DEPARTMENT OF MATHEMATICS

Syllabus Distribution and Teaching Plan

Odd Semester **Session: 2023-2024**

Term I: Commencement of classes to 1st internal,

Term II: 1st internal to 2nd internal.

Term III: 2nd internal to ESE preparatory break.

Semester I

Name of the Teacher	Syllabus Allotted	Teaching Plan
Dr. Bimal Krishna Das	**Course type:** Mathematics (Honours) **Paper- Major-1(4 year Hons.)** ***No of Classes (Hour) per week*: 1** **Major-1-: Calculus, Geometry & Differential Equation** **Unit-II: (Calculus -II): Marks: 14** Reduction formulae, derivations and illustrations of reduction formulae of the type ∫sin nx dx, ∫cos nx dx, ∫tan nx dx, ∫sec nx dx, ∫(log x)n dx, ∫sinnx sinmx dx, parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.	**Term I** (4 Lectures) Lecture 1: Illustrations of reduction formulae of the type ∫sin nx dx, ∫cos nx dx, ∫tan nx dx, ∫sec nx dx. If $\phi(n) = \int_0^{\frac{\pi}{4}} tan^n x dx$, show that $\phi(n) + \phi(n-2) = \frac{1}{n-1}$ and deduce the value of $\phi(5)$. Lecture 2: Find the reduction formulae of ∫(log x)n dx, $\int sin^m x cos^n x dx$, $\int_0^{\frac{\pi}{2}} sin^m x cos^n x dx$. Deduce the value of $\int_0^{\frac{\pi}{2}} sin^8 x cos^6 x dx$ Lecture 3: Reduction formula for $\int cos^m x cosnx dx$ and $\int cos^m x sinnx dx$, *m, n* being positive integer. If $I_{m,n} = \int_0^{\frac{\pi}{2}} cos^m x cosnx dx$, prove that $I_{m,n} = \frac{m(m-1)}{m^2-n^2} I_{m-2,n}$ Lecture 4: Tutorial **Term II** (4 Lectures) Lecture 5: Parametric equations, Parameterizing a curve and its related problems, arc length of a curve and Arc length of parametric curves Lecture 6: Find the length of arc of the following curves between the indicated points (i) $x = e^\theta sin\theta, y = e^\theta cos\theta; \theta = 0 \text{ and } \frac{\pi}{2}$ (ii) $y = \frac{1}{2}a\left(e^{\frac{x}{a}} + e^{-\frac{x}{a}}\right); x = 0 \text{ and } x = x$ Lecture 7: Find the perimeter of the hypocloid $\left(\frac{x}{a}\right)^{\frac{2}{3}} + \left(\frac{y}{b}\right)^{\frac{2}{3}} = 1$, Find the length of the perimeter of the astroid $(x)^{\frac{2}{3}} + (y)^{\frac{2}{3}} = (a)^{\frac{2}{3}}$ Lecture 8: Area under a curve and its related problems. Lecture 8: Find the area of the region bounded by the parabola $y^2 = 4x$ and its latus rectum, Find the area of the circle $r = 2asin\theta$. **Term III** (4 Lectures) Lecture 9: Area and volume of surface of revolution, Techniques of sketching conics. Lecture 10: Find the volume generated by revolution about x-axis of the area bounded by the loop of the curve $y^2 = x^2(2-x)$, Find the volume and the surface area of the solid generated by revolving the cycloid $x = a(\theta + sin\theta), y = a(1 + cos\theta)$ about its base. Lecture 11: Tutorial Lecture 12: Tutorial

Dr. Pradip Kumar Gain	**(HONOURS)** ***No of Classes (Hour) per week*: 1** **MJ-1T: (Unit-I)** **Calculus :- Marks-16** Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, envelopes, asymptotes, curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.	**Term I:** (07 Lectures+ 01 Tutorial) **Lecture-1.** Discussion on previous knowledge of calculus. **Lecture-2.** Hyperbolic functions. **Lecture-3.** Discussion on meaning of higher order of differential co-efficient. Method of finding higher order of differential co-efficients of some standard functions. **Lecture-4.** Discussion on Leibnitz rule and its applications. **Lecture-5.** Applications of Leibnitz rule to the problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, **Lecture-6.** Discussion on Convexity and concavity. **Lecture-7.** Discussion on the problems related to Convexity and concavity and Point of inflection. **Tutorial-1.** **Term II:** (06 Lectures + 02 Tutorial) **Lecture-1.** Discussion on concept of envelops. **Lecture-2.** Methods of finding envelops of the family of curves of single parameter **Lecture-3.** Methods of finding envelops of the family of curves of two parameters. **Lecture-4.** Discussion on the concept of asymptotes of a curve having infinite branches **Lecture-5.** Methods of finding asymptotes of an algebraic curve. **Lecture-6.** Asymototes in polar co-ordinate system **Tutorial-1** **Tutorial-2** **Term III:** (02 Lectures + 01 Tutorial) **Lecture-1.** Discussion on L' Hospitals Rule **Lecture-2.** L' Hospitals Rule and its Applications **Tutorial-1**
Dr. Sangita Chakraborty	**Course:** B. Sc. (Hons.) Major in Mathematics **Course Type:** Major-1 **Course Code:** MATHMJ101 **Course Title:** T: Calculus, Geometry & Ordinary Differential Equation ***No of Classes (Hour) per week*: 1** **UNIT-4:** General, particular, explicit, implicit and singular solutions of a differential equation. First order but not first degree. Exact differential equations and integrating factors, and equations reducible to this form, linear equation, Bernoulli equation and special integrating factors and transformations.	**Term I: (05 Lectures+ 02 Tutorials)** Lecture-1: Introduction to the ordinary differential equation(ODE) and its applications in different fields. Lecture-2: Types of solutions of an ODE: General, particular, explicit, implicit and singular solutions with examples. Lecture-3: Conditions for existence and uniqueness of the solution of an ODE with examples. Lecture-4: Definition and examples of first order exact differential equations and condition of exactness. Lecture-5: Method of solution of first order exact differential equations with problems solving. Tutorial-1 Tutorial-2 **Term II: (04 Lectures+ 02 Tutorials)** Lecture-6: Concepts of integrating factors, rules to find an integrating factor. Lecture-7: Linear differential equations of first order and its solution procedure. Lecture-8: Bernoulli's Equations and its solution techniques. Lecture-9: Continuation of Lecture 8. Tutorial 1: Tutorial 2:

		<u>Term III</u>: (05 Lectures+ 02 Tutorials) Lecture-10: First order higher degree equations solvable for x and solvable for y. Lecture-11: First order higher degree equations solvable for p. Lecture-12: Theory of singular solutions. Lecture-13: Discussion on special integrating factors. Lecture-14: Transformations applied to an ODE. Tutorial 1: Tutorial 2: Doubt-clearing session 1. Doubt-clearing session 2.
Prof. Sankar Das	**Course type:** Mathematics (Honours) **Paper- MJ A1/B1T:** ***No of Classes (Hour) per week*: 1** **Unit-3: Geometry (2D):** **<u>UNIT-3:</u>** Reflection properties of conics, rotation of axes and second-degree equations, classification of conics using the discriminant, polar equations of conics.	**<u>Term I</u>:** (06 Lectures) **Lecture 1:** Introduction of General equation of Second degree. **Lecture 2:** Reflection properties of conics, rotation of axes. **Lecture 3:** Transformation from one pair of rectangular axes to another with the same origin. **Lecture 4:** Metric classification of conics. Nature of the conic. **Lecture 5:** Centre of a conic. Conic with centre at the origin. **Lecture 6:** Tutorial **<u>Term II</u>:** (06 Lectures) **Lecture 7:** Reduction of the equation of a conic. **Lecture 8:** Canonical form of a conic. Nature of the conic. **Lecture 9:** Polar coordinates. Change from cartesian to polar system of coordinates and vice-versa. **Lecture 10:** Polar equation of a straight line, Circle. **Lecture 11:** Polar equation of a conic referred to a focus as pole. **Lecture 12:** Tutorial **<u>Term III</u>:** (05 Lectures) **Lecture 13:** Equation of the chord of a conic. **Lecture 14:** Tangent and normal of a conic. **Lecture 15:** Polar equation of chord of contact of tangents. **Lecture 16:** Equation of the polar of a point with respect to a conic. **Lecture 17:** Tutorial
	Course type: Mathematics (General) **Paper-** 3 years MI-1 **(Geometry & Differential Equations)** ***No of Classes (Hour) per week*: 2** **<u>UNIT-3:</u>** Reflection properties of conics, rotation of axes and second-degree equations, classification of conics using the discriminant, polar equations of conics. Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating	**<u>Term I:</u>** (12 Lectures) **Lecture 1:** Introduction of General equation of Second degree. **Lecture 2:** Reflection properties of conics, rotation of axes. **Lecture 3:** Transformation from one pair of rectangular axes to another with the same origin. **Lecture 4:** Metric classification of conics. Nature of the conic. Centre of a conic. Conic with centre at the origin. **Lecture 5:** Reduction of the equation of a conic. **Lecture 6:** Canonical form of a conic. Nature of the conic. **Lecture 7:** Polar coordinates. Change from cartesian to polar system of coordinates and vice-versa. **Lecture 8:** Polar equation of a straight line, Circle. **Lecture 9:** Polar equation of a conic referred to a focus as pole. Equation of the chord of a conic. Tangent and normal of a conic. **Lecture 10:** Polar equation of chord of contact of tangents. Equation of the polar of a point with respect to a conic.

	lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid. **UNIT-4:** General, particular, explicit, implicit and singular solutions of a differential equation. First order but not first degree. Exact differential equations and integrating factors, and equations reducible to this form, linear equation, Bernoulli equation and special integrating factors and transformations.	**Lecture 11:** Tutorial **Lecture 12:** Tutorial **Term II**: (10 Lectures) **Lecture 13:** Equation of Spheres. Equation of a circle. **Lecture 14:** Sphere through a given circle. Equation of tangent plane. **Lecture 15:** Equation of Cylindrical surfaces. **Lecture 16:** Equation of right circular cylinder. **Lecture 17**: Equation of Central conicoids, paraboloids, ellipsoid. **Lecture 18:** Plane sections of conicoids. **Lecture 19**: Generating lines, classification of quadrics, **Lecture 20:** Illustrations of graphing standard quadric surfaces like cone. **Lecture 21:** Tutorial **Lecture 22:** Tutorial **Term III**: (13 Lectures) **Lecture 23:** Introduction of Ordinary differential equation of first order. **Lecture 24:** Formation of differential equations. **Lecture 25:** General, particular, explicit, implicit and singular solutions of a differential equation. **Lecture 26:** Differential equations of first order but not first degree. **Lecture 27:** Exact differential equations and integrating factors, and equations reducible to this form. **Lecture 28:** Equations solvable by separation of variables. **Lecture 29:** Homogeneous differential equations. **Lecture 30:** Linear differential equations. **Lecture 31:** Differential equations with Clairaut's form. **Lecture 32:** Bernoulli differential equations. **Lecture 33:** Special integrating factors and transformations. **Lecture 34:** Tutorial **Lecture 35:** Tutorial
Dr. Anjana Mondal	**Course:** B. Sc. (Hons.) Major in Mathematics **Course Type:** Major-1 **Course Code:** MATHMJ101 **Unit-III: 3D Geometry** (Marks-18) ***No. of Classes (Hour) per week*: 1** Spheres, Cylindrical surfaces, Central conicoids, Paraboloids, Plane sections of conicoids, Generating lines, Classification of quadrics, Illustration of graphing standard quadric surfaces like cone, Ellipsoid	**Term I**: **(5 Lectures+ 01 Tutorial)** Lecture-1: Equation of sphere in standard and central form. Radius and coordinate of centre of sphere from general equation of sphere. Equation of a sphere when coordinates of extreme points of diameter is given. Lecture-2: Section of a sphere by a plane. Lecture-3: Equation of sphere through the intersection of two given spheres. Intersection of two spheres. Lecture-4: Tangent plane of sphere at a given point. Equation of normal at a point. Lecture-5: Cylinder, Equation of Right Circular Cylinder. Tutorial-1 **Term II**: **(03 Lectures+ 01 Tutorial)** Lecture-6: Cone, right circular cone Lecture-7: General equation of central conicoid. Ellipsoid Lecture-8: Classification of quadrics Tutorial-2

		<u>Term III</u>: (03 Lectures+ 01 Tutorial) Lecture-9. Ellipsoid Lecture-10: Paraboloid Lecture-11: Hyperboloid of one sheet and two sheets Tutorial-3
	Course: B. Sc. (Hons.) Major in Mathematics **Course Type:** SEC **Course Code:** MATSEC01 **Course Title: P: MATLAB-1:** (Marks-50) ***No. of Classes (Hour) per week*: 2** MATLAB interface, data types, variables, flow control statements, arrays: creating, indexing, operations, Matrix creating, indexing, operations, input and output function, mathematical library functions, user-defined function: anonymous function. Plotting of two dimensional functions: graph plotting, graph formatting (title, axis, line styles, colours, etc.), Multiple plots, matrix plots, polar plots, 3D plotting (line, surface, mesh, and contours) of three dimensional functions. i. Find the sum, product, max, min of a list of number in an array, in a sub-array without library function. ii. Find a sub-matrix of a given matrix. iii. Find the column sum, product, max, min of a given matrix without library function. iv. Find the row sum, product, max, min of a given matrix without library function. v. Define any transcendental function and then find and show the table of its functional values. vi. Plotting of graph of functions e^{ax+b}, $\log(ax+b)$, $\log\left(\frac{1}{ax+b}\right)$, $\sin(ax+b)$, $\cos(\mathrm{ax}+\mathrm{b})$, $\lvert \mathrm{ax}+\mathrm{b} \rvert$ and to illustrate the effect of a and b on the graph. vii. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.	**<u>Term I</u>: (10 Practicals)** Practical-1: MATLAB interface, data types, variables, flow control statements Practical-2: arrays: creating, indexing, operations, Matrix creating Practical-3: Matrix creating, indexing operations, input and output functions Practical-4: user-defined function: anonymous function Practical-5: Plotting of two dimensional functions: graph plotting, graph formatting, title, axis, line, colours, etrc Practical-6: Multiple plots, matrix plots Practical-7: Polar plots Practical-8: 3D plotting (line, surface, mesh and contours) Practical-9: different types of loops in MATLAB Practical-10: Finding the sum, product of a list of number in an array and sub-array without using library function **<u>Term II</u>: (06 Practicals)** Practical-11: Finding max, min of a list of number in an array, in a sub-array without using library function Practical-12: Finding a sub-matrix of a given matrix Practical-13: Finding the column sum, product, max, min of a given matrix without using library function. Practical-14: Finding the column sum, product, max, min of a given matrix without using library function. Practical-15: Defining any transcendental function and then finding and showing the table of its functional values. Practical-16: Plotting of graph of functions e^{ax+b}, $\log(ax+b)$, $\log\left(\frac{1}{ax+b}\right)$, $\sin(ax+b)$, $\cos(\mathrm{ax}+\mathrm{b})$, $\lvert \mathrm{ax}+\mathrm{b} \rvert$ and to illustrate the effect of a and b on the graph. **<u>Term III</u>: (06 Practicals)** Practical-17. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them. Practical-18: Sketching parametric curves (e.g., trochoid, cycloid, epicycloids, hypocycloid). Practical-19: Tracing of conics in Cartesian coordinates/ polar coordinates. Practical-20: Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates. Practical-21: Revision Practical-22: Revision

	viii. Sketching parametric curves (e.g., trochoid, cycloid, epicycloids, hypocycloid). ix. Tracing of conics in Cartesian coordinates/ polar coordinates. x. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates.	
Dr. Kousik Bhattacharya	**Course type:** Mathematics (Honours) and 3 year MDC **Paper- Minor-1(4 year Hons.), Minor-1(3 year MDC: Physical Science)** ***No of Classes (Hour) per week*: 2** **Minor-1-: Calculus, Geometry & Differential Equation** **Unit-I: (Calculus -I): Marks: 16** Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type eax+bsinx, eax+bcosx, (ax+b)nsinx, (ax+b)ncosx, concavity and inflection points, envelopes, asymptotes, curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences. **Unit-II: (Calculus -II): Marks: 14** Reduction formulae, derivations and illustrations of reduction formulae of the type ∫sin nx dx, ∫cos nx dx, ∫tan nx dx, ∫sec nx dx, ∫(log x)n dx, ∫sinnx sinmx dx, parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.	**Term I** (8 Lectures) Lecture 1: Hyperbolic functions, higher order derivatives Lecture 2: Leibnitz rule and its applications to problems of type eax+bsinx, eax+bcosx, (ax+b)nsinx, (ax+b)ncosx, Lecture 3: concavity and inflection points Lecture 4: Concept and geometrical foundation of envelopes Lecture 5: Related problems of envelopes Lecture 6: Concept and geometrical foundation of asymptotes Lecture 7: Related problems of Asymptotes Lecture 8: Tutorial **Term II** (8 Lectures) Lecture 9: curve tracing in cartesian coordinates Lecture 10: tracing in polar coordinates of standard curves Lecture 11: L'Hospital's rule, applications in business, economics and life sciences Lecture 12: Different kind of typical problems Lecture 13: Reduction formulae with general derivation Lecture 14: Illustrations of reduction formulae of the type ∫sin nx dx, ∫cos nx dx, ∫tan nx dx, ∫sec nx dx Lecture 15: Illustrations of reduction formulae of the type ∫(log x)n dx, ∫sinnx sinmx dx, parametric equations Lecture 16: Tutorial **Term III** (8 Lectures) Lecture 19: Parameterizing a curve, arc length of a curve, Lecture 20: Arc length of parametric curves, area under a curve Lecture 21: Area and volume of surface of revolution Lecture 22: Techniques of sketching conics. Lecture 23: Tutorial Lecture 24: Tutorial
Buddhadeb Mondal	**Course type:** Mathematics (Minor): **Paper- MTMI01:** **No of Classes (Hour) per week: 2** **Unit III: Geometry** **:** (Marks-09) Reflection properties of conics, rotation of axes and second-degree equations, classification of conics	**Term I** (9 Lectures) **Lecture 1:** Introduction to Reflection properties of conics, rotation of axes **Lecture 2:** Second-degree equations, **Lecture 3:** Classification of conics using the discriminates with examples **Lecture 4:** The polar equations of conics and some examples **Lecture 5:** Spheres, Cylindrical surfaces.

