION

Dynamics of first order difference equation, linear first order difference equation, equilibrium points, their stair step (cobweb) diagram, cobweb theorem of economics, criteria for asymptotic stability of equilibrium points, periodic points and cycles, the equation & bifurcation equilibrium-(fixed) points, 2-cycles, 2_2- cycles.

Linear difference equation of higher order: Difference calculus – the power shift factorial polynomials, antidifference operator, general theory of linear difference equation, linear homogeneous equation with constant coefficients, linear variation of parameters, limiting behaviour of solution, application – propagation of annual plans, gambles ruin national income, the transition of information.

Linear system: System of difference equations, autonomous system, the development of algorithm for A^n the basic theory of the linear system.

Reference Books:
1. Introduction to Difference Equation:S. N. Elaydi
2. Difference Equation An Introduction with Application: Kelly & Peterson
3. Difference Equation: D. C. Agarwal
4. Advanced Difference Equations: M. D. Raisinghania

3) ELASTICITY

Equations of compatibility for stress and strain components, boundary value problems and uniqueness of solutions.
Torsion of cylindrical beams, torsion function, solution of torsion problem in simple cases, effect of grooves, solution of torsion problem by conformal mapping, application of conformal mapping to solve the torsion problem of elliptic limacon torsion of hollow beams. Bending of beams by terminal couples and terminal load along a principal axis of the section. Solution of the flexure problem for the circular and elliptic beams
Two dimensional elastostatic problems. Plane deformation, plane stress, generalized plane stress. Airy's stress function and the formulae for stresses and displacements.Boundary value problems of plane elasticity, role of conformal representation, solution of the fundamental problem for the regions bounded by a circle, a circular ring and the interior of an ellipse.
Wave propagation in infinite elastic regions, surface waves.
Theorem of minimum potential energy, theorem of minimum complementary energy, theorems of work and reciprocity

Reference Books:
1. Mathematical Theory of Elasticity: I. S. Sokolnikoff
2. Mathematical Theory of Elasticity (For reference only): A. E. H. Love.

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Paper XV: Elective II

Code no. : - 403

Select any one from bellow three

1) INTEGRAL TRANSFORM

1. The Stieltjes integrals: Existence of Stieltjes integrals, properties of Stieltjes integrals, the Stieltjes integral as a series or a Lebesgue integral, normalization, improper Stieltjes integral. laws of the mean, change of variable of indefinite integral, Stieltjes integral as infinite series- second method.
2. The Laplace-Stieltjes transform: Region of convergence, abscissa of convergence, absolute convergence, uniform convergence.
3. Abelian theorem for the Laplace and Stieltjes transform, Tauberian theorems, Tauberian theorems for the Stieltjes transform.
4. Inversion and representation problems for the Laplace transform, Laplace asymptotic of an integral, application to integrals leading to direct inversion formula, general representation theorem.
5. The Stieltjes transform: Elementary properties of the transform, asymptotic properties of Stieltjes transform, relation to the Laplace transform.
6. The Fourier transform, the Mellin transform, inversion theorem, application of Laplace and Fourier transform to boundary value problems

Reference Books:

1. The Laplace Transform: D. V. Widder
2. The Fourier Transform: I. N. Sneddon

2) MATHEMATICAL MODELLING

Basic idea of mathematical modelling.
Single species non-age structured population models: Simple logistic models, the logistic equation, Smith's model, generalized logistic models, logistic model for a non-isolated population, stochastic model for population growth.
Two species population model: Stability of the equilibrium of population described by following models:LolkaVolterra model, May's Prey predator models, general discrete generation prey predator model.

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Models in population genetics: Basic model for critance of genetics characteristics, diallelic and multiallulie cases, models for selection, motation and imbreeding.
Models in operation research: Different models, their construction and general method of solution.
Different models: Iconic, analogues, symbolic construction components, combining and dividing components, substituting the symbols, general idea of solution from models-analytic numerical, Monte-Carlo models associated with recurrent type of problems, inventory, allocation, waiting line, replacement competitive.

Reference Books:

1. Mathematical Models in Biology & Medicine: J. N. Kapoor
2. Introduction to Operation Research: Russell L. Ackoff&Arnoff

3) Computer language (Pyathon)

Reference Books:

Paper XVI: Project based on on Elective Paper (compulsory) Code no. : - 404

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