S. S. Jain Subodh P. G. (Autonomous) College

Affiliated to University of Rajasthan

Re-Accredited with 'A' Grade with (Highest Rating in Northern India) CGPA - 3.72 by NAAC - UGC

SCHEME OF EXAMINATION

&

DETAILED COURSE STRUCTURE

FOR

MASTER OF SCIENCE/ ARTS (M.Sc. / M.A.)

SUBJECT – MATHEMATICS

(2017-2020)

DEPARTMENT OF MATHEMATICS

S.S. JAIN SUBODH P.G. AUTONOMOUS COLLEGE

RAMBAGH CIRCLE, JAIPUR-302004

S. S. Jain Subodh PG (Autonomous) College, Jaipur
Department of Mathematics
Master of Science (M.Sc./ M.A.)

Examination Scheme:

Semester - I		
Paper	**Nomenclature of paper**	**Max. Marks**
MAT 101	ALGEBRA -I	70 Marks
MAT 102	REAL ANALYSIS	70 Marks
MAT 103	DIFFERENTIAL EQUATIONS-I	70 Marks
MAT 104	DIFFERENTIAL GEOMETRY	70 Marks
MAT 105	DYNAMICS OF RIGID BODIES	70 Marks
MAT 106	CALCULUS OF VARIATION AND SPECIAL FUNCTION-I	70 Marks
Semester - II		
Paper	**Nomenclature of paper**	**Max. Marks**
MAT 201	MAT 201 ALGEBRA -II	70 Marks
MAT 202	MAT 202 TOPOLOGY	70 Marks
MAT 203	MAT 203 DIFFERENTIAL EQUATIONS-II	70 Marks
MAT 204	MAT 204 RIEMANNIAN GEOMETRY AND TENSOR ANALYSIS	70 Marks
MAT 205	MAT 205 HYDRODYNAMICS	70 Marks
MAT 206	MAT 206 SPECIAL FUNCTION-II	70 Marks
Semester - III		
Paper	**Nomenclature of paper**	**Max. Marks**
MAT 301	FUNCTIONAL ANALYSIS-I	70 Marks
MAT 302	VISCOUS FLUID DYNAMICS-I	70 Marks
MAT C01	MATHEMATICAL PROGRAMMING-I	70 Marks
MAT E01	INTREGRAL TRANSFORMS	70 Marks
MAT F01	RELATIVISTIC MECHANICS	70 Marks
MAT G01	NUMERICAL ANALYSIS-I	70 Marks

Semester – IV		
Paper	**Nomenclature of paper**	**Max. Marks**
MAT 401	FUNCTIONAL ANALYSIS-II AND ADVANCED CALCULUS	70 Marks
MAT 402	VISCOUS FLUID DYNAMICS-II	70 Marks
MAT C02	MATHEMATICAL PROGRAMMING-II	70 Marks
MAT E02	INTREGRAL EQUATIONS	70 Marks
MAT F02	GENERAL RELATIVITY & COSMOLOGY	70 Marks
MAT G02	NUMERICAL ANALYSIS-II	70 Marks

Examination Scheme for each Paper

Part A- comprises of eight very short answer questions from all units. It's a compulsory question andattempt any seven (Science/Arts) 7X 2 mark each =14 Marks
Part B- 4 questions (1 question from each unit with internal choice)
(Science/Arts) 4X14 mark each = 56 Marks
Total of End semester exam (duration of exam 3 hours) =70Marks
Internal assessment = 30Marks

SEMESTER – I

MAT 101: Algebra-I

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit-1

Direct product of groups (External and Internal) .Isomorphism theorems – Diamond isomorphism Theorem, Butterfly Lemma, Conjugate classes (Excluding p-groups).

Unit - 2

Commutators, Derived subgroups, Normal series and Solvable groups, Composition series,Refinement theorem and Jordan-Holder theorem for infinite groups.

Unit - 3

Field theory – Extension fields, Algebraic and Transcendental extensions, Separable and inseparable extensions, Normal extensions. Splitting fields.