	using the discriminant, polar equations of conics. Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics, illustrations of graph in standard quadric surfaces like cone, ellipsoid **Unit IV: Differential Equation :** (Marks- 14) 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, linear equation and Bernoulli equations, special integrating factors and transformations.	**Lecture 6:** Central conicoids, paraboloids with examples **Lecture 7:** Examples solve **Lecture 8:** Tutorial **Lecture 9:** Tutorial **Term II** (9 Lectures) **Lecture 10:** Introduction to plane sections of conicoids **Lecture 11:** Generating lines with an example **Lecture 12:** classification of quadrics with examples **Lecture 13:** Illustrations of graph in standard quadric surfaces like cone, ellipsoid **Lecture 14:** Introduction to differential equations and mathematical models **Lecture 15:** General, particular, explicit, implicit and singular solutions of a differential equation **Lecture 16:** Examples solve **Lecture 17:** Tutorial **Lecture 18:** Tutorial **Term III** (8 Lectures) **Lecture 19:** Exact differential equations with examples **Lecture 20:** What is integrating factors with examples **Lecture 21:** Separable equations and equations reducible to this form **Lecture 22:** linear equation with examples **Lecture 23:** Bernoulli equations with examples **Lecture 24:** Special integrating factors and transformations. **Lecture 25:** Tutorial **Lecture 26:** Tutorial

Semester III

Name of the Teacher	Syllabus Allotted	Teaching Plan
Dr. Bimal Krishna Das	**Course type:** Mathematics (Honours) Core Course **Paper-** C7T & C7P ***No of Classes (Hour) per week*: 1 (Theory)** ***No of Classes (Hour) per week*: 4 (Practical)** **Unit 1: (Introduction) Marks: 02** Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation. **Unit 2: (Transcendental and Polynomials Equations) Marks: 07** Transcendental and polynomial equations: Bisection method, Newton's method, secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods. **C-7P : Numerical Methods Lab:** (Marks 20) 1. Solution of transcendental and algebraic equations by i) Bisection method ii) Newton Raphson method. iii) Secant method. iv) Regula Falsi method. 2. Solution of system of linear equations i) LU decomposition method ii) Gaussian elimination method iii) Gauss-Jacobi method iv) Gauss-Seidel method 3. Interpolation i) Lagrange Interpolation ii) Newton Interpolation 4. Numerical Integration i) Trapezoidal Rule ii) Simpson's one third rule iii) Weddle's Rule iv) Gauss Quadrature 5. Method of finding Eigenvalue by Power method 6. Fitting a Polynomial Function 7. Solution of ordinary differential	**Theory** **Term I** (4 Lectures) Lecture 1: Algorithms. Convergence. Errors: absolute. relative, percentage Lecture 2: Errors: Inheritance, Truncation, Round off. And related problems Lecture 3: Concept of Transcendental and polynomial equations. Bisection method Lecture 4: Related problems of Bisection method **Term II** (4 Lectures) Lecture 5: Newton's method and its related problems Lecture 6: Regula-falsi method and its Related problems Lecture 7: secant method and its related problems Lecture 8: Tutorial **Term III** (4 Lectures) Lecture 9: fixed point iteration and its related problems Lecture 10: Newton-Raphson method and its related problems Lecture 11: Rate of convergence of these methods Lecture 12: Tutorial **Numerical Methods (Practical Lab)** **Term I** (16 Lectures) Lecture 1: Solution of transcendental and algebraic equations by Bisection method. Lecture 2: Solution of transcendental and algebraic equations by Newton Raphson method. Lecture 3: Practice Session: Demonstrate your program Bisection method for the equation $x^3 + x^2 - 1 = 0$ and $x^3 - 4x - 9 = 0$ Lecture 4: Practice session: Demonstrate your program NR method for the equation $3x - cosx - 1 = 0$ and $x^3 - 3x + 1 = 0$ Lecture 5: Solution of transcendental and algebraic equations by Secant method Lecture 6: Solution of transcendental and algebraic equations by Regula Falsi method Lecture 7: Practice Session: Demonstrate your program Secant method for the equation $x^3 + x^2 - 1 = 0$ Lecture 8: Practice session: Demonstrate your program Regula Falsi for the equation $3x - cosx - 1 = 0$ Lecture 9: Solution of system of linear equations by LU decomposition method Lecture 10: Solution of system of linear equations by Gaussian elimination method

	equations i) Euler method ii) Modified Euler method iii) Runge Kutta method	Lecture 11: Practice Session: Write a program to solve the equations: $10x_1 + 8x_2 - 3x_3 + x_4 = 16$ $2x_1 + 10x_2 + x_3 - 4x_4 = 9$ $3x_1 - 4x_2 + 10x_3 + x_4 = 10$ $2x_1 + 2x_2 - 3x_3 + 10x_4 = 11$ By using LU decomposition method Lecture 12: Practice session: Write a program to solve the equations: $10x_1 + 8x_2 - 3x_3 + x_4 = 16$ $2x_1 + 10x_2 + x_3 - 4x_4 = 9$ $3x_1 - 4x_2 + 10x_3 + x_4 = 10$ $2x_1 + 2x_2 - 3x_3 + 10x_4 = 11$ By using Gauss Elimination method Lecture 13: Solution of system of linear equations by Gauss-Seidel method Lecture 14: Solution of system of linear equations by Gauss-Jacobi method Lecture 15: Practice Session: Write a program to solve the equations: $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$ By using Gauss Jacobi method Lecture 16: Practice session: Write a program to solve the equations: $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$ By using Gauss Seidal method **<u>Term II</u>** (16 Lectures) Lecture 17: Newton forward Interpolation Lecture 18: Newton backward Interpolation Lecture 19: Practice Session: Write a program to find the value of $f(142)$ by Newton Forward interpolation formula of the following information : x | 140 | 150 | 160 | 170 | 180 $f(x)$ | 3.685 | 5.854 | 6.302 | 8.072 | 10.225 Lecture 20: Practice session: Write a program to find the value of $f(172)$ by Newton Backward interpolation formula of the following information : x | 140 | 150 | 160 | 170 | 180 $f(x)$ | 3.685 | 5.854 | 6.302 | 8.072 | 10.225

Lecture 21: Lagrange Interpolation

Lecture 22: Numerical Integration by Trapezoidal Rule

Lecture 23: Practice Session: Write a program to evaluate $f(9)$ using Lagrange's interpolation formula, given the following set of tabulated values:

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

Lecture 24: Practice session: Write a program to evaluate the integral $\int_0^1 x^3 dx$, $n = 10\ and\ 20$ numerically by Trapezoidal rule.

Lecture 25: Numerical Integration by Simpson's one third rule

Lecture 26: Numerical Integration by Weddle's Rule

Lecture 27: Practice Session: Write a program to evaluate the integral $\int_{1.2}^{1.6}(x+\frac{1}{x})dx$ numerically by Simpson's $\frac{1}{3}$ rule, correct up to 2 significant figures taking 4 intervals.

Lecture 28: Practice session: Write a program to evaluate the integral $\int_0^5 \frac{dx}{1+x}$ taking $h = 1$ numerically by Weddle's rule.

Lecture 29: Numerical Integration by Gauss Quadrature

Lecture 30: Method of finding Eigenvalue by Power method

Lecture 31: Practice session: Write a program to find the largest eigen value in magnitude of the matrix $\begin{bmatrix} 10 & 7 & 8 & 7 \\ 7 & 5 & 6 & 5 \\ 8 & 6 & 10 & 9 \\ 7 & 5 & 9 & 10 \end{bmatrix}$ by Power method.

