Lecture Plan Mathematics

Semester	Sem-1(Calculus) CC-1
Course Name	B.Sc. (Hons)
Text books	
Text 1	G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
Text 2	
References books	
Reference 1	R.K.Dwivedi, Calculus, 1st edition 2018, Pragati Prakashan, Meerut.
Reference 2	Calculus-Lal ji Prasad
Lecture	**Lecture Title**
3	Higher order derivatives,
4	Leibniz rule and its applications to problems of type eax+bsinx, eax+bcosx,(ax+b) nsinx, (ax+b)ncosx, concavity and inflection points,
3	asymptotes,
3	L'Hospital's rule
3	Reduction formulae,
3	derivations and illustrations of reduction formulae of the type ∫sinnx dx, ∫cosnx dx,
3	∫tannx dx, ∫sinnx cosmx dx, ∫sin mx cos nx dx, ∫ (log x)n dx,
3	parametric equations,parameterizing a curve,
3	arc length, arc length of parametric curves.
3	Triple product,
3	introduction to vector functions,
3	operations with vector-valued functions,
4	limits and continuity of vector functions,
4	differentiation and integration of vector functions.

Lecture Plan Mathematics

Semester	Sem-1(Algebra) CC-2
Course Name	B.Sc. (Hons)
Text books	
Text 1	David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
Text 2	
References books	
Reference 1	P.K. Manjhi, Algebra, 1st edition 2018, Pragati Prakashan, Meerut.
Reference 2	
Lecture	**Lecture Title**
3	Polar representation of complex numbers,
2	nth roots of unity,
3	De Moivre's theorem for rational indices and its applications,
3	logarithmic of complex numbers.
2	One to one correspondence and cardinality of a set.
3	Well-ordering property (WOP) of positive integers,
2	Division algorithm, Divisibility and Euclidean algorithm,
2	Congruence relation between integers,
2	Principles of Mathematical Induction,
2	Fundamental Theorem of Arithmetic.
2	Rank of a matrix,
4	row and column rank of a matrix,
4	system of linear equations Ax=B, Consistency of the system Ax=B,
3	Set of Solutions of Ax=0, invertible matrices and Characterizations of invertible matrices,
3	Characteristic polynomial of a matrix, Eigen values and Eigen vectors of a matrix.

Lecture Plan Mathematics

Semester	Sem-2(Real Analysis) CC-3
Course Name	B.Sc. (Hons)
Text books	
Text 1	S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994
Text 2	
References books	
Reference 1	Real Analysis -Lal ji Prasad
Reference 2	Real Analysis -S.K.Mittal and S.K.Pundir
Lecture	**Lecture Title**
2	Review of Algebraic and Order Properties of R,
3	neighborhood of a point in R, introduction to countable sets, uncountable sets.
2	Bounded Sets, Unbounded sets, Suprema and Infima,
2	The Completeness Property of R,
2	The Archimedean Property, Intervals.
2	Limit points of a set, Isolated points, Bolzano-Weierst
2	Sequences, Bounded sequence, Convergent sequence,
2	Limit of a sequence. Limit Theorems,
2	Monotone Sequences,
3	Monotone Convergence Theorem,
3	Bolzano Weierstrass Theorem for Sequences.
2	Cauchy sequence, Cauchy's Convergence Criterion.
2	Infinite series, convergence and divergence of infinite series,
2	Cauchy Criterion Tests for convergence:
2	Comparison test, Limit Comparison test, Ratio Test,
2	Cauchy's nth root test,
2	Raabe,s test, Alternating series,
2	Leibniz test for alternating series ,
2	Absolute and Conditional convergence.

Lecture Plan Mathematics

Semester	Sem-2(Differential Equations) CC-4
Course Name	B.Sc. (Hons)
Text books	
Text 1	S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004. 5. Martha L Abell,
Text 2	
References books	
Reference 1	Differential Equations- Lal Ji Prasad
Reference 2	Differential Equations- Pundir and Pundir
Lecture	**Lecture Title**
4	First order exact differential equations. Integrating factors, rules to find an integrating factor.
4	First order and higher degree equations solvable for x, y, p. Clairaut's form,
4	singular solutions, general solution.
4	Second order linear differential equation with constant coefficient.
4	General solution of second order linear homogeneous and non-homogeneous equations,
4	linear homogeneous and non-homogeneous equations of higher order with constant coefficients,
4	The Cauchy-Euler equation.
4	Second order linear differential equations with variable coefficients.

