Lesson Plan for Course: B.Sc(H)Sem-I **Code:** MTMACOR01T **Credit: 6**

- Course Name: Calculus, Geometry and Ordinary Differential Equation
- Course coordinator: Dr. Pintu Debnath
- Course Outcomes:
  - CO-1. To trace curve in two dimensional Cartesian and polar coordinates.
  - CO-2. Able to work with higher order derivatives, and concavity, inflection points, envelopes, asymptotes of a curve and to calculate their arc length, area and surface of revolution.
  - CO-3. To construct Reduction formulae, derivations and illustrations of reduction formulae.
  - CO-4. To solve several ODEs.
  - CO-5. To solve the problems related to two and three dimensions.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Sep	**Unit-1:** Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n sinx$, $(ax+b)^n cos\, x$, Concavity and inflection points, envelopes, asymptotes, curvetracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.	BS	20	Theoretical-18 Tutorial-02
Oct	**Unit-2 :** Reduction formulae, derivations and illustrations of reduction formulae for the integration of $sin^n x$, $cos^n x$, $tan^n x$, $sec^n x$, $(\log x)^n$, $sin^n x\, sin^m x$.	BS	03	Theoretical-03 Tutorial-00
Nov	1st Internal Assessment			
	Unit-2 : Parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics. **Unit-4:** Differential equations and mathematical models, General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form.	BS	22	Theoretical-20 Tutorial-02
	Unit-3: Reflection properties of conics, translation & rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics, Spheres, Cylindrical surfaces.	SM	10	Theoretical-08 Tutorial-02
Dec	**Unit-3:** Central conicoids, paraboloids, plane sections of conicoids, Generating lines, classification of quadrics, Illustrations of graphing standard quadric surfaces like cone,ellipsoid.	SM	08	Theoretical-06 Tutorial-02
	Unit-4: Linear equation and Bernoulli equations, Special integrating factors and transformations.	BS	11	Theoretical-09 Tutorial-02
	2nd Internal Assessment			
Jan	Revision	BS SM	04 04	Theoretical-08 Tutorial-00
	End Semester Examination			

For CBCS courses

	Assessment: Internal Assessment & Assignment		**Total: 82 Hrs**	**Theoretical-72 Tutorial-10**

Books:

- An Introduction to Integral Calculus, Ghosh&Maity, Central Book Agency.
- An Introduction to Differential Equation, Ghosh&Maity, Central Book Agency.
- G.F.Simmons, Differential Equations, Tata Mcgraw Hill.
- Coordinate Geometry, R. M. Khan, Central Book Agency

Lesson Plan for Course: B.Sc(H)Sem-I **Code:** MTMACOR02T **Credit: 6**

- Course Name: Algebra
- Course coordinator: Dr. Sudip Mondal
- Course Outcomes:
  - CO-1. To aware with polar representation of complex numbers, n-th roots of unity, De Moivre's theorem with its application.
  - CO-2. Able to apply Descarte's rule of signs and to solve cubic and biquadratic equations, AM≥GM≥HM in inequality.
  - CO-3. To familiar with equivalence relations, well-ordering property of positive integers, Division algorithm, principles of mathematical induction.
  - CO-4. To find rank of a given matrix, and to solve systems of linear equations
  - CO-5. To find out Eigen values, Eigen Vectors, inverse of a matrix though Cayley-Hamilton theorem.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Sep	**Unit-1:** Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications. *Theory of equations*: Polynomial	SM	10	Theoretical-08 Tutorial-02
	Unit-1: *Inequality*: The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality. **Unit-2:** Equivalence relations and partitions, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set. Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm. Congruence relation between integers. Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.	PD	20	Theoretical-18 Tutorial-02
Oct	**Unit-1:** *Theory of equations*: Descartes rule of signs.	SM	01	Theoretical-01 Tutorial-00
Nov	1st Internal Assessment			
	Unit-3: Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax = b$, Solution sets of linear systems, applications of linear systems, linear independence.	PD	16	Theoretical-14 Tutorial-02
Dec	**Unit 4:** Matrix, inverse of a matrix, characterizations of invertible matrices, Rank of a matrix, Eigen values, Eigen Vectors. Characteristic Equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix.	PD	16	Theoretical-14 Tutorial-02
	Unit-1: *Theory of equations*: Relation between roots and coefficients, Transformation of equation, Cubic (Cardan's method) and biquadratic equations (Ferrari's method).	BS	12	Theoretical-10 Tutorial-02
	2nd Internal Assessment			
Jan	Revision	PD SM BS	04 02 02	Theoretical-08 Tutorial-00
End Semester Examination				

For CBCS courses

	Assessment: Internal Assessment & Assignment		**Total: 83 Hrs**	**Theoretical-73 Tutorial-10**

Books:

- S. K. MAPA, Classical Algebra, Sarat Book Distributor,India, 2019.
- S. K. MAPA, Higher Algebra, Sarat Book Distributor,India, 2019.
- David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
- W.S. Burnstine and A.W. Panton, Theory of equations.

