

JAMSHEDPUR WOMEN'S COLLEGE
(A Constituent Autonomous College of Kolhan University, Chaibasa)
JAMSHEDPUR-831037

DEPARTMENT OF MATHEMATICS

APPROVAL TO START M.Sc. COURSE IN MATHEMATICS FROM 2015 & SYLLABUS FOR M.Sc. :

The Board of Studies decided to admit 75 students in M.Sc. It recommended to accept the syllabus for M.Sc. on the pattern ratio 20 : 80 in all Theory papers i.e. 20% will be awarded through internal assessment & 80% of the papers through external assessment and in Computer Lab papers of 100 marks, it will be 100% external evaluation. Pass marks will be 45 in all theory as well as in practical papers of 100 marks. In all Theory papers Theory-Theorems and numerical-problems will generally in ratio 50:50. The syllabus of M.Sc. is at par with syllabus of M.Sc. Maths & Computing of ISM, Dhanbad and NIT's. It was decided to introduce some relevant topics of Industries like Operations Research and latest topics in Computer Programming so that employment opportunities may increase. All relevant Theory & Practical Papers is to be divided into 4 semester as follows:--

Each semester will have 6 papers & each paper will carry 100 marks of which Internal & External assessment will be of 20 marks and 80 marks respectively. Each paper will have 4 classes + 1 tutorials i.e. 5 classes weekly. Practical papers will have 2 Labs per week.

SEMESTER-I

PAPER 101: REAL ANALYSIS

Paper will consist of 12 questions of which 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS:

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 the series of function, Weirstrass's M test for uniform convergence, Term by term integration & differentiation ----- 3 questions.

Fourier series: Fourier series expansion of a function relative to an orthonormal system. Bessel's inequality, point wise convergence of trigonometric Fourier series, Dirichlet's integral, Parseval's theorem, Riemann-Lebesgue theorem, Problems on finding trigonometric Fourier series representation of periodic functions.----- 3 questions.

R^n and function of several variable: n-dimensional Euclidean space, open & closed set, compact set, triangular inequality, limit point of a set, Bolzano-Weirstrass theorem, Heine-Borel theorem. Concept of limit & continuity of real valued function of several variables and related problems, function continuous on compact set, uniform continuity, intermediate value problem, partial derivative, directional derivative, mean value theorem, properties of differentiable function of several variables, related problems. partial derivatives of higher order. Schwartz's theorem, Young's theorem, Taylor's theorem on R^n , extreme value of a function, related problem. Invertible function, implicit function, Jacobian of the transformation, implicit function theorem, trigonometric Fourier series representation of periodic function -----6 questions.

Reference Books ---

1. Principle of Mathematical Analysis-Walter Rudin
2. Mathematical Analysis - Shanti Narayan
3. Real Analysis-H.L.Royden
4. Advanced Real Analysis- K.K.Jha

PAPER-102: Measure Theory

Paper will consist of 12 questions of which 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

Topics: Outer measure, measurable set through Caratheodory approach, arithmetic properties of measurable sets, two fundamental theorem and examples of uncountable sets of zero measure . -----3 questions.
 Measurable Functions: closure of class measurable function under all algebraic and limit operations, Littlewood's third principle, trigonometric Fourier series representation of periodic functions . -----3 questions.
 Function bounded over a set of finite measure, condition of measurability, Lebesgue integral and its arithmetical properties, comparison with R-integral, bounded convergence theorem. -----2 questions.
 Intgral of non-negative function, arithmetical properties, Fatou's lemma, monotone convergence theorem -----2 questions.
 General Lebesgue integral, arithmetical properties, Lebesgue convergence theorem. ----- 2 questions.

Reference Books:

- 1.. Measure Theory-- Gupta & Gupta

PAPER 103: COPMPLEX ANALYSIS

12 questions of which 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Cauchy's integral theorem, Cauchy's integral formula , Morera's theorem, Liouillies theorem, Taylor's theorem, Laurent's theorem, Rouche's theorem, fundamental theorem of algebra. -----4 questions

Residues & poles, Contour integration & problems. --- -----4 questions.

Analytic continuation & application : Definition of analytic continuation & related problems, uniqueness theorem of analytic continuation, circle of convergence theorem, standard method of analytic continuation & other theorem ----- 4 questions.

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

PAPER 104: TOPOLOGY

Paper will consist of 12 questions of which 6 is to be answered in 3 hrs. duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Compactness in metric space, Ascoli's theorem. -----2 questions.