Unit -4

Galois theory – the elements of Galois theory, Automorphism of extensions, Fundamental theorem of Galois theory, Solutions of polynomial equations by radicals and Insolvability of general equation of degree five by radicals.

MAT 102: Real Analysis

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Algebra and algebras of sets, Algebras generated by a class of subsets, Borel sets, Lebesguemeasure of sets of real numbers, Measurability and Measure of a set, Existence of Nonmeasurablesets.

Unit - 2

Measurable functions, Realization of non-negative measurable function as limit of an increasing sequence of simple functions, Structure of measurable functions, Convergence in measure, Egoroff's theorem.

Unit - 3

Weierstrass's theorem on the approximation of continuous function by polynomials, Lebesgue integral of bounded measurable functions, Lebesgue theorem on the passage to the limit under the integral sign for bounded measurable functions.

Unit - 4

Summable functions, Space of square summable functions. Fourier series and coefficients, Parseval's identity, Riesz-Fisher Theorem.

MAT 103: Differential Equations- I

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Non-linear ordinary differential equations of particular forms.Riccati's equation – General solution and the solution when one, two or three particular solutions are known.

Unit - 2

Total Differential equations. Forms and solutions, necessary and sufficient condition, Geometrical Meaning Equation containing three and four variables, total differential equations of second degree.

Unit - 3

Series Solution: Radius of convergence, method of differentiation, Cauchy-Euler equation, Solution near a regular singular point (Method of Forbenius) for different cases, Particular integral and the point at infinity.

Unit - 4

Partial differential equations of second order with variable co-efficients- Monge's method.

MAT 104: Differential Geometry

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Space curves, Tangent, Contact of curve and surface, Osculating plane, Principal normal and Binormal, Curvature, Torsion, Serret-Frenet's formulae, Osculating circle and Osculating sphere, Existence and Uniqueness theorems, Bertrand curves, Involute and Evolutes.

Unit - 2

Conoids, Inflexional tangents, Singular points, Indicatrix.Ruled surface, Developablesurface, Tangent plane to a ruled surface. Necessary and sufficient condition that a surface $\zeta = f(\xi,\eta)$ should represent a developable surface. Metric of a surface, First, Second and Third fundamental forms.Fundamental magnitudes of some important surfaces, Orthogonaltrajectories.

Unit - 3

Normal curvature.Pricipal directions and Principal curvatures, First curvature, Mean curvature, Gaussion curvature, Radius of curvature of a given section through any point on $z = f(x,y)$. Lines of curvature, Principal radii, Relation between fundamental forms.

Unit - 4

Asymptotic lines, Differential equation of an asymptotic line, Curvature and Torsion of an asymptotic line. Gauss's formulae, Gauss's characteristic equation, Weingarten equations, Mainardi-Codazzi equations. Fundamental existence theorem for surfaces, Parallel surfaces, Gaussian and mean curvature for a parallel surface.

MAT 105: Dynamics of Rigid Bodies

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

D'Alembert's principle.The general equations of motion of a rigid body.Motion of centre ofinertia and motion relative to centre of inertia.Motion about a fixed axis.

Unit - 2

The compound pendulum, Centre of percussion.Motion of a rigid body in two dimensions under finite and impulsive forces.

Unit - 3

Motion in three dimensions with reference to Euler's dynamical and geometrical equations.Motion under no forces, Motion under impulsive forces.Conservation of momentum (linear and angular).

Unit - 4

Lagrange's equations for holonomous dynamical system, Energy equation for conservative field, Small oscillations, Motion of a top, Hemilton's equations of motion, Hamilton'sprinciple and principle of least action.

