FACULTY OF SCIENCES
PG DEPARTMENT OF MATHEMATICS

SYLLABUS/ SCHEMES
Session: 2021-22

- Master of Science (Mathematics) (Semester I-IV)
- Bachelor of Science (Honours) Mathematics (Semester I-VI)
- Nine Months certificate course in Vedic Mathematics

➢ **Interdisciplinary subjects**

- Bachelor of Science (Honours) Physics (Semester I-IV)
- Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) (Semester I-VI)
- Bachelor of Commerce in Honours (Semester -III)
- Bachelor of Science (Bio-Technology) (Semester-II)
- Bachelor of Science (Economics) (Semester-I)
- Master of Arts (Economics) (Semester-I)
- Master of Science (Chemistry) (Semester-II)
- Master of Science (Zoology) (Semester-II)
- Master of Science (Botany) (Semester-II)

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

Master of Science (Mathematics)
Session :2021 -22
Programme Outcomes

Upon successful completion of this course, students will be able to:

PO 1: Solve complex Mathematical problems by critical understanding, analysis and synthesis. Students will also be able to provide a systematic understanding of the concepts and theories of Mathematics and their applications in the real world to enhance career prospects in a huge array of field.

PO 2: Have knowledge of advanced models and methods of mathematics, including same from the research frontiers of the field and expert knowledge of a well defined field of study, based on the international level of research in Maths.

PO 3: To generate skills in independently comprehending, analysing, modelling and solving problems at a high level of abstracts based on logical & structured reasoning.

PO 4: Use computer calculations as a tool to carry out scientific investigation and develop new variants.

PO 5: Use mathematical and statistical techniques to solve well defined problems and present their mathematical work, both in oral and written format.

PO 6: Propose new mathematical linear programming techniques & suggest possible software packages or computer programming to find solution to their questions.

PO 7: Apply the knowledge in modern industry or teaching or secure acceptance in high quality graduate program in maths and other fields such as the field of quantitative/mathematical finance, mathematical computing, statistics and actuarial sciences.

PO 8: Read, Understand construct correct mathematical and use the library and electronic data basis to locate information on mathematical problem.

Master of Science (Mathematics)
Session -2021-22
Program Specific outcomes

After the successful completion of this course, the students will be able to

PSO 1: Develop a deeper and more rigorous understanding of calculus including defining terms and proving theorems about sets, functions, sequences, series, limits, continuity, derivatives, the Riemann integrals, and sequence of functions. The course will develop specialized techniques in problem solving.
PSO 2: Handle mathematical operations, analysis and problems involving complex numbers. Justify the need for a complex number system and explain how it is related to other existing number systems.

PSO 3: Understand the importance of algebraic properties with regard to working within various number systems, demonstrate ability to form and evaluate conjectures.
PSO 4: Apply differential equations to significant applied and/or theoretical problems, to model physical and biological phenomenon by differential equations and dynamical systems.
PSO 5: To describe fundamental properties including convergence, measure, differentiation and integration of the real numbers developing the theory underpinning real analysis, to appreciate how ideas and abstract methods in mathematical analysis can be applied to important practical problems.
PSO 6: To use tensor to describe measured quantities, to formulate and solve physics problems in areas such as stress, elasticity including problems in geometry, to analyze shapes in computer version and other areas of mathematical sciences.
PSO 7: To demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from field extension and Galois theory , to apply problem solving to diverse situations in physics, engineering and other mathematical contexts.
PSO 8: To understand forces linear and circular and their effects on motion, to analyze how a physical system might develop or alter over time and to study the cause of these changes.
PSO 9: Explain fundamental concepts of theory of integral equations, distinguish the difference between differential equations and integral equations, to develop, analyze and solve mathematical models for multidisciplinary problems.

Scheme and Curriculum of Examinations of Two Year Degree Programme
Master of Science (Mathematics) Semester-I
Session: 2021-22

Master of Science (Mathematics) Semester-I							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MMSL-1331	Real Analysis-I	C	100	80	-	20	3
MMSL-1332	Complex Analysis	C	100	80	-	20	3
MMSL-1333	Algebra-I	C	100	80	-	20	3
MMSL-1334	Mechanics-I	C	100	80	-	20	3
MMSL-1335	Differential Equations	C	100	80	-	20	3
Total			500				

C-Compulsory

Master of Science (Mathematics)
Semester-I
Session: 2021-22
Course Title: Real Analysis-I
Course Code: MMSL-1331
Course outcomes

After the completion of this course, students should be able to

CO 1: Explain the fundamental concepts of real analysis and their role in modern mathematics.

CO 2: Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts of real analysis.

CO 3: Give argument related to convergence, continuity, completeness, compactness, connectedness in metric spaces.

CO 4: Understand and derive proofs of mathematical theorems. This includes understanding the role of axiom, logic and particular proof techniques such as proof by induction, proof by contradiction etc.

CO 5: To perform RS Integration on certain type of functions for carrying out the computation fluently. Also to compute integral by using the fundamental theorem of calculus.

Master of Science (Mathematics)
Semester-I
Session: 2021-22
Course Title: Real Analysis-I
Course Code: MMSL-1331

Examination Time: 3 Hrs Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Set Theory: Finite, countable and uncountable sets. Metric spaces: Definition and examples, open sets, closed sets, compact sets, elementary properties of compact sets, K- cells, compactness of K- cells, Compact subsets of Euclidean space R^K,Perfect sets, The Cantor set.

Unit –II

Separated sets, connected sets in a metric space, Connected subsets of real line, Components, Sequences in Metric Spaces: Convergent sequences (in Metric Spaces), subsequences, Cauchy sequences, Complete metric spaces, Cantor's Intersection Theorem

Unit –III

Baire's theorem, Banach contraction principle, Continuity: Limits of functions (in metric spaces) Continuous functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic functions, Uniform Continuity.

Unit –IV

The Riemann Stieltje's Integral: Definition and existence of Riemann Stieltje's integral, Properties of integral. Integration and Differentiation. Fundamental Theorem of Calculus, 1st and 2nd Mean Value Theorems of Riemann Stieltje's integral.

Text Book:
Robert G.Bartle and Donald R. Sherbet: Introduction to Real Analysis

Reference Books:

1.Walter Rudin: Principles of Mathematical Analysis (3rd Edition) McGraw-Hill Ltd Ch.2, Ch.3, (3.1-3.12), Ch.4, Ch.6, (6.1-6.22)
2. Simmons, G.F.: Introduction to Topology and Modern Analysis, McGraw- Hill Ltd(App.1) pp337-338, Ch.2(9-13)
3.Apostol, T.M. : Mathematical Analysis 2nd Edition 7.18(Th.7.30&7.31)
4.Malik, S.C. : Mathematical Analysis, Wiley Eastern Ltd

Master of Science (Mathematics)
Semester-I
Session: 2021-22
Course Title: Complex Analysis
Course Code : MMSL-1332
Course Outcomes

Course objectives of Complex Analysis are aimed to provide an introduction to the theories for functions of complex variables. Upon successful completion of this course the student will be able to:

CO1. Justify the need for a complex number system and explain how it is related to other existing number system.

CO2. Define a function of complex variable and carry out basic mathematical operations with complex numbers.

CO3. State and prove the Cauchy Riemann Equation and use it to show that a function is analytic.

CO4. Define singularities of a function, know the different types of singularities and be able to determine the points of singularities of a function.

CO5. Understand the concept of sequences and series with respect to the complex numbers system.

Master of Science (Mathematics)
Semester-I
Session: 2021-22
Course Title: Complex Analysis
Course Code : MMSL-1332

Examination Time: 3 Hrs Max. Marks: 100
Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit –I

Functions of complex variables, continuity and differentiability. Analytic functions, Conjugate function, Harmonic function. Cauchy Riemann equations (Cartesian and Polar form). Construction of analytic functions, Complex line integral, Cauchy's theorem, Cauchy's integral formula and its generalized form.

Unit –II

Cauchy's inequality. Poisson's integral formula, Morera's theorem. Liouville's theorem, Conformal transformations. Bilinear transformations. Critical points, fixed points, cross-ratio. Problems on cross-ratio and bilinear transformation, Analytic Continuation, Natural Boundary, Schwartz Reflection Principle.

Unit –III

Power Seires, Taylor's theorem, Laurent's theorem. Maximum Modulus Principle. Schwarz's lemma. Theorem on poles and zeros of meromorphic functions. Argument principle. Fundamental theorem of Algebra and Rouche's theorem.

Unit-IV

Zeros, Singularities, Residue at a pole and at infinity. Cauchy's Residue theorem, Jordan's lemma. Integration round Unit circle. Evaluation of integrals of the type of $\int_{-\infty}^{\infty} f(x)dx$ and integration involving many valued functions.

Text Book:
S.Ponnusamy: Complex variables with applications.

Reference Books:
1. Kasana, H.S. : Complex variables theory and applications.
2. Shanti Narayan : Functions of Complex Variables.
3. Copson, E.T.: Theory of functions of complex variables.
4. Ahlfors, D. V.: Complex analysis.

Master of Science (Mathematics)
Semester-I
Session- 2021-22
Course Title: Algebra-I
Course Code : MMSL-1333
Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Demonstrate understanding of and the ability to work within various algebraic structures.

CO 2: Demonstrate understanding of the importance of algebraic properties with regard to working with various number systems.

CO 3: Effectively write abstract mathematical proofs in a clear and logical manner.

CO 4: Explain the fundamental concepts of finite group theory and finite field theory.

CO 5: Use Lagrange's theorem to analyze the cyclic subgroups of a group.

CO 6: Explain the significance of the notion of a normal subgroup, quotient group and simple group.

CO 7: Use the concepts of homomorphism, isomorphism and automorphism to prove or disprove the given map is a homomorphism, isomorphism or automorphism.

CO 8: State isomorphism theorems and use them to work with quotient groups.

CO 9: Describe the structure of finite abelian group.

CO 10: Use Sylow's theorems to describe the structures of certain finite groups.

CO 11: State the definitions of ring, subring, ideal, ring homomorphism

Master of Science (Mathematics)
Semester-I
Session: 2021-22
Course Title: Algebra-I
Course Code: MMSL-1333

Examination Time: 3Hrs Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Groups: Definition & examples, Subgroups, Normal subgroups and Quotient Groups, Lagrange's Theorem, Generating sets, Cyclic Groups.

Unit–II

The Commutator subgroups, Homomorphism, Isomorphism Theorems, Automorphisms, Permutation groups, the alternating groups, Simplicity of A_n, n, Cayley's theorem. Direct Products: External and Internal. Fundamental theorem of finitely generated Abelian groups (Statement only) and applications.

Unit–III

Structure of finite Abelian groups. Conjugate elements, class equation with applications, Cauchy's Theorem, Sylow's Theorems and their simple applications, Solvable Groups, Composition Series, and Jordan Holder Theorem.

Unit–IV

Rings, Subrings, Ideals, Factor Rings, Homomorphism, Integral Domains. Maximal and prime ideals.

Text Book:
.Surjit Singh and Qazi Zameerudin : Modern Algebra by Vikas Publishing.

Reference Books:
1.Herstein, I.N. : Topics in Algebra, Willey Eastern 1975.
2.Fraleigh, J. B : An Introduction to Abstract Algebra.

Master of Science (Mathematics)

Semester-I

Session: 2021-22

Course Title: Mechanics-I

Course Code: MMSL-1334

Course Outcomes

After the successful completion of the course, the students will be able to

CO 1: Determine velocity and acceleration of a particle along a curve , differentiate between radial and transverse components.

CO 2: Apply knowledge of angular velocity in circular motion to explain natural physical process and related technological advances.

CO 3: Understand and define the concept of Newton's law of motion and identify situations from daily life that they can explain with the help of these laws.

CO 4: Define Work, energy, power, conservative forces and impulsive forces.

CO 5: Define and differentiate between uniform acceleration motion, resisted motion, and simple harmonic motion.

CO 6: Solve complex problems related to projectile motion under gravity, constrained particle motion and angular momentum of a particle; define cycloid and its dynamical properties.

CO 7: Manage to solve problems related to reciprocal polar coordinates, pedal coordinates and equation, apply Kepler's law of planetary motion and Newton's law of gravitation in real life problems.

CO 8: Understand the concept of moment of inertia of a rigid body rotating about a fixed point, Momental ellipsoid and coplanar distribution.

Master of Science (Mathematics)

Semester-I

Session - 2021 -22

Course Title: Mechanics-I

Course Code : MMSL-1334

Examination Time: 3Hrs Max. Marks: 100

Theory:80 CA:20

Instructions for the paper setters/examiners:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

Velocity and acceleration of a particle along a curve, Radial & Transverse components (plane motion). Relative velocity and acceleration. Kinematics of a rigid body rotating about a fixed point. Vector angular velocity, General motion of a rigid body, General rigid body motion as a screw motion. Composition of angular velocities. Moving axes. Instantaneous axis of rotation and instantaneous centre of rotation.

Unit-II

Newton's laws of motion, work, energy and power. Conservative forces, potential energy. Impulsive forces, Rectilinear particle motion:- (i) Uniform accelerated motion (ii) Resisted motion (iii) Simple harmonic motion (iv)Damped and forced vibrations. Projectile motion under gravity, constrained particle motion, angular momentum of a particle. The cycloid and its dynamical properties.

Unit-III

Motion of a particle under a central force, Use of reciprocal polar coordinates, pedal- co- ordinates and equations. Kepler's laws of planetary motion and Newton's Law of gravitation. Disturbed orbits, elliptic harmonic motion (scope and standard of syllabus is the same as given by Chorlton).

Unit-IV

Moments and products of Inertia, Theorems of parallel and perpendicular axes, angular motion of a rigid body about a fixed point and about fixed axes. Principal axes, Kinetic energy of a rigid body rotating about a fixed point, Momental ellipsoid, equimomental systems, coplanar distribution.

Text Book:

Chorlton, F : Text Book of Dynamics

Reference Books:

1.Loney, S.L. : Dynamics of rigid body

2. Rutherford, D.E. : Classical Mechanics.

Master of Science (Mathematics)
Semester-I
Session:2021-22
Course Title: Differential Equations
Course Code : MMSL-1335
Course outcomes

After studying this course students will be able to

CO 1: Analyse real world scenarios to recognize when ordinary differential equations or system of ordinary differential equations are appropriate and formulate problems about the scenarios.

CO 2: Work with ordinary differential equations and system of ordinary differential equations and use correct mathematical terminology to solve these equations.

CO 3: Express the basic existence theorem for higher order linear differential equations.

CO 4: Perform Laplace Transform in finding the solution of linear differential equations and explain basic properties of Laplace transform and also express the inverse Laplace transform.

CO 5: Perform Fourier Transform in finding the solution of linear differential equations and explain basic properties of Fourier transform and also express the inverse Fourier transform.

CO 6: Solve total differential equations and simultaneous differential equations and will calculate orthogonal trajectories of different curves and will learn Sturm Comparison Theorem and Sturm Separation Theorem and also learn to apply these theorems to solve various problems.

Master of Science (Mathematics)

Semester-I

Session:2021 -22

Course Title : Differential Equations

Course Code : MMSL-1335

Examination Time: 3Hrs Max.Marks:100

Theory:80

CA:20

Instructions for the paper setters/examiners:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Existence and uniqueness theorem for solution of the equation f (x, y) dx , The method ofdy successive approximation, general properties of solution of linear differential equation of order n, adjoint and self-adjoint equations, Total differential equations. Simultaneous differential equations, orthogonal trajectories, Sturm Liouville's boundary value problems. Sturm comparison and Separation theorems, Orthogonality solution.

Unit-II

Laplace Transform: Definition, existence, and basic properties of the Laplace transform, Inverse Laplace transform, Convolution theorem, Laplace transform solution of linear differential equations and simultaneous linear differential equations with constant coefficients.

Unit-III

Fourier Transform: Definition, existence, and basic properties, Convolution theorem, Fourier transform of derivatives and Integrals, Inverse Fourier transform, solution of linear ordinary differential equations, Complex Inversion formula.

Unit-IV

Special Functions: Solution, Generating function, recurrence relations and othogonality of Legendre polynomial, Bessel functions, Hermite and Laguerre polynomials.

Text Book:

M.D. Raisinghania: Advanced Differential Equations, S.Chand Publishing

Reference Books:

1.Piaggio: Differential equations.
2.Ross, S.L.: Differential equations.
3. Rainvile: Special Functions.
4.Watson, G.N.: A treaties on the theory of Bessel functions.
5.Coddington, E.A.: Introduction to Ordinary Differential Equations.

Kanya Maha Vidyalaya , Jalandhar(Autonomous)

Scheme and Curriculum of Examinations of Two Year Degree Programme
Master of Science (Mathematics) Semester-II
Session 2021-22

Master of Science (Mathematics) Semester II							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MMSL-2331	Real Analysis-II	C	100	80	-	20	3
MMSL-2332	Tensors and Differential Geometry	C	100	80	-	20	3
MMSL-2333	Algebra-II	C	100	80	-	20	3
MMSL-2334	Mechanics-II	C	100	80	-	20	3
MMSL-2335	Differential and Integral Equations	C	100	80	-	20	3
Total			500				

C-Compulsory

Master of Science (Mathematics)
Semester-II
Session 2021-22
Course Title: Real Analysis-II
Course Code : MMSL-2331
Course Outcomes

After the completion of this program, students should be able to

CO 1: Differentiate between sequence and series of functions and able to solve problems related to uniform convergence and differentiation and use the polynomials to approximate a function.

CO 2: Understand the fundamentals of measure theory which include the topics of outer measure, measurable sets, non-measurable sets, measurable functions.

CO 3: Manage to understand Little wood's three principles and apply Lebesgue Integral on different kind of function and also to make comparison between Riemann Integral and Lebesgue Integral.

CO 4: Demonstrate Differentiation and Integration and Solve Problems related to Absolute Continuity.

Master of Science (Mathematics)
Semester-II
Session 2021-22
Course Title: Real Analysis-II
Course Code : MMSL-2331

Examination Time: 3 Hours Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section

Unit-I

Sequence and Series of functions: Discussion of main problem, Uniform Convergence, Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous families of functions, Arzela's Theorem, Weierstrass Approximation theorem.

Unit-II

Outer Measure, Lebesgue Measure, Properties of Measurable Sets, Non Measurable Sets, Measurable Functions: Definition & Properties of Measurable functions.

Unit-III

Characteristic functions, Step Functions and Simple Functions, Little wood's three Principles, Lebesgue Integral: Lebesgue Integral of bounded function, Comparison of Riemann and Lebesgue Integral, Integral of a non negative function, General Lebesgue Integral, Convergence in measure.

Unit-IV

Differentiation and Integration: Differentiation of monotone functions, Differentiation of an integral, Absolute Continuity.

Text Book:

1.Malik, S.C. :Mathematical Analysis, Wiley Eastern

Reference Books:

1. Walter Rudin :Principles of Mathematical Analysis (3rd edition) McGraw Hill Ltd. Ch. 7 (7.1-7.27)
2. Royden, H.L. :Real Analysis, Macmillan Co. (Ch. 3, 4, 5 excluding section 2, 5)
3. Jain, P.K. and Gupta, V.P. : Lebesgue Measure and Integration.
4. Barra, G De. : Introduction to Measure Theory, Van Nosh and Reinhold Company

Master of Science (Mathematics)
Semester-II
Session 2021-22
Course Title: Tensors and Differential Geometry
Course Code : MMSL-2332
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand tensor variables, metric tensor, contra-variant, covariant and mixed tensors & and able to apply tensors among mathematical tools for invariance.

CO 2: Understand the reason why the tensor analysis is used and explain usefulness of the tensor analysis.

CO 3: Able to explain the concept of theory of space curve, contact between curves and surfaces, locus of centre of curvature, spherical curvature as well as to calculate the curvature and torsion of a curve.

CO 4: Understand the concept of Spherical indicatrix, envelopes, and two fundamental forms, lines of curvature, principal curvature and to calculate the first and second fundamental forms of a surface.

CO 5: Manage to solve problems related to Geodesics curvature, mean curvature, curvature lines, and asymptotic lines.

Master of Science (Mathematics)
Semester-II
Session 2021-22
Course Title: Tensors and Differential Geometry
Course Code : MMSL-2332

Examination Time: 3 Hours Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section

Unit-I

Notation and summation convention, transformation law for vectors, Kronecker delta, Cartesian tensors, addition, multiplication, contraction and quotient law of tensors. Differentiation of Cartesians tensors, metric tensor, contra-variant, covariant and mixed tensors, Christoffel symbols. Transformation of christoffel symbols and covariant differentiations of a tensor.

Unit-II

Theory of Space Curves: Tangent, principal normal, bi-normal, curvature and torsion. Serret frenetformulae.Contact between curves and surfaces. Locus of centre of curvature, spherical curvature, Helices. Spherical indicatrix, Bertrand curves.

Unit-III

Surfaces, envelopes, edge of regression, developable surfaces, two fundamental forms. Unit-IV Curves on a surface, Conjugate Direction, Principle Directions, Lines of Curvature, Principal Curvatures, Asymptotic Lines. Theorem of Beltrami and Enneper, Mainardi- Codazzi equations.

Unit-IV

Geodesics, Differential Equation of Geodesic, torsion of Geodesic, Geodesic Curvature, Clairaut's theorem, Gauss- Bonnet theorem, Joachimsthal's theorem, Geodesic Mapping, Tissot's theorem.