Lesson Plan for Course: B.Sc(H)Sem-III **Code:** MTMACOR05T **Credit: 6**

- Course Name: Theory of Real Functions
- Course coordinator: Dr. Biswajit Sarkar
- Course Outcomes:
  - CO-1. To understand limits of functions including through their definition, continuous functions and uniform continuity theorem.
  - CO-2. Aware about differentiability of a function.
  - CO-3. To familiar with several mean value theorems and their applications.
  - CO-4. Able to express Taylor's and Maclaurin's series expression of several functions.
  - CO-5. Able to apply Taylor's theorem to convex functions and inequalities.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1**: Limits of functions (ε - δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity, Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.	PD	20	Theoretical-18 Tutorial-02
Sep	**Unit -2** : Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions, Relative extrema, interior extremum, theorem. Rolle's theorem. Mean value theorem, intermediate value property of derivatives, Darboux's theorem.	PD	25	Theoretical-22 Tutorial-03
Oct	**Unit-2**: Applications of mean value theorem to inequalities and approximation of polynomials.	PD	02	Theoretical-02 Tutorial-00
Nov	1st Internal Assessment			
	Unit-3: Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder.	PD	15	Theoretical-12 Tutorial-03
Dec	**Unit-3**: Application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $ln(1+x)$, $1/ax+b$ and $(1+x)^n$. Application of Taylor's theorem to inequalities.	PD	12	Theoretical-08 Tutorial-04
	2nd Internal Assessment			
Jan	Revision	PD	04	Theoretical-04 Tutorial-00
	End Semester Examination			

For CBCS courses

	Assessment: Internal Assessment & Assignment		**Total: 78 Hrs**	**Theoretical-66 Tutorial-12**

Books:

- Walter Rudin, Principles of Mathematical analysis, Third Edition, McGrawhill Education
- S. K. MAPA, Introduction to Real Analysis, Sarat Book Distributor,India, 2019.
- Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.

Lesson Plan for Course: B.Sc(H)Sem-III **Code:** MTMACOR06T **Credit: 6**

- Course Name: Group Theory-I
- Course coordinator: Dr. Sudip Mondal
- Course Outcomes:
  - CO-1. To understand various types of groups, order of an element of a group, subgroups and their product.
  - CO-2. To familiar with cyclic group and their classification, permutation on group and cosets.
  - CO-3. To prove Lagrange's theorem and its application to prove Fermat's little theorem.
  - CO-4. To understand external direct product of a finite number of groups and other familiar groups.
  - CO-5. To learn group homomorphisms and their properties.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1:** Symmetries of a square, Dihedral groups, definition and examples of groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.	BS	19	Theoretical-17 Tutorial-02
Sept	**Unit-2:** Subgroups and examples of subgroups. Centralizer, normalizer, center of a group.	BS	13	Theoretical-11 Tutorial-02
Oct	**Unit-2:** Product of two subgroups.	BS	02	Theoretical-02 Tutorial-00
Nov	1st Internal Assessment			
	Unit-4: External direct product of a finite number of groups. Normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. **Unit-5:** Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms.	PD	14	Theoretical-12 Tutorial-02
	Unit-3: Properties of cyclic groups, classification of subgroups of cyclic groups, Cycle notation for permutations, properties of permutations, even and odd permutations. Alternating group, properties of cosets.	BS	14	Theoretical-12 Tutorial-02
Dec	**Unit-5:** First, Second and Third isomorphism theorems.	PD	06	Theoretical-04 Tutorial-02
	Unit-3: Lagrange's theorem and consequences including Fermat's Little theorem.	BS	09	Theoretical-08 Tutorial-01
	2nd Internal Assessment			
Jan	Revision	BS PD	02 02	Theoretical-04 Tutorial-00
	End Semester Examination			
	Assessment: Internal Assessment & Assignment		**Total: 81 Hrs**	**Theoretical-70 Tutorial-11**

Books:

- David S. Dummit and Richard M. Foote, Abstract Algebra (http://library.lol/main/36E6532B72807B9EF6B27E52E8C62CCC) , Third Edition , Wiley pvt.Ltd.
- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, 1997.
- S. K. Mapa, Higher Algebra, Sarat Book Distributor,India 2019.