$C(X,R)$, Weirstrass Approximation theorem & Picard's theorem -----2 questions.

Topological spaces: Definitions, example, base, sub-base, first axion space, second axiom space, Lindeloff space, comparision of topological space -----2 questions.

Compactness: Compact space, product space, Tychonoff's theorem, locally compactness. -----2 questions

Separation: T-1 space, T-2 space, normal & completely regular space, Uryshon's lemma, Tietze extension theorem, Uryshon's metrisation theorem. -----2 questions.

Connectedness: connectedness & its properties. -----2 questions.

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

PAPER105: Programming in Blue JAVA

This paper consists of 100 marks divided in two parts of Theory & Lab work. Each part consists of 50 marks in which pass marks is separately 23 in each Theory & in Practical. In Theory there will be 8 questions out of which 5 questions is to be answered in 3 hours duration each consisting 10 marks.

THEORY TOPICS IN BLUE JAVA:

1. Introduction to JAVA – History and development of JAVA, Object oriented programming (OOP), Operators and Expressions in JAVA 1 Ques
2. Decision making in JAVA – if Statement, if - else statement, Nested if, Switch case. 1 Ques

- | | |
|---|--------|
| 3. Iteration through loops – for loop, while loop, do – while loop. | 1 Ques |
| 4. String manipulation in JAVA | 1 Ques |
| 5. Arrays | 2 Ques |
| 6. Functions / Methods | 2 Ques |

LAB- PRACTICAL WORK ON BLUE JAVA: Examination in Practicals based on above mentioned theory of Blue Java Programming will be of 3 hours duration consisting of 50 marks.

Reference Book : 1.Programming in Java- E.Balaguruswamy.

PAPER 106: GRAPH THEORY & PROBABILITY

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPIC: 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, Dijkstra's algorithm.

-----6 questions

Pigeon hole principle, principle of inclusion & exclusion, derangement.

-----3 questions

PROBABILITY: Probability distribution, binomial, Poisson's and normal distributions Regression analysis: Lines of regression, properties of coefficients of regression.

-----3 questions

Reference books:

- 1.Graph Theory --R.J. Wilson
2. Introductory Probability & Statistical Application --P.L.Meyer

SEMESTER-II

PAPER-201 : Differential Geometry

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Space Curve: Curvature & torsion, Serret-Frenet formulae, helix, uniqueness theorem for space curve, the circle of curvature, spherical curvature, locus of centre of spherical curvature, Bertrand curve.

-----4 questions.

Curvilinear co-ordinate on a surface, fundamental magnitudes, direction on a surface.

-----2 questions.

Curve on a surface: Parametric curves, curvature of normal surface, Meunier's theorem, principal direction & principal curvature, line of curvature, Theorem on Euler & Dupin, conjugate direction & asymptotic line.

-----3 questions.

Equations of Gauss & Mainardi- Codazzi.

----- 1 question.

Geodesics: Differential equation of geodesics via normal properties, geodesics on developable, curvature & torsion of a geodesics.

-----2 questions.

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

PAPER 202: Analytical Dynamics

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Motion about a fixed axis: Moment of momentum about the axis of rotation, equation of motion, compound pendulum, reaction of axis of rotation & problems. -----2 questions.

Motion in two dimension: Motion of C.G. & motion about C.G., K.E., slipping of rod, motion of sphere on inclined plane when rolling & sliding are combined, motion of circular disc on a plane & related problems. -----2 questions.

Equation of motion & its application in 3 dimension: General equation of motion, Euler's equation of motion, momentum of rigid body, moments about instantaneous axes, K.E. of rigid body & related problems. -----2 questions.

Lagrange's equation of motion of small oscillation, generalised co-ordinates constraints, classification of mechanical system, Lagrange's equation of motion, principle of energy, small oscillation, normal co-ordinates. -----3 questions.

Hamilton's canonical equations, Routh's equations, Canonical variables, Hamiltonian, Hamilton's canonical equation, equation from Lagrange's equation of motion, Cyclic co-ordinate, Routh's equation of motion. ----- 3 questions.

Reference Books: 1.Rigid Dynamics: P.P.Gupta & C.S Mallik.
2.Dynamics Part-II: A.S.Ramsey

PAPER 203:Discrete Mathematics

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS:

Logic: Boolean algebra, Boolean expression, application to switching circuits . -----3 questions

Introductory compatibility theory: Finite state machine and their transition table, diagrams, equivalence of finite state machine, reduced machine, homomorphism, finite automata, turning machine and partial recursive function. -----5 questions.