Text Book:

1. Gupta, Malik and Pundir: Tensors and Differential Geometry, Pragati Publications.

Reference Books:

1. Lass, H.: Vector and Tensor Analysis
2. Shanti Narayan: Tensor Analysis
3. Weather burn, C.E.: Differential Geometry
4. Willmore, T.J.: Introduction to Differential Geometry
5. Bansi Lal. Differential Geometry

Master of Science (Mathematics)
Semester-II
Session: 2021-22
Course Title: Algebra-II
Course Code : MMSL-2333

Course Outcomes

After passing this course, the students will be able to:

CO 1: State definitions of important classes of rings associated with factorization: Unique Factorization Domain, Principal Ideal Domain, and Euclidean Domains. Show that a given ring falls into one of these classes (or not). Relate these classes of rings to each other.

CO 2: Explain the notion of an extension of a field.

CO 3: State the definitions of algebraic extension, finite extension, simple extension, separable extensions, splitting field and Galois extension. Identify in specific examples whether an extension satisfies one of these properties.

CO 4: Describe the structure of finite fields.

CO 5: Do computations in specific examples of finite fields.

CO 6: Relate the concept of solvability by radicals to Galois groups.

CO 7: State the definition of constructible point, line and number. Relate constructability to field extension degrees.

CO 8: Check if a given set is a module or not. State the definitions of a sub module and quotient module. Compute with quotient module. State the definitions of module homomorphism's, Isomorphism theorems for modules and apply them where appropriate to analyze structure of modules.

CO 9: Define free module, generating set, cyclic module.

Master of Science (Mathematics)
Semester-II
Session- 2021-22
Course Title: Algebra-II
Course Code : MMSL-2333

Examination Time: 3 Hours Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

The field of Quotients of an integral domain. Principal Ideal domains, Euclidean Rings. The ring of Gaussian Integers, Unique Factorization domains, Polynomial Rings, Gauss's theorem and irreducibility of a polynomial.

Unit-II

Extension Fields: Finite and Infinite, Simple and Algebraic Extensions, Splitting fields: Existence and uniqueness theorem. Separable and inseparable extensions, perfect fields, finite fields.

Unit-III

Existence of GF(pn), construction with straight edge ruler and compass, GaloisTheory: Group of automorphisms of a field. Normal extensions and Fundamental Theorem of Galois theory. Symmetric rational functions, Solvability by radicals.

Unit-IV

Modules, Cyclic Modules, simple modules, Free Modules, Fundamental structure theorem for finitely generated modules over a P.I.D. (Statement only).

Text Book:
.Surjit Singh and QaziZameerudin : Modern Algebra by Vikas Publishing.
Reference Books:

1. Herstein, I.N. : Topics in Algebra, Willey Eastern 1975. 2
2. Fraleigh, J. B. : An Introduction to Abstract Algebra.
3. Bhattacharya, P.B., Jain, : Basic Abstract Algebra (1997); Ch-14 (Sec. 1-5) S.K. & Nagpal S.R.
4. Joseph A. Gallion: Contemporary Abstract Algebra.

Master of Science (Mathematics)
Semester-II
Session :2021-22
Course Title: Mechanics – II
Course Code : MMSL-2334
Course Outcomes

On the Successful completion of this course, the students will be able to

CO 1: Define general motion of a rigid body, linear momentum of a system of particles, angular momentum of a system, use of centroid, moving origins and impulsive forces.
CO 2: Illustrate the laws of motion, law of conservation of energy and impulsive motion.
CO 3: Manage to solve Euler's dynamical equation for the motion of a rigid body about a fixed point and state the properties of a rigid body motion under no force.
CO 4: Understand the concept of generalized coordinates and velocities, virtual work, generalized forces and solve Lagrange's equation for a holonomic system and impulsive forces.
CO 5: Demonstrate the concept of Kinetic energy as a quadratic function of velocities and equilibrium configuration for conservative holonomic systems.
CO 6: Work and communicate effectively on linear functional, Euler's-Lagrange's equations of single independent and single dependent variable.
CO 7: Recognize Brachistochrone problem, Hamilton's Principle, Principle of Least action, differentiate between Hamilton's Principle and the Principle of Least action.
CO 8: Find approximate solution of BVP using Rayleigh-Ritz Method.

Master of Science (Mathematics)
Semester-II
Session: 2021-22
Course Title: Mechanics -II
Course Code : MMSL-2334

Examination Time: 3 Hours Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

General motion of a rigid body, linear momentum of a system of particles. Angular momentum of a system, use of centroid, moving origins, impulsive forces. Problems in two-dimensional rigid body motion, law of conservation of Angular momentum, illustrating the laws of motion, law of conservation of energy, impulsive motion.

Unit-II

Euler's dynamical equations for the motion of a rigid body about a fixed point, further properties of rigid body motion under no forces. Problems on general three-dimensional rigid body motion.

Unit-III

Generalized co-ordinates and velocities Virtual work, generalized forces. Lagrange's equations for a holonomic system and their applications to small oscillation. Lagrange's equations for impulsive forces. Kinetic energy as a quadratic function of velocities. Equilibrium configurations for conservative holonomic dynamical systems. Theory of small oscillations of conservative holonomic dynamical systems (Scope and standard of the syllabus is the same as given by Chorlton).

Unit-IV

Linear functional, Extremal. Euler's - Lagrange's equations of single independent and single dependent variable. Brachistochrone problem, Extension of the variational method. Hamilton's Principle, Principle of Least action. Distinctions between Hamilton's Principle and the Principle of Least Action. Approximate solution of boundary value problems:- Rayleigh-Ritz Method.

Text Book:
1.Chorlton, F : Text Book of Dynamics
Reference Books:
1. Elssgists, L.: Differential equations and the calculus of variations.
2. Gupta: Calculus of Variation with Application. (PHI Learning Pvt. Ltd.)

Master of Science (Mathematics)
Semester-II
Session: 2021-22
Course Title: Differential and Integral Equations
Course Code : MMSL-2335
Course Outcomes

On satisfying the requirements of this course, students will have the Knowledge and skills to
CO 1: Apply a range of techniques to find solutions of partial differential equations.
CO 2: Understand basic properties of standard partial differential equations.
CO 3: Demonstrate accurate and efficient use of Fourier analysis techniques and their applications in the theory of partial differential equations.
CO 4: Demonstrate capacity to model physical phenomenon using partial differential equations in particular using the Heat and Wave equations.
CO 5: Apply problem solving using concepts and techniques from partial differential equations and Fourier analysis applied to diverse situations in physics, engineering, financial mathematics and in other mathematical contexts.
CO 6: Have acquired sound knowledge of Green's functions and Fredholm and Volterra integral equations.
CO 7:Perform various techniques to solve homogeneous and non-homogeneous Fredholm and Volterra Integral equations.

Master of Science (Mathematics)
Semester-II
Session 2021-22
Course Title: Differential and Integral Equations
Course Code : MMSL-2335

Examination Time: 3 Hours Max. Marks:100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Partial Differential Equations of First Order: origin of first order partial differential equations. Cauchy problem of first order equations. Integral surface through a given curve. Surface orthogonal to given system of surfaces. Non linear p.d.e of first order, Charpit's method and Jacobi's method. Partial differential equations of the 2nd order. Origin of 2nd order equations. Linear p.d.e. with constant coefficients and their complete solutions.

Unit-II

Second order equation with variable coefficient and their classification and reduction to standard form. Solution of linear hyperbolic equation. Non-linear equations of second order, Monge's Method. Solution of Laplace, wave and diffusion equations by method of separation of variables and Fourier transforms. Green function for Laplace, waves and diffusion equation.

Unit-III

Volterra Equations : Integral equations and algebraic system of linear equations. Volterra equation L2 Kernels and functions. Volterra equations of first & second kind. Volterra integral equations and linear differential equations.

Unit-IV

Fredholm equations, solutions by the method of successive approximations. Neumann's series, Fredholm's equations with Pincherte-Goursat Kernel's, The Fredholm theorem (Scope same in chapters I and II excluding 1.10 to 1.13 and 2.7 of integral equations by F.G. Tricomi's.)

Text Books:
1.MD Raisinghania :Advanced Differential Equations , S Chand Publishing
2.MD Raisinghania : Integral equations and boundary value problems, S Chand Publishing

Reference Books:
1. Piaggio: Differential equations.
2. Tricomi, F.G.: Integral equation (Ch. I and II)
3. Kanwal R, P: Linear integral equations
4. Sneddon, I.N.: Elements of partial differential equations.
5. Levitt, W.W.: Integral Equations.
6. Mikhlin: Integral Equations.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Two Year Degree Programme
Master of Science (Mathematics) Semester-III
Session 2021-22

Master of Science (Mathematics) Semester-III							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MMSL-3331	Functional Analysis-I	C	100	80	-	20	3
MMSL-3332	Topology-I	C	100	80	-	20	3
Optional Subjects							
MMSL-3333 (OPT-II)	Integral Transforms	E	100	80	-	20	3
MMSL-3334 (OPT-III)	Statistics-I	E	100	80	-	20	3
MMSL-3335 (OPT-IV)	Operations Research-I	E	100	80	-	20	3
Total			500				

Note:
In addition to two compulsory papers in third and fourth semester, student has to choose three optional papers in each third and fourth semesters keeping in view the prerequisites and suitability of the combinations.

OPT-I Discrete Mathematics-I
OPT-II Integral Transforms
OPT-III Statistics-I
OPT-IV Operations Research-I
OPT-V Advanced Numerical Analysis
OPT-VI Discrete Mathematics-II
OPT-VII Number Theory
OPT-VIII Statistics-II
OPT-IX Operations Research-II
OPT-X Computer Programming with C

C-Compulsory
E-Elective

Master of Science (Mathematics)

Semester-III

Session:2021-22

Course Title:Functional Analysis-I

Course Code : MMSL-3331

Course outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of normal linear spaces like,$L^{P(n)}l$(infinite), quotient and LP-spaces.

CO 2: This area combines ideas from linear Algebra and analysis in order to handle infinite dimensional reactor spaces and linear mapping theorem.

CO 3: Correlate functional analysis with mathematical physics, partial differential equation, Mathematics and numerical analysis.

CO 4: Demonstrate the open mapping theorem, closed graph theorem and uniform bounded principal.

CO 5: Describe the concept of continuous linear transformation, equation noun and compactness.

Master of Science (Mathematics)

Semester-III

Session :2021-22

Course Title: Functional Analysis-I

Course Code: MMSL-3331

Examination Time: 3Hrs | Max. Marks: 100

Theory:80

CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Normed linear spaces, Banach spaces, subspaces, quotient spaces, L^P-spaces: Holder's and Minkowski's Inequalities, Convergence and Completeness, Riesz-Fischer Theorem, Continuous linear transformations, equivalent norms.

UNIT-II

Finite dimensional normed linear spaces and compactness, Riesz Theorem, The conjugate space N*, The Hahn-Banach theorem and its consequences, natural imbedding of N into N**, reflexivity of normed spaces.

UNIT-III

Open mapping theorem, projections on a Banach space, closed graph theorem, uniform boundedness principle, conjugate operators.

UNIT-IV

Inner product spaces, Hilbert spaces, orthogonal complements, orthonormal sets, the conjugate space H*.

Text Book:
P.K.Jain, O.P Ahuja: Functional Analysis, New Age International (P) Ltd. Publishers

Reference Books:
1. K. Chanrashekhra Rao: Functional Analysis, Narosa, 2002
2. D. Somasundram A First Course in Functional Analysis, Narosa, 2006.
3. Royden, H. L.:Real Analysis, Ch 6 (Sections 6.1 -6.3), Macmillan Co.
4. Erwin Kreyszig: Introduction to Functional Analysis with Applications,
John Wiley & Sons, 1978.

Master of Science (Mathematics)

Semester-III

Session:2021-22

Course Title :Topology-I

Course Code: MMSL-3332

Course Outcomes

. Upon successful completion of this course the student will be able to:

CO 1: Demonstrate knowledge and understanding of concepts such as open and closed sets, closure and boundary.

CO 2: Apply theoretical concepts in topology to understand real world application.

CO 3: Will understand the behaviour of sequence in different topological spaces.

CO 4:Create new topological spaces by using subspace and product topologies.

CO 5:Know and understand the concepts related to separation axioms such as T_0, T_1 and, T_2 spaces.

Master of Science (Mathematics)

Semester-III

Session-2021-22

Course Title: Topology-I

Course Code: MMSL-3332

Examination Time: 3Hrs | Max. Marks: 100

Theory:80

CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Topological Spaces, Basic concepts :- closure, interior, exterior and boundary of a set, Dense sets, Closure operator [Kuratowski function] and Interior operator, Neighbourhood's and Neighbourhood system .Coarser and finer topologies. Local bases, bases and sub – bases for a topological space. Convergence of a sequence. First and second countable spaces. Lindeloff spaces, Separable spaces. Sub-spaces, Hereditary properties.

UNIT-II

Separated sets, connected sets, Connected and disconnected spaces, Connectedness on real line. Components, locally connected space. Totally disconnected space. Continuous functions, Restriction and extension of a mapping. Sequential continuity at point.Invariants under a continuous mapping. Open and closed mappings. Homeomorphism and embedding. Topological properties.

UNIT-III

Separation Axioms: T0, T1, T2 – spaces. Regular spaces, T3 – spaces, Normal spaces, T4 – space. Tychonoff lemma, Urysohn lemma, Tietze extension theorem.

UNIT-IV

Product of two spaces, The product of n spaces. Base for a finite product topology. General product spaces. Sub-base and base for product topology. Productive properties. Quotient spaces.

Text Book:

J.R.Munkers : Topology

Reference Books:

1. T.O. Moore : Elementary general Topology (Chapters 2–8).
2. J.L. Kelley: General Topology (Chapters 1–5).
3. G.F. Simmons : Introduction to Topology and Modern Analysis.
4. S.W. Davis : Topology, McGraw Hill 2005.

Master of Science (Mathematics)

Semester-III

Session-2021-22

Course Title: Integral Transforms

Course Code: MMSL-3333

Course Outcomes

Having Successfully completed this course the students will be able to:

CO 1: Understand how Integral Transforms can be used to solve a variety of Differential Equations.

CO 2: Understand purpose of Fourier series and Transformation.

CO 3: Know the use of Laplace Transform in Solving Boundary Value Problems.

CO 4: Use Z-Transform in the characterization of Linear Time Invariant System in development of Scientific Simulation algorithms.

CO 5: Recognize the different methods of finding Laplace Transforms and Fourier Transforms of different functions.

CO 6: Apply the knowledge of linear Transforms, Fourier Transforms and Finite Fourier Transforms in finding the solutions of Differential Equations ,Initial value problems and Boundary value problems.

Master of Science (Mathematics)

Semester-III

Session-2021-22

Course Title : Integral Transforms

Course Code: MMSL-3333

Examination Time: 3Hrs Max. Marks: 100

Theory:80
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Finite Fourier Transforms : Finite Fourier sine, cosine transforms, inversion formula for sine & cosine transforms, multiple finite Fourier transforms, problems related to finite Fourier transforms, Applications of Fourier transforms in initial and boundary value problems.

UNIT-II

Application of Laplace Transforms in Initial and Boundary Value Problems: Heat conduction equation, wave equation, Laplace equation and problems based on above equations.

UNIT-III

Hankel Transforms: Hankel transforms, inversion formula for the Hankel transform, infinite Hankel transform, Hankel transform of the derivative of a function, Parseval's theorem. The finite Hankel transforms, Applications of Hankel transform in boundary value problems.

UNIT-IV

Z- Transform, Convergence, properties of Z-Transform, convolution theorem, Inverse Z-transforms, Applications to Difference equations.

Text Book:

Integral Transform : J.K.GOYAL ,K.P.GUPTA
Publisher : PragatiPrakashan

Reference Books:

1.IanN.Sneddon: The Uses of Integral Transforms
2.Churchill,R.V.: Operational Mathematics
[Chapters I, II, III (28-36), IV (40-49), VI (65-68, 70), VII, XI (119-124,129), XII, XIII (138-144), XIV (148-150,152)]
3.Integral Transforms and Fourier Series : A.N.Srivastava, Mohammad Ahmad
Publisher : Narosa publishing house
4.Integral Transforms and Fourier Series: Cambridge International Press.

Master of Science (Mathematics)

Semester-III

Session-2021 -22

Course Title: Statistics-I

Course Code: MMSL-3334

Course Outcomes

Upon the successful completion of course, students will be able to:

CO 1: Distinguish between different types of data

CO 2: Interpret examples of methods for summarizing data sets, including common graphical tools such as histogram and summary statistics such as mean median mode and variance.

CO 3: Find the probability of single even and complementary event

CO 4: Contrast discrete and continuous random variable.

CO 5: Apply general properties of expectations and variance.

CO 6: Compute probabilities for Binomial and Poisson distribution

Master of Science (Mathematics)

Semester-III

Session-2021-22

Course Title: Statistics-I

Course Code: MMSL-3334

Examination Time: 3Hrs Max. Marks: 100

Theory:80

CA:20

Instructions for the paper setters/examiners:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

UNIT-I

Measures of central tendency and dispersion, moments, Measures of skewness and kurtosis, Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem. Random variable, probability mass function, probability density function, cumulative distribution function

UNIT-II

Two and higher dimensional random variables, joint distribution, marginal and conditional distributions, Stochastic independence, function of random variables and their probability density functions, Mathematical expectations and moments, moment generating function and its properties

UNIT-III

Chebyshev’s inequality and its application, stochastic convergence, central limit (Laplace theorem Linder berg, Levy's Theorem). Discrete Probability Distributions: Bernoulii, Binomial, Poisson, Negative Binomial, Geometric Distribution (For distributions only Mean, Variance, Moment Generating Function).

UNIT-IV

Continuous probability distributions: Uniform, Normal , Gamma , Beta , Exponential distributions. (For distributions only Mean, Variance, Moment Generating Function), Least square principle, correlation and linear regression analysis for bi-variate data, Theory of attributes: independence of attributes, association of attributes.

Text Book:

S.C. Gupta and V.K.Kapoor: Fundamentals of Mathematical Statistics.

(Scope in chapters 2-8)

Reference Books:

1.A.M. Mood, F.A. Graybill, D.C. Boes : Introduction to the Theory of Statistics

2.A.M. Goon , M.K. Gupta & B. Dasgupta: Fundamentals of Statistics Vol-I.

Master of Science (Mathematics)

Semester-III

Session-2021-22

Course Title: Operations Research-I

Course Code: MMSL-3335

Course outcomes

After studying this course students will be able to:

CO 1: Identify and develop operational research models from the verbal description of the real system.

CO 2: Understand the mathematical tools that are needed to solve optimization problems.

CO 3: Identify optimum solutions.

CO 4: Determine better solutions in decision making problems with great speed, competence and confidence.

CO 5: Plan optimum allocation of various limited resources such as men, machines, material, time, money etc. for achieving the optimum goal.

CO 6: Find out a profit plan for the company.

CO 7: Plan, forecast and make rational decisions.

CO 8: Construct linear programming and integer linear programming models and discuss the solution techniques.

CO 9: Apply the Duality concepts to find the solutions of the primal problems.

CO 10: Analyze the transportation and assignment problems and solve those using mathematical models.

CO 11: Explain fundamentals of Dynamic Programming.

Master of Science (Mathematics)

Semester-III

Session-2021-22

Course Title: Operations Research-I

Course Code: MMSL-3335

Examination Time: 3Hrs Max.Marks:100

Theory:80

Instructions for the paper setters/examiners: CA:20

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator.
The question paper must contain 30% of the article/theory from the syllabus.

UNIT-I

The linear programming problem, properties of a solution to the linear programming problem,generating extreme point solution, simplex computational procedure, development of minimum feasible solution, the artificial basis techniques, a first feasible solution using slack variables, two phase and Big-M method with artificial variables.

UNIT-II

General Primal-Dual pair, formulating a dual problem, primal-dual pair in matrix form, Duality theorems, complementary slackness theorem, duality and simplex method, economic interpretation of duality, dual simplex method, Integer Programming: Gomory's all I.P.P. method, constructions of Gomory's constraints, Fractional cut method-all integer and mixed integer, Branch-and-Bound method, applications of integer programming.

UNIT-III

General transportation problem, transportation table, duality in transportation problem, loops in transportation tables, LP formulation, solution of transportation problem, test for optimality, degeneracy, transportation algorithm (MODI method), time- minimization transportation problem.Mathematical formulation of assignment problem,assignment method, typical assignment problem, the traveling salesman problem.

UNIT-IV

Game Theory: Two-person zero-sum games, maximin-minimax principle, games without saddle points(Mixed strategies), graphical solution of2 * n and m * 2 games, dominance property, arithmetic method of n * n games, general solution of m * n rectangular games.

Game Theory: Two-person zero-sum games, maximin-minimax principle, games without saddle points(Mixed strategies), graphical solution of2 * n and m * 2 games, dominance property, arithmetic method of n * n games, general solution of m * n rectangular games.

Dynamic Programming: The recursive equation approach, characteristics of dynamic programming, dynamic programming algorithm, solution of-Discrete D.P.P. , some applications, solution of L.P.P. by Dynamic Programming.

Text Book:

KantiSawrup, Gupta,P.K. and Manmohan: Operations Research.

