B.Sc. (PASS & HONOURS) SYLLABUS IN MATHEMATICS.

Pass & Honours

	PASS		Credits	HONOURS		Credits
Semester I	MAT 101	Calculus I	5	MAT 102	Analysis	3
		Algebra I				
Semester II	MAT 201	Calculus II	5	MAT 202	Advanced Algebra I	3
		Algebra II			Elementary Number Theory	
Semester III	MAT 301	Advanced Calculus I	5	MAT 302	Advanced Algebra II	3
		Higher Trigonometry			Advanced Differential Equations	
Semester IV	MAT 401	Advanced Calculus II	5	MAT 402	Complex Analysis	3
		Analytical Geometry				
Semester V	MAT 501	Mechanics I (Dynamics)	5	MAT 502	Differential Geometry	3
		Numerical Methods				
Semester VI	MAT 601	Mechanics II (Statics)	5	MAT 602	CHOICE BASED (any one) a.Programming in C b.Mathematical Methods c.Special Theory of Relativity d.Advanced Mechanics	3
		Vector Analysis			PROJECT	2

MAT 101(P&H) (Calculus-I & Algebra-I)

CALCULUS I

Unit 1: Real variables. Continuous and discrete. Interval. Function. Domain of definition. Monotone functions. Inverse functions. Geometrical representations.
Limit of a function on the real line. One-sided limits– right hand and left hand limits. Different types of limits. Theorems on limits.
Continuous functions. Definitions. Discontinuous functions. Theorems. Properties. Uniform continuity (definition only).

Unit 2: Derivatives. Definition. Continuity of a derivable function. Algebraic and transcendental functions. General rules of differentiation. Function of a function. Chain rule. Inverse function. Logarithmic differentiation. Implicit functions. Parametric equations.
Derivative as a rate measurer. Time rate of change. Rectilinear motion. Related rates. Geometric interpretation. Meaning of the sign of the derivative. Determination of multiple roots. Newton's method of approximating a root. Approximate calculations.

Unit 3: Basic methods of integration. Integration by substitution. Integration by parts. Integration of trigonometric and hyperbolic functions. Rational function of sine and cosine. Standard integrals. Integrals of the forms
$1/(a + b\sin x + c\cos x)$, $1/(a\cos x + b\sin x)$, $(a + b\sin x + c\cos x)/(a' + b'\sin x + c'\cos x)$, $\sin^n x$, $\cos^n x$, $\sin^m x \cos^n x$, $\tan^n x$, $\cot^n x$, $\sec^n x$,$\operatorname{cosec}^n x$. Trigonometric substitutions.

ALGEBRA I

Unit 4: Theory of Equations
Division algorithm. Remainder theorem. Factor theorem. Fundamental theorem of algebra. Nature of the roots of an equation. Complex roots. Surd roots. Relation between roots and coefficients. Symmetric functions of roots. Transformation of equations. Cardan's method of solution of a cubic equation. Descartes' rule of signs.

Unit 5: Matrix Algebra
Matrices of real numbers. Operations on matrices. The transpose of a matrix. Properties of transposes. Special types of matrices. Rank of a matrix. Its determination. Determination of rank by considering minors. Determination of rank by elementary transformations. Consistency and solution of system of linear equations with not more than three variables.

Recommended Books:
1. Differential Calculus – Ghosh & Maity (New Central Book Agency, Kolkata)
2. Integral Calculus – Ghosh & Maity (New Central Book Agency, Kolkata)
3. Higher Algebra – Ghosh & Maity (New Central Book Agency, Kolkata)
References:
1. Calculus and Analytical Geometry – Thomas & Finney (Pearson Education)
2. Differential Calculus – Gorakh Prasad (Pothishala, Allahabad)
3. Integral Calculus – Gorakh Prasad (Pothishala, Allahabad)
4. Theory of Equations – M L Khanna

MAT 201(P&H) (Calculus II & Algebra II)

CALCULUS II

Unit 1: Second and higher order derivatives. Use of partial fractions. Use of De Moivre's theorem. Leibnitz theorem. Differentiability and differentials. Rolle's theorem. Theorem of Darboux. Mean value theorem. Lagrange's and Cauchy's forms. Indeterminate forms. L'Hospital's rule. Taylor's theorem. Lagrange's, Cauchy's and generalized form of remainder. Taylor's infinite series. Maclaurin's theorem and infinite series. Maxima and minima. Applied problems.

