SYLLABUS

MATHEMATICS

(ANNUAL SCHEME)

(ONLY FOR PRIVATE STUDENTS)

M.Sc./M.A. (Previous) Examination 2020

JAI NARAIN VYAS UNIVERSITY
JODHPUR

FACULTY OF THE DEPARTMENT AND THEIR RESEARCH/TEACHING INTEREST

Sr. No.	Name/Designation	Academic Qualification	Field of Specialization
	Professor		
01.	Dr. Chena Ram	M.Sc., Ph.D.	Special Functions, Fractional Calculus, Statistical Distributions.
02.	Dr. R.K.Yadav **(Head)**	M.Sc., Ph.D.	Special Functions, Integral Transforms, Fractional Calculus, Complex Analysis.
03.	Dr. Jeta Ram	M.Sc., Ph.D.	Integral Transform, Fractional Calculus, Special Functions
04.	Dr. R.K.Gupta	M.Sc., Ph.D.	Special Functions, Fractional Calculus, Integral Transforms
05.	Dr. Vijay Mehta	M.Sc., Ph.D.	Fluid Dynamics and M.H.D.
06.	Dr. Aiyub Khan	M.Sc., Ph.D.	Computational Fluid Dynamics
	Assistant Professor		
07.	Dr. Ramdayal Pankaj	M.Sc., Ph.D.	Applied Mathematics
08.	Mr. Madan lal	M.Sc.	
09.	Dr. Meena Kumari Gurjar	M.Sc., Ph.D.	Special Functions, Fractional Calculus and Operation Research

MASTER OF SCIENCE

General Information for Students

The examination for the degree of Master of Science will consist of two examinations: (i) The Previous Examination, and (ii) The Final Examination.

The subject of examination shall be one of the following:

Mathematics, Statistics, Physics, Electronics, Chemistry, Zoology, Geology, Botany and Home Science.

The examination will be through theory papers/practical. Pass marks for the previous and final examination are 36% of the aggregate marks in all the theory papers and practical and not less than 25% marks in an individual theory paper. A candidate is required to pass in the written and the practical examinations separately.

Successful candidates will be placed in the following division on the basis of the total marks obtained in previous and final examinations taken together.

First division 60%; Second division 48% and Third division 36%. No student will be permitted to register himself/herself simultaneously for more than one post-graduate course.

ATTENDANCE

1. For all regular candidates in the faculties of Arts, Education and Social Sciences, Science, Law and Commerce the minimum attendance requirement should be that a candidate should have attended at least 75% of the lectures delivered and tutorials held taken together from the date of her/his admission.
2. The shortage of attendance up to the limits specified below may be condoned.
   (i) Up to 3% of the total (a) Lectures delivered and tutorials held (taken together), and (b) Practical or Practical and Sessionals subject-wise condonable by the Dean/Director/Principal on the recommendation of the Department concerned.
   (ii) Up to 6% including (i) above by the Syndicate on the recommendation of the Dean/Director/Principal.
   (iii) Up to 5% attendance in all subjects/papers/practical and sessionals (taken together) by the Vice-Chancellor in special cases, on the recommendation of the Dean/Director/Principal.
3. The N.C.C. cadets sent out to parades and camps and such students who are deputed by the University to take part in games, athletics or cultural activities may, for purpose of attendance, be treated as present for the days of their absence in connection with the aforesaid activities and that period shall be added to their total attendance subject to the maximum of 20 days.
4. Advantage of fraction while calculating the attendance, shall be given to the candidate.

EXAMINATION AND TEACHING SCHEME
M.Sc./M.A. (Previous / Final)

Nomenclature/Paper	Periods/week	Exam Hours	Max.Marks
M.Sc.(Previous)			
I Algebra	6	3	100
II Real Analysis and Measure Theory	6	3	100
III Differential Equations and Hydrodynamics	6	3	100
IV Special Functions and Integral Transforms	6	3	100
V Analytical Dynamics and Numerical Analysis	6	3	100

M.Sc./M.A. (Previous) Mathematics
Examination – 2020

Paper – I
ALGEBRA

Duration of Paper : 3:00 hours **Max. Marks:** 100

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C
Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2.
Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 7.
Section – C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 15.

Unit 1: Groups: Law of isomorphism. Direct products of groups. Theorems related to composition series. Jordan-Holder theorem. Definition of P-Group H-Conjugate Cauchy's theorems for finite Abelian and finite group. Sylow's theorems for abelian groups, solvable groups.

Unit 2: Rings and Fields of Extension: Theorems on endomorphism of an abelian group. Direct product of rings. Polynomials rings, Factorisation in integral domain. Theorems related to finite and infinite extension of field. Minimal, Polynomials, Splitting field. Theorems on roots and coefficients of polynomial separable and inseparable extensions.