Reference Books:

1. Kambo, N. S.: Mathematical Programming.
2. Sharma S.D.: Operations Research.
3.Taha, H.A.: Operations Research.

Kanya Maha Vidyalaya, Jalandhar(Autonomous)

Scheme and Curriculum of Examinations of Two Year Degree Programme
Master of Science (Mathematics) Semester-IV
Session 2021-22

Master of Science (Mathematics) Semester-IV							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MMSL-4331	Functional Analysis-II	C	100	80	-	20	3
MMSL-4332	Topology-II	C	100	80	-	20	3
MMSL-4333	Number Theory	C	100	80	-	20	3
MMSL-4334	Operations Research-II	C	100	80	-	20	3
MMSM-4335	Statistics-II	C	100	60	20	20	3+3
Total			500				

C-Compulsory

Master of Science (Mathematics) Semester-IV
Session 2021-22
Course Title: Functional Analysis-II
Course Code: MMSL-4331
Course Outcomes

After passing this course, the students will be able to:
CO 1: Understand the concept of strong and weak convergence in finite and infinite dimensional normed linear spaces.
CO 2: Describe the different operator like, adjoint of an operator, self adjoint operator, and unitary operator.
CO 3: Demonstrate how to find the eigen values and egien vectors for finite dimensional spaces.
CO 4: Classify the regular and singular elements.
CO 5: To know the topological division of zeros and formulate for spectral radius.

Master of Science Mathematics
Semester-IV
Session 2021-22
Course Title: Functional Analysis-II
Course Code: MMSL-4331

Examination Time: 3 Hours

Max Marks: 100
Theory: 80
CA: 20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Strong and weak convergence in finite and infinite dimensional normed linear spaces. Weak convergences in Hilbert spaces, weakly compact sets in Hilbert spaces, The adjoint of an operator, self adjoint operators, normal operators, Unitary operators.

UNIT-II

Finite dimensional spectral Theory.: Eigen- values and Eigen vectors, Spectrum of a bounded linear operator, spectrum of self-adjoint, positive and Unitary operators. Spectral Theorem fornormal operators.

UNIT-III

Compact Linear Operator on normed spaces, properties of compact linear operators, spectral properties of compact linear operators.

UNIT-IV

Banach algebras: definitions and simple examples. Regular and singular elements. Topological divisors of zero, Spectrum of an element of Banach Algebra, formula for spectral radius.

Text Books:

1. Erwin Kreyszig: Introduction to Functional Analysis with Applications, Ch 8, Sections 8.1-8.3, John Wiley & Sons (1978).
2. Somasundram D.: A first course in Functional Analysis, Narosa, 2006

Reference Books:

1. Jain, P.K., Ahuja, O.P & Khalil Ahmed: Functional Analysis, New Age International (P) Ltd. Publishers, 1995.
2. Chandrasekhra Rao, K.: Functional Analysis, Narosa, 2002.

Master of Science (Mathematics)
Semester-IV
Session 2021-22
Course Title: Topology-II
Course Code : MMSL-4332
Course Outcomes

After passing this course, the students will be able to:
CO 1:Demonstrate knowledge and understanding of Metric spaces & Metrizability of topological spaces.
CO 2: Understand terms, definitions & theorems related to Net, Filter,Ultra filter and Compactness.
CO 3: Apply theoretical concepts in topology to understand real world application
CO 4: Will be able to work with new ideas in mathematics
CO 5: To know the importance of topology in mathematics and its application in Physics, chemistry and human sciences.

Master of Science (Mathematics)
Semester-IV
Session : 2021-22
Course Title: Topology-II
Course Code : MMSL-4332

Examination Time: 3Hours

Max. Marks: 100
Theory:80
CA:20

Instructions for the paper setters/examiners
Eight questions of equal marks (16 marks each)are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Higher Separation Axioms: Completely regular spaces. Tychonoff spaces, Completely normal space, T5 – spaces. Metric spaces as Hausdorff regular, normal and completely normal space. Product of metric spaces.

UNIT-II

Compact spaces, Compact sets, Subsets of compact space. Finite intersection property. Compactness of subsets of real line. Relation of compact spaces with Hausdorff spaces, Regular spaces and normal spaces. Sequentially compact spaces, Bolzano Weierstrass property. Countably compact spaces. Locally compact spaces. Compactness in terms of base elements and sub – base elements. Tychonoff theorem. One point compactification.

UNIT-III

The Stone-Čechcompactification, Evaluation mappings, Separate point family, Separate point and closed set family. Embedding lemma, Tychonoff cube, Embedding theorem, Metrization. Urysohnmetrization theorem.

UNIT-IV

Directed sets and nets. Convergence of a net in a space, Clustering of a net, nets and continuity, Nets in product spaces, Ultra nets. Compactness in term of nets, Topologies determined by nets. Filters and their convergence. Canonical way of converting nets to filters and vice-versa. Ultra-filters and compactness.

Text Book:

1. J.R. Munkres :Topology, Pearson Publications.

Reference Books:

1. T.O. Moore :Elementary general topology (Chapter 2 to 8).
2. J.L. Kelley:General Topology (Chapter 1to 5)
3. G.F. Simmons :Introduction to Topology and Modern Analysis.
4. S.W. Davis :Topology, McGraw Hill 2005.

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Master of Science Mathematics Semester-IV

Session 2021-22

Course Title: Number Theory

Course Code: MMSL-4333

Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Prove results involving divisibility and greatest common divisors.

CO 2: Solve system of linear congruences.

CO 3: Find integral solutions of specified linear Diophantine equation.

CO 4: Apply Euler- Fermat's theorem to prove relation involving prime numbers.

CO 5: Apply the Wilson's theorem to solve numerical problems.

CO 6: To understand the criterion for an integer to be expressed as sum of two squares and sum of four squares.

CO 7: Apply the Pell's equation to real life problems.

CO 8: Understand the basic concept of periodic and purely periodic continued fractions.

Master of Science (Mathematics)
Semester-IV
Session 2021-22
Course Title: Number Theory
Course Code: MMSL-4333

Examination time: 3 Hours

Max. Marks: 100

Theory: 80
CA: 20

Instructions for the paper setters/examiners
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Simultaneous Linear Congruences, Chinese Remainder theorem with applications, Wolsten-Holme's theorem, Lagrange's proof of Wilson theorem, Fermat numbers, The order of an integer modulo n. Primitive roots, Existence and number of primitive roots.

UNIT-II

Indices and their applications, Quadratic residues , Euler's criterion, Product of quadratic residues and quadratic non-residues, The Legendre symbol and its properties, Gauss's Lemma, Quadratic reciprocity law, Jacobian symbol and its properties..

UNIT-III

Arithmetic functions τ (n), σ (n), σ_k (n), μ (n) , Perfect numbers, Mobius inversion formula, Diophantine equation $x^2 + y^2 = z^2$and its applications to $x^n + y^n = z^n$ when n=4. Criterion for an integer to be expressible as sum of two squares and sum of four squares.

UNIT-IV

Fare series, Farey dissection of a circle and its applications to approximations of irrationals by rationals. Finite and Infinite simple continued fractions, periodic and purely periodic continued fractions, Lagrange's Theorem on periodic continued fractions. Applications to Pell's equation. The fundamental solution of Pell's equation.

Text Book
Burton, David M.: Elementary Number Theory ,McGraw Hill 2002

Reference Books:
1.Hardy and Wright: Theory of Numbers
2.Niven and Zuckerman: An introduction to number Theory

Master of Science (Mathematics)
Semester-IV
Session- 2021-22
Course Title: Operations Research-II
Course Code: MMSL-4334
Course Outcomes

After the completion of the course, the student will be able to:
CO 1: Identify and develop operational research models from the verbal description of the real system.
CO 2: Understand the mathematical tools that are needed to solve optimization problems.
CO 3: Identify optimum solutions.
CO 4: Determine better solutions in decision making problems with great speed, competence and confidence.
CO 5: Plan optimum allocation of various limited resources such as men, machines, material, time, money etc. for achieving the optimum goal.
CO 6: Find out a profit plan for the company.
CO 7: Plan, forecast and make rational decisions.
CO 8: Solve the Queuing problems using various Queuing models.
CO 9: Define the term inventory, list the major reasons for holding inventories, and list the main requirements for effective inventory management.
CO 10: Describe the economic order quantity model and solve typical problems.
CO 11: Determine the optimum replacement policies.
CO 12: Apply the Simulation techniques to solve business and industry problems.

Master of Science (Mathematics)
Semester-IV
Session 2021-22
Course Title: Operations Research-II
Course Code: MMSL-4334

Examination time: 3 Hours Max. Marks: 100

Theory: 80
CA: 20

Instructions for the paper setters/examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator.

Unit-I

Queueing Theory: Introduction, Queueing System, elements of queueing system, distributions ofarrivals, inter arrivals, departure and service times. Classification of queueing models, singleservice queueing model with infinite capacity (M/M/1): (∞/FIFO), Queueing Models: (M/M/1): (N/FIFO), Generalized Model: Birth-Death Process

Unit-II

(M/M/C):(∞/FIFO), (M/M/C) (N/FIFO), (M/M/R) (KIGD), Power supply model. Inventory Control: The inventory decisions, costs associated with inventories, factors affecting Inventory control, economic order quantity (EOQ), Deterministic inventory problems with no shortage and with shortages, EOQ problems with price breaks, Multi item deterministic problems.

Unit-III

Replacement Problems: Replacement of equipment/Asset that deteriorates gradually, replacement of equipment that fails suddenly, recruitment and promotion problem, equipment renewal problem.

Unit-IV

Need of simulation, methodology of simulation. Simulation models, event-type simulation, generation of random numbers, Monto-carlo simulation, simulation of inventory problems, queueing systems, maintenance problem, job sequencing.

Text Book:
1. Kanti Sawrup, Gupta,:P.K. and Manmohan : Operations Research
Reference Books:
1. Handley, G.: Mathematical Programming
2. Kambo, N.S.: Mathematical Programming
3. Panneerselvam, R. : Operations Research
4. Taha, H.A.: Operations Research

Master of Science in Mathematics
Semester-IV
Session 2021-22
Course Title: Statistics-II
Course Code: MMSM-4335

Course Outcomes

CO 1: Understand the concept of sampling distribution of statistics and in particular describe the behaviour of sample mean.
CO 2: Distinguish between population and sample and between parameters and statistics.
CO 3: Describe the property of unbiasedness.
CO 4: Interpret the confidence interval and confidence level.
CO 5: Identify the components of classical hypothesis test including the parameter of interest, the null and alternative hypothesis and test statistic.
CO 6: Compute or approximate the probable value of test statistic and explain two types of errors.
CO 7: State and apply the definitions of t, F and chi-square distribution in terms of standard normal.
CO 8: Demonstrate the techniques of one way and two ways ANOVA.

Master of Science in Mathematics
Semester-IV
Session 2021-22
Course Title: Statistics-II
Course Code: MMSM-4335

Examination Time: (3+3) Hours | Max. Marks: 100
Theory:60
Practical:20
CA:20

Instructions for the paper setters/examiners:
Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

UNIT-I

Sampling Distributions: Chi-square, t and F-distributions with their properties, distribution of sample mean and variance, distribution of order statistics and sample range from continuous populations.

UNIT-II

Point Estimation: Estimators, Properties of unbiasedness, consistency, sufficiency, efficiency, uniqueness and completeness, methods of estimation, Testing of Hypothesis: Null hypothesis and its test of significance, simple and composite hypothesis, M.P. test, UMP test, BLUE

UNIT-III

Likelihood ratio test (without properties), Applications of Sampling Distributions: Test of mean and variance in the normal distribution, Tests of single proportion and equality of two proportions, Chi-square test, t-test, F-test.

UNIT-IV

Analysis of variance, analysis of variance for one way and two-way classified data with one observation per cell.

Text Books

1. Gupta S.C. and Kapoor V.K. : Fundamental of Mathematical Statistics
2. Hogg R.V., Mckean, J.W. and Craig A.T. : Introduction to Mathematical Statistics

Reference Books:

1. Hoel P.G. : Introduction to Mathematical Statistics
2. Mukhopadhyay, P : Mathematical Statistics
3. Goon, A. M., Gupta M.K. & Dasgupta B. : Fundamental of Statistic, Vol I

Bachelor of Science (Honours) Mathematics
Session: 2021 -22
Programme Specific Outcomes

Upon successful completion of this course, students will be able to:

PSO1: Solve complex Mathematical problems by critical understanding, analysis and synthesis. Students will also be able to provide a systematic understanding of the concepts and theorem of Mathematics and their applications in the real world to an advanced level, enhance career prospects in a huge array of field suitable to succeed at an entry level position in Mathematics post graduate program.

PSO2: Demonstrate proficiency in Mathematics and the Mathematical concepts needed for a proper understanding of Physics, Chemistry, Electronics, Computer Science and Economics.

PSO3: Create and develop Mathematical software application using a systematic approach & apply discrete Mathematical concept to practical application.

PSO4: Demonstrate knowledge of Calculus I & II, Matrices and Theory of Equations, Analytical and Solid Geometry, Statics & Tensor Calculus and able to apply this knowledge to analyze a variety of Mathematical Phenomena.

PSO5: Demonstrate knowledge of physical chemistry & apply this knowledge to analyze a variety of chemical phenomena & will be able to interpret and analyze quantitative data.

PSO6: Understand and demonstrate the knowledge of Mechanics, area, volume and displacement with differential equation of the orbit.

PSO7: Understand the basic concepts and basic principles of Demand and Supply, Measurement of Price Elasticity of Demand and apply Economic theories to derive cost function from Production Function.

PSO8: Learn implications of Revenue curves and their mutual relationships.

PSO9: Develop statistical approach and mathematical thinking among students to problem solving on a diverse variety of disciplines.

PSO10: Have knowledge of computer fundamentals, able to handle practical programming problems using C and analyze large volume of data using various statistical techniques

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Science (Honours) Mathematics Semester-I
Session- 2021-22

Bachelor of Science (Honours) Mathematics Semester-I							
Course Code	Course type	Course Title	Max.Marks				Examination time in hours
			Total	Ext.		CA	
				L	P		
BOML-1421/ BOML-1031/ BOML-1431	C	Punjabi (Compulsory) [1] Basic Punjabi/ [2] PHC	50	40	-	10	3
BOML-1102	C	Communication Skills in English	50	40	-	10	3
BOML-1333	C	Calculus-I	100	80	-	20	3
BOML-1334	C	Coordinate Geometry	100	80	-	20	3
BOMM-1085 OR BOML-1175	C C	[5] Physical Chemistry OR [4]Micro Economics-I	100 100	60 80	*20* -	20 20	3+3 3
BOML-1336 OR BOMM-1396	C C	[4] Statics OR [5] Mechanics	100 100	80 60	- 20	20 20	3 3+3
AECD-1161	AC	[3] Drug Abuse: Problem, Management and Prevention (Compulsory)	50	40	-	10	3
SECF-1492	AC	[3] Foundation Course	25	20	-	5	1
		Total Marks	500				

Note:
[1] Special Course in lieu of Punjabi (Compulsory)
[2] Special Course in lieu of Punjabi (Compulsory) for those students who are not domicile of Punjab.
[3] Marks of these papers will not be added in total marks. Grades will be provided.
[4] Only those students can opt these courses who have not studied Chemistry at +2 level.
[5] Only those students can opt these courses who have studied Chemistry at +2 level.
C-Compulsory
AC-Audit Course

Bachelor of Science (Honours) Mathematics
Semester–I
Session- 2021-22
Course Title: Calculus-I
Course Code: BOML-1333

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand real number system, lub & glb of set of real numbers, limit of a function, basic properties of limit & to apply it in real world problem.

CO 2: Analyses continuous and discontinuous function, Apply concept of continuity in uniform continuity.

CO 3: Demonstrate Asymptotes, points of inflexion, multiple points on a curve & also to differentiate between concavity and convexity & hence tracing of curve.

CO 4: Apply reduction formula on different functions & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

CO 5 : To understand the concepts of Riemann sum, partitions, upper and lower sums, Riemann integrability of continuous functions and of monotone functions.

CO 6: To Classify the difference between increasing and decreasing functions.

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Bachelor of Science (Honours) Mathematics
Semester–I
Session-2021-22
Course Title: Calculus-I
Course Code: BOML-1333

Examination Time: 3 Hours

Max. Marks: 100
Theory: 80
CA:20

Instructions for Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I
Real line, intervals, l.u.b. and g.l.b., the l.u.b. property of real numbers and order properties of real numbers , Archimedean property, definition of the limit of a function of real variable, algebra of limits, continuity, classification of discontinuities

Unit II
Differentiability of functions of real variable, increasing and decreasing functions, maxima and minima, mean values theorems

Unit III
Intermediate-value theorems, Asymptotes, concavity and convexity, points of inflexion, curve tracing .

Unit IV
Anti derivative of function of real variable, Riemann sums, definite integrals and their properties, the fundamental theorem of calculus, applications to length of arc and area bounded between curves, Reduction Formulae.

Text Book:
George B. Thomas and Ross L. Finney,Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998(Scope as inCh.1-5)

Reference Books:
1. A.D.R. Choudary and C.P. Niculescu, Real Analysis on Intervals, Springer, 2014. (Chapter 1).
2. Kreyszig, E., Advanced Engineering Mathematics.
3. Ghorpade, Sudhir R., Limaye, Balmohan V. , A Course in Calculus and Real Analysis.

Bachelor of Science (Honours) Mathematics
Semester–I
Session- 2021 -22
Course Title: Coordinate Geometry
Course Code: BOML-1334

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of the geometry of lines and conics in the Euclidian plane.

CO 2: Develop geometry with a degree of confidence and will gain fluency in the basics of Euclidian geometry.

CO 3: Sketch conic sections; identify conic sections, their focal properties and classifications.

CO 4: Demonstrate the concept of parabola, ellipse, hyperbola, sphere and the general quadratic equation.

CO 5: Understand the concept of coordinate geometry on a wider scale with the help of shifting of origin and rotation of axis.

Bachelor of Science (Honours) Mathematics
Semester–I
Session 2021 -22
Course Title: Coordinate Geometry
Course Code: BOML-1334

Examination Time: 3 Hours | Max. Marks: 100
Theory: 80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit I

Pair of Straight lines: Joint equation of pair of straight lines and angle between them, condition of parallelism and perpendicularity, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

Unit II

Circle: General equation of circle, circle through intersection of two lines, tangent and normal, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in midpoint form, angle of intersection and orthogonality, power of a point w.r.t circle, radical axis, co-axial family of circles, limiting points.

Unit III

Conic sections: Parabola, ellipse and hyperbola, tangent and normal, chord of contact, pole and polar of tangent from a point, equation of chord in terms of midpoint, diameter, conjugate diameters of ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

Unit IV

Transformation of axes in two dimensions: shifting of origin, rotation of axes, the second degree equation $S=ax^2+2hxy+by^2+2gx+2fy+c=0$, its invariants t, Δ, and O. Reduction of the second degree equation into standard form. Identification of curves represented by S=0 (including pair of lines).Polar coordinates: Polar equations of straight lines, circles and conics.

Text Book:
Loney, S.L., The Elements of Coordinate Geometry, London, Macmillan

Reference Book:
P.K Jain and Khalil Ahmed, Text book of Analytical Geometry, New Age International Publishers

Bachelor of Science (Honours) Mathematics
Semester–I
Session-2021 -22
Course Title: Statics
Course Code: BOML-1336

Course Outcomes

After passing this course, the students will be able to:

CO 1: Apply parallelogram law of forces, triangle law of forces, Lami's theorem to real life problems.

CO 2: Understand that how one can resolve number of coplanar forces, parallel forces and concurrent forces acting at a body.

CO 3: Find the moments of number of coplanar forces acting at a particle

CO 4: Find the resultant of a force and couple acting on a body.

CO 5: Find the applications of CG of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.

Bachelor of Science (Honours) Mathematics
Semester-I
Session 2021 -22
Course Title: Statics
Course Code: BOML-1336

Examination Time: 3 Hours | Max. Marks: 100

Theory:80

CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit I
Composition and resolution of forces (parallelogram law, triangle law, polygon law, Lami's Theorem, (ג-µ) theorem). Resultant of a number of coplanar forces.

Unit II
Parallel forces, Moments, Varignon's theorem of moments, Couples, Resultant of two Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple.

Unit III
Equilibrium of a rigid body acted on by three forces in a plane, General Conditions of equilibrium of a rigid body acted on by forces in one plane.

Unit IV
Friction, Laws of friction, Equilibrium of a particle on a rough plane. Centre of Gravity: Centre of gravity of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.

Text Book:
S.L. Loney, The Elements of Statics and Dynamics Part-I Statics.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Three-Year Degree Programme
Bachelor of Science (Honours) Mathematics Semester-II
Session 2021-22

Bachelor of Science (Honours) Mathematics Semester-II							
Course Code	Course type	Course Title	Max. Marks				Examination time in hour
			Total	Ext.		CA	
				L	P		
BOML-2421/ BOML-2031/ BOML-2431	C	Punjabi (Compulsory)/ Basic Punjabi/ PHC	50	40	-	10	3
BOMM-2102	C	Communication skills in English	50	25	15	10	3
BOML-2333	C	Calculus-II	100	80	-	20	3
BOML-2334	C	Matrices and Theory of Equations	100	80	-	20	3
BOML-2335	C	Solid Geometry	100	80	-	20	3
BOML-2336 OR BOMM-2396	C C	[2]Dynamics OR [3]Modern Physics-I	100 100	80 60	- 20	20 20	3 3+3
BOMM-2137	C	Computer Fundamentals and Introduction to 'C' Language	100	50	30	20	3+3
AECD-2161	AC	[1]Drug Abuse : Problem, Management and Prevention (Compulsory)	50	40	-	10	3
SECM-2502	AC	[1]Moral Education	25	20	-	5	1
		Total Marks	600				

Note:
[2] Only those students can opt these courses who have not studied Chemistry at +2 level.
[3] Only those students can opt these courses who have studied Chemistry at +2 level.
[1] Marks of these papers will not be added in total marks. Grades will be provided.

C-Compulsory
AC-Audit Course

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Calculus-II
Course Code: BOML-2333

Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate an understanding of limits and how they are used in sequences and series.