Unit 2: Reduction formulae for $\sin^n x$, $\cos^n x$, $\sin^m x \cos^n x$, $\tan^n x$, $\cot^n x$, $\sec^n x$, $\operatorname{cosec}^n x$, $\cos^m x \sin nx$, $1/(a + b\cos x)^n$, $1/(x^2 + a^2)^n$. Integration by special devices.
Definition of a definite integral as the limit of a sum. Definite integral as an area. Geometric interpretation. Calculations. Primitives. Fundamental theorem of calculus. Summation of series. Properties of definite integral.

ALGEBRA II

Unit 3: Sequences. Definition. Bounded and unbounded sequences. Limit of a sequence. Convergent sequences. Limits of combination of sequences (proofs not required). Examples and counter examples. Non-convergent sequences. Monotone sequences. Cauchy sequences. Infinite series. Convergence and divergence of infinite series. Positive series - criterion of convergence. General theorems on convergence. Tests for convergence - series of positive terms. Comparison tests. D'Alembert's ratio test. Cauchy's root test. Raabe's test.

Unit 4: Recap of sets and mappings. Equivalence relations. Equivalence classes. Binary operations Group. Definition Examples. Abelian Group. Order of a group (types of group). Elementary properties of groups using definition. Integral power of an element of a group. Subgroups. Intersection of two subgroups.

Unit 5: Cyclic groups. Groups of permutation (definition and examples). Even and odd permutations. Rings. Integral domains. Fields. Definition. Examples. Elementary theorems. Simple consequences of the definitions.

Note: In Units 4 & 5, definitions & examples only to be discussed. Simple consequences of the definitions and theorems to be discussed. (Detailed discussion to be done in Honours course only).

Recommended Books:

1. Differential Calculus - Ghosh & Maity (New Central Book Agency, Kolkata)
2. Integral Calculus - Ghosh & Maity (New Central Book Agency, Kolkata)
3. Higher Algebra - Ghosh & Maity (New Central Book Agency, Kolkata)

References:

1. Calculus and Analytical Geometry - Thomas & Finney (Pearson Education)
2. Differential Calculus - Gorakh Prasad (Pothishala, Allahabad)
3. Integral Calculus - Gorakh Prasad (Pothishala, Allahabad)
4. Modern Algebra - A R Vasishtha

MAT 301(P&H) (Advanced Calculus I & Higher Trigonometry)

ADVANCED CALCULUS I

Unit 1: Tangents and Normals Analytic Representation of a plane curve. Tangent. Normal. Subtangent. Subnormal. Polarcoordinate system. Pedal equation. Differential of arc length. Curvature
Measure of bending. Radius of curvature. Theorem on centre of curvature. Concept of curvature. Newton's approach. Curvature at the origin. Coordinates of centre of curvature. Equation of circle of curvature. Evolute and involute. Chord of curvature.

Unit 2: Functions of Several Variables Function of two variables. Domain of definition. Geometric representation. Limit and continuity. Theorems-partial derivatives. Higher order-homogenous functions. Euler's theorem. Total differential. Concept of differentiability. Composite functions. Chain rules. Implicit functions. Maxima and minima of function of two variables.

Unit 3: Improper Integrals Types of improper integrals (1) infinite intervals (2) integrand having discontinuities. Comparison test for convergence. Beta and Gamma functions. Definitions and Relations. Multiple Integrals Calculation of a double integral. Equivalence with repeated integrals. Double integrals over domains other than rectangles. Change of variable.

HIGHER TRIGONOMETRY

Unit 4: De Moivre's Theorem. Statement. Proof of De Moivre's theorem for integral indices.
Alternative method. Proof for rational indices. All possible values of $(\cos x + i \sin x)^{p/q}$. Application of De Moivre's theorem for integral and fractional indices. Expansion of sin nx, cos nx, in series of sinx, cosx. Expansion of $\sin^n x$, $\cos^n x$ in terms of sin and cosine of multiple angles. Series expansion of sinx, cos x and tan x.