Unit 3: Canonical Forms: Jordan Matrix, Jordan canonical form, Some decomposition theorems. Jordan normal forms. Definition and examples of linear algebra. Linear transformations. Kernel and range space of a linear mapping, Rank and nullity, Singular and non-singular mapping or transformations. Invariance and Reducibility.

Unit 4: Galois Theory: Monomorphism and their Linear Independence. Arten theorem on automorphism, Normal extensions and Fundamental theorem of Galois theory, Radical extensions and solvability by Radicals. Constructions by Ruler and Compass Ring with Chain conditions. Hilbert's Bases theorem. Artinian rings.

Unit 5: Linear transformations and system of linear equations. Quotient transformations. Inner product. Inner product spaces. Algebra of linear operators. Matrix representation of linear operators. Dual spaces. Unitary and normal operators. Matrices of linear transformations with respect of different bases.

BOOKS RECOMMENDED

Surjeet Singh and Qazi Zammeruddin: Modern Algebra
Aggarwal, R.S.: Modern Algebra
Shanti Narain: Abstract Algebra; S. Chand & Co., New Delhi
Raisinghania, N.D. : Modern Algebra
Kofman, Kunj, Linear Algebra

Paper – II

REAL ANALYSIS AND MEASURE THEORY

Duration of Paper : 3:00 hours **Max. Marks:** 100

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2.

Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 7.

Section – C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 15.

Unit 1: Real Sequences and convergence: Definition, limit point, bounds and properties of real sequences. Limit inferior and limit supirior of sequences. Bolzano – Weierstrars theorem for sequences, convergent and non-convergent sequences. Cauchy's general principle of convergence. Cauchy sequence, various theorems on limit of sequences. Monotonic sequence and its convergence. Cantor's set, Continuity and Discontinuity of functions of two and more variables, types of discontinuity.

Unit 2: Jacobians, Uniform Convergence of sequences and series of functions. Various tests for uniform convergence. Weierstrass's M – Test. Uniform convergence and continuity. Uniform convergence and integration. Uniform convergence and differentiation.

Unit 3: Definitions of measure, Lebesgue outer measure, Measure of sets, Non-measurable sets, Exterior and interior measure of sets and their simple properties, Measurable functions. Definition of Lebesgue Integral of a bounded measurable function, Comparison of Lebesgue and Riemann Integral.

Unit 4: Lebesgue theorem of bounded convergence, Egoroff's theorem. Lebesgue Integral of unbounded function, Elementary properties of Integrals, Definition and simple properties of function of bounded variation and absolutely continuous functions. Definition of Reimann-Stieltjes Integral.

Unit 5: The Lebesgue set, Integration by parts, The second mean value theorem, The Lebesgue class L^p, Schwarz's inequality, Holder's inequality, Holder's inequality for sums, Minkowski's inequality. Integration of a function of L^p, mean convergence for the function of the class L^p.

BOOKS RECOMMENDED

Shanti Narayan: Mathematical Analysis;S. Chand & Co., New Delhi.
Royden, H.L.: Real Analysis;MacMillan Publishing Co., New York
H.K. Pathak: Real Analysis; Shiksha Sahitya Prakashan; Meerut.
Malik, S.C. and Arora, S.: Mathematical Analysis. New Age India Int. (P) Ltd., New Delhi.
Jain, P.K. and Gupta, V.P. Lebsegue Measure and Integration, New Age Int. (P) Ltd., New Delhi.

Paper – III

DIFFERENTIAL EQUATIONS AND HYDRODYNAMICS

Duration of Paper : 3:00 hours **Max. Marks:** 100

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C
Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2.
Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 7.
Section – C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 15.

Unit 1 : Classification of second order partial differential equations, solutions of Laplace, Wave and Heat conduction equations, Fourier series with application to simple boundary value problems on wave and heat conduction equations.

Unit 2 : Kinematics of fluids in motion, Lagrange's and Euler's methods, Stream lines and path lines, Velocity potential. Vorticity vector, Equation of continuity in orthogonal curvilinear, Cartesian, spherical polar and cylindrical coordinates, Boundary surface condition.

Unit 3 : Euler's equations of motion, Bernoulli's equation, Impulsive motion, Two dimensional motion, complex potential. Motion of a circular cylinder in perfect liquid and motion of liquid past through a circular cylinder.

Unit 4 : Source, sinks and doublet; and their images in two dimensions. Motion of Sphere in perfect liquid and Motion of liquid past sphere. Milne Thomson circle theorem. Theorem of Blasius.

Unit 5 : Viscosity, Navier-stoke's, equations of motion for viscous incompressible flow. Dynamical similarity, Dimensional analysis. P-Buckimgham theorem. Physical importance of non-dimensional parameters. Renold's number, Prandtl number. Mach number, Froude Number, Nusselt number. Some exact solutions of N-S. equations, Plane Couette flow. Plane Poisseulle flow, Generalized plane Couette flow, Haigan-Poisseulle flow through circular pipe.

