

**DEPARTMENT OF MATHEMATICS**  
**LESSION PLAN**  
**SESSION 2023-24**  
**SEMESTER – V**

**NAME OF TEACHER: HARICHARAN MAHANTA**

**PAPER ALLOTTED: MTMADSE03T(PROBABILITY AND STATISTIC),  
MTMGDSE01T(MATRICES)**

| Month   | Paper  | Topic   | No of classes |
|---|--|---|---------------|
| September 2023<br>(25.09.2023)                      | MTMADSE03T<br>(Probability and Statistic)                  | 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,  | 6             |
| October 2023  | MTMADSE03T<br>(Probability and Statistic)                  | Unit 1 characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.   | 12            |
| <b>PUJA VACATION<br/>(19.10.2023 to 15.11.2023)</b> |  |   |               |
| November 2023                                       | MTMADSE03T<br>(Probability and Statistic)                  | 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, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables. | 10            |
| December 2023                                       | MTMADSE03T<br>(Probability and Statistic)                  | 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, Markov Chains, Chapman-Kolmogorov equations, classification of states.<br>Unit 4 : Random Samples, Sampling Distributions, Estimation of parameters, Testing of hypothesis.                        | 16            |
| December 2023                                       | <b>Internal Examination<br/>(26.12.2023 to 02.01.2024)</b> |   |               |
| January, 2024                                       | <b>Class for Slow Learners</b>                             |   | 8             |
| Jan-Feb 2024  | <b>END SEMESTER EXAMINATION</b>                            |   |               |
| <b>Total Classes</b>                                |  |   | <b>52</b>     |

| Month                                       | Paper  | Topic   | No of classes |
|---|--|---|---------------|
| September 2023<br>(25.09.2023)              | MTMGDSE01T<br>(Matrices)                           | R, R <sup>2</sup> , R <sup>3</sup> as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R <sup>2</sup> , R <sup>3</sup> .   | 8             |
| October 2023                                | MTMGDSE01T<br>(Matrices)                           | Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.  | 12            |
| PUJA VACATION<br>(19.10.2023 to 15.11.2023) |  |   |               |
| November 2023                               | MTMGDSE01T<br>(Matrices)                           | Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.  | 10            |
| December 2023                               | MTMAGSE01T<br>(Matrices)                           | Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics | 16            |
| December 2023                               | Internal Examination<br>(26.12.2023 to 02.01.2024) |   |               |
| January, 2024                               | Class for Slow Learners                            |   | 8             |
| Jan-Feb 2024                                | END SEMESTER EXAMINATION                           |   |               |
| Total Classes                               |  |   | 54            |

**NAME OF TEACHER: DR. KUSUMIKA KUNDU**

**PAPER ALLOTTED: MTMADSE01T(LINEAR PROGRAMMING PROBLEM)**

| Month                          | Paper                                  | Topic  | No of classes |
|--------------------------------|--|--|---------------|
| September 2023<br>(25.09.2023) | MTMADSE01T(Linear Programming Problem) | Unit 1 : : Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format  | 8             |
| October 2023                   | MTMADSE01T(Linear Programming Problem) | Unit 1 introduction to artificial variables, two-phase method. Big-M method and their comparison<br>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 | 12            |

| <b>PUJA VACATION<br/>(19.10.2023 to 15.11.2023)</b> |   |  |           |
|---|---|--|-----------|
| <b>November<br/>2023</b>                            | <b>MTMADSE01T(L<br/>inear<br/>Programming<br/>Problem)</b>    | <b>Unit 2 : Vogel approximation method for determination of starting basic solution , algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem</b> | <b>8</b>  |
| <b>December<br/>2023</b>                            | <b>MTMADSE01T(L<br/>inear<br/>Programming<br/>Problem)</b>    | <b>Unit 3 :: Game theory: Formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies<br/>Unit 4 : graphical solution procedure, linear programming solution of games</b>                       | <b>16</b> |
| <b>December<br/>2023</b>                            | <b>Internal Examination<br/>(26.12.2023 to 02.01.2024)</b>    |  |           |
| <b>January,<br/>2024</b>                            | <b>Internal Examination &amp;<br/>Class for Slow Learners</b> |  | <b>8</b>  |
| <b>Jan-Feb,<br/>2024</b>                            | <b>END SEMESTER EXAMINATION</b>                               |  |           |
| <b>Total Class</b>                                  |   |  | <b>52</b> |