Unit 5: Exponential, sine, cosine and logarithms of a complex number. Definitions. Logarithmic, exponential and hyperbolic functions. Inverse functions - trigonometric and hyperbolic functions. Laws of logarithm. Summation of series.

Recommended Books:

1. Differential Calculus - Ghosh & Maity (New Central Book Agency, Kolkata)
2. Integral Calculus - Ghosh & Maity (New Central Book Agency, Kolkata)
3. Higher Algebra - Ghosh & Maity (New Central Book Agency, Kolkata)

References:

1. Calculus and Analytical Geometry - Thomas & Finney (Pearson Education)
2. Differential Calculus - Gorakh Prasad (Pothishala, Allahabad)
3. Integral Calculus - Gorakh Prasad (Pothishala, Allahabad)
4. Trigonometry - Mazumdar & Dasgupta

MAT 401(P&H) (Advanced Calculus II & Geometry)

ADVANCED CALCULUS II

Unit 1: Envelopes Family of curves. Envelope. Definition. Relation between envelope and curves enveloped. Evolute. Arc. Involute. Related curves. Inversion. Pedal curves. Reciprocal polars. Concavity and convexity. Concavity and Convexity. Criterion - points of inflexion. Singular points - at the origin of an algebraic curve and at points other than the origin. Conditions for existence of double points. Discrimination of species of a cusp.

Unit 2: Evaluation of area Quadrature of plane areas - Cartesian coordinates, sign of area. Area in parametric forms. Area included between two curves. Area of a closed curve. Area in polar coordinates. Lengths of plane curves Cartesian, polar and pedal forms. Intrinsic equation to a curve.
Volumes and surfaces of revolution. Solids of revolution. Volumes and areas of surfaces.

Unit 3: Differential equations of the first order and first degree - Equation reducible to homogenous form. Bernonlli's equation. Exact differential equations. Differential equation of the first order but not of the first degree. Equations solvable for p, x, y. General and singular solutions. Clairaut's equation Linear differential equations of higher order with constant coefficients. Complementary function and particular integrals. Orthogonal trajectories.

GEOMETRY

Unit 4: 2D Geometry
General equation of the 2^{nd} degree. Chord of contact. Pole and Polar. Conjugate points. Chord in terms of its middle point. Diameter. Conjugate diameter. Intersection of two conics. Conics through the points of intersection of two given conics. Pair of tangents. Director circle. Asymptotes.
Polar equation of a conic. Derivations of polar equation of a conic.

Unit 5: 3D Geometry
Sphere. Equation. Section of a sphere by a plane. Equation of a circle in space. Intersection of two spheres. A sphere passing through a circle. Tangent and tangent plane to a sphere. Cone. Equation of a cone with its vertex at the origin. Right circular cone. Tangent plane to a cone. Reciprocal cone. Three mutually perpendicular generators. Cylinder. Equation. Right circular cylinder.

Recommended Books:

1) Differential Calculus - Ghosh & Maity (New Central Book Agency, Kolkata)
2) Integral Calculus - Ghosh & Maity (New Central Book Agency, Kolkata)
3) Analytical Geometry - B Das (Orient Book Company)

MAT 501(P&H) (Mechanics I & Numerical Methods)

MECHANICS I (DYNAMICS)

Unit 1: Fundamental definitions and principles. Motion in a straight line. Simple harmonic motion. Motion under earth's attraction. Uniplanar motion where the accelerations parallel to fixed axes are given. Composition of simple harmonic motion.

Unit 2: Uniplanar motion referred to polar coordinates. Central orbit. Apses. Apsidal distance. Uniplanar motion when the acceleration is central and varying as the inverse square of the distance. Kepler's laws. Time of describing any arc of the path. Planetary motion.

Unit 3: Tangential and normal accelerations. Constrained motion. Conservation of energy. The simple pendulum. Motion on a rough curve. Motion in a resisting medium. Motion where the mass moving varies.

NUMERICAL METHODS

Unit 4: Finite differences. The operators A and E. Properties. Interpolation with equal intervals. Newton-Gregory formula for forward interpolation. Newton-Gregory formula for backward interpolation. Interpolation with unequal intervals. Divided differences. Properties. Newton's formula for unequal intervals. Lagrange's interpolation formula for unequal intervals. Lagrange's interpolation formula for equal intervals.