Partially ordered set, Lattices, geometrical lattices, distributive lattices, modular lattice, complemented lattice. -----4questions.

Reference Books: 1.Lattice-K.K.Jha
2.Discrete Mathematics-K.D.Joshi

PAPER 204:(Numerical Methods & Computational Techniques)

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Introduction to numerical computing, computing concepts, computer codes, arithmetic approximation & error in computing. -----2 question.

Flow chart & programming techniques: flow chart for simple problems, branching, conditional & unconditional jumps, main structure of high level language, constants, variables, arithmetic & relational expression, I/O controls, loop structures, array, data, sub-programs, Character handling. -----2 questions.

Fortran: Need & scope, a sample program, Fortran constants, Fortran variables, subscripted variables, I/O statements, computation, Fortran expression, control of execution, if-else, relational expression, do-while structure, sub-program, sub-routine sub-program

Examples of program: (a) Matrix addition, multiplication and transpose, (b) To find out prime number, odd or even number, GCD, Fibonacci sequence (c) To convert from Fahrenheit to Celsius (d) Write any program using subroutine. ----- 4 questions.

Numerical technique: Bisection method, Newton-Raphson method for roots of non linear equations, Basic Gauss elimination method, Triangular factorisation method for direct solution of system of linear equations, Linear interpolation, Lagrange's & Newton's interpolation, Spline interpolation. -----4 questions.

Reference Books: 1.Numerical Methods-E. Balaguruswamy
2.Fundamental of Computer Algorithm- H.Horornitz & S.Sahni .

PAPER 205: TENSOR CALCULUS

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Tensor algebra- contravariant and covariant vector (tensor of first order), tensor of second order (or of rank 2), the Kronecker delta, the tensor of higher rank, invariant or scalars, addition and subtraction of tensor, contraction, product of tensor, inner product symmetric tensor, generalised quotient law, conjugate or reciprocal symmetric tensor, relative tensors, group property of tensor, related problems -----6 questions.

Covariant differentiation, The Christoffel three index symbols, transformation of Christoffel symbol, covariant differentiation of vector, covariant differentiation to tensor, laws of covariant differentiation of tensor. divergence & curl of a vector, intrinsic derivative, derived vector, cross product of two vectors, Ricci's Theorem, related problems -----6 questions.

PAPER 206: DATA STRUCTURE & ALGORITHM

Out of 12 questions , 6 is to be answered during 3 hours.

Examination will be of 80 marks (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

Topics: Programming language, Stack & queues, Linked List, Direct address tables, Indexing, hash tables, open addressing, trees, Binary search tree, height balanced tree, Red-black tree, B- tree, B-tree,, Basic concept of algorithms, Complexity, Asymptotic notations, Trees: Binary tree, Binary search tree, Tree traversals. Heap as data structure, Basic sorting algorithms: selection sort, insertion sort. Greedy algorithms: Coin change problem, activity selection, Minimum spanning tree, Single source shortest path, knapsack problem. Divide a & a Conquer technique: Merge sort, quick sort, Solving recurrence relations. Dynamic programming: matrix chain multiplication, all pair shortest path algorithm, Graph algorithm: Warshall' algorithm, Depth First search, Breadth First search. Branch & bound technique, Backtracking. NP completeness. ---12 questions.

Reference Books: 1. Fundamentals of Data Structure--Horowitz & Sahni.
2. Data Structure using C-- Tennenbam.

SEMESTER-III

PAPER 301: FUNCTIONAL ANALYSIS

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

Topics: Normed linear space, Banach space, definitions & example including classic Banach space, sub space & Quotient space. -----2 questions.

Hahn-Banach theorem & consequences, open mapping theorem & projection on Banach space, closed graph theorem & uniform boundness principle. -----3 questions.

Hilbert space: definition & examples, Schwartz inequalities, orthogonal completeness characterisation, Gram-Schmidt orthogonalisation. -----3 questions.

Dual of H. Reisz representaion theorem, reflexivity. -----2 questions.

Adjoint of an operator, self-adjoint operator, unitary & normal operator. -----2 questions.

Reference Books: 1.Functionanal Analysis- J.N.Sharma & A.R.Vashistha.
2.Elements of Functional Study--Soboreve Lusternic.