CO 2: Know and describe the converging behaviour of Power series and Taylor series.

CO 3: Distinguish between the absolute convergence and conditional convergence.

CO 4: Manage to solve the problem related to Fourier series expansion, Fourier series for even and odd functions and half range series.

Bachelor of Science (Honours) Mathematics Semester–II
Session: 2021-22
Course Title: Calculus-II
Course Code: BOML-2333

Examination Time: 3 Hours | Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setter: Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Sequence, sub sequence, bounded sequences, monotone sequences, convergence, Cauchy criterion, algebra of limit of sequences (proofs with ε-N rigor), Sandwich Theorem

Unit-II

Infinite series, Sequences of partial sums, convergence of series, series of non-negative terms, comparison tests, Cauchys' Integral test. Ratio test, Raabe's test, logarithmic test and Gauss test (all tests with proofs).

Unit-III

Alternating series, absolute and conditional convergence, Leibnitz Theorem, Convergence of Power Series, Taylor Series, Error estimates

Unit-IV

Periodic functions, trigonometric series, Fourier series expansion, Fourier series for even and odd functions, half range series.

Text Books:

1.Malik, S. C. and Savita Arora, Mathematical Analysis, 3rd Edition. New Age International Publishers, 2008.
2.George B. Thomas and Ross L. Finne, Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998.

Reference Books:

1. Ghorpade Sudhir R. and Limaye B.V., A course in calculus and real analysis, Springer, 2006.
2.Kreyszig Erwin, Advanced Engineering Mathematics, 9th edition, Wiley India Edition, 2011.

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Matrices and Theory of Equations
Course Code: BOML-2334

Course Outcomes

After passing this course, the students will be able to:

CO 1: Distinguish between solution of cubic equations and Bi-quadratic equations.

CO 2: Explain how all polynomials can be broken down by using Fundamental Theorem of Algebra to provide structure for abstraction into fields like Modern Algebra.

CO 3: Understand the concept of matrix congruence of skew symmetric matrices and its reduction in real field.

CO 4: Solve system of linear equations and obtain Eigen values, Eigen vectors, minimal and characteristic equation of a matrix and to apply it in advanced dynamics and electric current.

CO 5: To find the relations between the roots and coefficients of general polynomial equation in one variable.

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Matrices and Theory of Equations
Course Code: BOML-2334

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setter: Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Hermitian, Skew-Hermitian, Orthogonal and Unitary matrices, Linear independence/dependence of row and column vectors, Elementary operations on matrices, Inverse of a matrix using Gauss Jordan method, Row rank, column rank and their equivalence, System of linear equations and conditions for consistency

Unit-II

Eigen values, Eigen vectors and the characteristic equation of a matrix, Cayley-Hamilton Theorem and its applications, Polynomials, zeros of a polynomial, division algorithm, greatest common divisor, repeated roots, equal roots, unique factorization of polynomials over fields, The fundamental theorem of algebra.

Unit-III

Relationship between roots and the coefficients, Fundamental theorem of symmetric polynomials (without proof). Evaluation of symmetric functions of roots, Rational roots of polynomials with integral coefficients. Descartes rule of sign.

Unit-IV

Strum's theorem (statement only), Solution of cubic equation using Cardano's method, and biquadratic equation by Descartes method and Ferrari's method.

Text Book:

Romesh Kumar, Algebra & Trigonometry, Pardeep publication.

Reference Books:

1. A. Kurosh ,Higher Algebra, (Moscow Mir Publisher 1972).
2. R.N. Gupta, Surjeet Singh and R.J. Hans-Gill, Theory of Equations. (Lecture notes for inter University Leadership project in Mathematics.)
3. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi-2000.
4. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, First course in Linear Algebra, Wiley Eastern, New Delhi 1983.
5. Shanti Narayan & P.K.Mittal, A Text Book of Matrices, S.Chand & Co. Ltd., New Delhi, Reprint 2002.
6. J. Gilbert & L. Gilbert, Linear Algebra and Matrix Theory, Academic Press.

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Solid Geometry
Course Code: BOML-2335

Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate the concept of cone, classification of cone, intersection of line and cone, reciprocal cone.

CO 2: Understand the concept of cylinder, enveloping cylinder and its limiting form.

CO 3: Describe the concept of conicoids or quadratic surface, its classification, trace different types of conicoids.

CO 4: Manage to find surface of revolution and concept of tangent and normal to the conicoid

CO 5: Identify the conicoids and representing it in the form of hyperboloid, ellipsoid, paraboloid.

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Solid Geometry
Course Code: BOML-2335

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setter: Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

Intersection of three planes, condition for three planes to intersect in a point or along a line or to form a prism, change of axes, shift of origin, rotation of axes, sphere and section of a sphere by a plane. Sphere through a given circle. Intersection of a line and sphere.

Unit-II

Tangent and normal, tangent plane, angle of intersection of two spheres and condition of orthogonality, power of a point w.r.t. a sphere, Radical planes, radical axis, radical centre, coaxial family of spheres, limiting points.

Unit-III

Cylinder: Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Right circular cylinder, enveloping cylinder, Cone: homogeneous equation of cone in second degree in x,y,z, Quadratic cone, reciprocal cone, right circular cone, enveloping cones.

Unit-IV

Surface of revolution, Identification of quadratic surfaces: Ellipsoid, hyperboloid, paraboloid.

Text Book

1. P.K Jain and Khalil Ahmed, A text book of Analytical Geometry of three dimensions, Wiley Eastern Ltd, 1999.

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Dynamics
Course Code: BOML-2336

Course Outcomes

After passing this course, the students will be able to:

CO 1: Identify the basic relations between distance, time, velocity and acceleration.
CO 2: Explain the relationship between forces and motion. Differentiate between balanced and unbalanced forces and Explain how unbalanced force affect motion.
CO 3: Understand Newton's Laws of Motion and Apply the laws to solve many problems.
CO 4: Discuss the motion of particles connected by a string, motion along a smooth inclined plane.
CO 5: Solve different types of problems with Variable Acceleration.
CO 6: Discuss Simple Harmonic Motion and Illustrate it with a variety of examples.
CO 7: Solve Pendulum, Damped and forced Oscillations oscillating system problems.
CO 8: Define Work, Power and Energy and Explain their relationship. Use measurement tools to apply the concepts of Work and power to solve real life problems.
CO 9: Define Energy and Identify the different types that exist

Bachelor of Science (Honours) Mathematics Semester–II
Session 2021-22
Course Title: Dynamics
Course Code: BOML-2336

Examination Time: 3 Hours

Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setter: Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

Rectilinear motion in a straight line with uniform acceleration, Newton's laws of motion. Motion of two particles connected by a string.

Unit-II

Motion along a smooth inclined plane. Variable acceleration. Simple Harmonic Motion.

Unit-III

Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles. Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum.

Unit-IV

Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.

Text Book:

S.R.Gupta, A text book of Dynamics.

Reference Books:

1. F. Chorlton, Dynamics.
2. S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Cambridge University Press, 1956.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three-Year Degree Programme
Bachelor of Science (Honours) Mathematics
Semester-III
Session- 2021-22

Sr. No.	Course Code	Course type	Course Title	Max. Marks				Examination Time in hours
				Total	Ext.		CA	
					L	P		
1	BOML-3331	C	Calculus III	100	80	-	20	3
2	BOML-3332	C	Ordinary Differential Equations & Special Functions	100	80	-	20	3
3	BOML-3333	C	Probability Theory	100	80	-	20	3
4	BOML-3334	C	Linear Algebra	100	80	-	20	3
5	BOMM-3135	C	Python Programming	100	50	30	20	3+3
6	AECE-3221	AC	[1] Environmental Studies (Compulsory)	100	60	20	20	3
7	SECG-3532	AC	[1] Gender Sensitization	25	10	*10*	*5*	1
Total Marks				500				

Note:

C-Compulsory
AC-Audit Course

[1] Marks of these papers will not be added in total marks and only grades will be provided

Bachelor of Science (Honours) Mathematics
Semester–III

Session- 2021-22

Course Title: Calculus III

Course Code: BOML-3331

Course Outcomes

After passing this course, the students will be able to:

CO1: Evaluate Partial derivatives and recognize the various notations used r partial derivatives.

CO2: To find optimization value for a function of several variables.

CO3: Apply double integration technique in finding the area of a region.

CO4: Recognize the appropriate tools of calculus to solve applied problems.

CO5: Analyze functions using limit, continuity, derivative and integration

Bachelor of Science (Honours) Mathematics
Semester–III
Session- 2021-22
Course Title: Calculus III
Course Code: BOML-3331

Examination Time: 3 Hours | Max. Marks:100
Theory: 80
CA:20

Instructions for Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one questions from each section. The fifth question may be attempted from any Section.

Unit I

Real Valued functions of several variables with emphasis on functions of two variables, Limits and continuity, Partial derivatives, Homogenous Functions, Euler's Theorem

Unit II

Total differentiation, Differentiation of composite functions, Implicit functions, Chain Rule, Jacobians, Directional Derivatives, Gradient Vectors.

Unit III

Saddle Points, Maxima and Minima of functions of two variables, Lagrange's Multipler method, Higher dimensional analogues of Lagrange's Mean value Theorem and Taylor's theorem for functions of twovariables.

Unit IV

Double integration over rectangular and non-rectangular regions, change of order of integration, double integration in polar co-ordinates, triple integration over parallelepiped and other solid regions, Applications of double and triple integrals to area, volume, centre of gravity, moment of inertia etc.

Text Book:
George B. Thomas and Ross L. Finney: Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998. (Scope as inCh.12-13)

Reference Books:
1. Kreyszig, E.: Advanced Engineering Mathematics.
2. Ghorpade, Sudhir R., Limaye, Balmohan V. :A Course in Calculus and Real Analysis.

Bachelor of Science (Honours) Mathematics
Semester–III

Session- 2020 -21

Course Title: Ordinary Differential Equations & Special Functions

Course Code: BOML-3332

Course Outcomes

After passing this course, the students will be able to:

CO1: Demonstrate the concept Of Linear Differential equation with constant and variable coefficients

CO2: Apply in wide variety of disciplines Physics, Biology, Economics

CO3: Manage to solve the problems related to series solution of Differential equation by power series method.

CO4: Understand the Bessel function and their application to physical world

CO5: Understand the Legendre function and their application to physical world

Bachelor of Science (Honours) Mathematics
Semester–III

Session- 2021-22

Course Title: Ordinary Differential Equations & Special Functions

Course Code: BOML-3332

Examination Time:3Hours Max. Marks:100

Theory: 80

CA:20

Instructions for Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the fourSections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit –I

Exact differential equations. First order and higher degree equations solvable for *x, y, p.* Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant coefficients.

Unit II

Linear differential equations with variable coefficients, Variation of Parameters method, reduction method, series solutions of differential equations. Power series method, Bessel and Legendre equations (only series solution).

Unit III

Bessel's Functions: Recurrence relations, Generating Function, Orthogonal Property,Trigonometric Expansions involving Bessel's Functions.

Unit –IV

Legendre's Functions: Recurrence Relations, Generating Function, Rodrigue's Formula, Orthogonal Property, Trigonometric Series, Laplace definite integrals, Christoffel's expansion

Text Book:
M.D Raisinghania: Ordinary and Partial Differential Equations. S Chand Publication

Reference Books:

1.D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
2.G.F. Simmons: Differential Equations, Tata McGraw Hill,1972.
3.E.A. Codington: An Introduction to Ordinary Differential Equations, Prentice Hall of India,1961.
4.F.D. Rainville: SpecialFunctions

Bachelor of Science (Honours) Mathematics

Semester–III

Session- 2021-22

Course Title: Probability Theory

Course Code: BOML-3333

Course Outcomes

After passing this course, the students will be able to:

CO1: Find the probability of single event and compound and complimentary event

CO2: Contrast discrete and continuous random variable

CO3: Apply general Properties of expectation and variance

CO4: Differentiate between the events with Binomial and Poisson distribution

CO5: Apply Normal distribution in real time applications

CO6: Translate the real world problem into probability based mathematical model

CO7: Identify the characteristics of different continuous and discrete distribution

CO8: Use different distributions to solve practical problems

Bachelor of Science (Honours) Mathematics
Semester–III
Session 2021-22
Course Title: Probability Theory
Course Code: BOML-3333

Examination Time:3Hours Max. Marks:100

Theory: 80

CA: 20

Instructions for Paper Setter:Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

The question paper must contain 30% of the article/theory from the syllabus.

Unit I

Measures of central tendency: Mean, Median, Mode, and Measure of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Skewness, Kurtosis, Sample Space, Probability axioms, Probability on finite sample space, Conditional probability and Independence, Baye's theorem.

Unit II

Random variables, Probability mass function, Probability density function, Distribution function, Function of a random variable and its distribution. Multiple random variables, Joint distribution, Marginal and Conditional distributions.

Unit III

Mathematical Expectation, Conditional Expectation, Variance, Covariance, Moments, Moment generating function, Chebychev's inequality, Bernoulli's Law of large numbers.

Unit –IV

Discrete Probability Distributions: Bernoulli, Binomial, Poisson, Negative Binomial, Geometric distribution. Continuous Probability Distributions: Uniform, Normal, Gamma, Beta, Exponential distribution (For All distributions only Mean, Variance, Moment Generating Function)

Text Book:

S.C Gupta and V.K Kapoor: Fundamentals of Mathematical Statistics
(Scope in Chapters 2-8).

Reference Book:

A.M. Mood , F.A. Graybill , D.C. Boes: Introduction to the Theory of Statistics

Bachelor of Science (Honours) Mathematics
Semester–III

Session- 2021-22
Course Title: Linear Algebra
Course Code: BOML-3334

Course Outcomes

After passing this course, the students will be able to:

CO1: To understand the concepts of base and dimension of vector space.

CO2: To get familiar with row and column space of a matrix.

CO3: To understand matrix representation of a linear transformation

CO4: To find kernel and image spaces of a linear transformation.

Bachelor of Science (Honours) Mathematics
Semester-III
Session 2021-22
Course Title: Linear Algebra
Course Code: BOML-3334

Examination Time: 3 Hours

Max. Marks: 100
Theory: 80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Definition and examples of vector spaces, properties of vector spaces, subspaces, examples ofsubspaces, sums and direct sums of subspaces, finite dimensional vector space: span of a listof vectors, linear independence and dependence of vectors.

Unit II

Basis of a vector space, extension of a list to a Linear Independent basis, reduction of aspanning list to a basis, direct complement of subspace, dimension theorems, quotient space, dimension of a quotient space.

Unit III

Linear maps, Null space, Range space, Rank-Nullity Theorem, Matrix of a linear map, invertibility of a linear map, algebra of linear maps.

Unit IV

Elementary matrix operations, elementary matrices, rank of a matrix, equality of row and column rank, normal form for a matrix, invertible matrix as a product of elementary matrices, system of linear equations

Text Books:

1. Linear Algebra Done Rght by Sheldon Axler, Springer
2. Linear Algebra by Friedberg, S.H. Insel, A.J., Spence, L.E., PHI Learning Pvt. Ltd.
3. Linear Algebra by Vivek Sahai, Vikas Bist., Narosa Publishing House Pvt. Ltd.

FACULTY OF SCIENCES
Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three-Year Degree Programme
Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22

Bachelor of Science (Honours) Mathematics Semester-IV							
Course Code	Course Type	Course Title	Max. Marks				Examination time in hours
			Total	Ext.		CA	
				L	P		
BOML-4331	C	Vector calculus	100	80	--	20	3
BOML-4332	C	Partial Differential Equations	100	80	--	20	3
BOML-4333	C	Group Theory	100	80	--	20	3
BOMM-4334	C	Statistical Methods	100	50	30	20	3+3
BOMM-4135	C	Foundation of Statistical Computing	100	50	30	20	3+3
SECS-4522	AC	[1]Social Outreach	25	20	-	5	No Exam
		Total Marks	500				

Note:

C Compulsory
AC Audit Course

[1]Marks of these papers will not be added in total marks and only grades will be provided.

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title : Vector Calculus
Course Code:BOML-4331
Course Outcomes

After passing this course, the students will be able to:

CO 1: Apply the concepts of line integral, double integral and triple integral in solving engineering problems.

CO 2: Understand the physical concept of vectors.

CO 3: Perform basic calculus on vector-valued functions.

CO 4: Solve physical problems based on calculus using vector-valued functions.

CO 5: Calculate the unit tangent vector, the unit normal vector and the unit binomial vector at a point on a space curve described by a vector-valued position function.

CO 6: Find the values of gradient, divergence and curl operator of given vectors.

CO 7: Find the application of Gauss theorem, Green's theorem and Stokes's theorem in real life problems.

Bachelor of Science (Honours) Mathematics
Semester–IV
Session 2021-22
Course Title: Vector Calculus
Course Code: BOML-4331

Examination Time: 3 Hours Max. Marks: 100
Theory: 80
CA: 20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Scalar and vector product of three vectors, Product of four vectors, Reciprocal vectors, Vector differentiation, Scalar valued point functions, Vector valued point functions, Directional derivatives and the Gradient, Tangent plane and normal to a given surface.

Unit II

Gradient of a scalar point function, Divergence and Curl of a vector point function, Divergence and Curl of sums and products and their related vector identities, Laplacian operator.

Unit III

Orthogonal Curvilinear Coordinates, Conditions for orthogonality, Gradient, Divergence and Curl in terms of orthogonal curvilinear coordinates, Line integrals: Scalar and vector line integrals, line integrals along curves, Work done, Conservative vector fields, Green's theorem in plane.

Unit IV

Surface integral, Volume integral, Gauss Divergence Theorem, Stokes theorem and the problems based on these theorems.

Reference Books:

1. D. E. Bourne and P. C. Kendall, Vector analysis and Cartesian tensors, CRC Press, Taylor and Francis Group, London, Third edition, 1992 (Scope as in Chapters: 2-6)
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 42nd edition, 2012 (Scope as in Chapters: 3 (3.8-3.10) and 8)

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title: Partial Differential Equations
Course Code: BOML- 4332
Course Outcomes

After passing this course, the students will be able to:

CO 1: Apply a range of techniques to find solutions of partial differential equations.
CO 2: Understand basic properties of standard partial differential equations.
CO 3: Perform various methods to solve homogeneous and non-homogeneous partial differential equations and apply these methods in solving some physical problems.
CO 4: Formulate, classify and transform partial differential equations into canonical form.
CO 5: Determine the existence, uniqueness, and well-posedness of solution of PDEs
CO 6: Use computational tools to solve problems and applications of Partial Differential Equations.
CO 7: Apply in wide variety of disciplines Physics, Biology and Economics

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title: Partial Differential Equations
Course Code: BOML- 4332

Examination Time: 3 Hours Max. Marks: 100
Theory : 80

CA : 20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Partial Differential Equations of First Order: origin of first order partial differential equations. Formation of partial differential equations, Cauchy problem of first order equations,Linear P.D.E. of first order, Langrange's Method

Unit-II

Integral surface through a given curve, Surface orthogonal to given system of surfaces, Non linearP.D.E of first order, Charpit's method, Homogeneous linear P.D.E. with constant coefficients, method of finding the complementary function and particular integral.

Unit-III

Non homogeneous linear P.D.E. with constant coefficients, reducible and irreducible linear P.D.E. with constant coefficients, method of finding the complementary function and particular integral.

Unit-IV

Partial differential equations of the second order. Origin of 2nd order equations. Linear P.D.E. with constant coefficients and their complete solutions.Second order equation with variable coefficient and their classification and reduction to standard form.

Text Book:
1.MD Raisinghania: Ordinary and Partial Differential Equations, S Chand Publishing

Reference Books:
1. Piaggio: Differential equations.
2. Sneddon, I.N.: Elements of partial differential equations.

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title : Group Theory
Course Code: BOML - 4333
Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Demonstrate understanding and the ability to work within various algebraic structures.
CO 2: Demonstrate understanding of the importance of algebraic properties with regard to working with various number systems.
CO 3: Effectively write abstract mathematical proofs in a clear and logical manner.
CO 4: Explain the fundamental concepts of groups and subgroups.
CO 5: Use Lagrange's theorem to analyze the cyclic subgroups of a group.
CO 6: Explain the significance of the notion of a normal subgroup, quotient group, cyclic group.
CO 7: State isomorphism theorems and use them to work with permutation, cyclic and normal groups.
C O 8: Describe the structure of finite abelian group.
CO 9: Use Cauchy's theorems to describe the structures of certain abelian groups.

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title: Group Theory
Course Code: BOML – 4333

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Properties of Integers: Well ordering Principle, Division algorithm, Greatest common divisor, G.C.D. as a linear combination, Euclidean algorithm, Euclid's Lemma, Least common multiple, Fundamental Theorem of arithmetic, Integers modulo *n*, Binary relations, Equivalence relations, Equivalence classes partition.

Unit-II

Definition & examples of groups, Elementary properties of groups, Uniqueness of the identity element, Cancellation, Uniqueness of inverses, Subgroups, Examples of subgroups, Tests for a set to be a subgroup, Centralizer, Normalizer, Centre of a group.

Unit-III

Product of two subgroups, Properties of cosets, Lagrange's theorem, Normal subgroups, Factor groups, Cyclic groups, Properties of cyclic groups, Generators of cyclic groups, Fundamental theorem of cyclic groups.

Unit-IV

Permutation groups, Cyclic notation for permutations, Permutation as product of disjoint cycles, Order of a permutation, Commutativity of product of disjoint cycles, Permutation as a product of 2-cycles, Even and odd permutations, Alternating group.

Reference Books:

1. D. Burton, Elementary Number Theory, McGraw-Hill Education, New York, Seventh Edition, 2011 (Scope as in Chapters: 2, 3, 8).
2. J. A. Gallian, Contemporary Abstract Algebra, CRC Press, Taylor & Francis Group, New York, Ninth Edition, 2015 (Scope as in Chapters: 1-5, 7, 9).