**NAME OF TEACHER: DR. ABUL KALAM MONDAL**

**PAPER ALLOTTED: MTMACOR12T(GROUP THEORY-II)**

| <b>Month</b>  | <b>Paper</b>                            | <b>Topic</b>  | <b>No of<br/>classes</b> |
|---|---|---|--------------------------|
| <b>September<br/>2023<br/>(25.09.2023)</b>          | <b>MTMACOR12T<br/>(Group Theory-II)</b> | <b>Unit 1: Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups,</b>   | <b>8</b>                 |
| <b>October<br/>2023</b>                             | <b>MTMACOR12T<br/>(Group Theory-II)</b> | <b>Unit 1: Characteristic subgroups, Commutator subgroup and its properties.<br/>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.</b>              | <b>14</b>                |
| <b>PUJA VACATION<br/>(19.10.2023 to 15.11.2023)</b> |   |   |                          |
| <b>November<br/>2023</b>                            | <b>MTMACOR12T<br/>(Group Theory-II)</b> | <b>Unit 3 : Group actions, stabilizers and kernels, permutation presentation associated with a given group action. Applications of group actions. Generalized Cayley's theorem. Index theorem.</b>  | <b>10</b>                |
| <b>December<br/>2023</b>                            | <b>MTMACOR12T<br/>(Group Theory-II)</b> | <b>Unit 4 :Groups acting on themselves by conjugation, class equation and consequences, conjugacy in <math>S_n</math>, pgroups,<br/>Unit 4 : Sylow's theorems and consequences, Cauchy's theorem, Simplicity of <math>A_n</math> for <math>n \geq 5</math>, non-simplicity tests.</b> | <b>16</b>                |

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|---------------|--|----|
| December 2023 | Internal Examination<br>(26.12.2023 to 02.01.2024) |    |
| January, 2024 | Class for Slow Learners                            | 8  |
| Jan-Feb, 2024 | END SEMESTER EXAMINATION                           |    |
| Total Classes |  | 56 |

NAME OF TEACHER: SUMITA SAHA

PAPER ALLOTTED: MTMACOR11T(PARTIAL DIFFERENTIAL EQUATION AND APPLICATION OF ORDINARY DIFFERENTIAL EQUATIONS)

| Month                                       | Paper   | Topic   | No of classes |
|---|---|---|---------------|
| September 2023<br>(25.09.2023)              | MTMACOR11T<br>(PDE, Application of Ordinary Differential Equations) | Unit 1: PDE: Basic concepts and Definitions<br>Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations   | 8             |
| October 2023                                | MTMACOR11T<br>(PDE, Application of Ordinary Differential Equations) | Unit 1 Canonical Forms of First-order Linear Equations.<br>Method of Separation of Variables for solving first order partial differential equations<br>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. | 10            |
| PUJA VACATION<br>(19.10.2023 to 15.11.2023) |   |   |               |
| November 2023                               | MTMACOR11T<br>(PDE, Application of Ordinary Differential Equations) | 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.   | 8             |
| December 2023                               | MTMACOR11T<br>(PDE, Application of Ordinary Differential Equations) | Unit 3 : Non-Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating String Problem.<br>Solving the Heat Conduction problem<br>Unit 4 : Central force. Constrained motion, varying mass, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law  | 16            |
| December 2023                               | Internal Examination<br>(26.12.2023 to 02.01.2024)                  |   |               |
| January, 2024                               | Class for Slow Learners   |   | 8             |
| Jan-Feb, 2024                               | END SEMESTER EXAMINATION  |   |               |

|                      |  |           |
|----------------------|--|-----------|
| <b>Total Classes</b> |  | <b>50</b> |
|----------------------|--|-----------|