Lecture 32: Practice Session: Write a program to evaluate the integral $\int_0^1 \sqrt{1-x^3}\, dx$ numerically by Gaussian Quadrature rule taking 6 equal intervals and correct up to 2 decimal places.

Term III (08 Lectures)

Lecture 33: Fitting a Polynomial Function

Lecture 34: Solution of ordinary differential equations by Euler method

Lecture 35: Practice Session: Solve by Euler's method the ODE $\frac{dy}{dx} = x - y, y(0) = 1\ and\ h = 0.2$. Find $y(0.4)$.

		Lecture 36: Practice session: Write a program to find the value of y when $y(0.1)\ and\ y(0.2)$ from the differential equation $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$ by Euler's method. Lecture 37: Solution of ordinary differential equations by Modified Euler method Lecture 38: Solution of ordinary differential equations by R-K method 2nd order and 4th order Lecture 39: Practice Session: Given that $\frac{dy}{dx} = 2 + \sqrt{xy}\ with\ y(0) = 1$. Write a program to find the approximate value of $y\ at\ x = 2$ in steps of 0.2, using modified Euler's method. Lecture 40: Practice session: Write a program to find the value of y when $x = 0.1\ and\ 0.2$ from the differential equation $\frac{dy}{dx} = x^2 - y$, $y(0) = 1$ by modified Euler's method. Lecture 41: Practice Session: Write a program to solve the ODE $\frac{dy}{dx} = 1 + ysinx - x^2, y(0) = 0\ at\ x = 0.2$ by using R-K method of second order. Lecture 42: Practice Session: Write a program to solve the ODE $\frac{dy}{dx} = x^2 - y^2, y(0) = 2\ at\ x = 1.5, h = 0.5$ by using R-K method of fourth order.
Dr. Pradip Kumar Gain	**(HONOURS)** ***No of Classes (Hour) per week*: 3** **CC-5T: (Unit-II)** **Real Function-II Marks-14** 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. Applications of mean value theorem to inequalities and approximation of polynomials .	**Term I: (04 Lectures+ 01 Tutorial)** **Lecture-1.** Discussion on previous knowledge of differential co-efficient of a function. **Lecture-2.** Differentiability of a function at a point and in an interval **Lecture-3.** Algebra of differentiable functions. Relative extrema, interior extremum theorem. **Lecture-4.** Problems on differentiability. **Tutorial-1** **Term II: (04 Lectures + 01 Tutorial)** **Lecture-1.** Discussion on expansion of functions. **Lecture-2.** Discussion on Rolle's theorem and application of Rolle's theorem **Lecture-3.** Discussion on Mean value theorem, intermediate value property of derivatives. **Lecture-4.** Problems **Tutorial-1** **Term III: (04 Lectures + 01 Tutorial)** **Lecture-1.** Discussion on Darboux's theorem. **Lecture-2.** Applications of mean value theorem to inequalities. **Lecture-3.** Applications of mean value theorem for approximation of polynomials. **Lecture-4.** Various Problems on mean value theorem **Lecture-5.** Some examples and problems on Riemann integration. **Tutorial-1**

	(HONOURS) **CC-5T: (Unit-III)** **Real Function-III Marks-14** Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, 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(x+1)n . Application of Taylor's theorem to inequalities.	**Term I: (04 Lectures+ 01 Tutorial)** **Lecture-1.** Discussion on Cauchy's mean value theorem. **Lecture-2.** Taylor's theorem with Lagrange's form of remainder **Lecture-3.** Taylor's theorem with Cauchy's form of remainder **Lecture-4.** Various Problems on Taylor's Series. **Tutorial-1** **Term II: (03 Lectures + 01 Tutorial)** **Lecture-1.** Application of Taylor's theorem to convex functions. **Lecture-2.** Application of Taylor's theorem to relative extrema. **Lecture-3.** Discussion on Various problems **Tutorial-1** **Term III: (05 Lectures + 01 Tutorial)** **Lecture-1.** Maclaurin's series expansions. **Lecture-2.** Expansions of exponential and trigonometric functions in the neighbourhood of 0. **Lecture-3.** Expansions of ln (1 + x), 1/(ax + b) and $(x+1)^n$ **Lecture-4.** Application of Taylor's theorem to inequalities. **Lecture-5.** Problems **Tutorial-1**
Dr. Sangita Chakraborty	**Course type:** Mathematics (Honours) Core Course (Under CBCS) **Paper-** C6T: (Group Theory-I) *No of Classes (Hour) per week*: 3 **Unit-1:** (Marks-09) Symmetries of a square, dihedral groups, definition and examples of groups including permutation groups and quaternion groups(through matrices), elementary properties of groups. **Unit-2:** (Marks: 14) Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. **Unit-3:** (Marks: 14) 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, Lagrange's	**Term I: (10 Lectures+ 02 Tutorials)** **Lecture 1:** Introduction to Group Theory. Definition and examples of groups. **Lecture 2:** Elementary properties of groups with examples. **Lecture 3:** Symmetries of a group: symmetries of a square, dihedral groups. **Lecture 4:** Permutation groups and its properties. **Lecture 5:** Quaternion groups through matrices. **Lecture 6:** Concepts of order of an element with its properties and examples. **Lecture 7:** Definition and examples of subgroups. Properties of subgroups. **Lecture 8:** Some important subgroups: cyclic subgroups of various groups. **Lecture 9:** Continuation of Lecture 8: Center of a group with various examples, centralizer of an element. **Lecture 10:** Product of two subgroups with properties and examples. **Tutorial-1** **Tutorial-2** **Term II: (08 Lectures+ 02 Tutorials)** **Lecture 11:** Introduction to permutations and its properties.

	theorem and consequences including Fermat's Little theorem. **Unit-4:** (Marks-09) External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. **Unit-5:** (Marks: 14) Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.	**Lecture 12:** Cycle notation for permutations, even and odd permutations, alternating group. **Lecture 13:** Definition and properties of cyclic groups. **Lecture 14:** Classification of subgroups of cyclic groups. **Lecture 15:** Concept of cosets and its properties. **Lecture 16:** Normal subgroup and normalizer of a group and finding these for various groups. **Lecture 17:** Discussion on Lagrange's Theorem and its consequences. **Lecture 18:** Fermat's Little theorem in the context of Lagrange's theorem. **Tutorial-3** **Tutorial-4** **<u>Term III</u>: (09 Lectures+ 02 Tutorials)** **Lecture 19:** External direct product of a finite number of groups with properties and examples. **Lecture 20:** Factor groups and its poperties. **Lecture 21:** Cauchy's theorem for finite abelian groups. **Lecture 22:** Introduction to group homomorphisms, properties of homomorphisms, **Lecture 23:** Properties of isomorphisms. **Lecture 24:** Cayley's theorem. **Lecture 25:** First isomorphism theorem. **Lecture 26:** Second isomorphism theorem. **Lecture 27:** Third isomorphism theorem. **Tutorial-5** **Tutorial-6** *Doubt-clearing session:*
Prof. Sankar Das	**Course type:** Mathematics (Honours) Core Course **Paper- C5T (Introduction to Metric Space)** ***No of Classes (Hour) per week*: 1** **<u>Unit 4:</u>** Metric spaces: Definition and examples. open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces.	**<u>Term I</u>:** (06 Lectures) **Lecture 1:** Introduction of Metric Spaces. **Lecture 2:** Definition and examples of Metric Spaces. **Lecture 3:** Open balls and Closed balls, **Lecture 4:** Neighbourhood of a point in Metric Space. **Lecture 5:** Tutorial **Lecture 6:** Tutorial **<u>Term II</u>:** (05 Lectures) **Lecture 7:** Open sets, Interior of a set. **Lecture 8:** Limit point of a set. **Lecture 9:** Closed sets. **Lecture 10:** Tutorial **Lecture 11:** Tutorial **<u>Term III</u>:** (04 Lectures) **Lecture 12:** Diameter of a set, subspaces. **Lecture 13:** Dense sets, separable spaces. **Lecture 14:** Tutorial **Lecture 15:** Tutorial