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title: Statistical Methods
Course Code: BOMM-4334
Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Understand the concept ofcorrelation among the data and its physical significances.

CO 2: State and apply the techniques to identify correlation between given set of data.

CO 3: Fit regression curves depicting relation among the physical quantities.

CO 4: Understand the logic and framework of the inference of hypothesis testing.

CO 5: Understand hypothesis testing as making an argument

CO 6: Interpret the results of the hypothesis test.

Bachelor of Science (Honours) Mathematics Semester-IV
Session: 2021-22
Course Title : Statistical Methods
Course Code: BOMM-4334

Examination Time: (3+3) Hours

Max. Marks: 100
Theory : 50
Practical : 30
CA : 20

Instructions for the Paper Setters:
Eight questions of equal marks (10 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be ttempted from any Section. The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.
The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

Bivariate data, Karl–Pearson's correlation coefficient and its Properties, Spearman's rank correlation coefficient, fitting of straight line, regression analysis.

Unit-II

Sampling Distributions: Chi-square, t and F-distributions with their mean and variance. Relation between Chi-square, t and F-distributions.

Unit-III

Large Sample test (Z Test): Test of single mean and difference of means, test for single proportion and difference of proportions, t test for single mean and equality of means.

Unit –IV

Chi-square test - as goodness of fit and association of attributes, F-test as test of equality of population of variance.

Note:
Practical: Based on syllabus of Statistical Methods for inferential Statistics.

Text Books:
1. Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics
2. Hogg R.V. , Mckean, J.W. and Craig A.T.: Introduction to Mathematical Statistics

FACULTY OF SCIENCES
Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Science (Honours) Mathematics Semester-V
Session: 2021-22

Bachelor of Science (Honours) Mathematics Semester-V							
Course Code	Course Type	Course Title	Max. Marks				Examination time in hours
			Total	Ext.		CA	
				L	P		
BOML-5331	C	Number Theory	100	80	-	20	3
BOML-5332	C	Discrete Mathematics	100	80	-	20	3
BOML-5333	C	Linear Integral Equations	100	80	-	20	3
BOML-5334	C	Riemann Integration	100	80	-	20	3
BOML-5335	C	Metric Spaces	100	80	-	20	3
SECI-5541	AC	[1]Innovation, Entrepreneurship and Venture Development	25	20	-	5	1
SECJ-5551		[1]Job Readiness Course	25	20	-	5	1
Total Marks			500				

Note:
C -Compulsory
AC-Audit Course

[1]Marks of these papers will not be added in total marks and only grades will be provided.

Bachelor of Science (Honours) Mathematics
Semester–V
Session 2021 -22
Course Title: Number Theory
Course Code: BOML-5331

Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Find solutions of specified linear Diophantine equation.

CO 2: Solve system of linear congruences.

CO 3: Apply Fermat's and Euler's theorem to prove relation involving prime numbers.

CO 4: Apply the Wilson's theorem to solve numerical problems.

CO 5: Solve system of equations using congruences.

CO 6: Understand and apply properties functions in real world problems of phi.

CO 7: Understand application of important arithmetic functions.

Bachelor of Science (Honours) Mathematics
Semester–V
Session 2021 -22
Course Title: Number Theory
Course Code: BOML-5331

Examination Time: 3 Hours | Max. Marks: 100
Theory: 80
CA: 20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.
The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

The Diophantine equation ax + by = c and its solution, Basic properties of congruences, Complete and Reduced set of residues modulo n, Special divisibility tests.

Unit-II

Polynomial conguences, Langrange's theorem, Linear congruences, Chinese remainder theorem, The Fermat's theorem, Pseudo prime, Absolutely Pseudo prime.

Unit-III

Wilson's theorem. Euler's Phi function, Euler's theorem, some properties of the Phi Function, Gauss theorem.

Unit-IV

Number-Theoretic functions: The Sum and Number of divisors, The Mobius Inversion formula, The Greatest integer function for treating divisibility problems.

Text Book:
D. Burton, Elementary Number Theory, McGraw-Hill Education, Boston, Seventh edition, 2012 (Scope as in Chapters 2, 4-7).

Bachelor of Science (Honours) Mathematics
Semester–V
Session 2021 -22
Course Title: Discrete Mathematics
Course Code: BOML-5332
Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Write an argument using logical notation and determine if the argument is or is not valid.

CO 2: Have substantial experience to comprehend formal logical arguments.

CO 3: Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.

CO 4: Understand the language of graphs and trees.

CO 5: Understand the use of graphs as models.

CO 6: Understand various types of trees and methods for traversing trees.

Bachelor of Science (Honours) Mathematics
Semester–V
Session 2021 -22
Course Title: Discrete Mathematics
Course Code: BOML-5332

Examination Time: 3 Hours | Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit- I

Boolean Algebra – Boolean Algebra, Unary Operation, Binary Operation, Laws of Boolean Algebra, Principle of Duality, Boolean Function, Fundamental Product, Sum of Product form, Complete sum of Product form, Minterm, Disjunctive Normal form, Conjunctive Normal form, obtaining a Disjunctive Normal form, obtaining a Conjunctive Normal form, Karnaugh Map upto four variables, Applications of Boolean Algebra to Switching Circuits.

Unit- II

Graph, Subgraph, Paths, Directed and Undirected graphs, Connected graphs, Weakly connected graphs, Regular and bipartite graphs, Weighted graphs, Euler path and graphs, Hamiltonian path and graphs, planar graphs.

Unit- III

Chromatic number in graphs, shortest path in weighted graphs. Tree, directed tree, ordered tree, Binary tree, traversing binary tree, spanning tree, minimum spanning tree, Kruskal's algorithm to find minimum spanning tree.

Unit- IV

Propositional Calculus – Basic Logic Operations, Statement, Proposition, Propositional Variables, Truth Table, Combination of Propositions, Laws of the Algebra of Proposition, Variations in Conditional Statement, Principle of Duality, Logical Implication, Logical Equivalence of Proposition, Tautologies, Contradiction, Contingency, Argument, Proof of Validity, Quantifiers, Existential Quantifier, Universal Quantifier, Negation of Quantified Propositions, Propositions with Multiple Quantifier.

Text Book:
S. B. Gupta and C. P. Gandhi, Discrete Structures, University Science Press, Second edition, 2010 (Scope as in Chapters: 10, 11, 12, 13).

Bachelor of Science (Honours) Mathematics
Semester–V
Session 2021 -22
Course Title: Linear Integral Equations
Course Code: BOML-5333
Course Outcomes

On satisfying the requirements of this course, students will have the Knowledge of:
CO 1: Concept of Linear Integral equations and various kinds of Kernels.
CO 2: Volterra and Fredholm Integral equations of first and Second kind.
CO 3: Green's function and application of green's function in finding the solution of Boundary Value Problem and reduction of Boundary Value Problem to an Integral Equation.
CO 4: Techniques to solve homogeneous and non-homogeneous Fredholm and Volterra Integral equations.
CO 5: Laplace Transform and its basic properties.
CO 6: Application of Laplace Transform in finding solution of Abel's equation and Volterra Integral Equation.

Bachelor of Science (Honours) Mathematics
Semester–V
Session 2021 -22
Course Title: Linear Integral Equations
Course Code: BOML-5333

Examination Time: 3 Hours | Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Linear integral equations of the first and second kind of Fredholm and Volterra type, some basic identities, Types of kernels: Symmetric kernel, Separable kernel, Iterated kernel, resolvent kernel, Initial value problems reduced to Volterra integral equations, Solution of Volterra integral equation using: Resolvent kernel, Successive approximation.

Unit-II

Boundary value problems reduced to Fredholm integral equations, Solution of Fredholm integral equations using separable kernel, resolvent kernel. Methods of successive approximation to solve Fredholm equations of second kind. Solution of Homogeneous Fredholm integral equation: Eigen values, eigen vectors.

Unit-III

Integral transforms for solving integral equations: Basic properties of Laplace transforms, Solution of Abel's equation using Laplace transform, Application of Laplace transform to the Solution of Volterra integral equations with convolution type kernels.

Unit-IV

Green's function, Basic four properties of the Green's function, Procedure for construction of the Green's function by using its basic four properties, Construction of Green's function for boundary value problems, Solution of boundary value problems using Green's function, reducing boundary value problems to an integral equation using Green's function.

Text Book:

M.D. Raisinghania, Integral Equations & Boundary Value Problems, S. Chand Co. Pvt. Ltd., New Delhi, First Edition, 2007 (Scope as in Chapters 1-6,9,11).

Bachelor of Science (Honours) Mathematics
Semester–V
Session: 2021-22
Course Title: Riemann Integration
Course Code: BOML-5334
Course outcomes

After passing this course, the students will be able to:

CO 1: To understand the concepts of Riemann sum, partitions, upper and lower sums, Riemann integrability of continuous functions and of monotone functions.
CO 2: To know and describe the converging behavior of improper integrals and Beta, Gamma functions.
CO 3: To distinguish between the absolute convergence and conditional convergence.
CO 4: To find the relation between Beta and Gamma functions.
CO 5: Understand and apply properties of Beta and Gamma functions in real world problems.

Bachelor of Science (Honours) Mathematics
Semester–V
Session: 2021-22
Course Title: Riemann Integration
Course Code: BOML-5334

Examination Time: 3 Hours | Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Definition and Existence of the Riemann Integral, Partitions and Riemann (or Darboux) sums, Some properties of Darboux Sums, Upper and lower Riemann integrals, Refinement of partitions, Darboux's Theorem, Necessary and sufficient conditions for integrability.

Unit-II

Particular classes of Integrable functions, Properties of integrable functions, Integrability of the sum, difference, product, quotient and modulus, The Fundamental theorem of integral calculus, First and Second mean value theorems of integral calculus.

Unit-III

Improper Integrals and conditions for existence, Comparison test for convergence of improper integrals, Abel's Test and Dirichlet test for convergence.

Unit-IV

Absolute convergence and conditional convergence of improper integrals, Beta and Gamma functions, Properties of Beta functions, Recurrence formulae for Gamma function, Relation between Beta and Gamma functions.

Text Book:
S. Narayan and M. D. Raisinghania, Elements of Real Analysis, S. Chand & Co. Pvt. Ltd., New Delhi, Seventeenth Edition, 2016 (Scope as in chapters: 13, 16, 20).

Reference Books:
1. A. Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, Taylor & Francis Group, New York, First Edition, 2014 (Scope as in chapters: 6).
2. S. C. Malik and S. Arora, Mathematics Analysis, New Age International Publishers, New Delhi, Second Edition, 2005 (Scope as in chapters: 9,11).

Bachelor of Science (Honours) Mathematics
Semester–V
Session: 2021-22
Course Title: Metric Spaces
Course Code: BOML-5335
Course outcomes

After passing this course, the students will be able to:

CO 1: Explain the fundamental concepts of Metric Spaces and their role in modern mathematics.
CO 2: Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts of Metric Spaces.
CO 3: Give argument related to convergence, continuity, completeness, compactness, connectedness in metric spaces.
CO 4: Understand and derive proofs of mathematical theorems. This includes understanding the role of axiom, logic and particular proof techniques such as proof by induction, proof by contradiction etc.

Bachelor of Science (Honours) Mathematics
Semester–V
Session: 2021-22
Course Title: Metric Spaces
Course Code: BOML-5335

Examination Time: 3 Hours | Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Metric on a set, Metric space, definitions and examples, open sets, interior and closure of a set, closed set, dense and nowhere dense sets, exterior, frontier and boundary points and their properties.

Unit-II

Compact subsets of a metric space, elementary properties of compact sets, Heine-Borel theorem, separated sets, connected subsets of a metric space.

Unit-III

Sequences in a metric space, Convergent Sequences, Cauchy Sequences, Complete Metric Spaces, Cantor's Intersection Theorem, Baire's Category Theorem.

Unit-IV

Continuous Functions in a metric space, continuity and compactness, continuity and connectedness, discontinuities, monotonic functions, uniform continuity.

Text Book:
S. Narayan and M. D. Raisinghania, Elements of Real Analysis, S. Chand & Company, New Delhi, 12th Edition, 2011 (Scope as in Chapter- 19)

Reference Books:
1.S. C. Malik and S. Arora, Mathematics Analysis, New Age International Publishers, New Delhi, 5th Edition, 2021 (Scope as in Chapter- 19)
2. W. Rudin, Principles of Mathematical Analysis, McGraw-Hill Education, New York, 3rd Edition, 1976 (Scope as in Chapters- 2, 3(3.1-3.12), 4)

FACULTY OF SCIENCES
Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of ThreeYear Degree Programme
Bachelor of Science (Honours) Mathematics Semester-VI
Session: 2021-22

Bachelor of Science (Honours) Mathematics Semester-VI							
Course Code	Course Type	Course Title	Max. Marks				Examination time in hours
			Total	Ext.		CA	
				L	P		
BOML-6331	C	Complex Analysis	100	80	-	20	3
BOML-6332	C	Analytical Skills	100	80	-	20	3
BOML-6333	C	Numerical Analysis	100	80	-	20	3
BOML-6334	C	Special Functions	100	80	-	20	3
BOML-6335	C	Differential Geometry	100	80	-	20	3
Total Marks			500				

Note:
C -Compulsory

Bachelor of Science (Honours) Mathematics
Semester–VI
Session: 2021-22
Course Title: Complex Analysis
Course Code: BOML-6331
Course outcomes

After passing this course, the students will be able to:

CO1: Justify the need for a complex number system and explain how it is related to other existing number system.

CO2: Define a function of complex variable and carry out basic mathematical operations with complex numbers.

CO3: State and prove the Cauchy Riemann Equation and use it to show that a function is analytic.

CO4: Define singularities of a function, know the different types of singularities and be able to determine the points of singularities of a function.

Bachelor of Science (Honours) Mathematics
Semester–VI
Session: 2021-22
Course Title: Complex Analysis
Course Code: BOML-6331

Examination Time: 3 Hours | Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Functions of complex variables, Topology of real line and complex plane, limit, continuity and differentiability, Analytic functions, Conjugate function, Cauchy Riemann equations (Cartesian form), Harmonic function, Construction of analytic functions.

Unit-II

Complex line integral, Cauchy's theorem, Cauchy's integral formula and its generalized form, Cauchy's inequality, Poisson's integral formula, Morera's theorem, Liouville's theorem.

Unit-III

Taylor's theorem, Laurent's theorem, Zeros and Singularities of an analytic function, Residue at a pole and at infinity, Cauchy's Residue theorem.

Unit-IV

The Fundamental Theorem of Algebra, The Argument principle, Rouche's theorem, Conformal transformations, Bilinear transformations, Critical points, Fixed points, The cross ratio, Problems on cross ratio and bilinear transformation.

Text Book:

S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, New Delhi, Second Edition, 1995 (Scope as in Chapters: 1-5).

Reference Books:

1. S. Narayan, Theory of Functions of a Complex Variable, S. Chand Co. Pvt. Ltd., New Delhi, Fourth Edition, 2009 (Scope as in Chapters: 3, 5, 7, 9, 11).
2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw-Hill Education, New York, Eighth Edition, 2004 (Scope as in Chapters: 1, 2, 4, 5, 6, 7, 9).

Bachelor of Science (Honours) Mathematics
Semester–VI
Session: 2021-22
Course Title: Analytical Skills
Course Code: BOML-6332
Course outcomes

After passing this course, the students will be able to:

CO 1: Analyze data being presented in the form of tables, venn diagrams, pie charts.

CO 2: Demonstrate procedural fluency with real number arithmetic operations and use these operations to represent real world scenarios and to solve stated problems.

CO 3: Demonstrate number sense and conversion between fractions, decimals and percentages.

CO 4: Draw conclusions or make decisions in quantitatively based situations that are dependent upon multiple factors.

CO 5: Use simple and compound interest to do business calculations such as value of money, maturity value, present value, future value and able to differentiate which math method should be used for different problems.

Bachelor of Science (Honours) Mathematics
Semester–VI
Session: 2021-22
Course Title: Analytical Skills
Course Code: BOML- 6332

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Sequence and Series: Analogies of Numbers and Alphabets, Completion of blank spaces following the pattern in A: b::C: d relationship, Odd thing out, Missing number in a sequence or a series.

Date, Time and Arrangement Problems: Calendar Problems, Clock Problems, Blood Relationship.

Unit -II

Arithmetic Ability: Algebraic operations BODMAS, Fractions, Decimals Fractions, Divisibility rules, LCM & GCD (HCF), Elementary Algebra.

Quantitative Aptitude: Averages, Ratio and proportion, Problems on ages, Time and Work, Work and Wages, Pipes and Cisterns, Time and Distance, Trains, Streams.

Unit -III

Mensuration: Measurement of Areas, Surface Areas and Volume.

Business Computations: Percentages, Profit & Loss, Partnership, Simple and Compound Interest.

Unit-IV

Data Analysis: The data given in a Table, Graph, Bar Diagram, Pie Chart, Venn diagram or a Passage is to be analyzed and the questions pertaining to the data are to be answered.

Reference Books:

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Co. Pvt. Ltd., New Delhi, Eighth Edition, 2017 (Scope as in Chapters:1-4, 6, 8, 11-14, 16-20, 22-25, 27-28, 35 (Section I) and Chapters 36-39 (Section II)).
2. R.V. Praveen, Quantitative Aptitude and Reasoning, PHI Learning Pvt. Ltd., Delhi, Third Edition, 2016 (Scope as in Chapters: 1, 4-8, 13-21, 23-29, 32, 34, 36, 39 (Part I) and Chapters 1,3,5 (Part II)).

Bachelor of Science (Honours) Mathematics
Semester–VI
Session 2021 -22
Course Title: Numerical Analysis
Course Code: BOML-6333
Course Outcomes

After passing this course, the students will be able to:

CO 1. Perform computation for solving a system of equations.

CO 2. Understand its application in all branches of engineering.

CO 3. Know how to find the roots of transcendental equations.

CO 4. Learn how to interpolate the given set of values.

CO 5. Understand the curve fitting for various polynomials.

CO 6. Learn numerical solution of differential equations.

CO 7. Compute numerical integration and differentiation, numerical solution of ordinary differential equations.

Bachelor of Science (Honours) Mathematics
Semester–VI
Session 2021 -22
Course Title: Numerical Analysis
Course Code: BOML-6333

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setter:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.
The students can use only Non-Programmable& Non-Storage Type Calculator.

Unit-I

Error generation, error propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Method of false position, Newton-Raphson method, Generalized Newton-Raphson method, Iteration method, Muller's method, Rate of convergence of these methods.

Unit-II

Solution of linear system of equation: Direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative methods: Jacobi's method, Gauss Seidel method. Finite Differences: Forward, Backward, Central, Divided differences, shift operator, relationship between the operators and detection of errors by use of difference operator. Interpolation with divided difference, Newton's formula, Lagrangian method.

Unit-III

Finite difference interpolation, Gauss formula, Stirling formula, Bessel's formula, Error Estimation, Extrapolation. Numerical differentiation: Method based on interpolation. Numerical Integration: Trapezoidal rule, Simpson's rule, Weddle rule, Romberg integration, Gaussian integration method, Gaussian legendre integration. Double numerical integration.

Unit-IV

Numerical solution of ordinary differential equations, Initial value problem, Taylor's method, Euler's methods, Picard's method, Milne's method, Runge-Kutta method, Predictor- Corrector's method.

Text Book:

M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, Delhi, Fifth edition, 2007 (Scope as in Chapters 2-6).

Bachelor of Science (Honours) Mathematics
Semester–VI
Session: 2021 -22
Course Title: Special Functions
Course Code: BOML-6334
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the Hypergeometric function.

CO 2: Understand the special differential equations Bessel, Legendre, Hermite.

CO 3: Understand the Bessel function and its relation with Hypergeometric function .

CO 4: Understand the Legendre function and its Hypergeometric forms.

CO 5: Understand the Hermite Polynomials and its relation as ${}_2F_0$.

Bachelor of Science (Honours) Mathematics
Semester–VI
Session :2021 -22
Course Title: Special Functions
Course Code: BOML-6334

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Hypergeometric functions, The function $F(a,b,c,z)$, Integral form, Evaluation of $F(a,b,c,1)$, The contiguous function relations, The Hypergeometric differential equation, solution of hypergeometric equation, $F(a,b,c,z)$ as a function of its parameters, Relation between z and 1-z, A quadratic transformation, A theorem due to Kummer.

Unit -II

Bessel's functions of first and second kind, Bessel's differential equation, Recurrence relations, Generating functions, Bessel's integral, Modified Bessel functions, Neumann polynomials, Neumann series.

Unit –III

Legendre's function $P_n(x)$, A generating function, Recurrence relation, Legendre differential equation, The Rodrigues formula, Bateman's generating function, Hypergeometric forms of $P_n(x)$ Laplace's first integral form, Orthogonality.

Unit -IV

Hermite Polynomials, Recurrence relations, Rodrigues formula, Integrals, The Hermite polynomial as $2F_0$, Orthogonality.

Text Book:
1. S. S Trivedi, Special functions, Pragati Prakashan, Meerut, XXI edition, 2021 (Scope as in chapters 3,4,5,6,7)
Reference Book:

1. M.D. Raisinghania, Ordinary and Partial Differential equations, S. Chand publication, New Delhi , 18th edition, 2013 (Scope as in chapters 9,10,11,12,14)

Bachelor of Science (Honours) Mathematics
Semester–VI
Session 2021 -22
Course Title: Differential Geometry
Course Code: BOML-6335
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand tensor variables, metric tensor, contra-variant, covariant and mixed tensors & and able to apply tensors among mathematical tools for invariance.