Unit5: Central difference formula. Operators 8, V, *a* and |j,. Gauss's central difference formula. Inverse interpolation. Use of Lagrange's formula. Successive approximations. Roots of algebraic equation by inverse interpolation.
Numerical differentiation. Approximate expression for the derivative of a function. Numerical integration. General quadrature formula. The trapezoidal rule. Simpon's 1/8 and 3/8 rule.

Recommended Books:

1) An Elementary Treatise of the Dynamics of a Particle and of Rigid Bodies - S L Loney (Surjeet)
2) Finite Differences and Numerical Analysis - H C Saxena (S Chand & Co)

References:

1) Dynamics - P N Chatterjee

MAT 601(P&H) (Mechanics II & Vector Analysis)

MECHANICS II (STATICS)

Unit 1: Coplanar forces. Moment of a system of coplanar forces. Equation of line of action of the resultant of a system of coplanar forces. Necessary and sufficient condition for the equilibrium of a system of coplanar forces acting on a rigid body. Astatic equilibrium. Equilibrium of a rigid body under three forces. (m, n) theorem.

Unit 2: Work. Work done by a system of concurrent forces. Virtual work. Principle of virtual work for a system of coplanar forces acting on a particle. Omission of forces. Stability of equilibrium. Stable, unstable and neutral equilibrium. Work function test for the nature of stability of equilibrium. Energy test for equilibrium.

Unit 3: Centre of gravity. Definition and general formulation. Centre of gravity of arc, plane area, area bounded by curve, solid of revolution, surface of revolution. Centre of gravity bounded area in polar coordinates. The theorem of Pappus. Friction. Statical, dynamical and limiting friction. Laws of friction. Limiting equilibrium. Coefficient of friction. Angle of friction. Cone of friction. Equilibrium of a body on a rough inclined plane.

VECTOR ANALYSIS

Unit 4: Recap of vectors preliminaries. Scalar triple product and vector triple product. Their geometrical meanings. Product of four vectors. Reciprocal system of vectors. Vectors function of a scalar variable. Limit and continuity. Vector differentiation. Directional derivatives. Level surfaces. Tangent plane and normal to a level surface. Gradient, divergence and curl.

Unit 5: Vector integration. Line integrals. Surface integrals. Volume integral. Statements of Green's theorem. Gauss' theorem and Stoke's theorems. (proof not necessary). Problems based on surfaces like spheres, cylinders,cone, parallelepiped.

Recommended Books:

1) Statics - Md Motihur Rahman (New Central Book Agency, Kolkata)
2) A Textbook of Vector Analysis - Shanti Narayan and P K Mittal (S Chand & Co)

References:

1) A Textbook on Statics - M Ray, R D Sanglik
2)Vector Algebra - G C Sharma A R Vasishtha Sharma & Vasishtha
3)Vector Calculus - G C Sharma A R Vasishtha Sharma & Vasishtha

MAT 102(H) (Analysis)

ANALYSIS

Unit 1: Closed intervals. Open intervals. Semi-closed or semi-open intervals. Sets bounded above and sets bounded below. Bounded sets. Limit points of a set. Closed sets. Compact sets. Heine - Borel theorem. Concept of real sequence - boundedness, convergence, non-convergence. Infinite series - convergence and sum.

Unit 2: Real valued functions of a single variable. Limits. Continuity. Uniform continuity. Properties of functions continuous in closed intervals. Monotonic function. Function of bounded variation.

Unit 3: Derivability of real valued function of a single variable. Sign of derivative at a point. Darboux's Theorem. Rolle's Theorem. Higher derivatives. Young's form of Taylor's theorem. Applications of Taylor's theorem. The indeterminate forms.

Unit 4: Riemann integrability. Integral of a bounded function over finite domain. Darboux's theorem. Conditions for integrability. Particular class of bounded integrable functions. Properties of integrable functions. Functions defined by definite integrals. Mean value theorem of integral calculus. Change of variable in an integral. Integration by parts.