PAPER 302: DIFFERENTIAL EQUATION

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

Topic: Fourier transform, sin & cosine transform ,inverse Fourier transform, application to ordinary & partial differential equation. -----2 question.

Classification of second order partial differential equation, reduction to canonical forms. -----2 question.

Wave equation, one dimensional solution by separation of variables, D'Alembert's solution of wave equation. ----- 2 questions.

Heat equation-one dimensional heat flow in infinity bar, solution by Fourier series, solution by Fourier integral & transform. -----2 questions.

Green function, Sturm-Liouville boundary value problem, Eigen-value problem. -----2 questions.
Laplace transform, transform of derivative, inverse transform, convolution theorem, application to ordinary & partial differential equation. -----2 questions.

Reference Books: 1. Integral Transform--A.R. Vashistha.
2. Differential Equation & their Application--Martin Braun
3. Advanced Differential Equation--M.D. Raisinghania
4. Elements of ODE & Special Function-A. Chakravarti.

PAPER 303: HYDRODYNAMICS

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Kinematics: Methods of Lagrange & Euler, Equation of continuity. -----2 questions.

Equation of motion: Euler's dynamical equation, equation of motion, Bernoulli's theorem, pressure equation, impulsive equation. -----2 questions.

Motion in two dimension: image of source, sink, doublets with respect to line/circle, the theorem of Blasius. -----4 questions.

Irrrotational motion in three dimensions: The equation, motion of a sphere, motion past a sphere.----- 2 questions.

Vortex motion, rectilinear motion, vortex pairs, use of conformal groups, infinity row of parallel vortices, double line, Karman street. -----2 questions.

Reference Books: 1. Hydro Mechanics-Besant & Ramsay
2. Hydro Mechanics-M.D. Raisinghania

PAPER 304: RING & FIELD

Out of 12 questions 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Factorization in integral domain: Concept of divisibility in integral domain, GCD & LCM of two non-zero elements in an integral domain, irreducible & prime elements in an integral domain, relation between prime & irreducible elements, definition & example of Euclidean domain, principle ideal domain & unique factorisation domain, relation between Euclidean domain, principal domain & unique factorisation domain, the integral domain $Z[1]$ & $K[X]$, K field properties of Euclidean domain, principal ideal domain & unique factorization domain, Eisenstein criteria of irreducibility, Gauss's lemma. -----6 questions.

Field theory: Extension of a field, finite extension & infinite extension, algebraic extension & transcendental extension, properties of algebraic extension, relation between algebraic & finite extension, splitting field of a polynomial over a field, normal extension, characterization of finite normal extension, separable extension & properties of separable extension, perfect field & characterization of perfect field, primitive element theorem, finite field & their existence. -----6 questions.

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

PAPER 305: COMPUTER PROGRAMMING This paper consists of 100 marks divided in two parts of Theory & Lab work. Each part consists of 50 marks in which pass marks is separately 23 in each Theory & in Practical. In Theory there will be 8 questions out of which 5 questions is to be answered in 3 hours duration each consisting 10 marks.

THEORY TOPICS:

Introduction- the Von Neumann architecture, machine language, assembly language, high level programming language, compiler, interpreter, loader, linker, text editors, operating system, flow chart, Basic features of programming(using C)- Data types, variables, operators, expressions, statements, control structures, functions, Advance programming features-array & pointers, recursions, records(structures), memory management, files,

input/output, standard library functions, programming tools, testing & debugging, Fundamental operations on data-insert, delete, search, traverse & modify, Fundamental data structure-arrays, stacks, queues, linked lists, Searching & sorting-linear search, binary search, insert-sort, selection sort, Introduction to object oriented programming

LAB WORK: Programming lab will be set in consonance with material covered in lecture. This will include assignments in a programming language like C & C++ in GNU Linux environment.

Reference Books:

1. A Book on C- A Kelly & I.Pohl.
- 2.C: The Complete Reference- H.Schildt.
- 3.The C Programming Language-B.Kernighan & D.Ritchie.
- 4.Programming With C- B.Gottfried & J. Chhabra

PAPER 306: Group Theory

Topics: Paper will consist of 12 questions of which 6 is to be answered in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS:

Isomorphism and homomorphism of groups, isomorphism theorem -----2 ques.

Permutation group & simple group, two square theorem & quadratic reciprocity via permutation group ---- 2 ques.

Conjugacy class, normaliser, class equation of finite group. -----2 questions.