Lecture Plan Mathematics

Semester	Sem-3 (Theory of Real Functions) CC-5
Course Name	B.Sc. (Hons)
Text books	
Text 1	K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.
Text 2	A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
References books	
Reference 1	G.k.JHA and S.Jha, Theory of real functions, 1st Ed, Pragati Prakashan, Meerut, 2019
Reference 2	
Lecture	**Lecture Title**
3	Limits of functions (approach), sequential criterion for limits, divergence criteria.
3	Limit theorems, one sided limits. Infinite limits and limits at infinity.
3	Continuous functions, sequential criterion for continuity and discontinuity.
3	Algebra of continuous functions. Continuous functions on an interval,
3	intermediate value theorem,
3	location of roots theorem. Uniform continuity.
2	Differentiability of a function at a point and in an interval,
3	Caratheodory's theorem,
2	algebra of differentiable functions.
3	Relative extrema, interior extremum theorem.
3	Rolle's theorem,
2	Mean value theorem,
3	intermediate value property of derivatives, Darboux's theorem.

Lecture Plan Mathematics

Semester	Sem-1(Group Theory I) CC-6
Course Name	B.Sc. (Hons)
Text books	
Text 1	Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
Text 2	M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
References books	
Reference 1	P.K.Manjhi, Introduction to Group Theory, 1st Ed., Pragati Prakashan Meerut, 2019.
Reference 2	
Lecture	**Lecture Title**
3	Symmetries of a square, Dihedral groups, definition and examples of groups, abelian groups,
3	permutation groups, Cycle notation for permutations, even and odd permutations,
3	quaternion group and its matrix representation, elementary properties of groups.
3	Order of a group element and order of a group,
3	Subgroups and examples and theorems on subgroups,
3	normal subgroups and their properties,
3	centralizer (normalizer) of a group element, centre of a group.
2	Properties of cyclic groups, classification of subgroups of cyclic groups.
3	Cosets and their properties,
2	Lagrange's theorem and consequences including Fermat's Little theorem.
2	Group homomorphism, kennel of homomorphism, properties of homomorphism
3	factor groups (quotient groups),
3	Cauchy's theorem for finite abelian groups; Group isomorphism,
3	properties of isomorphisms, First, Second and Third isomorphism theorems,
3	Cayley theorem. External direct product of a finite number of groups.

Lecture Plan Mathematics

Semester	Sem-3 (Systems of ODE and PDE) CC-7
Course Name	B.Sc. (Hons)
Text books	
Text 1	S.L. Ross, Differential equations, 3rd Ed., John Wiley and Sons, India, 2004.
Text 2	
References books	
Reference 1	G.k.JHA and S.Jha, Partial Differential equation and system of ordinary diferential equations, 1st Ed, Pragati Prakashan, Meerut, 2019.
Reference 2	
Lecture	**Lecture Title**
3	Systems of linear differential equations,
3	types of linear systems,
4	differential operators, an operator method for linear systems with constant coefficients,
3	Basic Theory of linear systems in normal form.
4	Partial Differential Equations – Basic concepts and Definitions,
4	Mathematical Problems. First- Order Equations: Classification,
4	Construction and Geometrical Interpretation.
5	Nonlinear partial differential equation,
5	standard forms I, II,III and IV

Lecture Plan Mathematics

Semester	Sem-4 (Numerical Methods) CC-8
Course Name	B.Sc. (Hons)
Text books	
Text 1	Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
Text 2	M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering
References books	
Reference 1	Numerical Analysis -Lal Ji Prasad
Reference 2	
Lecture	**Lecture Title**
3	Transcendental and Polynomial equations:
3	Bisection method,
3	Newton-Raphson method,
3	Secant method.
3	System of linear algebraic equations:
3	Gaussian Elimination and Gauss Jordan methods.
3	Gauss Jacobi method, Gauss Seidel method.
3	Interpolation: Calculus of finite difference operators,
3	Newton's Gregory forward and backward difference interpolation.
3	Lagrange and Newton interpolation formula for unequal intervals.
3	Numerical differentiation,
3	Numerical Integration: Trapezoidal rule,
3	Simpson's rule, Simpsons 3/8th rule, Boole's Rule,
3	Midpoint rule, Composite Trapezoidal rule,
2	Composite Simpson's rule