MAT 106: Calculus of Variation and Special Function-I

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Calculus of variation – Functionals, Variation of a functional and its properties,Variationalproblems with fixed boundaries, Euler's equation, Extremals, Functional dependent onseveral unknown functions and their first order derivatives. (Variational Problems with fixed boundaries)

Unit - 2

Functionals dependent on higher order derivatives, Functionals dependent on the function ofmore than one independent variable.Variational problems in parametric form. (Variational Problems with fixed boundaries)

Unit - 3

Gauss hypergeometric function and its properties, Series solution of Gauss hypergeometricequation. Integral representation, Linear and quadratic transformation formulas, Contiguousfunction relations, Differentiation formulae, Linear relation between the solutions of Gausshypergeometric equation, Kummer's confluent hypergeometric function and its properties,Integral representation, Kummer's first transformation.

Unit - 4

Legendre polynomials and Series Solution of Legendre's equation and functions $P_n(x)$ and $Q_n(x)$.

SEMESTER - II

MAT 201: Algebra II

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Linear transformation of vector spaces, Dual spaces, Dual basis and their properties, Dualmaps, Annihilator.

Unit - 2

Matrices of a linear maps, Matrices of composition maps, Matrices of dual map, Eigenvalues, Eigen vectors, Rank and Nullity of linear maps and matrices, Invertible matrices,Similar matrices.

Unit - 3

Determinants of matrices and its computations, Characteristic polynomial and eigenvalues.Real inner product space, Schwartzs inequality.

Unit - 4

Orthogonality, Bessel's inequality, Adjoint, Self adjoint linear transformations and matrices,Othogonal linear transformation and matrices, Principal Axis Theorem

MAT 202: Topology

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Topological spaces, Subspaces, Open sets, Closed sets, Neighbourhood system, Bases andsub-bases.

Unit – 2

Continuous mapping and Homeomorphism, Nets, Filters.

Unit - 3

Separation axioms (To, T1, T2, T3, T4).Compact and locally compact spaces.Continuity and Compactness.

Unit - 4

Product and Quotient spaces.Tychonoff's one point compactification. Connected and Locallyconnected spaces, Continuity and Connectedness.

MAT 203: Differential Equation-II

Duration : 3 hrs. Max. Marks : 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Twofrom each Unit). Candidate has to attempt any seven questions. Each question carry 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Classification of linear partial differential equation of second order, Canonical forms,Cauchy's problem of first and second order partial differential equation.

Unit - 2

Linear homogeneous boundary value problem, Eigen values and eigen functions, Sturm-Liouville boundary value problems, orthogonality of eigen functions, Lagrange's identity,properties of Eigen functions, important theorems of sturm Liouville system, Periodicfunctions.

Unit - 3

Non-homogeneous boundary value problems, Non-homogeneous Sturm-Liouville boundaryvalue problems (method of eigen function expansion). Method of separation of variables,Laplace, wave and diffusion equations.

Unit - 4

Green's Functions: Non-homogeneous Sturm-Liouville boundary value problem (method ofGreen's function), Procedure of constructing the Green's function and solution of boundaryvalue problem, properties of Green's function, Inhomogeneous boundary conditions, Diracdelta function, Bilinear formula for Green's function, Modified Green's function.

MAT 204: Riemannian Geometry and Tensor Analysis

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Geodesics, Differential equation of a geodesic, Single differential equation of a geodesic,Geodesic on a surface of revolution, Geodesic curvature and torsion, Gauss-Bonnet Theorem.

Unit - 2

Tensor Analysis– Kronecker delta.Contravariant and Covariant tensors, Symmetric tensors,Quotient law of tensors, Relative tensor. Riemannian space. Metric tensor, Indicator,Permutation symbols and Permutation tensors.

Unit - 3

Christoffel symbols and their properties, Covariant differentiation of tensors. Ricci'stheorem, Intrinsic derivative, Geodesics, Differential equation of geodesic, Geodesiccoordinates, Field of parallel vectors.

Unit - 4

Reimann-Christoffel tensor and its properties.Covariant curvature tensor, Einstein space.Bianchi's identity.Einstein tensor, Flat space, Isotropic point, Schur's theorem.