Direct product: Direct product of a finite number of groups, necessary & sufficient condition for the isomorphism between the product & direct product of groups -----2 questions.

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. ----- 1 question

Group action orbit stabilizer theorem, Sylow theorem & application in proving non-simplicity for the isomorphism between the product and the direct product of groups. ----- 3 questions.

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

SEMESTER -IV

PAPER-401: OPERATION RESEARCH

Out of 10 questions 5 is to be answered in 3 hours duration. Each question carries 16 marks.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: Game Theory: Two persons zero sum games, games with mixed strategies, graphical solution, solution by linear programming. ----- 2 questions.

Integer programming: Branch & bound technique, Gomory's cutting plane method -----2 questions.

Non-linear programming: One and multivariable unconstrained optimization, Kuhn-Tucker condition for constrained optimization, Quadratic programming, Wolf's & Beale's method. ----- 2 questions.

Inventory: Known demand, probabilistic demand, deterministic model & probabilistic model without lead time. -----2 questions.

Project planning & control with PERT-CPM: rules for network construction, time calculation in network, critical path method, PERT calculation, advantage of network(PERT/CPM), difference between CP & PERT.

-----2 questions.

Reference Books:

- 1.Operations Research--R.K.Gupta.
2. Operations Research--S.D.Sharma
3. Operations Research --Prem Kumar Gupta & D.S Hira
4. Operations Research--Kanti Swaroop, P.K.Gupta & Manmohan
5. Operations Research-A.M.Natrajan &P.Balaguruswamy

6. Operations Research-- F.S. Hiller & G.S.Lieberman

PAPER 402: DIFFERENCE EQUATION

Out of 10 questions 5 is to be answered in 3 hours duration. Each question carries 16 marks.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

TOPICS: 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 & cycle, the equation & bifurcation equilibrium(fixed) points, 2-cycles 2-2 cycles.

-----5 questions.

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

-----5 questions.

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

PAPER 403: Theory of Numbers

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration. Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

Topics:

1. Primitive roots and indices, integers belonging to a given exponent modulo-p. primitive roots of composite moduli, index calculus. -----2 questions.

2. Quadratic residues, Euler's criterion, quadratic residues of primes and the Legendre symbol, Gauss lemma and quadratic reciprocity, Jacobi symbol, some special cases of Dirichlet's theorem. -----2 questions.

3. Distribution of primes, sums involving primes, the order of $\pi(x)$ and conjecture, the order and average and order of magnitude of 6 and 7. -----2 questions.

4. Rational approximation of irrationals: Approximation by Farey terms, Hurwitz theorem, Robinson's theorem on asymmetric approximation, Minkowski results on product of linear forms, Lionville's theorem and construction of transcendental numbers, simultaneous approximation. -----3 questions.

5. Some number fields and Diophantine equation, quadratic field, their integers, units and primes, failures of unique factorization, fundamental theorem of $K(I)$ and $K(W)$. $x^3+y^3=z^3$, $x^3+y^2=3z^3$, $x^3+y^3+z^3=t^3$ -----3 questions.

- Reference Books:
1. Topics in Number Theory Vol-I: Leveque. Ch- 4, 5, 6.
 2. Diophantine Approximation: Ivan Niven. Ch- 2
 3. An Introduction to Theory of Numbers: Hardy & Wright Ch- 12,13,20,21.
 4. Introduction to Analytic Number Theory: Tom M. Apostol.

PAPER 404 : BOUNDARY LAYER THEORY

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration.

Examination will be of 80 (external assessment) and marks and Theory-Theorems and numerical-problems will generally in ratio 50:50.

Topics: 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. -----4 questions.

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. -----4 questions.

3. The momentum equation for the boundary layer and its application to the flow past a flat place at zero incidence. -----2questions.

4. Idea of transition from laminar to turbulent flow, derivation of Orr-Sommerfeld stability equation, effect of boundary layer formation on a flow, methods of controlling boundary layer, Asymptotic suction profile.
-----2 questions.

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

PAPER 405/406 : Elective Paper-- In this elective papers students can select one paper each from two groups, Group - A & Group -B. Each elective paper will be of 100 marks and there will be no internal assessment in these elective papers.

GROUP A

1. CAM (Theory)

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration. Paper will carry of 100 marks.

Topics: 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 .
----2 questions.