For CBCS courses

Lesson Plan for Course: B.Sc(H)Sem-III **Code:** MTMACOR07T **Credit: 6**

- Course Name: Numerical Methods
- Course coordinator: Dr. Pintu Debnath
- Course Outcomes:
  - CO-1. To learn algorithms of various numerical methods including their convergences and error.
  - CO-2. To find root of a algebraic an transcendental equation and matrix inverse by various numerical methods.
  - CO-3. To learn various types of interpolation methods and finite differences, and their application on numerical differentiation.
  - CO-4. To integrate numerically by several rules, and power method for determining eigen values.
  - CO-5. To solve ordinary differential equations by Euler's method and Runge-Kutta methods.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1**: Algorithms, Convergence, Errors: Relative, Absolute. Round off, Truncation. **Unit-3**: *System of linear algebraic equations*: Gaussian Elimination and Gauss Jordan methods, Gauss Jacobi method, Gauss Seidel method and their convergence analysis, LU Decomposition.	SM	10	Theoretical-10 Tutorial-00
Sep	**Unit-2**: *Transcendental and Polynomial equations*: Bisection method, Newton's method, Secant method, Rate of convergence of these methods.	BS	03	Theoretical-03 Tutorial-00
	Unit-4: *Interpolation*: Lagrange and Newton's methods, Error bounds, Finite difference operators. Gregory forward and backward difference interpolations. *Numerical differentiation*: Methods based on interpolations, methods based on finite differences.	SM	16	Theoretical-16 Tutorial-00
Oct	------	-----	00	
Nov	1st Internal Assessment			
	Unit-5: *Numerical Integration*: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule.	SM	12	Theoretical-12 Tutorial-00
	Unit-2: *Transcendental and Polynomial equations*: Regula falsi method. Newton-Raphson method, Fixed point iteration, Rate of convergence of thses methods.	BS	04	Theoretical-04 Tutorial-00
Dec	**Unit-5**: *Numerical Integration*: Boole's rule, Midpoint rule, Composite Trapezoidal rule, Composite Simpson's 1/3rd rule, Gauss quadrature formula.	SM	10	Theoretical-10 Tutorial-00
	Unit–6: *Ordinary Differential Equations*: The method of successive approximations. Euler's method, the modified Euler method. Runge-Kutta methods of orders two and four.	BS	03	Theoretical-03 Tutorial-00
	Unit-5: *The algebraic eigenvalue problem*: Power method.	PD	02	Theoretical-02 Tutorial-00
	2nd Internal Assessment			

For CBCS courses

Jan	Revision	SM BS	_ _	Theoretical-00 Tutorial-00
	End Semester Examination			
	Assessment: Internal Assessment & Assignment		**Total: 60 Hrs**	**Theoretical-60** **Tutorial-00**

Books:

- Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
- Mollah S. A. Numerical Analysis and Computational Procedures. Publisher ArunabhaSen Books and Allied (P) Ltd. 2018.
- Gupta R. K. Numerical Methods: Fundamentals and Applications. Cambridge University Press; 2019 May 9.