CO 2: Understand the reason why the tensor analysis is used and explain usefulness of the tensor analysis.

CO 3: Able to explain the concept of theory of space curve tangent, normal, binormal and Serret-Frenet Formulae.

CO 4: Able to understand contact between curves and surfaces, locus of centre of curvature, spherical curvature as well as to calculate the curvature and torsion of a curve.

CO 5: Understand the concept of Spherical indicatrix, envelopes, two fundamental forms, lines of curvature, principal curvature and to calculate the first and second fundamental forms of a surface.

Bachelor of Science (Honours) Mathematics
Semester–VI
Session 2021 -22
Course Title: Differential Geometry
Course Code: BOML-6335

Examination Time: 3 Hours Max. Marks: 100
Theory:80
CA:20

Instructions for the Paper Setters:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Curves in R^3: A simple arc, curves and their parametric representation, arc length, contact of curves, tangent line, osculating plane, principal normal, binormal, normal plane, rectifying plane.

Unit-II

Curvature and torsion, Serret-Frenet Formulae, Helics, Evolute and Involute of a parametric curve, Osculating circle and osculating sphere, spherical curves.

Unit –III

Surfaces in R^3: Implicit and Explicit forms of the equation of surface, two fundamental forms of a surface, Family of surfaces, Edge of regression, Envelops .

Unit -IV

Einstein's summation convention, Transformations of coordinates, Tensor's law for transformation, contravariant, covariant and mixed Tensors, addition, outer product, contraction, inner product and quotient law of tensors, metric Tensor and Riemannian metric.

Text Book:
1. G.S Malik, Differential Geometry, Pragati Prakashan, Meerut , IX edition , 2013 (Scope as in chapters 1-10)

Reference Books:
1. D Somasundaram, Differential Geometry: A first Course, Alpha Science International Limited, New Delhi, 2005 (Scope as in chapters 1,2)
2. C.E Weather burn, Differential Geometry, Cambridge University Press, Cambridge (Scope as in chapters 1,2,3,4)

Certificate course in Vedic Mathematics.
Session-2021-22
Programme Specific Outcomes

After the successful completion of this certificate course, the students will be able to:

PSO 1: To enhance computational skills in maths.

PSO 2: Develop Analytical thinking through Vedic maths.

PSO 3: Enable further research in Indian mathematics.

PSO 4: Conduct seminar on the subject and bringing together scholars in mathematics.

PSO 5: Develop postal and online study courses on Indian mathematics.

PSO 6: Instil love and remove the fear of mathematics.

PSO 7: Promote Vedic culture.

PSO 8: Crack entrance of competitive exams.

Scheme and Curriculum of Examinations of Nine Months certificate course in Vedic Mathematics
Session- 2021-22

Vedic Arithmetic						
Course Code	Course Title	Course Type	Marks			Examination time (in Hours)
			Total	L	P	
CVML-1331	Vedic Arithmetic and Applications	C	50	50	-	3
CVML-1332	Vedic Algebra and Geometry	C	50	50	-	3
Total			100			

C - Compulsory

Certificate course in Vedic Mathematics.
Session-2021-22
Course Title: Vedic Arithmetic
Course Code: CVML-1331

Course Outcomes

The students will be able to

CO 1: Develop the understanding of objectives and features of Vedic Arithmetic.

CO 2: Recognize the meaning of mathematical sutras of vedic arithmetic in Sanskrit.

CO 3: Understand the concept of addition using completing the whole Method.

CO 4: Manage to solve the multiplication using vertically and crosswise and one more than the previous one method and demonstrate multiplication by 11, 12 and 13 by using Vedic sutras of multiplication.

CO 5: Distinguish between squaring numbers ending in 5 and squaring numbers near the base and subbase and manage to perform squaring by Duplex Method and Cubing by Anurupyen Sutra.

CO 6: To solve the square root and Cube Roots of perfect square and enhance the ability to find square root of imperfect square mentally.

CO 7: Understand and apply division by 9,19,29….. and understand the concept of division by using straight division. and also apply all these sutras to find percentages and interest quickly.

Certificate course in Vedic Mathematics.
Session-2021-22
Course Title: Vedic Arithmetic and Applications
Course Code: CVML-1331

Examination Time: 3 Hours Max. Marks: 50

Instructions for the paper setters/examiners:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

INTRODUCTION: History of Vedic maths, why Vedic maths, salient features of Vedic maths, Vedic maths formulas, 16 sutras and 13 sub sutras, terms and operations, Beejank, Vinculum Operations, High speed addition by using the concept of completing the whole and superfast subtraction by Nikhilam Sutram from basis 100,1000,10,000…and with any sub base like 200, 300 ,400 ,500…, Subtraction using Vinculum.

UNIT-II

SUTRAS OF MULTIPLICATION: Multiplication by Nikhilam Sutra, multiplication of numbers nearest to the bases 10,100,1000,10000, and multiplication of numbers near sub bases 20,30,40,50,60,70,80,90,500,5000…. fast multiplication by 11,12,13….,19, Multiplication with multiples of 111 and 1111, multiplication of numbers consisting of all 9s by Eknuyena and Nikhilam Sutra, multiplication of Numbers ending with 9, Multiplication by Anatyodarshkeyapi, Multiplication by Urdhav triyaghbhyam sutram, (two, three and four digits), Formation of any Two Digit table.

UNIT-III

SUTRAS OF SQUARES,SQUARE ROOTS,CUBE AND CUBE ROOTS : Meaning of Ekadhiken Sutram and its applications in finding squaring of numbers ending in 5, squaring by Anurupeyana Sutra, squaring by Yavdunamthavadunikrityavargamchayojyet sutra, squaring by Dwandvayoga sutra (General method of squaring), Verification by Beejank Method, squaring numbers nearest 50 and any other subbase, square roots of perfect squares (upto 5 digits) by Viloknam Sutra, general method of square roots, cubes by Anurupeyana sutra, Cube Roots of Exact Cubes (upto 6digits).

UNIT-IV

SUTRAS OF FACTORISATION AND DIVISION: HCF AND LCM, Divisibility test, Division by Nikhilam Navatascaramam Dasatah Sutra, division by Paravartya Yojayet, division by Anurupeyana, Division by Dwazank Sutra (Straight division), Conversion of vulgar fractions 1/19,1/29,1/39,1/49…..into decimals by Ekadhiken Purven Sutra, Recurring Decimals of fractions 1/13,1/23,5/33,9/11….by Anurupyen, Auxiliary fractions and its application in finding out recurring decimals of Vulgar fractions, Ratio and proportions Percentage, Profit and Loss, Simple interest, Compound Interest.

Text Book:

S. B. Tirthaji, Vedic Mathematics, Motilal Banarsidass Private Limited, Revised Edition, 1992 (Scope as in Chapters 2, 3, 4, 5, 10, 26, 27, 28, 31, 32, 33, 34, 35, 36)

Reference Books:

1 K. R. Williams, Vedic Mathematics Teacher's Manual, Inspiration Books, Revised Edition, 2009 (Scope as in Chapters 1, 2, 3, 5, 7, 9, 10, 11)

2 M. Tyra, Magical Book On Quicker Maths, ESC Publications, 5th Edition, 2018 (Scope as in Chapters 2-10, 18, 20, 22, 23, 24, 25)

Course Name: Certificate course in Vedic Mathematics.
Session-2021-22
Course Title: Vedic Algebra and Geometry
Course Code: CVML-1332

Course Outcomes

The students will be able to

CO 1: Develop the understanding of objectives and features of Vedic algebra and Geometry

CO 2: Recognize the meaning of mathematical sutras of Algebra and Geometry in Sanskrit.

CO 3: Distinguish between factorization of Quadratic and cubic polynomials

CO 4: Understand the concept of Algebraic addition

CO 5: Manage to solve the Algebraic multiplication using urdhavtrigabhyam sutra

CO 6: To find the roots of different equations using different sutras and upsutras

CO 7: Understand and apply Triples in coordinate geometry of two dimension

Course Name: Certificate course in Vedic Mathematics.
Session-2021-22
Course Title: Vedic Algebra and Geometry
Course Code: CVML-1332

Examination Time: 3 Hours Max. Marks: 50

Instructions for the paper setters/examiners:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

SUTRAS FOR ALGEBRAIC OPERATIONS: Addition of polynomials by Ekadhiken Poorven Sutra, Subtraction of Polynomials by Paravartya Yojyet Sutra, multiplication of polynomials by Urdhvatiragbhyam Sutra: Binomial ×Binomial, Trinomial× Trinomial, Trinomial ×Binomial, division of polynomials by paravartya yojyet Sutra (Divisor: Linear expression of single variable), Algebraic Squaring, Combined Algebraic operations.

UNIT-II

SUTRAS OF FACTORIZATION: HCF of two Polynomials by Sakalana-Vyavkalana Sutra, Factorization of Quadratic Polynomials, Factorization of Cubic polynomials by Gunita Sauccaya: Samuccaya Gunita sutra, factorization of Homogeneous equation of second degree by Lopstapanabhyam Sutra.

UNIT-III

SUTRAS FOR ROOTS OF EQUATIONS: Solution of linear equations with one or two terms of x by Paravartya yojyet Sutra, solution of linear equations in two variables by Paravartya yojyet, Anurupyen sutra and Sankalana-vyavakalana-bhyam, solution of Quadratic equations by Anurupyen Sutra and Adyamadye Nantyamaantyena sutra.

UNIT-IV

SUTRAS FOR GEOMETRY: Triples, triples addition, double angle, quadrant angels, rotations, application of triples: Triple Subtraction, Triple Geometry, Angle between two lines, Half Angle, Coordinate Geometry (two dimension): Length of perpendicular from a point onto a line, Circle problems, Equation of a straight line through two given points by Urdhavtriagbhyam Sutra, Triple Trigonometry, Bodhayan Sutra as Pythagoras theorem, Mensuration(Measurement of Volume and Surface area of Cuboid, Cylinder, Cone, Sphere)

Text Book:

S. B. Tirthaji, Vedic Mathematics, Motilal Banarsidass Private Limited, Revised Edition, 1992 (Scope as in Chapters 3, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 37)

Reference Books:

1 K. R. Williams, Vedic Mathematics Teacher's Manual, Inspiration Books, Revised Edition, 2009 (Scope as in Chapters 4, 5(5.3), 6, 7(7.2), 8, 10(10.7))

2 M. Tyra, Magical Book On Quicker Maths, ESC Publications, 5th Edition, 2018 (Scope as in Chapters 11 and 34)

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Science (Honours) Physics
Semester-I
Session: 2021-22

Bachelor of Science (Honours) Physics Semester-I							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
BOPL-1335	Mathematics-I	C	50	40	-	10	3

C-Compulsory

Bachelor of Science (Honours) Physics
Semester-I
Session: 2021-22
Course Title: Mathematics-I
Course Code: BOPL-1335
Course outcomes

After the completion of this course, students should be able to:

CO 1: Give argument related to limits, continuity and derivative of a function.
CO 2: Understand the concept of maxima and minima of a function of a single variable.
CO 3: Explain the significance of Roll's theorem, Mean Value theorem, and Taylor's and Maclaurin's theorem to find the expansions of functions.
CO 4: Demonstrate the geometrical meaning of integral calculus as an area and their uses in the determination of C.G & moments of inertia.
CO 5: Understand how to solve linear differential equations with constant coefficients and linear homogeneous and inhomogeneous differential equations of second order.

Bachelor of Science (Honours) Physics

Semester-I

Session: 2021-22

Course Title: Mathematics-I

Course Code: BOPL-1335

Maximum Marks: 50 (External 40 + Internal 10) Examination Time: 3 Hours

Pass Marks: 18 Total Teaching hours: 60

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT –I

Functions and Derivatives: Limits, continuity and derivative of function. Differentiation of standard functions, Successive differentiation. Geometrical significance of derivative. Maxima and Minima of a function of single variable. Partial differentiation. Chain rule of differentiation.

15 Lectures

UNIT –II

Differential Calculus: Statement of Rolle's theorem and Mean value theorem, Taylor's and Maclaurins theorems and their applications to formal expansion of functions. Tangents and normals. Basic idea about asymptotes.

15 Lectures

UNIT –III

Integral Calculus: Integration as inverse of differentiation. Indefinite integrals of standard forms. Method of substitution. Integration using partial fractions. Integration by parts. Reduction formulae. Definite integrals. Definite integral as limit of a sum and geometrical interpretation as an area.

15 Lectures

UNIT –IV

Differential Equations: Definition & formation of differential equations. Linear differential equation of first order and first degree. Linear homogenous and inhomogeneous differential equation of second order. Linear differential equations with constant coefficients.

15 Lectures

Text Book:

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi.

Reference Books:

1. Shanti Narayan, Differential Calculus, Shyam Lal, New Delhi.
2. Shanti Narayan, Integral Calculus, S. Chand, Delhi.
3. M. Vygodsky, Mir, Mascow, Mathematical Hand Book.

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Science (Honours) Physics
Semester-II
Session: 2021-22

Bachelor of Science (Honours) Physics Semester-II							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
BOPL-2335	Mathematics-II	C	50	40	-	10	3

C-Compulsory

Bachelor of Science (Honours) Physics

Semester-II

Session: 2021-22

Course Title: Mathematics-II

Course code: BOPL-2335

Course outcomes

After the completion of this course, students should be able to

CO 1: Manage to solve problems related to series solution of Bessel, Legendre and Hermite functions.

CO 2: Understand the concept of Partial differential equations& its applications to find the solution of Laplace, Wave & Diffusions equations.

CO 3: Apply Laplace transforms on periodic functions and differential equations with constant coefficients.

CO 4: Differentiate between Fourier Sine & Cosine series and Fourier Sine & Cosine transforms.

CO 5: Classify the difference between Laplace transforms and Fourier transforms.

Bachelor of Science (Honours) Physics

Semester-II

Session: 2021-22

Course Title: Mathematics-II

Course code: BOPL-2335

Maximum Marks: 50 (External 40 + Internal 10) Examination Time: 3 Hours

Pass Marks: 18 Total Teaching hours: 60

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT –I

Second order Differential Equations: Linear differential equations with variable coefficients. Series Solution of Bessel, Legendre, Hermite, Laguerre and Hypergeometric differential equations by Frobenius method. Recurrence relations and orthogonality properties.

15 Lectures

UNIT –II

Partial Differential Equations: Definition and formation of first and second order partial differential equations, Laplace, Wave and diffusion equation in one and two dimensions, Solutions of these equations by separation of variables.

15 Lectures

UNIT –III

Laplace Transforms: Definition, elementary Laplace transforms, transforms of derivatives, integration of transforms, Laplace transform of periodic functions, solution of differential equations with constant coefficients using Laplace transforms.

15 Lectures

UNIT –IV

Fourier series and Transforms: Periodic functions, Drichlet's conditions, Fourier coefficients, Sine and Cosine series, half range expansions, exponential series, differentiation and integration of Fourier transform, Fourier Sine and Cosine transforms, Inversion formulae, Fourier transforms of derivatives.

15 Lectures

Text Book:

George Arfken, Mathematical Methods for Physicists, Academic Press, New York.

Reference Books:

1. M. Vygodsky, Mir, Mascow, Mathematical Hand Book.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi.
3. Pipes & Harvill, Applied Mathematics for Engineers and Physicists, McGraw Hill, London.
4. Sokolnikoff & Recheffer, Mathematics of Physics and Modern Engineering.

Scheme and Curriculum of Examinations of Three-Year Degree Programme
Bachelor of Science (Honours) Physics
Semester-III
Session: 2021-22

Bachelor of Science (Honours) Physics Semester-III							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
BOPL-3333	Mathematics-III	C	50	40	-	10	3

C-Compulsory

Bachelor of Science (Honours) Physics
Semester–III
Session 2021-22
Course Title: Mathematics-III
Course Code: BOPL-3333

Course outcomes

After the completion of this course, students should be able to

CO 1: Understand the concept of complex numbers and De Moivre's theorem.

CO 2: Understand De Moivre's theorem.

CO 3: Understand the basic concept of lines, parabola, hyperbola and ellipse.

CO 4: Understand and demonstrate the concept of cone, cylinder and sphere.

CO 5: Understand the concept of tangent plane and normal plane to the surfaces.

Bachelor of Science (Honours) Physics

Semester–III

Session 2021-22

Course Title: Mathematics-III

Course Code: BOPL-3333

Examination Time: 3 Hours Maximum Marks: 50

Theory:40

CA:10

Instructions for the Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT –I

Complex numbers and their geometrical interpretation, De Moivre's theorem and its applications.

UNIT –II

Polar and Cartesian co-ordinates, Distance Formula, Section Formula of a line in different forms, Angle between two lines, Intersection of two lines, Standard equation of ellipse, parabola, hyperbola and their properties.

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UNIT –III

Sphere, Cone, Cylinder and simple properties of these surfaces, Equation of tangent and normal planes to above surfaces.

UNIT –IV

Double and Triple integrals, Evaluation of areas and volumes using double triple integrals, Change of order of integration in double integrals, Area in polar co-ordinates, Triple integrals in spherical and polar coordinates.

Reference Books:

1)Mathematics Textbook for class XI, NCERT , New Delhi, 2006 (Scope as in Chapters 6,11,12)

2)B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers , Delhi, 42th , edition, 2012 (Scope as in chapters 3,7,19)

Scheme and Curriculum of Examinations of Three-Year Degree Programme
Bachelor of Science (Honours) Physics
Semester-IV
Session: 2021-22

Bachelor of Science (Honours) Physics Semester-IV							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
BOPL-4333	Mathematics-IV	C	50	40	-	10	3

C-Compulsory

Bachelor of Science (Honours) Physics
Semester–IV
Session 2021-22
Course Title: Mathematics-IV
Course Code: BOPL-4333

Course outcomes

After the completion of this course, students should be able to

CO 1: Understand the concept of matrices, determinants.

CO 2: Solve system of linear equations and obtain eigen values, eigen vectors and Characteristic polynomial.

CO 3: Understand the concept of Vector Spaces, Linear Independence and Dependence.

CO 4: Understand the concept of Basis and Dimension.

CO5: Understand the concept of linear Transformation and its matrix representation.

Bachelor of Science (Honours) Physics

Semester–IV

Session 2021-22

Course Title: Mathematics-IV

Course Code: BOPL-4333

Examination Time: 3 Hours | Maximum Marks: 50

Theory: 40

CA :10

Instructions for the Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT –I

Matrices, Determinants and their properties, algebra of matrices, Eigen values and Eigen vectors, Unitary, Hermitian and Orthogonal matrices and their properties, Cayley-Hamilton theorem and its applications.

UNIT –II

Elementary operations on matrices, Rank of a matrix, Row Rank, Column rank and their equivalence, System of linear equations and conditions for consistency, Quadratic forms .

UNIT-III

Vector spaces, vector subspaces, linear spans, linear dependence and independence, basis and dimension, Linear transformation, Representation of linear transformation by matrices.

UNIT –IV

Infinite Series, Series of positive terms, alternate series, Behaviour of infinite series,Cauchy's convergence criterion, D' Alembert Ratio Test, Cauchy's root test, Rabbes test ,Gauss test, Cauchy's Integral test, Absolute and conditional convergence (Tests without Proof)

Reference Books:

1)B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd edition, 2012 (Scope as in chapters 2,9)

2)S. Narayan, P.K Mittal, A textbook of Matrices, S.Chand Publications, New Delhi,11th edition, 2005 (Scope as in chapters 4,5)

Kanya MahaVidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-I
Session: 2021-22

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-I									
Programme Name	Course Code		Course Title	Course Type	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-1333 BECM-1333 BSNM-1333 BCSM-1333	(I)	Mathematics (Algebra)	E/C	50	40	-	10	3
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science	BARM-1333 BECM-1333 BSNM-1333 BCSM-1333	(II)	Mathematics (Calculus and Trigonometry)		50	40	-	10	3

C-Compulsory
E-Elective

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–I

Session: 2021-22

Course Title: Mathematics (Algebra)

Course Code: BARM/ BECM/ BCSM/ BSNM-1333(I)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Distinguish between solution of cubic equations and Bi-quadratic equations.

CO 2: Classify real quadratic form in variables, definite, semi- definite and indefinite real quadratic form.

CO 3: Understand the concept of matrix congruence of skew symmetric matrices and its reduction in real field.

CO 4: Solve system of linear equations and obtain Eigen values, Eigen vectors, minimal and characteristic equation of a matrix and to apply it in advanced dynamics and electric current.

CO 5: To find the relations between the roots and coefficients of general polynomial equation in one variable.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–I

Session: 2021-22

Course Title: Mathematics (Algebra)

Course Code: BARM/ BECM/ BCSM/ BSNM-1333(I)

Examination Time: 3 hrs. Max.Marks:50

Theory:40

CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

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Unit–I

Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks, Nullity of matrix, Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations.

Unit-II

Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix. Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field.

Unit–III

Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Matrix Congruence of skew–symmetric matrices. Reduction in the real field. Classification of real quadratic forms in variables. Definite, semi–definite and indefinite real quadratic forms. Characteristic properties of definite, semi–definite and indefinite forms.

Unit-IV

Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equations and symmetric function of roots, Descarte's rule of signs, Newton's Method of divisors, Solution of cubic equations by Cardon method, Solution of biquadratic equations by Descarte's and Ferrari's Methods.

Text Book:

Chandrika Parsad: Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad.