Dr. Anjana Mondal	**Course type:** Mathematics (Honours) Core Course **Paper-** C5-T **Unit- I: (Real Function-I) Marks: 21** ***No. of Classes (Hour) per week*: 2** 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.	**Term I: (10 Lectures+ 02 Tutorials)** Lecture-1: Limits of functions Lecture-2: Limits of functions (ε - δ approach) Lecture-3: Sequential criteria for limit of functions Lecture-4: Limit theorems Lecture-5: Limit theorems Lecture-6: Sandwich theorem and its application Lecture-7: One sided limits Lecture-8: Infinite limits Lecture-9: Limit at infinity Lecture-10: Some important limits Tutorial-1 Tutorial-2 **Term II: (06 Lectures+ 02 Tutorials)** Lecture-11: Continuous functions Lecture-12: , sequential criterion for continuity and discontinuity Lecture-13: Algebra of continuous functions Lecture-14: Algebra of continuous functions Lecture-15: Different types of discontinuity Lecture-16: Continuous functions on an interval Tutorial-3 Tutorial-4 **Term III: (06 Lectures+ 02 Tutorials)** Lecture-17. Neighborhood property of continuous functions Lecture-18: Intermediate value theorem Lecture-19: location of roots theorem Lecture-20: preservation of intervals theorem Lecture-21: Uniform continuity, non-uniform continuity criteria, Lecture-22: uniform continuity theorem. Tutorial-5 Tutorial-6
	Course type: Mathematics (General) **Paper-** DSC-1C/2C/3C-T ***No. of Classes (Hour) per week*: 2** Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem. Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem	**Term I: (10 Lectures+ 02 Tutorials)** Lecture-1: Finite and infinite sets, examples of countable and uncountable sets Lecture-2: Properties of real number system Lecture-3: Properties of real number system Lecture-4: bounded sets, suprema and infima Lecture-5: completeness property of R Lecture-6: Archimedean property of R Lecture-7: Neighbourhood, Interior point, open set Lecture-8: Limit point, isolated point Lecture-9: Closed set, derived set

	on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).	Lecture-10: Bolzano-Weierstrass theorem Tutorial-1 Tutorial-2 **<u>Term II</u>: (06 Lectures+ 02 Tutorials)** Lecture-11: Sequences, Convergent sequences Lecture-12: Limit of sequences, geometrical interpretation, examples, technique of proving convergent sequence using $\epsilon - \delta$ definition. Lecture-13: Divergent sequences, bounded sequences, relation between convergent and bounded sequences Lecture-14: Some theorems on convergent sequences Lecture-15: Limit point of sequences, difference between limit and limit point of sequences Lecture-16: Algebraic properties of limit of sequences and applications Tutorial-3 Tutorial-4 **<u>Term III</u>: (06 Lectures+ 02 Tutorials)** Lecture-17. **:** Sandwich theorem and applications Lecture-18: Monotone sequences, Monotone convergence theorem Lecture-19: Subsequence, divergence criteria, applications Lecture-20: Monotone subsequence theorem, applications Lecture-21: The Bolzano Weierstrass theorem, applications Lecture-22: Limit superior and Limit inferior, applications Tutorial-5 Tutorial-6
Dr. Kousik Bhattacharya	**Course type:** Mathematics (Honours) Core Course **Paper-** C7T & C7P ***No of Classes (Hour) per week*: 4** **C-7T : Unit III: System of Linear Equations:** (Marks 07) System of linear algebraic equations: Gaussian elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. LU decomposition **C-7T : Unit IV: Interpolation:** (Marks 10) Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference	**<u>Term I</u>** (Lectures 16) Lecture 1: System of linear algebraic equations: Gaussian elimination Lecture 2: Related problems of Gauss elimination method Lecture 3: System of linear algebraic equations: Gauss Jordan methods. Lecture 4: Related problems of Gauss Jordan method Lecture 5: Gauss Jacobi method Lecture 6: Related problems of Gauss Jacobi method Lecture 7: Gauss Seidel method Lecture 8: Related problems of Gauss Seidel method Lecture 9: Convergence of Gauss Jacobi Method Lecture 10: Convergence of Gauss Seidel Method Lecture 11: LU decomposition Lecture 12: Related problems of LU decomposition Lecture 13: Diagonally dominant and its related problems

	operators. Gregory forward and backward difference interpolation. Numerical differentiation: Methods based on interpolations, methods based on finite differences. **C-7P : Numerical Methods Lab:** (Marks 20) 1. Solution of transcendental and algebraic equations by i) Bisection method ii) Newton Raphson method. iii) Secant method. iv) Regula Falsi method. 2. Solution of system of linear equations i) LU decomposition method ii) Gaussian elimination method iii) Gauss-Jacobi method iv) Gauss-Seidel method 3. Interpolation i) Lagrange Interpolation ii) Newton Interpolation 4. Numerical Integration i) Trapezoidal Rule ii) Simpson's one third rule iii) Weddle's Rule iv) Gauss Quadrature 5. Method of finding Eigenvalue by Power method 6. Fitting a Polynomial Function 7. Solution of ordinary differential equations i) Euler method ii) Modified Euler method iii) Runge Kutta method	Lecture 14: Several kinds of typical problems Lecture 15: Tutorial Lecture 16: Tutorial **Term II** (16 Lectures) Lecture 17: Interpolation: concept and its geometrical interpretation Lecture 18: Lagrange interpolation Lecture 19: Related problems of Lagrange interpolation Lecture 20: Newton forward interpolation Lecture 21: Related problems of Newton forward interpolation Lecture 22: Newton backward interpolation Lecture 23: Related problems of Newton backward interpolation Lecture 24: Gregory forward difference interpolation Lecture 25: Related problems of Gregory forward method Lecture 26: Gregory backward difference interpolation Lecture 27: Related problems of Gregory backward method Lecture 28: Numerical differentiation methods based on interpolations Lecture 29: Numerical differentiation methods based on finite differences. Lecture 30: Related problems of numerical differentiation Lecture 31: Tutorial Lecture 32: Tutorial **Term III** (16 Lectures) **Numerical Methods Lab** Lecture 33: Solution of transcendental and algebraic equations by Bisection method & Newton Raphson method. Lecture 34: Solution of transcendental and algebraic equations by Secant method & Regula Falsi method Lecture 35: Solution of system of linear equations by LU decomposition method Lecture 36: Solution of system of linear equations by Gaussian elimination method Lecture 37: Solution of system of linear equations by Gauss-Jacobi method and Gauss-Seidel method Lecture 38: Lagrange Interpolation Lecture 39: Newton forward Interpolation Lecture 40: Newton backward Interpolation Lecture 41: Numerical Integration by Trapezoidal Rule and Simpson's one third rule Lecture 42: Numerical Integration by Weddle's Rule and Gauss Quadrature Lecture 43: Method of finding Eigenvalue by Power method Lecture 44: Fitting a Polynomial Function

		Lecture 45: Solution of ordinary differential equations by Euler method and Modified Euler method Lecture 46: Solution of ordinary differential equations by R-K method 2nd order and 4th order Lecture 47: Practice session Lecture 48: Practice session
	Course type: Mathematics (Honours) Skill Enhancement Course **Paper-** SEC-1T (Logic & Sets) ***No of Classes (Hour) per week*: 1** **Unit 1: Marks: 17** Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, quantifiers, binding variables and negations. **Unit 2: Marks: 07** Sets, subsets, set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. classes of sets. Power set of a set. **Unit 3: Marks: 16** Difference and Symmetric difference of two sets. Set identities, generalized union and intersections. Relation: Product set. Composition of relations, types of relations, partitions, equivalence Relations with example of congruence modulo relation. Partial ordering relations, n- ary relations.	**Term I** (4 Lectures) Lecture 1: Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions Lecture 2: converse, contra positive and inverse propositions and precedence of logical operators. Lecture 3: Propositional equivalence: Logical equivalences. Lecture 4: Predicates and quantifiers: Introduction, quantifiers, binding variables and negations. **Term II** (4 Lectures) Lecture 5: Sets, subsets, set operations and the laws of set theory and Venn diagrams. Lecture 6: Examples of finite and infinite sets. Finite sets and counting principle. Lecture 7: Empty set, properties of empty set. Standard set operations. classes of sets. Power set of a set. Lecture 8: Difference and Symmetric difference of two sets. Set identities, generalized union and intersections. **Term III** (4 Lectures) Lecture 9: Relation: Product set. Composition of relations, types of relations, partitions. Lecture 10: equivalence Relations with example of congruence modulo relation. Lecture 11: Partial ordering relations, n- ary relations. Lecture 12: Tutorial Lecture 13: Tutorial
	Course type: Mathematics (General) Skill Enhancement Course **Paper-** SEC-1T **(Logic & Sets)** ***No of Classes (Hour) per week*: 1** **Marks -40** Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, single words and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations. Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting	**Term I** (4 Lectures) Lecture 1: Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions Lecture 2: converse, contra positive and inverse propositions and precedence of logical operators. Lecture 3: Propositional equivalence: Logical equivalences. Lecture 4: Predicates and quantifiers: Introduction, quantifiers, binding variables and negations. **Term II** (4 Lectures) Lecture 5: Sets, subsets, set operations and the laws of set theory and Venn diagrams. Lecture 6: Examples of finite and infinite sets. Finite sets and counting principle.