MAT 205: Hydrodynamics

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Kinematics of ideal fluid.Lagrange's and Euler's methods.Equation of continuity inCartesian, cylindrical and spherical polar coordinates.Boundary surface.

Unit - 2

Stream-lines, path-lines and streak lines, velocity potential, irrotational motion.

Unit - 3

Euler's hydrodynamicequations.Bernoulli'stheorem.Helmholtzequations.Cauchy's integral.

Unit - 4

Motion due to impulsive forces.Motion in two-dimensions, Stream function, Complexpotential.Sources, Sinks, Doublets, Images in two-dimensions.

MAT 206 : Special Functions- II

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Bessel functions Jn(x).

Unit - 2

Hermite polynomials Hn(x), Laguerre and Associated Laguerre polynomials.

Unit - 3

Jacobi Polynomial: Definition and its special cases, Bateman's generating function, Rodrigue's formula, orthogonality, recurrence relations, expansion in series of polynomials.

Unit - 4

Chebyshev polynomials Tn(x) and Un(x): Definition, Solutions of Chebyshev's equation,expansions, Generating functions, Recurrence relations, Orthogonality.

SEMESTER - III
MAT 301: Functional Analysis- I

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit 1:

Normed linear spaces.Quotient space of normed linear spaces and its completeness.Banachspaces and examples.Bounded linear transformations.Normed linear space of bounded linear transformations.

Unit – 2

Equivalent norms. Basic properties of finite dimensional normed linear spaces and compactness. Reisz Lemma. Multilinear mapping. Open mapping theorem. Closed graph theorem. Uniform boundness theorem.

Unit - 3

Continuous linear functionals.Hahn-Banach theorem and its consequences.Embedding and Reflexivity of normed spaces.Dual spaces with examples.Inner product spaces.Hilbert space and its properties.

Unit – 4

Orthogonality and Functionals in Hilbert Spaces.Phythagorean theorem, Projection theorem, Orthonormal sets, Bessel's inequality, Complete orthonormal sets, Parseval's identity, Structure of a Hilbert space, Riesz representation theorem, Reflexivity of Hilbert spaces.

MAT 302: Viscous Fluid Dynamics-I

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Viscosity , Analysis of stress and rate of strain, Stoke's law of friction, Thermal conductivity and generalized law of heat conduction, Equations of state and continuity , Navier- Stokes equations of motion.

Unit – 2

Vorticity and circulation, Dynamical similarity, Inspection and dimensional analysis, Buckingham theorem and its application, Non-dimensional parameters and their physical importance : Reynolds number, Froude number, Mach number, Prandtl number, Eckartnumber, Grashoff number, Brinkmann number, Non – dimensional coefficients : Lift and drag coefficients, Skin friction , Nusselt number, Recovery factor.

Unit – 3

Exact solutions of Navier – Stokes equations, Velocity distribution for plane couette flow, Plane Poiseuille flow, Generalized plane Couette flow, Hagen-Poiseuille flow, Flow in tubes of uniform cross-sections.

Unit – 4

Flow between two concentric rotating cylinders. Stagnation point flows :Hiemenz flow, Homann flow. Flow due to a rotating disc.

MAT C01: Mathematical Programming –I

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Separating and supporting hyperplane theorems. Revised simplex method to solve Linear Programming problems, Bounded variable problems.

Unit – 2

Integer programming: Gomory's algorithm for all and mixed integer programming problems,Branch and Bound algorithm; Goal programming: Graphical goal attainment method, Simplex method for GPP.

Unit – 3

Separable programming: Piece-wise Linear approximations to non-linear functions, Reduction to separable programming problem to l.p.p., separable programming algorithm, fractional programming: computational procedure.

Unit - 4

Dynamic programming: Introduction, Bellman principle of optimality, solution of problems with finite number stages, solution of l.p.p. by dynamic programming.

MAT E01: Integral Transforms

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Fourier transform – Defiition and properties of Fourier sine, cosine and complex transforms. Convolution theorem.Inversion theorems. Fourier transform of derivatives.