Unit 5: Fourier Series. Preliminary and main theorem. Fourier series for odd and even functions. Half-range series. Definite integral as functions of a parameter. Uniform convergence of improper integrals. The test for uniform, convergence. Properties of uniformly convergent integrals.

Recommended Books:

1) Mathematical Analysis - Shanti Narayan (S Chand & Co

References:

1) Real Analysis - S C Malik (New Age Publishers)
2) Fundamental Concepts of Analysis - Alton Smith & Walter Albrecht (PHI)

MAT 202(H) (Advanced Algebra I & Elementary Number Theory)

ADVANCED ALGEBRA I

Unit 1: Groups. Subgroups. Cosets. Normal subgroups. Cyclic group. Lagrange's theorem. Homomorphism Isomorphism.. Quotient groups. Permutation groups. Conjugate classes. Cauchy's theorem. Sylow's theorems.

Unit 2: Rings. Integral domains. Homomorphism. Isomorphism. Quotient fields. Ideals. Quotient rings. Prime and maximal ideals.

Unit 3: Factorisation. Euclidean domain. Principal ideal domain. Unique factorisation domain. Polynomial rings. Roots of polynomials. Factorisation of polynomials.

ELEMENTARY NUMBER THEORY

Unit 4: Divisibility. Primes. Congruences. Solution of congruences. Congruences of degree 1. Chinese remainder theorem. The function § (n).

Unit 5: Quadratic Residues. Quadratic reciprocity. The Jacobi symbol. Greatest integer function. Arithmetic functions.

Recommended Books:

1) University Algebra
2) An Introduction to the Theory of Numbers
Gopalakhrishanan (New Age) Niven and Zuckerman (New Age)

References:
1) An Introduction to Number Theory
- Ajay Kr Chaudhuri (New Central Book Agency, Kolkata)
2) Elementary Number Theory
- David M Burton (UBS, Guwahati)

MAT 302(H) (Advanced Algebra II & Advanced Differential Equations)

ADVANCED ALGEBRA II

Unit 1: Vector spaces. Definition and examples. Subspaces. Definition and examples. Linear dependence, independence and basis. Dimension. Linear transformation. Kernel. Isomorphism. Quotient space. First Isomorphism Theorem. Non-singular linear transformation. Orthogonal complement.

Unit 2: Modules. Submodule. Definition and example. Isomorphism theorems. Generator. Annihilator. Preliminaries of matrices. Matrices and linear transformation. Trace and transpose. Symmetric and skew-symmetric.

Unit 3: Rank. Row and column rank. Linear equations. Homogeneous and non-homogeneous. Minimum polynomial. Characteristic vector and root. Characteristic polynomial. Cayley Hamilton theorem.

ADVANCED DIFFERENTIAL EQUATIONS

Unit 4: Linear equation of second order. Standard form. Complete solution. Complementary function. Particular integral. Reduction to normal form. Transformation by changing the independent variable. Method of variation of parameters. Solution by operators.

Unit 5: Simultaneous equations of the form $dx/P = dy/Q = dz/R$. Solution. Geometrical interpretation Total differential equations. Solution by inspection. Homogeneous case (homogeneous in x, y, z). Solution by taking one variable as constant. . Linear partial differential equation of order one. Lagrange's method. Integral surfaces passing through a given curve. Surfaces orthogonal to a given system of surfaces.

Recommended Books:

1) University Algebra - Gopalakhrishanan (New Age)
2) Ordinary and Partial Differential Equations - Raisinghania (S Chand & Co)

References:

1) Elements of Partial Differential Equations - I N Sneddon (McGraw Hill)
2) Linear Algebra - K P Gupta

MAT 402(H) (Complex Analysis)

COMPLEX ANALYSIS

Unit 1: Complex number. Definition. Algebraic operations. Modulus, amplitude and their properties. Conjugate of a complex number and related results. Triangle inequality. Polar form of a complex number. Euler's formula. Functions of a complex variable. Limits, continuity, derivative, and differentiation formulas.

Unit 2: Definition of analytic function. Cauchy-Riemann equations. Necessary and sufficient condition for a function to be analytic (to be discussed and proved). Cauchy-Riemann equations in polar coordinates. Harmonic functions. Finding of harmonic conjugate given an analytic function. Zeros and poles of analytic functions. Examples of analytic functions.