Reference Books:

1.K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
2.Shanti Narayan and P.K. Mittal : Text Book of Matrices.
3.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–I

Session: 2021-22

Course Title: Mathematics (Calculus and Trigonometry)

Course Code: BARM/ BECM/ BCSM/ BSNM-1333(II)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand real number system, lub& glb of set of real numbers, limit of a function, basic properties of limit & to apply it in real world problem.

CO 2: Analyse continuous and discontinuous function, Apply concept of continuity in uniform continuity.

CO 3: Manage to solve problems related to successive differentiation, Leibnitz theorem, Taylor's & Maclaurin's theorem with various forms of remainders and to use these expansion to compute values of Sine, Cosine, tangent or log function.

CO 4: Understand the concept of De Moivre's theorem & its applications. Identify circular, hyperbolic function and their inverses and use these function to describe the shape of the curve formed by high voltage line suspended between two towers.

CO 5: Demonstrate exponential and logarithmic function of complex numbers, and to solve Gregory's series and summation of series.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–I

Session: 2021-22

Course Title: Mathematics (Calculus and Trigonometry)

Course Code: BARM/ BECM/ BCSM/BSNM-1333(II)

Examination Time: 3 hrs. Max.Marks:50 Theory :40

CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Real number system and its properties, lub, glb of sets of real numbers, limit of a function, Basic properties of limits, Continuous functions and classification of discontinuities, Uniform continuities.

Unit-II

Differentiation of hyperbolic functions, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's theorem with various forms of remainders, Indeterminate forms.

Unit-III

De–Moivre's Theorem and its applications, circular and hyperbolic functions and their inverses.

Unit-IV

Exponential and Logarithmic function of a complex numbers, Expansion of trigonometric functions, Gregory's series, Summation of series.

Text Books:

1.George B.Thomas and Ross L.Finney: Calculus and Analytic Geometry, 9thedition, Addison Wesley,1998(Relevant portions related to Unit-I &II)

2..S.L.Loney: Plane trigonometry part -II(relevant portions related to Unit-III & IV) Cambridge university press.

Reference Books:

1.Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999.

2.N. Piskunov: Differential and Integral Calculus, Peace Publishers, Moscow.

3.Gorakh Prasad: Differential Calculus, PothishalaPvt. Ltd., Allahabad.

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-II
Session: 2021-22

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-II									
Programme Name	Course Code		Course Title	Course Type	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science	BARM-2333 BECM-2333 BSNM-2333 BCSM-2333	(I)	Mathematics (Calculus and Differential Equations)	E/C	50	40	-	10	3
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science	BARM-2333 BECM-2333 BSNM-2333 BCSM-2333	(II)	Mathematics (Calculus)		50	40	-	10	3

C-Compulsory
E-Elective

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)

Semester–II
Session: 2021-22
Course Title: Mathematics (Calculus and Differential Equations)
Course Code: BARM/BECM/ BCSM/BSNM-2333(I)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate Asymptotes, points of inflexion, multiple points on a curve & also to differentiate between concavity and convexity & hence tracing of curve.

CO 2: Understand the concept of linear differential equation with constant and variable coefficients & also the exact differential equations & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

CO 3: Demonstrate the geometrical meaning of a differential equation & the orthogonal trajectories.

CO 4: Manage to solve the problem related to series solution of differential equations like Bessel and Legendre equation by Power series method.

CO 5: Apply reduction formula on different functions & to develop the concept of variation of parameter.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–II
Session: 2021-22
Course Title: Mathematics (Calculus and Differential Equations)
Course Code: BARM/BECM/ BCSM/BSNM-2333(I)

Examination Time: 3 Hours

Max.Marks:50
Theory :40
CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple Points, Curvature, Tracing of Curves (Cartesian and Parametric coordinates only).

Unit-II

Integration of hyperbolic functions. Reduction formulae. Definite integrals. Fundamental theorem of integral calculus. Quadrature, rectification.

Unit– III

Exact differential equations. First order and higher degree equations solvable for x,y,p. Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories.

Unit-IV

Linear differential equations with constant and variable coefficients. Variation of Parameters method, reduction method, series solutions of differential equations. Power series method, Bessel and Legendre equations (only series solution).

Text Book:

Om P.Chug, Parmanand Gupta, R.S.Dahiya: Topics in Mathematics: Calculus and Differential Equations, Laxmi Publications Private Ltd.

Reference Books:

1. D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India), 1967.
2. G.F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
3. Gorakh Prasad: Integral Calculus, PothishalaPvt. Ltd., Allahabad.
4. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 1999. 52

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–II
Session: 2021-22
Course Title: Mathematics (Calculus)
Course Code: BARM/BECM/ BCSM/BSNM-2333(II)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of Double and Triple integrals, & application to evaluation of areas, volumes, surfaces of solid of revolution and to apply to find out area and volume of plane and solid figure.

CO 2: Differentiate between limit and continuity of function of two variables and apply this concept in partial derivatives & differentiability of real valued function of two variables.

CO 3: Manage to solve problems related to Maxima, Minima & Saddle points of functions of two variables.

CO 4: Classify Envelopes & Evolutes, Application of inverse & implicit function theorems.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–II
Session: 2021-22
Course Title: Mathematics (Calculus)
Course Code: BARM/BECM/ BCSM/BSNM-2333(II)
Examination Time: 3 Hours

Max.Marks:50
Theory :40
CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Limit and Continuity of functions of two variables, Partial differentiation, Change of variables, Partial derivatives and differentiability of real–valued functions of two variables, Schwartz's and Young's Theorem, Statements of Inverse and implicit function theorems and applications.

Unit-II

Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Envelopes. Evolutes, Maxima, Minima and saddle points of functions of two variables.

Unit-III

Lagrange's undetermined multiplier method, Double and Triple Integrals, Change of variables, Change of order of integration in double integrals.

Unit-IV

Application to evaluation of area, volume, surface of solids of revolutions.

Text Book:

George B. Thomas and Ross L. Finney: Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998

Reference Books:

1. Narayan, S. and P.K. Mittal: Integral Calculus. Sultan Chand & Sons.
2. Kreyszig, E.: Advanced Engineering Mathematics.
3. Narayan S. and P.K. Mittal : Differential Calculus, Sultan Chand & Sons.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of ThreeYear Degree Programme
Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-III
Session: 2021-22

Bachelor of Arts/ Bachelor of Science(Economics, Non-Medical, Computer Science) Semester-III									
Programme Name	Course Code		Course Title	Course Type	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-3333 BECM-3333 BSNM-3333 BCSM-3333	(I)	Mathematics (Analysis)	E/C	50	40	-	10	3
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-3333 BECM-3333 BSNM-3333 BCSM-3333	(II)	Mathematics (Analytical Geometry)		50	40	-	10	3

C-Compulsory
E-Elective

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–III

Session: 2021-22

Course Title: Mathematics (Analysis)

Course Code: BARM/ BECM/ BCSM/ BSNM-3333(I)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate an understanding of limits and how they are used in sequences and series.
CO 2: To understand the concepts of Riemann sum, partitions, upper and lower sums, Riemann integrability of continuous functions and of monotone functions.
CO 3: To know and describe the converging behavior of improper integrals and Beta , Gamma functions.
CO 4: Distinguish between the absolute convergence and conditional convergence.
CO 5: To find the relation between Beta and Gamma functions.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–III

Session: 2021-22

Course Title: Mathematics (Analysis)

Course Code: BARM/ BECM/ BCSM/ BSNM-3333(I)

Examination Time: 3 hrs. Max.Marks:50

Theory:40

CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

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Unit-I

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion.

Unit-II

Series of non-negative terms. Comparison tests. Cauchy's integral tests. Ratio tests. Cauchy's root test. Raabe's test, logarithmic test. Demorgan's and Bertrand's tests. Kummer's test, Cauchy Condensation test, Gauss test, Alternating series. Leibnitz's test, absolute and conditional convergence.

Unit-III

Partitions, Upper and lower sums. Upper and lower integrals, Riemann integrability. Conditions of existence of Riemann integrability of continuous functions and of monotone functions. Algebra of integrable functions.

Unit-IV

Improper integrals and statements of their conditions of existence. Test of the convergence of improper integral, beta and gamma functions.

Text Book:

Ajit Kumar and S. Kumaresan : A Basic Course in Real Analysis, CRC Press

Reference Books:

1. Malik, S.C.: Mathematical Analysis, Wiley Eastern Ltd. (1991).
2. Apostal, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics (1974).

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–III

Session: 2021-22

Course Title: Mathematics (Analytical Geometry)

Course Code: BARM/ BECM/ BCSM/ BSNM-3333(II)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of the geometry of lines and conics in the Euclidian plane.

CO 2: Develop geometry with a degree of confidence and will gain fluency in the basics of Euclidian geometry.

CO 3: Sketch conic sections; identify conic sections, their focal properties and classifications.

CO 4: Demonstrate the concept of parabola, ellipse, hyperbola, sphere and the general quadratic equation.

CO 5: Understand the concept of coordinate geometry on a wider scale with the help of shifting of origin and rotation of axis.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–III

Session: 2021-22

Course Title: Mathematics (Analytical Geometry)

Course Code: BARM/ BECM/ BCSM/ BSNM-3333(II)

Examination Time: 3 hrs.
Max.Marks:50

Theory:40
CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Transformation of axes, shifting of origin, Rotation of axes in two dimension and three dimension, the invariants, Joint equation of pair of straight lines, equations of bisectors

Unit-II

Parabola and its properties. Tangents and normal, Pole and polar, pair of tangents at a point, Chord of contact, equation of the chord in terms of mid point and diameter of conic.

Unit-III

Ellipse and hyperbola with their properties. Tangents and normal, Pole and polar. pair of tangents at a point, Chord of contact, Identifications of curves represented by second degree equation (including pair of lines).

Unit-IV

Intersection of three planes, condition for three planes to intersect in a point or along a line or to form a prism. Sphere: Section of a sphere by a plane, spheres of a given circle. Intersection of a line and a sphere. Tangent line, tangent plane, power of a point with respect to a sphere, radical planes.

Text Book:

S.L. Loney: The Elements of Coordinate Geometry, Macmillan and Company, London.

Reference Books:

1. Gorakh Prasad and H.C. Gupta: Text Book on Coordinate Geometry.
2. Narayan, S and P.K.Mittal.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
3. Kreyszig, E.: Advanced Engineering Mathematics.
4. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-IV
Session: 2021-22

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-IV									
Programme Name	Course Code		Course Title	Course Type	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-4333 BECM-4333 BSNM-4333 BCSM-4333	(I)	Mathematics (Statics and Vector Calculus)	E/C	50	40	-	10	3
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-4333 BECM-4333 BSNM-4333 BCSM-4333	(II)	Mathematics (Solid Geometry)		50	40	-	10	3

C-Compulsory
E-Elective

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–IV
Session: 2021-22
Course Title: Mathematics (Statics and Vector Calculus)
Course Code: BARM/BECM/ BCSM/BSNM-4333(I)

Course Outcomes

After passing this course, the students will be able:

CO 1: To apply parallelogram law of forces, triangle law of forces, Lami's theorem to real life problems.

CO 2: To understand that how one can resolve number of coplanar forces, parallel forces and concurrent forces acting at a body.

CO 3: To find the moments of number of coplanar forces acting at a particle

CO 4: To find the resultant of a force and couple acting on a body.

CO 5: To find the applications of CG of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.

CO 6: To find the values of gradient, divergence and curl operator of given vectors.

CO 7: To find the application of Gauss theorem, Green's theorem and Stokes's theorem in real life problems.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–IV
Session: 2021-22
Course Title: Mathematics (Statics and Vector Calculus)
Course Code: BARM/BECM/ BCSM/BSNM-4333(I)
Examination Time: 3 Hours

Max.Marks:50
Theory :40
CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Composition and resolution of forces (parallelogram law, triangle law, polygon law, Lami's Theorem(ɤ-μ) theorem). Resultant of a number of coplanar forces, parallel forces. Moments ,Varignon's Theorem of moments, Couples , Resultant of two Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple, Equilibrium of coplanar forces.

Unit-II

Friction, Laws of friction, Equilibrium of a particle on a rough plane. Centre of Gravity: Centre of gravity of a rod, triangular lamina, solid hemisphere, hollow hemisphere, solid cone and hollow cone.

Unit-III

Vector differentiation, Gradient, divergence and curl operators, line integrals, Vector identity, and Vector integration.

Unit-IV

Theorems of Gauss, Green, Stokes and problems based on these.

Text Books:

1. N.P.Bali: Statics, Laxmi Publications (P) Ltd.
2. Spiegal,M.R.: Vector Analysis, Schaum's outline Series, McGraw Hill.

Reference Books:

1. S.L. Loney: Statics, Macmillan and Company, London.
2. R.S. Verma: A Text Book on Statics, Optical Pvt. Ltd., Allahabad.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–IV
Session: 2021-22
Course Title: Mathematics (Solid Geometry)
Course Code: BARM/BECM/ BCSM/BSNM-4333(II)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate the concept of cone, classification of cone, intersection of line and cone, reciprocal cone.

CO 2: Understand the concept of cylinder, enveloping cylinder and its limiting form.

CO 3: Describe the concept of conicoids or quadratic surface, its classification, trace different types of conicoids.

CO 4: Manage to find surface of revolution and concept of tangent and normal to the conicoid

CO 5: Identify the conicoids and representing it in the form of hyperboloid, ellipsoid, paraboloid.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–IV
Session: 2021-22
Course Title: Mathematics (Solid Geometry)
Course Code: BARM/BECM/ BCSM/BSNM-4333(II)

Examination Time: 3 Hours

Max.Marks:50
Theory :40
CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms

Unit-II

Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z . Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve. Right circular and elliptic cones.

Unit-III

Equation of surface of revolution obtained by rotating the curve f(x,y)=0 about the z-axis in the form of $f(x^2+y^2, z) =0$.Equation of ellipsoid, hyperboloid and Paraboloid in standard forms.

Unit-IV

Surfaces represented by general equation of 2nd degree S = 0. Tangent lines, tangent planes and Normal Plane.

Text Book:

P.K.Jain& Khalil Ahmed: A text book of Analytical Geometry of three dimensions, Wiley Eastern Ltd. 1999.

Reference Books:

1. Narayan, S &P.K.Mittal : Analytical Solid Geometry, Sultan Chand & Sons(2005)
2. Kreyszig, E : Advanced Engineering Mathematics

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-V
Session: 2021-22

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-V									
Programme Name	Course Code		Course Title	Course Type	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-5333 BECM-5333 BSNM-5333 BCSM-5333	(I)	Mathematics (Dynamics)	E/C	50	40	-	10	3
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-5333 BECM-5333 BSNM-5333 BCSM-5333	(II)	Mathematics (Number Theory)		50	40	-	10	3

C-Compulsory
E-Elective

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–V

Session: 2021-22

Course Title: Mathematics (Dynamics)

Course Code: BARM /BECM / BCSM/ BSNM-5333(I)

Course Outcomes

After passing this course, the students will be able to:

CO 1: Identify the basic relations between distance, time, velocity and acceleration.

CO 2: Explain the relationship between forces and motion. Differentiate between balanced and unbalanced forces and Explain how unbalanced force affect motion.

CO 3: Understand Newton's Laws of Motion and Apply the laws to solve many problems.

CO 4: Discuss the motion of particles connected by a string, motion along a smooth inclined plane.

CO 5: Solve different types of problems with Variable Acceleration.

CO 6: Discuss Simple Harmonic Motion and Illustrate it with a variety of examples.

CO 7: Solve Pendulum, Damped and forced Oscillations oscillating system problems.

CO 8: Define Work, Power and Energy and Explain their relationship. Use measurement tools to apply the concepts of Work and power to solve real life problems.

CO 9: Define Energy and Identify the different types that exist

Bachelor of Arts /Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–V

Session: 2021 -22

Course Title: Mathematics (Dynamics)

Course Code: BARM/ BECM/ BCSM/ BSNM-5333(I)

Examination Time:3 Hours Max.Marks: 50

Theory:40

CA:10

Instructions for the paper setter:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

Rectilinear motion in a straight line with uniform acceleration, Newton's laws of motion. Motion of two particles connected by a string.

Unit-II

Motion along a smooth inclined plane. Variable acceleration. Simple Harmonic Motion.

Unit-III

Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles, velocity and direction of motion of a projectile after a given time, projectiles on an inclined plane. Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum.

Unit-IV

Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.

Text Book:

S.R.Gupta: A text book of Dynamics

Reference Books:

1. F. Chorlton: Dynamics.

2. S.L. Loney: An Elementary Treatise on the Dynamics of a Practice and of Rigid Bodies, Cambridge University Press, 1956.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–V

Session: 2021-22

Course Title: Mathematics (Number Theory)

Course Code: BARM/ BECM/ BCSM/ BSNM-5333(II)

Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Prove results involving divisibility and greatest common divisors.

CO 2: Solve system of linear congruences.

CO 3: Find solutions of specified linear Diophantine equation.

CO 4: Apply Fermat's and Euler's theorem to prove relation involving prime numbers.

CO 5: Apply the Wilson's theorem to solve numerical problems.

CO 6: Solve system of equations using congruences.

CO 7: Understand and apply properties of phi functions in real world problems.

CO 8: Understand application of important arithmetic functions.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester–V

Session: 2021-22

Course Title: Mathematics (Number Theory)

Course Code: BARM/ BECM/ BCSM/ BSNM-5333(II)

Examination Time: 3 hrs. Max.Marks: 50

Theory: 40

CA:10

Instructions for the Paper Setter:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.

Unit-I

The division algorithm, The greatest common divisor, least common multiple, The Euclidean algorithm.

Unit-II

The Diophantine equation ax + by = c, Prime numbers and their distribution, the fundamental theorem of arithmetic, Basic properties of congruences.

Unit-III

Linear congruences, Special divisibility tests, Chinese remainder theorem, The Fermat's theorem, Wilson's theorem

Unit-IV

Euler’s Phi function, Euler's theorem, some properties of the Phi Function, σ and τ functions, Mobius Inversion formula, Greatest integer function

Text Book:

D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill. (Scope in Chapters 2-5, 7) 2005.

Reference Book:

Niven and Zuckerman: An Introduction to Number Theory, Wiley 1972.

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-VI
Session: 2021-22

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-VI									
Programme Name	Course Code		Course Title	Course Type	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-6333 BECM-6333 BSNM-6333 BCSM-6333	(I)	Mathematics (Linear Algebra)	E/C	50	40	-	10	3
Bachelor of Arts Bachelor of Science (Economics) Bachelor of Science (Non-Medical) Bachelor of Science (Computer Science)	BARM-6333 BECM-6333 BSNM-6333 BCSM-6333	(II)	Mathematics (Numerical Analysis)		50	40	-	10	3

C-Compulsory
E-Elective

Bachelor of Arts/Bachelor of Science (Economics/Computer Science/Non-Medical)
Semester–VI
Session- 2021-22
Course Title: Mathematics (Linear Algebra)
Course Code: BARM/BECM/BCSM/BSNM-6333(I)

Course Outcomes

After the completion of this course, students should be able to:

CO 1: Express the algebraic concepts such as binary operation, groups, rings and fields.
CO 2: Define a vector space and subspace of a vector space.
CO 3: Check the linear dependence and linear independence of vectors.
CO 4: Describe the concepts of basis and dimension of vector spaces.
CO 5: Investigate properties of vector spaces and subspaces using linear transformation.
CO 6: Express linear transformations between vector spaces.
CO 7: Perform algebra operations between linear transformations.
CO 8: Find the matrix representing a linear transformation.

Bachelor of Arts/Bachelor of Science (Economics/Computer Science/Non-Medical)
Semester–VI
Session: 2021-22
Course Title: Mathematics (Linear Algebra)
Course Code: BARM/BECM/ BCSM/BSNM-6333(I)

Examination Time: 3 Hours Max. Marks: 50
Theory:40
CA:10

Instructions for the paper setters/examiners:
Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Definition of groups, rings and fields with examples. Definition of a vector space, subspaces with examples. Direct sum of subspaces. Linear span, Linear dependence, Linear independence of vectors. Linear combination of vectors.

Unit-II

Basis of a vector space, Finitely generated vector spaces. Existence theorem for basis. Invariance of the number of elements of the basis set. Dimension of sum of two subspaces. Quotient space and its dimension.

Unit-III

Linear transformation. Algebra of linear transformation. Rank-Nullity theorem, Isomorphism and Isomorphic spaces.

Unit-IV

Matrix of a linear transformation. Changes of basis, Linear operator.

Text Book:
Charles W.Curtis : Linear Algebra
Reference Books:
1.Surjit Singh: Linear Algebra, Vikas Publishing ,1997.
2.V. Krishnamurthy, V. P. Mainra and J.L. Arora: An Introduction to Linear Algebra, East West Press, 1976.
3.Shanti Narayan & P.K. Mittal: A Text Book of Matrices, 10th Edition (2002), S. Chand & Co.

Bachelor of Arts/Bachelor of Science (Economics/Computer Science/Non-Medical)
Semester–VI
Session: 2021-22
Course Title: Mathematics (Numerical Analysis)
Course Code: BARM/BECM/ BCSM/BSNM-6333(II)

After passing this course, the students will be able to:

CO 1. Perform computation for solving a system of equations.

CO 2. Understand its application in all branches of engineering.

CO 3. Know how to find the roots of transcendental equations.

CO 4. Learn how to interpolate the given set of values.

CO 5. Understand the curve fitting for various polynomials .

CO 6. Learn numerical solution of differential equations.

CO 7. Compute numerical integration and differentiation, numerical solution of ordinary differential equations.

Bachelor of Arts/Bachelor of Science (Economics/Computer Science/Non-Medical)
Semester–VI
Session: 2021-22
Course Title: Mathematics (Numerical Analysis)
Course Code: BARM/BECM/ BCSM/BSNM-6333(II)

Examination Time: 3 Hours Max. Marks: 50
Theory:40
CA:10

Instructions for the Paper Setter: Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.
The students can use only Non Programmable & Non Storage Type Calculator.