	principle. Empty set, properties of empty set. Cartesian product. Partition of sets. Power set of a set. Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.	Lecture 7: Empty set, properties of empty set. Standard set operations. classes of sets. Power set of a set. Lecture 8: Difference and Symmetric difference of two sets. Set identities, generalized union and intersections. **Term III** (4 Lectures) Lecture 9: Relation: Product set. Composition of relations, types of relations, partitions. Lecture 10: equivalence Relations with example of congruence modulo relation. Lecture 11: Partial ordering relations, n- ary relations. Lecture 12: Tutorial Lecture 13: Tutorial
Buddhadeb Mondal	**Course type:** Mathematics (Honours) Core Course **Paper-** C-7T ***No of Classes (Hour) per week*: 2** **Unit-V: Integration:** (Marks-09) Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule, Boole's Rule. midpoint rule, Composite trapezoidal rule, composite Simpson's 1/3rd rule, Gauss quadrature formula. The algebraic eigen value problem: Power method. Approximation: Least square polynomial approximation. **Unit-VI: Ordinary differential equations:** (Marks-05) Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four. .	**Term I** (10 Lectures) **Lecture 1:** Introduction to Numerical Integration **Lecture 2:** Derivation of Newton Cotes formula **Lecture 3:** Trapezoidal rule with examples **Lecture 4:** Simpson's 1/3rd rule with examples **Lecture 5:** Simpsons 3/8th rule with examples **Lecture 6:** Weddle's rule with examples **Lecture 7:** Midpoint rule with examples **Lecture 8:** Composite trapezoidal rule with explanation. **Lecture 9:** Tutorial **Lecture 10:** Tutorial **Term II** (9 Lectures) **Lecture 11:** Composite Simpson's 1/3rd rule with examples **Lecture 12:** Derivation of Gauss quadrature formula **Lecture 13:** Introduction to algebraic eigen value problem **Lecture 14:** Power method with examples **Lecture 15:** Introduction to Approximation **Lecture 16:** Least square polynomial approximation with examples. **Lecture 17:** Some problems solve **Lecture 18:** Tutorial **Lecture 19:** Tutorial **Term III** (7 Lectures) **Lecture 20:** Introduction to Ordinary differential equations with examples **Lecture 21:** The method of successive approximations with examples **Lecture 22:** Euler's method with examples **Lecture 23:** Modified Euler method with examples **Lecture 24:** Runge-Kutta methods of orders two and four with examples **Lecture 25:** Tutorial **Lecture 26:** Tutorial

	Course type: Mathematics (General) Core Course **Paper-** DSC-1CT **(Real Analysis)** ***No of Classes (Hour) per week*: 2** Infinite series: Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional Convergence Series. Sequences and series of functions, Pointwise and uniform convergence. μ-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.	**Term I** (9 Lectures) **Lecture 1:** Introduction to Infinite series with examples **Lecture 2:** Cauchy convergence criterion for series, positive term series with examples **Lecture 3:** Geometric series with examples **Lecture 4:** comparison test with examples **Lecture 5:** Convergence of p-series with examples **Lecture 6:** Root test with examples **Lecture 7:** Ratio test with examples **Lecture 8:** Tutorial **Lecture 9:** Tutorial **Term II** (10 Lectures) **Lecture 10:** Alternating series with examples **Lecture 11:** Leibnitz's test with examples **Lecture 12:** Definition and examples of absolute Convergence Series **Lecture 13:**Conditional Convergence Series with examples **Lecture 14:** Sequences of functions with examples **Lecture 15:** Series of functions with examples **Lecture 16:** Pointwise and uniform convergence with an examples **Lecture 17:** μ-test with some examples **Lecture 18:** Tutorial **Lecture 19:** Tutorial **Term III** (08 Lectures) **Lecture 20:** M-test with examples **Lecture 21:** Algebra of field **Lecture 22:** uniform convergence with examples **Lecture 23:** Integrability and differentiability of functions **Lecture 24:** Power series with examples **Lecture 25:** Radius of convergence with some examples **Lecture 26:** Tutorial **Lecture 27:** Tutorial

Semester V

Name of the Teacher	Syllabus Allotted	Teaching Plan
Dr. Bimal Krishna Das	**Course type:** Mathematics (Honours) Discipline Specific Course **Paper-DSE1T (Linear Programming Problem)** ***No of Classes (Hour) per week*: 2** **Unit-I: (Simplex Algorithm) Marks: 25** Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison. **Unit 2: (Duality) Marks: 11** Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.	**Term I** (8 Lectures) Lecture 1: Introduction to linear programming problem Lecture 2: Formulation of LPP and related problems Lecture 3: convex sets, convex hull, convex polyhedron, Hyperplane Lecture 4: Related theorems and problems on convex sets, Hyperplanes Lecture 5: Linearly dependent and independent sets, Basic solutions and Degenerate and Non-degenerate basic solutions Lecture 6: Basic feasible solutions and Degenerate and Non-degenerate basic feasible solutions Lecture 7: $x_1 = 2, x_2 = 3, x_3 = 1$ is a feasible solution of $Maximize\ z = x_1 + 2x_2 + 4x_3$ $subject\ to, 2x_1 + x_2 + 4x_3 = 11$ $3x_1 + x_2 + 5x_3 = 14$ $x_1, x_2, x_3 \geq 0$ the LPP. Find a basic feasible solution. Lecture 8: Tutorial **Term II** (8 Lectures) Lecture 9: Graphical solution of LPP Lecture 10: Optimal solution, No feasible solution, Unbounded solution, infinitely many solutions of graphical solution of LPP, Standard form of LPP, Introduction of slack and surplus variables Lecture 11: Prove that if for a basic feasible solution $\mathbf{X_B}$ of a LPP $\boldsymbol{Maximize}\ z = \mathbf{CX}$ $\boldsymbol{subject\ to}, \mathbf{AX} = \mathbf{b}, \mathbf{X} \geq \mathbf{0}$ we have $z_j - c_j \geq 0$ for every column $\boldsymbol{a_j}$ of $\mathbf{A}$ then $\mathbf{X_B}$ is an optimal solution**.** Lecture 12: Prove that if at any iteration of the simplex algorithm we get $z_j - c_j < 0$ for at least one j and for this j, $y_{ij} \leq 0\ for\ all\ i = 1,2,..,m$ then the LPP admits of an unbounded solution in a maximization problem. Lecture 13: Theory of simplex method, the simplex algorithm, simplex method in tableau format. Define Simplex, give an example of simplex at E^1, E^2, E^3 Lecture 14: Solve the LPP by simplex method : $Maximize\ z = 3x_1 + 2x_2 + 5x_3$ $subject\ to, x_1 + 2x_2 + x_3 \leq 430$ $3x_1 + 2x_3 \leq 460$ $x_1 + 4x_2 \leq 420$ $x_1, x_2, x_3 \geq 0$ Lecture 15: Use simplex method to solve the LPP $Maximize\ z = 2x_2 + x_3$ $subject\ to, x_1 + x_2 - 2x_3 \leq 7$ $-3x_1 + x_2 + 2x_3 \leq 3$ $x_1, x_2, x_3 \geq 0$ Lecture 16: Introduction to artificial variables

Term III (14 Lectures)

Lecture 17: Big-M method and corresponding problems

Lecture 18: Use penalty method to solve the LPP

$$Maximize\ z = 4x_1 + x_2$$
$$subject\ to, 3x_1 + x_2 = 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

Lecture 19: Solve the LPP using Charnes Big M method

$$Maximize\ z = -3x_1 + x_2 + 3x_3 - x_4$$
$$subject\ to, x_1 + 2x_2 - x_3 + x_4 = 0$$
$$2x_1 - 2x_2 + 3x_3 + 3x_4 = 9$$
$$x_1 - x_2 + 2x_3 - x_4 = 6$$
$$x_1, x_2, x_3, x_4 \geq 0$$

Lecture 20: Concept of Two-phase method and corresponding theorems

Lecture 21: Solve the following LPP using Two Phase method

$$Maximize\ z = 2x_1 - 3x_2$$
$$subject\ to, -x_1 + x_2 \geq -2$$
$$5x_1 + 4x_2 \leq 46$$
$$7x_1 + 2x_2 \geq 32$$
$$x_1, x_2 \geq 0$$

Lecture 22: Solve the following LPP using Two Phase simplex method

$$Maximize\ z = x_1 + x_2$$
$$subject\ to, 2x_1 + x_2 \geq 4$$
$$x_1 + 7x_2 \geq 7$$
$$x_1, x_2 \geq 0$$

Lecture 23: Concept of Duality and formulation of dual problem.

Lecture 24: Fundamental theorem of Duality, Theorems on Duality.

Lecture 25: primal-dual relationships, Dual of the dual is primal.