Modelling and Simulation: System concepts and modelling, types of modelling, mathematical modelling of discrete and continuous linear systems, simulation and its uses, nature and techniques of simulation. ---3 questions

Elements of C programming: Constants, variables, data types, operators. Decision making and branching; GOTO, IF, IF-ELSE, nesting, switching statement. Decision making and looping; WHILE, DO and FOR statements. ---2 question

Handling of character strings: String manipulation and string handling functions. User defined functions; Forms, category, nesting, recursion, function with array, parameter passing. ---3 questions.

Structure and union: Array of structure, array within structure, structure within structure, union and structures, structures and functions. ---2 questions.

Reference Books:1. Schaum's Outline Series "Programming in C": Gottfried
2. Mathematical Modelling: J. N. Kapoor
3. Introduction to Simulation; J. A. Payne(Mc-Graw Hill)
4. A Computer Illustrated Text I, II, III, Adam Hilyer(1989): R. D. Harding.
5. Mathematical Modelling with Computers: Jacobis & Kowallie(Prantice Hall)

2.THEORY OF SUMMABILITY

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration. Paper will carry of 100 marks.

Topics:1. Special methods of summation: Norlund means regularity and consistency of Norlund means, equivalence, Euler's means, abelian means, Riesz typical means

2. Arithmetic means: Holder means, simple theorem concerning Holder's summability, Cesaro means, means of non-integral orders, simple theorem concerning Cesaro summability, equivalent theorem, Cesaro and Abel Summability, Cesaro means as Norlund means.

3. Tauberian theorem for Cesaro summability, divergent series.

4. The methods of Euler and Borel: The (E, q) method, the formal relation between Euler's and Borel's methods, normal absolute and regular summability, example of series not summable.

5. Multiplication of series: Multiplication of summable series, Euler's summability, Borel's summability, Dirichlet's multiplication.

Reference Books: 1, Divergent series: G. H. Hardy

3.INTEGRAL TRANSFORM

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration. Paper will carry 100 marks.

Topics:

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

GROUP B

1. CAM PRACTICAL

TOPICS: This paper carries 100 marks. There will be two sections. Section A on Projects of 40 marks and section B on Lab of 60 marks.

Section A:

Project must be on computer based modelling of problems related to:

- (a) Local industries.
- (b) Pollution and environment.
- (c) Pollution and family planning.
- (d) Literacy management.
- (e) Forestry.
- (f) time bound area-wise development model: Guide to MLA's & MP's.

One project will be undertaken by one team of five to six students. There will be a common dissertation/ project report, Viva will carry 20 marks and dissertation/ project report will carry 20 marks.

Section B: LAB.(60 Marks).

- Matrix manipulation: Matrix inversion, Eigen value computation.

Niyte Carlo method and its application: Evaluation of two and three dimensional integrals Familiarity and use of scientific packages such as scientific work place, MATLAB/SIMULINK and MAPPLE-V to solve mathematical problems.

Time domain analysis of systems in MATLAB environment using mathematical models.

Programming examples in C to study the following numerical methods to investigates problems in mathematics;

- Least square approximation, Fourier approximation.
- Numerical differentiation and integration.
- Ordinary differential equation, Taylor's series method, Euler's method, Runga-Kutta methods.
- Predictor corrector method, stability issue, modelling & simulation application.

Note: Each student must complete at least 15 practicals on the topics mentioned above.

Reference Books: 1. Programming in ANSI C: C. E. Balaguruswamy (Tata Mc-Graw Hill)

2. User's Manual: MATLAB/SIMULINK & MAPPLE V

3. Numerical Analysis; Raistont & Rabinowitz

Practical examination will be of three hours duration. External for practical examination will also evaluate the projects.

2. ELASTICITY

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration. Paper will carry of 100 marks.

Topics:

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 limaçon 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.

3.MATHEMATICAL MODELLING

12 questions will be set and students will be required to answer any 6 of them in 3 hours duration. Paper will carry of 100 marks.

Topics:

Basic idea of mathematical modelling. [No of questions: 1]

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. [No of questions: 2]

Two species population model: Stability of the equilibrium of population described by following models: Lotka Volterra model, May's Prey predator models, general discrete generation prey predator model. [No of questions: 2]

Models in population genetics: Basic model for change of genetics characteristics, diallelic and multiallelic cases, models for selection, mutation and inbreeding. [No of questions: 2]

Models in operation research: Different models, their construction and general method of solution. [No of questions: 2]

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. [No of questions: 3]

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