Unit-I

Error generation, propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Iteration method, Newton's Method, Generalized Newton's Method, Method of false position, Muller's method, Rate of convergence of these methods.

Unit-II

Solution of linear system of equation; Direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative Method, Jacobi's Method, Gauss Seidel Method. Finite Differences: Forward, Backward, Central, Divided differences, shift operator, relationship between the operators and detection of errors by use of difference operator. Interpolation with divided difference, Newton's formula, Lagrangian Method.

Unit-III

Finite difference interpolation, Gauss formula, Stirling formula, Bessel's formula, Error Estimation Extrapolation. Numerical differentiation, Method based on interpolation. Numerical Integration, Trapezoidal rule, Simpson's rule, Weddle rule, Romberg Integration, Gaussian integration method, Gaussian legendre integration. Double numerical integration.

Unit-IV

Numerical solution of ordinary differential equations, Initial value problem, Taylor's method, Euler's methods, Picard's method, Milne's Method, Runge-Kutta Method. Predictor- Corrector's Method.

Text Book:

Iyenger, S. R. K., R. K. Jain, and Mahinder Kumar. Numerical Methods for Scientific and Engineering Computation. Delhi: New Age International Publishers, 2012.

Bachelor of Commerce in Honours
Semester -III
Session: 2021-22
Course Title: Analytical Skills
Course Code: BCOL-3331

Course Outcomes

After the successful completion of this course students will be able to

CO 1: Analyze data being presented in the form of tables, venn diagrams, pie charts.

CO 2: Demonstrate procedural fluency with real number arithmetic operations and use these operations to represent real world scenarios and to solve stated problems.

CO 3: Demonstrate number sense and conversion between fractions, decimals and percentages.

CO 4: Draw conclusions or make decisions in quantitatively based situations that are dependent upon multiple factors.

CO 5: Use simple and compound interest to do business calculations such as value of money, maturity value, present value, future value and able to differentiate which math method should be used for different problems.

Bachelor of Commerce in Honours
Semester -III
Session: 2021-22
Course Title: Analytical Skills
Course Code: BCOL-3331

Examination Time: 3 Hours | Max. Marks: 100
Theory: 80
CA: 20

Instructions for the Paper Setter:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one from each section. The fifth question may be attempted from any section. Each question will carry 8 marks.

UNIT-I

Data Analysis:- The data given in a Table, Graph, Bar Diagram, Pie Chart, Venn diagram or a passage is to be analyzed and the questions pertaining to the data are to be answered.

UNIT-II

Sequence and Series:- Analogies of numbers and alphabets completion of blank spaces following the pattern in A:b::C: d relationship odd thing out; Missing number in a sequence or a series.

UNIT-III

Arithmetic ability:- Algebraic operations BODMAS, Fractions, Divisibility rules, LCM&GCD (HCF).
Date, Time and Arrangement Problems: Calendar Problems, Clock Problems, Blood Relationship.

UNIT-IV

Quantitative aptitude:- Averages, Ratio and proportion, Problems on ages, Time, distance, speed.

Business computations: -Percentages, Profit &loss, Partnership, simple and compound interest.

Reference Books:

1. R S Agrawal, Quantitative Aptitude for Competitive Examination, S. Chand publications.
2. R V Praveen, Quantitative Aptitude and Reasoning, PHI publishers.
3. Abhijit Guha, Quantitative Aptitude for Competitive Examination, Tata McGraw Hill publications.

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Science (Bio-Technology)
Semester-II
Session: 2021-22

Bachelor of Science (Bio-Technology) Semester-II							
Course Title	Course Code	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
Biostatistics	BBTL-2333	C	40	32	--	8	3

C-Compulsory

Bachelor of Science (Bio-Technology)
Semester–II
Session 2021-22
Course Title: Biostatistics
Course Code: BBTL-2333
Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Discuss and explain what Biostatistics is and how it is used in the field of Biology.

CO 2: Calculate summary statistics (mean, median, mode, range, standard deviation and variance) from the data.

CO 3: Apply basic statistical concepts commonly used in health and medical sciences.

CO 4: Familiar with the concepts of probability, conditional probability and Bayes theorem.

CO 5: Familiar with the concepts of correlation and regression.

CO 6: Know what drawing a random sample from a population means and why it is important.

CO 7: State the null hypothesis and alternative hypothesis (both one way and two ways) appropriate to a given scenario.

CO 8: Determine if it is appropriate to use the Chi-Square test for testing the significance of fit between data and predicted data.

CO 9: Perform basic test (Chi-Square test) to evaluate results

Bachelor of Science (Bio-Technology)
Semester–II
Session 2021-22
Course Title: Biostatistics
Course Code: BBTL-2333

Examination Time: 3 Hours

Max. Marks: 40
Theory: 32
CA:8

Instructions for the Paper Setter:

There will be five sections, namely A, B, C, D, E

Section –A: The examiner shall set 10 short answer type questions covering entire syllabus and the candidates will have to attempt 8 questions of 1 mark each. Answer to each question shall be approximately of 50 words.The total weight age of this section shall be 8 marks.

Section-B, C, D, and E: Eight questions of equal marks are to be set, two in each of the four sections (B-E). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt four questions, selecting at least one question from each section. Each question shall carry 6 marks. The total weightage of these sections shall be 24 marks.

The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

Unit-I

Elementary Statistics: Collection of data. Frequency distribution and its graphical representation. The mean, median, mode, standard deviation, variance, covariance of data.

Unit-II

Probability: Basic concepts, sample space and events, use of counting method in probability, addition law, Multiplication Law, Conditional Probability and Independent Events, Bayes theorem with application (without proof).

Unit-III

Introduction to Correlation & Regression: Scatter diagram, linear correlation, linear regression lines

Unit-IV

Hypothesis Testing: Sample Statistics and parameters, Level of significance, Concept of Null and Alternate Hypothesis, Normal test for single mean (Z-test), Chi-square test (Goodness of fit and association of attributes).

Text Books:

1. Mathematics Textbook for class XI, NCERT.
2. Mathematics, Textbook for class XII, NCERT.

Reference Books

1. S.C Gupta, V.K Kapoor, Fundamentals of mathematical statistics.
2. Mendenhall W. and Sincich T. (1995). Statistics for engineering and sciences (IVth edition). PrenticeHall. And sciences (IVth edition). Prentice Hall.
3. B.A./ B.Sc Part-I (12+3 System of Education) 225 Gupta S.P. (2000). Statistical methods. Sultan Chand and Company, New Delhi.

Scheme and Curriculum of Examinations of Three Year Degree Programme
Bachelor of Science (Economics) Semester-I
Session- 2021-22

Bachelor of Science (Economics) Semester-I							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
BECL-1453	Quantitative Techniques-I	E	100	80	-	20	3

E-Elective

Bachelor of Science (Economics)
Semester-I
Session: 2021-22
Course title: Quantitative Techniques–I
Course Code: BECL-1453
Course Outcomes

After the successful completion of this course, the students will be able to

CO 1: Solve linear equations of two variables and its applications in economics, under the quadratic equations, arithmetic progression, geometric progression and their applications in economics.

CO 2: Develop understanding of elements of analytical geometry, straight lines, basic concepts of trigonometry and permutations and combinations.

CO 3: Differentiate between a constant and a variable, graph of linear and quadratic functions and its applications in economics.

CO 4: Recognize derivative of implicit functions, parametric functions, exponential functions, logarithmic functions and how to apply these derivatives in economics theory.

Bachelor of Science (Economics)
Semester-I
Session: 2021 -22
Course title: Quantitative Techniques–I
Course Code: BECL-1453

ExaminationTime:3Hours Max. Marks: 100
Theory: 80
CA:20

Note: Instructions for the Paper–Setters/Examiners:
Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT–I

Solution of Linear Equations: Solution of Simultaneous Linear Equations (upto two variable case), Application of Linear Equation in Economics; Solution of Quadratic Equations Series: Arithmetic Progression Series, Geometric Progression Series and their applications in economics.

UNIT–II

Elements of Analytical Geometry: Straight line; Basic concepts of trigonometry (with formulae); Concepts of combination and permutation, Elements of set theory, union, intersection, difference, symmetric difference, complementation, Venn diagrams.

UNIT–III

Difference between a constant and a variable, concept of functions, classifications of functions, graph of linear and quadratic functions (Economic applications). Limits and continuity of a function. Concept of differentiation.

UNIT–IV

Derivatives of elementary functions excluding inverse trigonometric functions, Rules of derivatives; functions of functions rule; derivatives of implicit functions, parametric functions, logarithmic differentiation (Application in Economics).

Text Book:
R.S. Aggarwal, Mathematics for Economists.

Reference Books:
1. Monga, G.S., Mathematics and Statistics for Economics.
2. Yamane, Taro, Mathematics for Economists.
3. Allen, R.G.D., Mathematical Analysis for Economists.
4. Edward T Dowling, Introduction to Mathematical Economics.
5.Chiang, A.C., Fundamental Methods of Mathematical Economics, McGraw Hill, New York

Master of Arts (Economics) Semester-I
Session- 2021-22

Master of Arts (Economics) Semester-I							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MECL-1453	Quantitative Methods for Economists-I	C	100	80	-	20	3

C-Compulsory

Master of Arts (Economics)
Semester-I
Session: 2021-22
Course Title: Quantitative Methods for Economists–I
Course Code: MECL-1453
Course Outcomes

CO 1: Recognize the concept of functions and rules of differentiation and apply this to find out revenue, cost, demand, supply function, elasticity and their types.

CO 2: Understand the rule of partial differentiation and interpretation of partial derivatives.

CO 3: Manage to solve the problem related to maxima and minima in single and multivariable functions for application in market equilibrium.

CO 4: Learn concepts of integration and its applications to consumer's surplus and producer's surplus.

CO 5: Determine the solution of simultaneous equation through crammer's rule and understand the concept of quadratic forms, Eigen roots and Eigen vectors.

CO 6: Recognize linear programming problem and its formulation and solution through graphical and simplex methods.

CO 7: Well understanding the concept of duality, concept of a game, saddle point solution and its simple applications in economics.

Master of Arts (Economics)
Semester-I
Session: 2021-22
Course Title: Quantitative Methods for Economists–I
Course Code: MECL-1453

Examination Time: 3 Hrs | Max. Marks: 100
Theory: 80
CA:20

Instructions for the Paper–Setters/Examiners:

Eight questions of equal marks (16 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. The students can use only Non Programmable & Non Storage Type Calculator.

Unit– I

Concept of function and types of functions; Rules of differentiation; Application to revenue, cost, demand, supply functions; Elasticities and their types; production function; Rules of partial differential and interpretation of partial derivatives; homogeneous functions and Euler's theorem.

Unit– II

Problem of maxima and minima in single and multivariable (upto 3) functions; Unconstrained and constrained optimization in simple economic problems; Simple applications in market equilibrium; Concept of integration; Simple rules of integration; Application to consumer's surplus and producer's surplus.

Unit– III

Determinants and their basic properties; Solution of simultaneous equations through Cramer's rule, Concept of matrix–their types, simple operations on matrices, matrix inversion and rank of a matrix; Concept of quadratic form, Eigen roots and Eigen vectors; Introduction to input–output analysis

Unit– IV

Linear Programming –Formulation and solution through graphical and simplex method. Statement of basic theorems of linear programming; Formulation of the dual of primal and its interpretation; Shadow prices and their uses; Concept of duality; Concept of a game; Strategies – simple and mixed; Value of a game; Saddle point solution; Simple applications.

Text Book:

S.C. Aggarwal, R. K. Rana, Leena Gupta, Mathematics for Economists, VK Publishers.

Reference Books:

1. Chiang, A.C., Fundamental Methods of Mathematical Economics, McGraw Hill, New York.
2. Allen, R.G.D., Mathematical Analysis for Economists, Macmillan Press and ELBS, London.
3. Yamane, Taro, Mathematics for Economists Prentice Hall of India, New Delhi.
4. Vygodsky, G.S., Mathematical Handbook (Higher Mathematics), Mir Publishers, Moscow.
5. Kothari, C.R., An Introduction to Operations Research, Vikas Publishing House, New Delhi.
6. Mustafi, C.K., Operations Research: Methods and Practice, Wiley Eastern, New Delhi.
7. Kanti Sawrup, Gupta, P.K. and Manmohan: Operations Research.

Scheme and Curriculum of Examinations of Two Year Degree Programme
Master of Science (Chemistry) Semester-II
Session: 2021-22

Master of Science (Chemistry) Semester-II								
Course Title	Program Name	Course Code	Course Type	Marks				Examination time (in Hours)
				Total	Ext.		CA	
					L	P		
Mathematics for Chemists	Master of Science (Chemistry)	MCHL-2336	E	25	20	--	5	3

E- Elective

Master of Science (Chemistry) Semester-II
Session 2021-22
Course Title: Mathematics for Chemists
Course Code-MCHL-2336
Course Outcomes

After the successful completion of this subject, the students should be able to:

CO 1: Understand the trigonometric functions with the help of unit circle and application of trigonometric identities.

CO 2: Demonstrate the concept of matrices and type of matrices and how to calculate transpose, adjoint and inverse of matrices. Manage to solve problems related to addition, subtraction and multiplication

CO 3: To understand the concept and solve system of linear equations.

CO 4: Solve Complex problems related to derivative of sum, difference, product and quotient of functions and also to find derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions.

CO 5: Recognize Integration as an inverse of differentiation and to calculate area under curve and understand integrals as limit of sum and its geometrical interpretation.

Master of Science (Chemistry) Semester-II
Session 2021-22
Course Title: Mathematics for Chemists
Course Code-MCHL-2336

Examination Time: 3 Hours Max. Marks: 25

Theory: 20
CA: 5

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Trigonometry and Determinants:

Definition of sin, cos, tan, cot, sec, cosec functions with the help of unit circle, values of sin x, cos x for x = 0, π/6, π /3, π /2. Trigonometric identities (without proofs) and their applications. Definition and expansion properties of determinants, product of two determinants of 3rd order.

Unit-II

Matrices:

Introduction to various forms of Matrices, row, column, diagonal unit, Submatrix, square, equal matrices, null, symmetric and skew symmetric matrices, transpose of a matrix, adjoint and inverse of matrices. Addition, multiplication, characteristic equation of a matrix, statement of Cayley Hamilton theorem. Rank of matrix, condition of consistency of a system of linear equations. Eigen vectors and Eigen values of matrices.

Unit-III

Differential Calculus

Differentiation of standard functions, theorems relating to the sum, difference, product and quotient of functions (without proofs), derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions, differentiation of implict functions, logarithmic differentiation

Unit-IV

Integral Calculus

Integration as an inverse of differentiation, area under a curve, indefinite integrals of standard forms, method of substitution, method of partial fractions, integration by parts, definite integrals, definite integrals as limit of a sum and geometrical interpretation.

Text Books:

1. Mathematics Textbook for class XI, NCERT

2 Mathematics Textbook for class XII, NCERT

Reference Books:

1. Joseph B. Dence , Mathematical Techniques in Chemistry.

2. Margenau and Murphy, The Mathematics of Physics and Chemistry.

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Scheme and Curriculum of Examinations of Two Year Degree Programme
Master of Science (Zoology) Semester-II
Session: 2021-22

Master of Science (Zoology) Semester-II							
Course Title	Course Code	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
Biostatistics	MZOL-2334	C	50	40	--	10	3

C-Compulsory

Master of Science (Zoology)
Semester–II
Session 2021-22
Course Title: Biostatistics
Course Code: MZOL-2334
Course Outcomes

After the Successful Completion of the subject students will be able to

CO 1: Know how to collect, analyze and interpret data and use this data to find out different measures of central tendency, dispersion, skewness, kurtosis and moments.

CO 2: Define event, outcome, trial, simple event, sample space and calculate the probability of events for more complex outcomes related to conditional, additive and multiplicative law of probability.

CO 3: Able to use and stimulate random variable, distribution function, probability mass function and probability density function using calculus to answer the quantitative questions about the outcome of probabilistic systems.

CO 4: Understand the concept of mathematical expectation and use it to find out the mean, variance, standard deviation, kurtosis etc. of different probability distributions like Binomial, Poisson and Normal etc.

CO 5: Use Correlation to identify the strength and direction of a linear relationship between two variables and using Regression to predict how much a dependent variable changes based on adjustments to an independent variable and also apply Karl Pearson Correlation coefficient and Spearman's Rank Correlation and Least Square technique for Regression lines.

CO 6: Understand how to develop Null and Alternative Hypothesis and examine the process of Hypothesis testing with reference to one or two tailed test at a given level of significance.

CO 7: Manage to solve problems using t, Z and Chi-Square test.

CO 8: To describe the use of ANOVA for one way and two way classified data with one observation per cell.

Master of Science (Zoology)
Semester–II
Session 2021-22
Course Title: Biostatistics
Course Code: MZOL-2334

Examination Time: 3 Hours | Max.Marks: 50
Theory:40
CA:10

Instructions for the Paper Setter:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

UNIT-I

Statistical Method: Collection of data. Frequency distribution and its graphical representation. Measures of central tendency, dispersion, moments ,skewness and kurtosis .

Probability: Random experiments, sample space, events. Mathematical definition of probability of an event. Use of permutations and combinations in calculations of probability, Conditional probability, Additive and multiplication law of probability

UNIT-II

Random variables and its pmf, pdf, cdf, mathematical expectation and variances, Distribution of binomial, Poisson and normal variables and (without derivation)

UNIT-III

Correlation and Regression: Relationship between variables, covariance, Karl-Pearson's correlation coefficient, Spearman's rank correlation coefficient, interpretation of correlation coefficients, Least square technique for regression lines (without proof), regression coefficients, relationship between correlation analysis and regression analysis.

UNIT-IV

Hypothesis Testing: Sample statistics and parameters, population null hypothesis, level of significance. Definitions of Chi-square test, , Application of X^2-test as a goodness of fit and association of attributes, t-test as a test of single and difference of means and F-test as a test of equality of population variances in testing of hypothesis.

Analysis of Variance: Analysis of variance for one-way classified data.

Text Books:

1. Mathematics, Textbook for class XI, NCERT.
2. Mathematics, Textbook for class XII, NCERT.
3. S.C Gupta, V.K Kapoor, Fundamentals of mathematical statistics

Reference Books

1. Batschelet, Mathematics for Life Sciences.
2. S. Sokal, R. and James F. Introduction to Biostatistics.

Master of Science (Botany) Semester-II
Session- 2021-22

Master of Science (Botany) Semester-II							
Course Code	Course Title	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MBTL-2336	Theoretical Biology	C	50	40	-	10	3

C-Compulsory

Master of Science (Botany)
Semester–II
Session: 2021-22
Course Title: Theoretical Biology
Course Code: MBTL-2336

Course outcomes

After the successful completion of this subject, the students should be able to:
CO 1: Understand linear function, power function and periodic function.
CO 2: Recognize algebraic, exponential, logarithmic function and will come to know how to calculate their differentiation and apply derivatives of sum, difference, product and quotient of two functions.
CO 3: Recognize Integration as an inverse of differentiation and to calculate area under curve and understand integrals as limit of sum and its geometrical interpretation.
CO 4: Understand the concept of mathematical expectation and use it to find out the mean, variance, standard deviation, kurtosis etc. of normal probability distribution.

CO 5: Use Correlation to identify the strength and direction of a linear relationship between two variables and using Regression to predict how much a dependent variable changes based on adjustments to an independent variable and also apply Karl Pearson Correlation coefficient and Spearman's Rank Correlation and Least Square technique for Regression lines.

CO 6: Manage to solve problems using t and Chi-Square test.

Master of Science (Botany)
Semester–II
Session: 2021-22
Course Title: Theoretical Biology
Course Code: MBTL-2336

Examination Time: 3 Hours | Max. Marks: 50
Theory: 40
CA: 10

Instructions for the Paper Setters:
Eight questions of equal marks (08 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.
The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

UNIT-I

1. Linear Function: $y=ax$ and $y=ax+b$
2.Power Function: $y=ax^n$.
3.Sine and cosine, trigonometric relations.
4. Exponential and Logarithmic Functions: Exponential function $y=aq^x$, logarithmic function.

UNIT-II

5.Differentiation and Integration: differentiation of some important functions (Linear function, Power function, Logarithmic, Exponential, Trigonometric functions), product rule and quotient rule of differentiation, chain rule of differentiation.
6.Integration: Rules of integration (Linear function, Power function, Logarithmic, Exponential, Trigonometric Functions), integration by substitution, integration of product of two functions.

UNIT-III

7.Probability: Random experiment, sample space events, mathematical definition of probability, addition and multiplication law of probability.

UNIT-IV

8.Statistics: Mean, standard deviation, Normal Distribution, Simple linear regression and correlation.
9.Hypothesis testing: Sample Statistics and parameters, standard error, Z-test, t-test as a test of single mean, chi square test as a goodness of fit and association of attributes (For uniformity , ratio and proportion)

Text Books:

1. Hussain I. et. al. Mathematics, A textbook for class XI, NCERT.
2. Joshi, D.D. et. al. Mathematics, A textbook for class XII, NCERT.
3. S.C Gupta, V.K Kapoor, Fundamentals of Mathematical Statistics

Reference Books:

1.Batschelet, E. (1971). Introduction to Mathematics for Life Scientists. Springer-Verlag, Berlin. 2nd edition
2. Ludwig, J and Reynolds, J.F. (1988). Statistical Ecology. John Wiley & Sons, New York.