BOOKS RECOMMENDED

Chaturvedi, J.C. and Ray, M.: Differential Equations; Ram nath Kedar Nath & Co. Agra.

Bansal, J.L. and Dharmi, H.S.: Differential Equations Vol. II, An Elementary Treatise Differential Equations; Jaipur Publishing House, Jaipur

Arnold, V.I.: Ordinary Differential Equations, MIT Press, Cambridge, 1981
Scheter, M.: Modern Methods in Partial Differential Equations, Wiley Eastern, Delhi, 1985.
Bansi Lal: Theoretical Hydrodynamics; jaipur Publishing House, Jaipur.
Milne-Thomson: Theoretical Hydrodynamics
Ray, M.: A Text Book of Fluid Dynamics; S. Chand & Co., New Delhi.
Chorlton, F.: Text Book of Fluid Dynamics
Bansal, J.L. : Viscous Fluid Dynamics; jaipur Publishing House, Jaipur.

Paper - IV

Special Functions and Integral Transforms

Duration of Paper : 3:00 hours **Max. Marks:** 100

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C
Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2.
Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 7.
Section – C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 15.

Unit 1: Hypergeometric functions: Definition of the Hypergeometric series and function. Properties of hypergeometric functions. Integral formula for hypergeometric series, Linear transformations, Contiguous function relations.

Unit 2: Linear relations between the solutions of hypergeometric differential equation. Kummer's confluent hypergeometric function. Elementary properties of generalized hypergeometric function ${}_pF_q$.

Unit 3 : Legendre Polynomials and Bessel Functions: Legendre's differential equation and its series solution, Generating Function of Legendre's polynomials $P_n(x)$, Orthogonality, Laplace's First and Second Integral for $P_n(x)$, Rodrigues formula, Recurrence Relations.

Bessel's equation and its solution; Bessel function of the first kind, Generating function for $J_n(x)$, Recurrence relations, Integral representations for $J_n(x)$, Addition formula for the Bessel functions, Orthogonality.

Unit 4 : Classical Orthogonal polynomials: Generating function and other properties associated with Hermite, laguerre Polynomials.

Unit 5 : Fourier sine and consine transforms, Fourier transforms and its properties, Hankel and Mellin transform and their properties.

BOOKS RECOMMENDED

Sneddon, I.N.: Use of Integral Transforms; Tata MacGraw-Hill, New Delhi.

Rainville, E.D.: Special Functions, Macmillan and Co., New York 1960.

Sneddon, I.N.: Special Functions of Mathematical Physics and Chemistry,Oliver and Byod, 1961.

Watson, G.N.: A Treatise on the Theory of Bessel Functions, Cambridge University Press, 1931

Labedye, N.N.: Special Functions and their Applications, Dover, 1972.

Saxena, R.K. and Gokhroo, D.C.; Special Functions, Jaipur Publishing House.

Paper - V
Analytical Dynamics and Numerical Analysis

Duration of Paper : 3 Hours **Max. Marks: 100**

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C
Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2.
Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 7.
Section – C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 15.

Unit 1 : Motion in two dimensions under impulsive forces. Conservation of linear and angular momentum under finite and impulsive forces.

Unit 2 : Lagrange's equations for finite as well as impulsive forces. Normal co-ordinates and normal modes of vibration. Motion in three dimensions. Euler's dynamical equation for the motion of a rigid body and problems related to no external forces.

Unit 3 : Calculus of variations; Linear functionals, Minimal functional theorem, general variation of a functional. Euler-Lagrange equation, Various fundamental problems including isoperimetric problems of calculus of variations. Variational Methods of solving Boundary value problems in ordinary and partial differential equations.

Unit 4 : Hamilton's canonical equations of motion. Hamilton's principle and principle of least action canonical transformations. Poisson brackets and their properties. General equations of motion in terms of Poisson brackets. Lagrange's brackets and their properties.

Unit 5 : Various methods of solving ordinary differential equations, Euler's method, Picard's method, Runge-Kutta method. Milne's method. Methods of solution of partial differential equations. Iteration methods.

BOOKS RECOMMENDED

Loney, S.L.: An Elementary Treatise on the Dynamics of a Particle and Rigid Bodies, Cambridge University Press.
Ray,M.: Dynamics of Rigid Bodies, Students Friends and Co.
Smart, E.H.: Advanced Dynamics, Vol.II, Macmillan
Gupta, P.P.: Dynamics of Rigid Bodies II, Jaiprakash Nath, Agra
Soarborough, James, B.: Numerical Analysis
Freeman, H.: Finite Differences and Mathemaics for Acturial Students
Richardson,H.C.: Calculus of Finite Differences
Elsgotts, L.E.: Calculus of Variations
Bansal, J.L.: Dynamics of a Rigid Body, Jaipur Publishing Co.,
Saxena, H.C.: Finite Differences and Numerical Analysis; S. Chand & Sons, New Delhi.