Lecture 26: economic interpretation of the dual.

Lecture 27: Given the LPP

$$Maximize\ z = 2x_1 + 3x_2 + 4x_3$$
$$subject\ to, x_1 - 5x_2 + 3x_3 = 7$$
$$2x_1 - 5x_2 \leq 3$$
$$3x_2 - x_3 \geq 5,$$

$x_1, x_2 \geq 0$ and $x_3\ is\ unrestricted\ in\ sign$

Formulate the dual of the LPP.

Lecture 28: Give the dual of the following LPP and hence solve it:

$$Maximize\ z = 3x_1 - 2x_2$$
$$subject\ to, x_1 \leq 4, x_2 \leq 6,$$
$$x_1 + x_2 \leq 5$$
$$-x_2 \leq -1$$
$$x_1, x_2 \geq 0$$

Lecture 29: Tutorial

Lecture 30: Tutorial

Dr. Pradip Kumar Gain	**(HONOURS)** ***No of Classes (Hour) per week*: 4** **DSE-2T: (Unit-I)** **Probability & Distribution** **Marks-16** 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	**Term I: (05 Lectures + 01 Tutorial)** **Lecture-1.** Concepts of sample space, random variables. Axioms of probability. **Lecture-2.** Classical definition of probability. Problems **Lecture-3.** Probabilty as the long run relative sequences. Statistical definition of probability, axiomatic definition of probability. **Lecture-4.** Probabilty distribution. Probabilty mass/density functions. **Lecture-5.** Problems **Tutorial- 1** **Term II: (06 Lectures + 01 Tutorial)** **Lecture-1.** Concept of mathematical expectation, moments, **Lecture-2.** Concept of moment generating function, characteristic function, **Lecture-3.** Discrete probability distributions. **Lecture-4.** Binomial probability distribution. **Lecture-5.** Poisson probability distribution, **Lecture-6.** Problems on discrete probability distributions. **Tutorial- 1**

		Term III: (04 Lectures + 01 Tutorial) **Lecture-1.** Continuous probability distributions: **Lecture-2.** Uniform probability distributions**.** **Lecture-3.** Normal probability distributions **Lecture-4.** Problems. **Tutorial-1**
	DSE-2T: (Unit-II) **Joint Distribution** **Marks-14** 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.	**Term I: (04 Lectures+ 01 Tutorial)** **Lecture-1.** Discussion on the concept of joint probability. distribution and its properties. **Lecture-2.** Joint probability density functions. **Lecture-3.** Marginal and conditional probability distributions. **Lecture-4.** Various Problems. **Tutorial-1** **Term II: (04 Lectures+ 01 Tutorial)** **Lecture-1.** Discussion on the concept of expectation of function of two random variables, **Lecture-2.** Conditional expectations, independent random variables,. **Lecture-3.** Discussion on bivariate normal distribution. **Lecture-4.** Problems.. **Tutorial-1** **Term III: (04 Lectures + 01 Tutorial)** **Lecture-1.** Discussion on correlation coefficient,: **Lecture-2.** Discussion on joint moment generating function (jmgf) **Lecture-3.** Calculation of covariance (from jmgf), linear regression for two variables. **Lecture-4.** Problems. **Tutorial-1**
	DSE-2T: (Unit-III) **Convergence in Probability** **Marks-09** 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.	**Term I: (03 Lectures + 01 Tutorial)** **Lecture-1.** Discussion on Chebyshev's inequality,: **Lecture-2.** Statement and interpretation of (weak) law of large numbers and strong law of large numbers. **Lecture-3.** Problems. **Tutorial-1** **Term II: (02 Lectures+ 01 Tutorial)** **Lecture-1.** Discussion on Central limit theorem for independent and identically distributed random variables with finite variance. **Lecture-2.** Problems. **Tutorial-1** **Term III: (02 Lectures+ 01 Tutorial)** **Lecture-1.** Discussion on Markov chains, Chapman Kolmogorov equations, classification of states. **Lecture-2.** Problems. **Tutorial-1**

Dr. Sangita Chakraborty	**Course type:** Mathematics (Honours) Core Course (Under CBCS) **Paper-** C12T: (Group Theory-II) *No of Classes (Hour) per week*: 3 **Unit-1:** (Automorphism Groups): (Marks-16) 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. **Unit 2:** (Direct Products): (Marks-11) 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 3:** (Group Actions): (Marks-14) Group actions, stabilizers and kernels, permutation representation associated with a given group action. Applications of group actions. Generalized Cayley's theorem. Index theorem. **Unit 4:** (Class Equations and Sylow's Theorems): (Marks-19) Groups acting on themselves by conjugation, Class equation and consequences, conjugacy in S_n, p-groups, Sylow's theorems and consequences, Cauchy's theorem. Simplicity of $A_n$for n>=5, non-simplicity tests.	**Term I: (10 Lectures+ 02 Tutorials)** **Lecture 1:** Recapitulation: Properties of homomorphism and isomorphism. Introduction to automorphism **Lecture 2:** Automorphism groups, and its relation with permutation groups. **Lecture 3:** Inner automorphism and its properties. **Lecture 4:** Finding automorphism groups of finite and infinite cyclic groups. **Lecture 5:** Solving problems on automorphisms, inner automorphisms. **Lecture 6:** applications of factor groups to automorphism groups. **Lecture 7:** Characteristic subgroups: Definition and properties **Lecture 8:** Commutator subgroup: Definition and properties. **Lecture 9:** Properties of external direct products with examples. **Lecture 10:** To establish the group of units modulo *n* as an external direct product. **Tutorial 1:** **Tutorial 2:** *Doubt-clearing session :* **Term II: (09 Lectures+ 02 Tutorials)** **Lecture 11:** Internal direct products: Definition and properties with example. **Lecture 12:** Criteria for a group to be an internal direct product. **Lecture 13:** Isomorphism between internal and external direct products. **Lecture 14:** Fundamental theorem of finite abelian groups and its applications for classification of groups of certain order upto isomorphism. **Lecture 15:** Introduction to **g**roup actions, stabilizers and kernels: Definition and properties with example. **Lecture 16:** Representation of permutation associated with a given group action. **Lecture 17:** Applications of group actions. **Lecture 18:** Generalized Cayley's theorem. **Lecture 19:** Index theorem. **Tutorial 3:** **Tutorial 4:** *Doubt-clearing session:* **Term III: (09 Lectures+ 02 Tutorials)** **Lecture 20:** Groups acting on themselves by conjugation. **Lecture 21:** Class equation and consequences. **Lecture 22:** Determination of conjugacy in S_n . Solving problems on conjugacy classes and class equations.

		Lecture 23: Definition of p-groups with examples. Cauchy's theorem**.** **Lecture 24:** Sylow's theorems: First, Second, Third with proof. **Lecture 25:** Continuation to Lecture 25. **Lecture 26:** Consequences of Sylow's theorems. **Lecture 27:** Solving problems on Sylow's theorems. **Lecture 28:** Simplicity of A_n for n>=5. Non-simplicity tests. **Tutorial 5:** **Tutorial 6:** *Doubt-clearing session:*
Prof. Sankar Das	**Course type:** Mathematics (Honours) **Paper-C11T** (**Partial Differential Equations)** ***No of Classes (Hour) per week*: 3** **C11T: Partial Differential Equations:** **Unit-1:** Partial differential equations – Basic concepts and definitions. 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. Method of separation of variables for solving first order partial differential equations. **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-Kovalevsky 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.	**Term I (8 Lectures)** **Lecture 1:** Partial differential equations – Basic concepts and definitions. **Lecture 2:** Formation of Partial differential equations. **Lecture 3:** First- order equations: classification, construction and geometrical Interpretation. **Lecture 4:** Method of characteristics for obtaining general solution of quasi linear equations. **Lecture 5:** Canonical forms of first-order linear PDEs. **Lecture 6:** Method of separation of variables for solving first order PDEs. **Lecture 7:** Tutorial **Lecture 8:** Tutorial **Term II (10 Lectures)** **Lecture 9:** Derivation of heat equation. **Lecture 10:** Derivation of wave equation. **Lecture 11:** Derivation of Laplace equation. **Lecture 12:** Classification of second order linear equations as hyperbolic. **Lecture 13:** Classification of second order linear equations as parabolic or elliptic. **Lecture 14:** Reduction of second order linear equations to canonical forms. **Lecture 15:** Reduction of second order linear equations to canonical forms. **Lecture 16:** Tutorial **Lecture 17:** Tutorial **Lecture 18:** Tutorial **Term III (10 Lectures)** **Lecture 19:** The Cauchy problem, Cauchy-Kovalevsky theorem, Cauchy problem of an infinite string. **Lecture 20:** The Cauchy problem, Cauchy-Kovalevsky theorem, Cauchy problem of an infinite string. **Lecture 21:** Initial boundary value problems. **Lecture 22:** Semi-infinite string with a fixed end, semi-infinite string with a free end.