Unit – 2

Mellin transform– Definition and elementary properties.Mellin transforms of derivatives andintegrals. Inversion theorem.Convolution theorem.

Unit - 3

Laplace transform– Definition and its properties.Rules of manipulation. Laplace transform of derivatives and integrals. Properties of inverse Laplace transform. Convolution theorem.

Unit – 4

Complex inversion formula.Infinite Hankel transform– Definition and elementary properties.Hankel transform of derivatives. Inversion theorem.Parseval Theorem.

MAT F01: Relativistic Mechanics

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Relative Character of space and time, Principle of Relativity and its postulates, Derivation of special Lorentz transformation equations, Composition of Parallel velocities, Lorentz- Fitzgerald contraction formula, Time dilation.

Unit – 2

Simultaneity, Relativistic transformation formulae for velocity, Lorentz contraction factor, Particle acceleration, Velocity of light as fundamental velocity, Relativistic aberration and its deduction to Newtonian theory.

Unit - 3

Variation of mass with velocity, Equivalence of mass and energy, Transformation formulae for mass, Momentum and energy, Problems on conservation of mass, Momentum and energy, Relativistic Lagrangian and Hamiltonian.

Unit - 4

Minkowski space, Space-like, Time-like and Light-like intervals, Null cone, Relativity and Causality, Proper time, World line of a particle. Principles of Equivalence and General Covariance.

MAT G01: Numerical Analysis – I

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Iterative methods – Theory of iteration method, Acceleration of the convergence, Chebyshevmethod, Muler's method, Methods for multiple and complex roots.

Unit - 2

Newton-Raphson method for simultaneous equations, Convergence of iteration process in the case of several unknowns.Solution of polynomial equations – Polynomial equation, Real andcomplex roots, Synthetic division, the Birge-Vieta, Bairstow and Graeffe's root squaringmethod.

Unit - 3

System of simultaneous Equations (Linear)- Direct method, Method of determinant, Gauss- Jordan, LU-Factorizations-Doolitte's, Crout's and Cholesky's. Partition method.Relaxation methods.

Unit - 4

Eigen value problems– Basic properties of eigen values and eigen vector, Power methods, Method for finding all eigen values of a matrix. Jacobi, Givens' and Rutishauser method.Complex eigen values.

SEMESTER – IV

MAT 401: Functional Analysis II and Advanced Calculus

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Adjoint of an operator on a Hilbert space.Self-adjoint, Positive, Normal and Unitary and their properties.Projection on a Hilbert space.Invariance.Reducibility. Orthogonal projections.

Unit – 2

Derivatives of a continuous map from an open subset of Banach space to a Banach space. Rules of derivation.Derivative of a composite, Directional derivative. Mean value theorem and its applications.

Unit - 3

Partial derivatives and Jacobian Matrix.Continuously differentiable maps. Higher derivatives. Taylor's formula.

Unit – 4

Inverse function theorem.Implicit function theorem. Step function, Regulated function, primitives and integrals. Differentiation under the integral sign.Riemann integral of function of real variable with values in normed linear space.

MAT 402: Viscous Fluid Dynamics – II

Duration : 3 hrs. Max. Marks: 70
Note: There will be two parts in end semester theory paper.
Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.
Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Concept of unsteady flow, Flow due to plane wall suddenly set in the motion (Stokes' first problem), Flow due to an oscillating plane wall (Stokes' second problem), Starting flow in plane Couette motion, Suction/injection through porous wall.

Unit - 2

Equation of energy, Temperature distribution : Between parallel plates, in a pipe, between two concentric rotating cylinders.

Unit - 3

Variable viscosity plane Couette flow, temperature distribution of plane Couette flow with transpiration cooling.Theory of very slow motion: Stokes' and Oseen's flows past a sphere.