Lesson Plan for Course: B.Sc(H)Sem-III **Code:** MTMACOR07P **Credit: 6**

- Course name: Numerical Methods Lab
- Course coordinator: Dr. Pintu Debnath
- Course Outcomes:
  - CO-1. To learn algorithms of various programing problems.
  - CO-2. Able to write C-programming of various methods to solve transcendental and algebraic equations.
  - CO-3. Able to write C-programming of various methods to solve system of linear equations and ODEs.
  - CO-4. Able to write C-programming for numerical integration and differentiation.
  - CO-5. Able to write C-programming of various methods to fitting a polynomial functions, Power method to find eigen values.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1**: Basic Programming **Unit-2**: Basic Programming **Unit-4**: *Solution of system of linear equations*: b) Gaussian elimination method. c) Gauss-Jacobi method.	SM	08	Practical-08
Sep	**Unit-3**: *Solution of transcendental and algebraic equations*: a) Bisection method. b) Newton Raphson method.	BS	04	Practical-04
	Unit-4: *Solution of system of linear equations*: d) Gauss-Seidel method. a) LU decomposition method. **Unit-5:** *Interpolation*: a) Lagrange Interpolation. b) Newton Interpolation.	SM	10	Practical-10
Oct	- - - -	- -	00	Practical-00
Nov	**Unit-3**: *Solution of transcendental and algebraic equations*: c) Secant method. d) Regula Falsi method.	BS	04	Practical-04
	Unit-6: *Numerical Integration*: a) Trapezoidal Rule. b) Simpson's one third rule. c) Weddle's Rule. d) Gauss Quadrature.	SM	10	Practical-10
Dec	**Unit-9:** *Solution of ordinary differential equations*: a) Euler method. b) Modified Euler method. c) Runge-Kutta method.	SM	10	Practical-10
	Unit-8: Fitting a Polynomial Function.	BS	04	Practical-04
	Unit-7: Method of finding Eigenvalue by *Power method*	PD	02	Practical-02
Jan	Revision	SM+BS	04	Practical-04
	End Semester Examination			
	Assessment: Assignment		**Total: 56 Hrs**	**Practical -56**

Books:

- Yashavant Kanetkar, Let Us C , BPB Publications, 2016.
- Kamthane AN. Programming in C, 2/e. Pearson Education India; 2011.
- SatbirMehla, Vishakha Gupta, M.L. Jain, AmitSehgal, New College Programming in C and Numerical Methods for B.A./B.Sc., Jeevansons Publications, India, Ninth Revised Edition, 2015

For CBCS courses

Lesson Plan for Course: B.Sc(H)Sem-III **Code:** MTMSSEC01M **Credit: 6**

- Course Name: C-Programming Language
- Course coordinator: Dr. Biswajit Sarkar
- Course Outcomes:
  - CO-1. Learn basic of high-level programming languages.
  - CO-2. To know about some arithmetic operators and logical operators to construct flowchart.
  - CO-3. Able to use for loop, while loop and do-while loop in C-programming.
  - CO-4. Able to use arrays and multi-dimensional arrays in C-programming.
  - CO-5. Capable to write programming by using functions.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1: Basics of Computer Programming**: Definition, Requirement of programming language, Machine language, high-level programming languages, machine code of a program: compilation process, Problem solving approaches: algorithm and flowchart.	SM	06	Theoretical-02 Tutorial-00
Sep	**Unit-2: Fundamentals of Programming:** Built in Data Types: int, float, double, char; Constants and Variables; first program: printf(), scanf(), compilation etc., keywords, Arithmetic operators: precedence and associativity, Assignment Statements: post & pre increment/decrement, logical operators: and, or, not. **Unit-3: Statements:** Relational operators, if-else statement, Iterative Statements: for loop, while loop and do-while loop; controlling loop execution: break and continue, nested loop.	SM	08	Theoretical-08 Tutorial-00
Oct	_ _ _ _	_ _	00	Theoretical-04 Tutorial-00
Nov	**Unit-4: Arrays:** Definition & requirement, declaration & initialization, indexing, one dimensional array: finding maximum, minimum, simple sorting and searching. **Unit-5: Multi-dimensional arrays:** Matrix Manipulations (Addition, Multiplication, Transpose). Arrays and Pointers, Memory allocation and deallocation: *malloc()* and *free()* functions.	SM	08	Theoretical-08 Tutorial-00
Dce	**Unit-6: Functions:** Why?, How to declare, define and invoke a function, Variables' scope, local& global variables and function parameters, Pointers, arrays as function parameters, *return* statement, Header files and their role. Illustrate different examples like swapping values, compute n!, nCr, find max/min from a list of elements, sort a set of numbers, matrix addition/ multiplication	SM	08	Theoretical-08 Tutorial-00
	End Semester Examination (By Department)			
	Assessment: Assignment		**Total: 30 Hrs**	**Theoretical-30** **Tutorial-00**

For CBCS courses

Books:

- Yashavant Kanetkar, Let Us C , BPB Publications, 2016.
- Kamthane AN. Programming in C, 2/e. Pearson Education India; 2011.
- Satbir Mehla, Vishakha Gupta, M.L. Jain, AmitSehgal, New College Programming in C and Numerical Methods For B.A./B.Sc., Jeevansons Publications, India, Ninth Revised Edition, 2015