		Lecture 23: Equations with non-homogeneous boundary conditions. **Lecture 24:** Non- homogeneous wave equation. **Lecture 25:** Method of separation of variables, solving the vibrating string problem. **Lecture 26:** Solving the heat conduction problem. **Lecture 27:** Tutorial **Lecture 28:** Tutorial
Dr. Anjana Mondal	**Course type:** Mathematics (Honours) Discipline Specific Elective **Paper-** DSE-2T **Unit 4: (Statistics) Marks: 21** ***No. of Classes (Hour) per week*: 2** Random Samples, Sampling Distributions, Estimation of parameters, Testing of hypothesis.	**Term I: (10 Lectures+ 02 Tutorials)** Lecture-1: Random variables, Discrete and continuous random variables, Distribution function, Probability density and probability mass function. Expectation of random variables Lecture-2: Some special discrete distributions and their properties. Lecture-3: Some special continuous distributions and their properties. Lecture-4: Definitions of population, sample, random sample, statistic, sampling distribution. Central limit theorem. Lecture-5: Chi-square distribution Lecture-6: Student's t distribution Lecture-7: F distribution. Lecture-8: Point estimation, Criteria of good estimators: unbiasedness Lecture-9: consistency and efficiency Lecture-10: Method of moment estimation Tutorial-1 Tutorial-2 **Term II: (06 Lectures+ 02 Tutorials)** Lecture-11: Method of moment estimation Lecture-12: Method of maximum likelihood estimation Lecture-13: Method of maximum likelihood estimation Lecture-14: Interval estimation Lecture-15: Interval estimation Lecture-16: Interval estimation Tutorial-3 Tutorial-4 **Term III: (06 Lectures+ 02 Tutorials)** Lecture-17. Hypothesis testing Lecture-18: Hypothesis testing Lecture-19: Hypothesis testing Lecture-20: Hypothesis testing Lecture-21: Hypothesis testing Lecture-22. Hypothesis testing Tutorial-5 Tutorial-6

	Course type: Mathematics (General) **Paper**- DSE-1AT ***No. of Classes (Hour) per week*: 2** R, R2, R3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R2, R3. Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigenvectors for such transformations and eigen spaces as invariant subspaces.	**Term I**: **(10 Lectures+ 02 Tutorials)** Lecture-1: Vector space over a field. Lecture-2: R, R2, R3 as vector spaces over R Lecture-3: Subspaces Lecture-4: Linear sum of two subspaces Lecture-5: Linear span Lecture-6: Linear dependence and independence Lecture-7: Basis of a vector space, Lecture-8: Standard basis for R, R2, R3 Lecture-9: Translation, Dilation, Rotation, Reflection in a point, line and plane Lecture-10: Translation, Dilation, Rotation, Reflection in a point, line and plane Tutorial-1 Tutorial-2 **Term II**: **(06 Lectures+ 02 Tutorials)** Lecture-11: Matrix form of basic geometric transformations Lecture-12: Characteristic equation and Cayley-Hamilton theorem Lecture-13: eigen values Lecture-14: eigen vectors Lecture-15: Revision Lecture-16: Revision Tutorial-3 Tutorial-4 **Term III**: **(06 Lectures+ 02 Tutorials)** Lecture-17. Revision Lecture-18: Revision Lecture-19: Revision Lecture-20: Revision Lecture-21: Revision Lecture-22 Revision Tutorial-5 Tutorial-6
Dr. Kousik Bhattacharya	**Course type:** Mathematics (Honours) Core Course **Paper-C11T** (**Partial Differential Equations & Applications)** ***No of Classes (Hour) per week*: 2** **Unit 4: (Particle Dynamics) Marks: 20** Central force. Constrained motion, varying mass, tangent and normal components of	**Term I** (8 Lectures) Lecture 1: Central force and related problems Lecture 2: Central orbits and related problems Lecture 3: Apses and related problems Lecture 4: Different Kind of typical problems-I Lecture 5: Different Kind of typical problems-II Lecture 6: Different Kind of typical problems-III Lecture 7: Tutorial Lecture 8: Tutorial **Term II** (8 Lectures)

	acceleration, modelling ballistics and planetary motion, Kepler's second law.	Lecture 9: Constrained motion: concept Lecture 10: Constrained motion in circular path Lecture 11: Constrained motion in parabolic path Lecture 12: varying mass: its concept Lecture 13: Related problems on varying mass Lecture 14: Related typical problems of constrained motion Lecture 15: Tutorial Lecture 16: Tutorial **Term III** (8 Lectures) Lecture 17: Tangent and normal components of acceleration Lecture 18: Related problems on Tangent and normal components of acceleration Lecture 19: Modelling ballistics and planetary motion Lecture 20: Related problems on planetary motion Lecture 21: Kepler's second law Lecture 22: Related problems on Kepler's law Lecture 23: Tutorial Lecture 24: Tutorial
	Course type: Mathematics (General) Skill Enhancement Course **SEC3T: (Number Theory)** **Marks - 40** ***No of Classes (Hour) per week*: 1** Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem. Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues. Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function, Euler's phi-function.	**Term I** (8 Lectures) Lecture 1: Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, Lecture 2: prime counting function, statement of prime number theorem. Lecture 3: Goldbach conjecture, binary and decimal representation of integers Lecture 4: Tutorial **Term II** (10 Lectures) Lecture 5: linear congruences, complete set of residues. Lecture 6: Number theoretic functions, sum and number of divisors, Lecture 7: totally multiplicative functions Lecture 8: Tutorial **Term III** (8 Lectures) Lecture 9: definition and properties of the Dirichlet product Lecture 10: the Möbius inversion formula, the greatest integer function, Euler's phi-function. Lecture 11: Tutorial Lecture 12: Tutorial
Buddhadeb Mondal	**Course type:** Mathematics (Honours) Core Course **Paper-** DSE-1T (**Linear Programming)** ***No of Classes (Hour) per week*: 2** **Unit-II: Number Theoretic Function**:	**Term I** (9 Lectures) **Lecture 1:** Introduction to Transportation problem with examples **Lecture 2:** Mathematical formulation **Lecture 3:** Northwest-corner method with examples **Lecture 4:** least cost method with examples **Lecture 5:** Vogel approximation method with explanation

	(Marks- 16) Transportation problem and its mathematical formulation, northwest-corner method, least cost method and 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 **Unit-III: Game Theory** (Marks- 14)**:** Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure of a linear programming of games.	**Lecture 6:** Algorithm for solving transportation problem **Lecture 7:** Some Transportation problems solve **Lecture 8:** Tutorial **Lecture 9:** Tutorial **Term II** (8 Lectures) **Lecture 10:** Introduction to Assignment problem **Lecture 11:** Its mathematical formulation **Lecture 12:** Hungarian method for solving assignment problem **Lecture 13:** Examples over Assignment problems **Lecture 14:** Test of optimality of Assignment problems **Lecture 15:** Tutorial **Lecture 16:** Tutorial **Lecture 17:** Tutorial **Term III** (7 Lectures) **Lecture 18:** Introduction to Game theory **Lecture 19:** Formulation of two person zero sum games **Lecture 20:** Solving two person zero sum games **Lecture 21:** Games with mixed strategies, **Lecture 22:** Graphical solution procedure of a linear programming of games. **Lecture 23:** Tutorial **Lecture 24:** Tutorial
	Course type: Mathematics (General) Discipline Specific Elective **DSE-1A-T:** **(Matrices)** ***No of Classes (Hour) per week*: 2** 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. .	**Term I** (8 Lectures) **Lecture 1:** Introduction to matrices **Lecture 2:** Matrices in diagonal form **Lecture 3:** Reduction to diagonal form upto matrices of order 3 **Lecture 4:** Inverse of a matrix with examples **Lecture 5:** Computation of matrix inverses using elementary row operations **Lecture 6:** Tutorial **Lecture 7:** Tutorial **Lecture 8:** Tutorial **Term II** (7 Lectures) **Lecture 9:** Introduction to rank of matrices **Lecture 10:** Determine rank of a matrix **Lecture 11:** Solutions of a system of linear equations using matrices **Lecture 12:** Examples **Lecture 13:** Tutorial **Lecture 14** Tutorial **Lecture 15:** Tutorial **Term III** (9 Lectures) **Lecture 16:** Illustrative examples of above concepts from Geometry

		Lecture 17: Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics **Lecture 18:** Introduction to statistics **Lecture 19:** Examples **Lecture 20:** Applications **Lecture 21:** Tutorial **Lecture 22:** Tutorial **Lecture 23:** Tutorial