Unit – 4

Concept of boundary layer , Derivation of velocity and thermal boundary equations in twodimensional flow. Boundary layer on flat plate (Balsius-Topfer solution), Simple solution of thermal boundary layer equation for Pr = 1

MAT C02: Mathematical Programming – II

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Convex function, Quadratic forms, constrained problem of maxima and minima, Lagrangianmethod, Non-linear programming: Formulation and Graphical method.

Unit – 2

Non-linear programming and its fundamental ingradients, Khun-Tucker necessary and sufficient conditions; Saddle point, Saddle-point theorems.

Unit – 3

Quadratic Programming: Kuhn-Tueker conditions, Wolfe method, Duality in QuadraticProgramming.

Unit - 4

Beals method to solve QPP, Geometric Programming: Formulation, geometric arithmetic inequality, necessary conditions of optimality.

MAT E02: Integral Equations

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Linear integral equations– Definition and classification. Conversion of initial and boundary value problems to an integral equation. Eigen values and Eigen functions. Solution of homogeneous and general Fredholm integral equations of second kind with separable kernels.

Unit - 2

Solution of Fredholm and Volterra integral equations of second kind by methods of successive substitutions and successive approximations. Resolvent kernel and its results.Conditions of uniform convergence and uniqueness of series solution.

Unit – 3

Integral equations with symmetric kernels– Orthogonal system of functions. Fundamental properties of eigen values and eigen functions for symmetric kernels. Expansion in eigenfunctions and bilinear form. Hilbert-Schmidt theorem.Solution of Fredholm integral equations of second kind by using Hilbert-Schmidt theorem.

Unit - 4

Solution of Volterra integral equations of second kind with convolution type kernels by Laplace transform. Solution of singular integral equations by Fourier transform. Classical Fredholm theory– Fredholm theorems.Solution of Fredholm integral equation of second kind by using Fredholm first theorem.

MAT F02: General Relativity & Cosmology

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit - 1

Mach's principle, Newtonian approximation of equation of motion, Einstein's field equation for matter and empty space, Reduction of Einstein's field equation to Poisson's equation,Removal of clock paradox in General Relativity.

Unit - 2

Schwarzschild exterior metric, its isotropic form, Singularity and singularities in Schwarzschild exterior metric, Derivation of the formula GM = c2m, Mass of sun in gravitational unit, Relativistic differential equation for the orbit of the planet.

Unit – 3

Three crucial tests in General Relativity and their detailed descriptions, Analogues of Kepler's laws in General Relativity, Trace of Einstein tensor, Energy-

momentum tensor and its expression for perfect fluid, Schwarzschild interior metric and boundary condition.

Unit – 4

Lorentz invariance of Maxwell's equations in empty space, Lorentz force on charged particle, Energymomentum tensor for electro-magnetic field. Einstein's field equation with cosmological term, Static cosmological models (Einstein &de-Sitter models) with physical and geometrical properties, Nonstatic form of de-Sitter line-element and Red shift in this metric, Einstein space, Hubble's law, Weyl's postulate.

MAT G02: Numerical Analysis – II

Duration : 3 hrs. Max. Marks: 70

Note: There will be two parts in end semester theory paper.

Part A- Question 1 is compulsory comprises eight very short answer questions (Two from each Unit). Candidate has to attempt any seven questions. Each question carries 2 marks.

Part B of the paper will consist four questions one question from each unit with internal choice. Each question will carry 14 marks.

Unit – 1

Curve Fitting and Function Approximations – Least square error criterion. Linear regression.Polynomial fitting and other curve fittings, Approximation of functions by Taylor series and Chebyshev polynomials.

Unit – 2

Numerical solution of Ordinary differential Equations – Taylor series Mathod, Picardmethod, Runge- Kutta methods upto fourth order, Multistep method (Predictor-correctorstrategies).

Unit - 3

Stability analysis – Single and Multistep methods.BVP's of ordinary differential Equations – Boundary value problems (BVP's), Shooting methods.

Unit - 4

Finite difference methods. Difference schemes for linear boundary value problems of the type y" =f(x, y), y" =f(x, y, y') and yiv =f (x, y).