Lesson Plan for Course: B.Sc(H)Sem-V **Code:** MTMACOR11T **Credit: 6**

- Course Name: Partial Differential Equations, Applications of Ordinary, Differential Equations
- Course coordinator: Dr. Biswajit Sarkar
- Course Outcomes:
  - CO-1. To conceptualize basic concepts of PDE, and able to solve different types of first order PDE.
  - CO-2. To classify second order linear PDE and transform into their canonical forms.
  - CO-3. To find out the solution of different types of initial and boundary value problems.
  - CO-4. To find solution of Cauchy problems of first order PDE including the method of separation of variables.
  - CO-5. To apply some application of ODE on particle dynamics like Central force, planetary motion, etc.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit 4:** Central force. Constrained motion, varying mass.	SM	16	Theoretical-14 Tutorial-02
Sep	**Unit-1**: *Partial Differential Equations*: Basic concepts and Definitions. Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms of First-order Linear Equations.	PD	13	Theoretical-11 Tutorial-02
Oct	**Unit-1**: *Partial Differential* Equations: Method of Separation of Variables for solving first order partial differential equations.	PD	02	Theoretical-02 Tutorial-00
Nov	1st Internal Assessment			
	Unit-2: Derivation of Heat equation, Wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equations to canonical forms. **Unit-3**: The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string. Initial Boundary Value Problems. Semi-Infinite String with a fixed end, Semi-Infinite String with a Free end. Equations with non-homogeneous boundary conditions. Non-Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating String Problem. Solving the Heat Conduction problem.	PD	14 15	Theoretical-27 Tutorial-02
Dec	**Unit 4:** Tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.	SM	13	Theoretical-10 Tutorial-03
	2nd Internal Assessment			
Jan	Revision	PD SM	04 02	Theoretical-06 Tutorial-00
	End Semester Examination			
	Assessment: Internal Assessment & Assignment		**Total: 79 Hrs**	**Theoretical-70 Tutorial-09**

For CBCS courses

Books:

- TynMyint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th Edition, Springer, Indian reprint, 2006.
- S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
- Martha L Abell, James P Braselton, Differential equations with MATHEMATICA, 3rd Ed., ElsevierAcademic Press, 2004.
- Sneddon, I. N., Elements of Partial Differential Equations, McGraw Hill,2013.
- Miller, F. H., Partial Differential Equations, John Wiley and Sons,2013.
- Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press,2007.

Lesson Plan for Course: B.Sc(H)Sem-V **Code:** MTMACOR12T **Credit: 6**

- Course Name: Group Theory II
- Course coordinator: Dr. Biswajit Sarkar
- Course Outcomes:
  - CO-1. To conceptualize some advance theoretical results like automorphism, inner automorphism, etc. on group and cyclic group.
  - CO-2. To know about characteristic subgroup, Commutator subgroup and its properties.
  - CO-3. To understand the direct product of groups and use it to prove fundamental theorem of abelian groups.
  - CO-4. To apply concepts and results of group actions to prove generalized Cayley's theorem and index theorem.
  - CO-5. To realize the beauty of Sylow's theorem and its applications to find simplicity of alternating group.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1**: Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups. Characteristic subgroups, Commutator subgroup and its properties.	PD	22	Theoretical-20 Tutorial-02
Sep	**Unit-3**: Group actions, stabilizers and kernels, permutation representation associated with a given group action. Applications of group actions. Generalized Cayley's theorem. Index theorem.	PD	17	Theoretical-14 Tutorial-03
Oct	_ _ _ _	_ _	00	Theoretical-00 Tutorial-00
Nov	1st Internal Assessment			
	_ _ _ _	_ _	00	Theoretical-00 Tutorial-00
Dec	**Unit-2**: Properties of external direct products, the group of units modulo n as an external direct product, internal direct products. Fundamental Theorem of finite abelian groups. **Unit-4**: Groups acting on themselves by conjugation, class equation and consequences, conjugacy in Sn, pgroups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$, non-simplicity tests.	PD	14 14	Theoretical-26 Tutorial-02
	2nd Internal Assessment			
Jan	Revision	PD	04	Theoretical-04 Tutorial-00
	End Semester Examination			
	Assessment: Internal Assessment & Assignment		**Total: 71 Hrs**	**Theoretical-64 Tutorial-07**

Books:

- John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., 1999.
- D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, Tata McGrawHill,1997.
- I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
- S.K.Mapa, Higher Algebra, Sarat Book Distributor,India, 2019.