Unit 3: Definite integrals of complex function of a real variable. Contours. Line integrals. Examples. Statement of Cauchy-Goursat theorem and problems based on the theorem. Cauchy's integral formula. Derivatives of analytic functions.

Unit 4: Morera's theorem. Maximum moduli of functions. Liouville's theorem. Fundamental theorem of algebra. Convergence of sequences and series of complex numbers. Taylor, Maclaurin, Laurent series. Problems. Definition of power series. Circle of convergence. Radius of convergence of a power series (definitions only).

Unit 5: Residues. Residue theorem. Principal part of a function. Residues at poles. Quotients of analytic functions. Evaluation of improper real integrals. Improper integrals involving sines and cosines. Definite integrals involving sines and cosines. Integration through a branch cut.

Recommended Books:

1) Complex Variables and Applications - R V Churchill & J W Brown (McGraw Hill) References:

1) Complex Analysis - J N Sharma

MAT 502(H) Differential Geometry

DIFFERENTIAL GEOMETRY

Unit 1: Space curve. Tangent. Arc length. Order of contact between curve and surface. Fundamental planes (osculating, normal and rectifying plane). Curvature. Torsion. Serret-Frenet formula. Direction cosines of the principal normal and binormal. Fundamental theorems for space curves (existence and uniqueness theorems).

Unit 2: Osculating circle. Osculating sphere. Involute. Evolute. Surface. Regular points and singularities on a surface. Curvilinear equation of the curve on the surface. Parametric curves. Tangent plane and normal and their Cartesian equation.

Unit 3: Family of surface. Envelope. The edge of regression. Ruled surface. Developable surface. Necessary and sufficient condition that any surface represents a developable surface. Theorems related to developable surfaces. Developable associated with space curve. Theorems and questions on osculating developables. Polar developables. Rectifying developables.

Unit 4: First fundamental form and its geometrical interpretation and properties. Second fundamental form and geometrical interpretation. Weingarton equations (derivative of N). Direction coefficients. Direction ratios. Differential equation of family of curves. Orthogonal trajectories. Condition for orthogonalities.

Unit 5: Normal curvature (curvature of normal section). Mensnier's theorem. Principal direction. Principal curvature. First curvature. Mean curvature. Gaussian curvature. Minimal surface. Necessary and sufficient condition for a surface to be developable. Lines of curvature. Rodrique's formula. Lines of curvature as parametric curves. Euler's theorem.

Recommended Books:

1) Differential Geometry of Three Dimensions
   - C E Weatherburn (Radha Publishing House, Kolkata)
2) Differential Geometry : An Integral Approach
   - Nirmala Prakash (Tata McGraw Hill)
3) Vector Calculus
   - M D Raisinghania (S Chand & Co., Guwahati)

References:

1) Three Dimensional Differential Geometry
   - Gupta and Malik (Pragati Prakashan, Meerut)
2) Differential Geometry
   - Mittal and Agrawal (Krishna Prakashan Media Pvt. Ltd., Meerut)
3) Differential Geometry M L Khanna
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MAT 602(H) Choice (a) Computer Programming in C

COMPUTER PROGRAMMING IN C (THEORY)

Unit 1: Introduction to Programming, Algorithms, Introduction to Modularity, Functions. The main() Function, the printf() function. Data types. Arithmetic operations, Displaying Numerical results, Variable and Declarations, integer qualifiers, Common programming errors.

Unit 2: Assignment, Addresses, the scanf( ) function, scanf( ) function with buffered input, Symbolic constants, Relational expressions, the if - else statement , nested if statement, if - else chain, the switch statement, the while statement, scanf( ) within a while loop, break and continue statement. The for statement, scanf( ) within a for loop, nested loops. The do statement, validity checks.

Unit 3: Function definitions and Declarations, standard library functions (input, output, mathematical, string), variable scope, variable storage class, passing addresses, arrays (single and two dimensional), array names as pointers, pointer arithmetic, passing and using array addresses. String fundamentals (input, output, processing, character by character input). Formatting strings.