Lecture Plan Mathematics

Semester	Sem-4 (Riemann Integration and Power series) CC-9
Course Name	B.Sc. (Hons)
Text books	
Text 1	K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
Text 2	
References books	
Reference 1	Degree Level Mathematics sem-4- Lal Ji Prasad
Reference 2	
Lecture	**Lecture Title**
3	Riemann integration; inequalities of upper and lower sums;
3	Riemann conditions of integrability.
4	Riemann sum and definition of Riemann integral through Riemann sums;
4	Riemann integrability of monotone and continuous functions,
4	Properties of the Riemann integral; Fundamental theorems of Calculus.
5	Improper integrals and their convergence, test ,
5	Dirichlets and abel's tests,
5	Convergence of Beta and Gamma functions.

Lecture Plan Mathematics

Semester	Sem-4 (Ring Theory) CC-10
Course Name	B.Sc. (Hons)
Text books	
Text 1	M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
Text 2	
References books	
Reference 1	Abstract Algebra-Lal Ji Prasad
Reference 2	
Lecture	**Lecture Title**
3	Definition and examples of rings, properties of rings,
3	subrings, integral domains and fields, characteristic of a ring, Ideals,
3	ideal generated by a subset of a ring, factor rings,
3	prime and maximal ideals, principal ideal domain.
3	Ring homomorphisms, properties of ring homomorphisms,
3	Isomorphism theorems,
3	field of quotients
3	Polynomial rings over commutative rings, division algorithm and consequences,
3	factorization of polynomials, reducibility tests, irreducibility tests,
3	Eisenstein criterion,unique factorization in Z[x].
3	Divisibility in integral domains, irreducibles, primes,
3	unique factorization domains,
3	Euclidean domains.

Lecture Plan Mathematics

Semester	Sem-1(Multivariate Calculus) CC-11
Course Name	B.Sc. (Hons)
Text books	
Text 1	G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
Text 2	
References books	
Reference 1	Advanced Calculus -Lal Ji Prasad
Reference 2	
Lecture	**Lecture Title**
4	Functions of several variables, limit and continuity of functions of two variables,
4	Partial differentiation,
4	total differentiability and differentiability,
4	sufficient condition for differentiability.
4	Extrema of functions of two variables.
4	Double and triple integrals,
4	change of order of integration,
4	surface area by double integral and Volume by triple integrals.
4	The gradient, divergence and curl.
3	Line integrals,
3	surface integral,
3	Green’s theorem.

Lecture Plan Mathematics

Semester	Sem-5(Group Theory II) CC-12
Course Name	B.Sc. (Hons)
Text books	
Text 1	M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
Text 2	
References books	
Reference 1	Modern Algebra -A.R.Vasishtha
Reference 2	Abstract Algebra- Lal Ji Prasad
Lecture	**Lecture Title**
3	Automorphism, inner automorphism, automorphism groups,
3	automorphism groups of finite and infinite cyclic groups,
3	applications of factor groups to automorphism groups,
3	Characteristic subgroups,
3	Commutator subgroup and its properties
3	Properties of external direct products, the group of units modulo n as an external direct product,
3	internal direct products,
3	Fundamental Theorem of finite abelian groups.
4	Class equation and consequences, conjugacy in Sn, p-groups,
4	Sylow's 1st , 2nd and 3rd theorems

Lecture Plan Mathematics

Semester	Sem-5 DSE-1 (Linear Programming)
Course Name	B.Sc. (Hons)
Text books	
Text 1	G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.
Text 2	
References books	
Reference 1	Optimization : Dr.B.N.Mishra and Dr.B.K.Mishra
Reference 2	Linear Programming- Lal Ji Prasad
Lecture	**Lecture Title**
2	Introduction to linear programming problem, convex sets and their properties,
3	Graphical method,
3	Theory of simplex method, optimality and unboundedness, the simplex method.
3	Duality, formulation of the dual problem,
2	primal-dual relationships
3	Transportation problem and its mathematical formulation,
3	northwest-corner method, lowest cost entry method and Vogel's approximation
4	method for determination of starting basic solution, optimality test,
4	algorithm for solving transportation problem.
4	assignment problem and its mathematical formulation,
4	Hungarian method for solving assignment problem.