For CBCS courses

Lesson Plan for Course: B.Sc(H)Sem-V **Code:** MTMADSE01T **Credit: 6**

- Course Name: Linear Programming
- Course coordinator: Dr. Dr. Sudip Mondal
- Course Outcomes:
  - CO-1. To analyze and solve linear programming models of real life situations.
  - CO-2. To provide several methods for solving LPP including the concept of convex set and extreme points.
  - CO-3. To understand the theory of the transportation problem, assignment problems etc.
  - CO-4. To know about the relationships between the primal and dual problems.
  - CO-5. To learn about the applications to two-person zero-sum game problems.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug	**Unit-1**: Introduction to linear programming problem. convex sets, Theory of simplex method, graphical solution, Optimality and unboundedness. The simplex algorithm, simplex method in tableau format. Introduction to artificial variables, two-phase method. Big-M method and their comparison.	BS	22	Theoretical-20 Tutorial-02
Sep	**Unit-2:** Duality, formulation of the dual problem, primal-dual relationships. Economic interpretation of the dual. Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution.	BS	24	Theoretical-22 Tutorial-02
Oct	**Unit-2:** Algorithm for solving transportation problem.	BS	02	Theoretical-02 Tutorial-00
Nov	1st Internal Assessment			
	Unit-2: Algorithm for solving assignment problem and its mathematical formulation, Hungarian method for solving assignment problem. **Unit 3:** Game theory: Formulation of two person zero sum games. Solving two person zero sum games, Games with mixed strategies, graphical solution procedure, linear programming solution of games.	BS	26	Theoretical-24 Tutorial-02
Dec	_ _ _ _	_ _	00	Theoretical-00 Tutorial-00
	2nd Internal Assessment			
Jan	Revision	BS	04	Theoretical-04 Tutorial-00
	End Semester Examination			
	Assessment: Internal Assessment & Assignment		**Total: 78 Hrs**	**Theoretical-72 Tutorial-06**

Books:

- P.M.Karak, Linear programming and Theory of Games, ABS Publishing House, Kolkata-700007
- F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
- Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
- G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

For CBCS courses

Lesson Plan for Course: B.Sc(H)Sem-V **Code:** MTMADSE03T **Credit: 6**

- Course Name: Probability & Statistics
- Course coordinator: Dr. Dr. Pintu Debnath
- Course Outcomes:
  - CO-1. To understand the basic concepts of classical probability.
  - CO-2. To learn probability distribution and density function, and their properties with example.
  - CO-3. To understand Chebyshev's inequality and central limit theorem and their applications.
  - CO-4. To conceptualize random samples, sampling distributions and estimation of parameters.
  - CO-5. Able to solve the real life data-based problems by testing of hypothesis.

Course planner

Month	Course Topic	Teacher	Class-hour	Remarks*
Aug				No classes
Sep	**Unit-1**: Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function. *Discrete distributions*: Uniform, binomial, Poisson, geometric, negative binomial. *Continuous distributions*: uniform, normal, exponential. **Unit-2**: Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions. Expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient.	SM	24	Theoretical-22 Tutorial-02
Oct	**Unit-2:** Joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.	SM	02	Theoretical-02 Tutorial-00
Nov	1st Internal Assessment			
	Unit-3: Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers. Central Limit theorem for independent and identically distributed random variables with finite variance.	SM	20	Theoretical-18 Tutorial-02
Dec	**Unit-3:** Markov Chains, Chapman-Kolmogorov equations, classification of states.	SM	10	Theoretical-08 Tutorial-02
	Unit-4: Random Samples, Sampling Distributions, Estimation of parameters, Testing of hypothesis.	BS	22	Theoretical-20 Tutorial-02
	2nd Internal Assessment			
Jan	Revision	SM	04	Theoretical-04 Tutorial-00
	End Semester Examination			
	Assessment: Internal Assessment & Assignment		**Total: 78 Hrs**	**Theoretical-70 Tutorial-08**

For CBCS courses

Books:

- Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, PearsonEducation, Asia, 2007.
- Sheldon Ross, Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint, 2007.
- Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw- Hill, Reprint 2007
- A. Gupta, Ground work of Mathematical Probability and Statistics, Academic publishers, 1983.
- A. Banerjee, S.K. De, S. Sen, Mathematical Probability, U.N.Dhur& Sons Pvt. Ltd., Kolkata-700073.
- S.K. De, S. Sen, Mathematical Statistics, U.N.Dhur& Sons Pvt. Ltd., Kolkata-700073.