COMPUTER PROGRAMMING IN C (PRACTICAL)

Unit 4: Programs involving interactive input and formatted output are to be practiced involving all the functions discussed in the theory part. More emphasis will be laid on programs involving mathematical computations like finding the roots of quadratic, cubic polynomials, addition, subtraction, multiplication of matrices.

Unit 5: Simple numerical methods in finding roots of polynomials and Quadrature.

Recommended Books:

1) The C Programming Language
- Brian W Kernighan & Dennis M Ritchie (PHI)

MAT 602 (H)Choice (b) Mathematical Methods

MATHEMATICAL METHODS

Unit 1: Hypergeometric functions. General solutions. Elementary functions. Confluent hypergeometric functions. Derivative of confluent hypergeometric functions. Integral representation of confluent hypergeometric functions.

Unit 2: Bessel's function. Bessel's differential equation. Bessel's function in terms of hypergeometric functions. Recurrence relations. Generating function of Bessel's functions. Bessel's function of second kind. Orthogonality of Bessel's functions.

Unit 3: Legendre functions. Legendre's differential equation. Generating function. Legendre's polynomials. Recurrence relations. Orthogonality of Legendre's polynomials. Associated Legendre's function.

Unit 4: Fourier transforms. Definition. Fourier sine and cosine series. Properties of Fourier transforms. Fourier transforms for functions of two variables. Parseval's relations. Evaluation of integrals. Fourier transforms of derivatives. Fourier sine and cosine transforms of derivatives.

Unit 5: Laplace transforms. Definition. Existence. Properties. Laplace transform of derivatives. Laplace transforms of integrals. Laplace transforms using power series, differentiation. Inverse Laplace transforms. Properties. Application.

Recommended Books:

1) Mathematical Physics - Binoy Bhattacharya (New Central Book Agency, Kolkata)

MAT 602(H)Choice (c) Special Theory of Relativity

Special Theory of Relativity

Unit 1: Review of Newtonian mechanics. Inertial frames. Speed of light and Galilean relativity. Michelson-Morley experiment. Lorentz-Fitzgerald hypothesis.

Unit 2: Relative character of space and time. Postulates. Special Theory of relativity. Lorentz transformation equations. Group properties of Lorentz transformations.

Unit 3: Length contraction. Time dilation. Lorentz contraction factor. Four dimensional Minkowskian space-time of special relativity.

Unit 4: Time-like, light-like and space-like intervals. Null cone. Proper time. World line of a particle.

Unit 5: Four vectors tensor in Minkowskian space-time relativistics mechanics. Variation of mass with velocity. Equivalence of mass and energy.

Recommended Books:

1. Theory of Relativity - J K Goyal & K P Gupta
2. Introduction to the Theory of Relativity - P G Bergmann

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MAT 611: Choice (d) Advanced Mechanics HYDROSTATICS

Unit 1: Fluid pressure under gravity. Related theorems. Differential equation of pressure.

Conditions of equilibrium. Homogeneous fluids. Equi-pressure surface. Lines of force. Curves of equi-pressure and equi-density. Pressures on plane surfaces (simple cases only) Centre of pressure. Centre of pressure of a parallelogram, triangular area, vertical circular area, etc (simple cases only)

Unit 2: Thrusts on curved surfaces. Resultant vertical thrust Resultant horizontal thrust. Buoyancy. Force of Buoyancy. Centre of Buoyancy.
Equilibrium of floating bodies. Bodies floating in more than one liquid. Stability of floating bodies. Meta centre. Surface of Buoyancy. Plane of floatation. Surface of floatation.

DYNAMICS OF RIGID BODIES

Unit 3: Moment and product of inertia. Momental ellipsoid. Principal axes. D'Alembert's principle. The general equations of motion. Independence of the motions of translation and rotation. Impulsive forces.

Unit 4: Motion about a fixed axis. Moment of momentum. The compound pendulum. Reactions of the axis of rotation. Motion about a fixed axis (impulsive forces). Centre of percussion.

Unit 5: Motion in two dimensions (Finite forces). Kinetic energy in two dimensions. Moment of momentum in two dimensions. Varying mass.

Recommended Books:

1) A Textbook of Hydrostatics - Ray and Sharma (S Chand)
2) Rigid Dynamics - Md Motiur Rahman (New Central Book Agency, Kolkata)