Lecture Plan Mathematics

Semester	Sem-5 DSE-2 (Probability and Statistics)
Course Name	B.Sc. (Hons)
Text books	
Text 1	Sheldon Ross, Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint, 2007
Text 2	
References books	
Reference 1	Mathematical Stasistics- J,K,Gotyal and J.N.Sharma
Reference 2	
Lecture	**Lecture Title**
3	Sample space, probability axioms,
3	real random variables (discrete and continuous),
3	cumulative distribution function, probability mass/density functions,
3	mathematical expectation, moments, moment generating function,
3	characteristic function, discrete distributions:
3	uniform, binomial, Poisson, continuous
3	distributions: uniform, normal, exponential.
3	Joint cumulative distribution function and its properties, joint probability density functions,
3	marginal and conditional distributions, expectation of function of two random variables, variables.
3	conditional expectations, independent random variables,
3	bivariate normal distribution, correlation coefficient,
3	rank correlation coefficient, covariance,
3	linear regression for two

Lecture Plan Mathematics

Semester	Sem-6 (Metric Spaces and Complex Analysis) CC-13
Course Name	B.Sc. (Hons)
Text books	
Text 1	S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
Text 2	Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
References books	
Reference 1	Metric Spaces-LalJi Prasad
Reference 2	
Lecture	**Lecture Title**
3	Metric spaces: definition and examples.
3	Sequences in metric spaces,
3	Cauchy sequences.
3	Complete Metric Spaces.
3	Open and closed balls, neighbourhood, open set, .
3	interior of a set. Limit point of a set, closed set, diameter of a set
3	Geometry of complex numbers,
3	regions in the complex plane,
3	Limits and continuity of functions of complex variable, Derivatives,
3	Necessary and sufficient conditions for differentiability.
3	Analytic functions,
3	examples of analytic functions,
3	Cauchy-Riemann equations

Lecture Plan Mathematics

Semester	Sem-6(Linear Algebra) CC-14
Course Name	B.Sc. (Hons)
Text books	
Text 1	M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
Text 2	S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
References books	
Reference 1	Linear Algebra- Lal Ji Prasad
Reference 2	Linear Algebra- K.P.Gupta
Lecture	**Lecture Title**
3	Vector spaces, subspaces, algebra of subspaces,
3	quotient spaces, linear combination of vectors,
3	linear span,
3	linear independence
3	basis and dimension, dimension of subspaces, theorems.
3	Linear transformations, null space, range,
3	rank and nullity of a linear transformation,
3	matrix representation of a linear transformation,
3	algebra of linear transformations.
3	Inner product spaces and norms,
3	Gram-Schmidt orthogonalization process,
3	orthogonal complements,
3	Bessel’s inequality.

Lecture Plan Mathematics

Semester	Sem-6 DSE-3 (Theory of Equations)
Course Name	B.Sc. (Hons)
Text books	
Text 1	W.S. Burnside and A.W. Panton, The Theory of Equations, Dublin University Press, 1954.
Text 2	C. C. MacDuffee, Theory of Equations, John Wiley & Sons Inc., 1954.
References books	
Reference 1	Theory of Equations- Lal Ji Prasad
Reference 2	
Lecture	**Lecture Title**
3	General properties of polynomials, Descarte's rule of signs,
3	Relation between the roots and the coefficients of equations
3	Transformation of equations.
3	Solutions of reciprocal and binomial equations.
3	Algebraic solutions of the cubic and biquadratic.
3	Symmetric functions,
3	Applications of symmetric function of the roots.
3	Newton's theorem on the sums of powers of roots, .
3	homogeneous products,
3	limits of the roots of equations,
3	Strum's theorem

Lecture Plan Mathematics

Semester	Sem-6 DSE-4 (Mechanics)
Course Name	B.Sc. (Hons)
Text books	
Text 1	R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
Text 2	
References books	
Reference 1	Mechanics- Lal Ji Prasad
Reference 2	Mechanics- Pundir and Singh
Lecture	**Lecture Title**
3	Analytical conditions of equilibrium of coplanar forces,
3	virtual work,
3	common catenary,
3	Poinsot's central axis, wrenches.
3	Null lines and planes,
3	stable and unstable equilibrium
3	Velocities and acceleration along radial and transverse directions,
3	along tangent and normal directions,
3	simple harmonic motion,
3	elastic string , Hook's law.
3	Central orbit,
3	kepler's laws of motion.