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Co-ordinators : Prof. Sivaji Ganesh

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Lecture 3 - First order Partial Differential Equations - Geometry of Quasilinear equations

Lecture 4 - FOPDE's - General Solutions to Linear and Semilinear equations

Lecture 5 - First order Partial Differential Equations- Lagrange's method for Quasilinear equations

Lecture 6 - Relation between Characteristic curves and Integral surfaces for Quasilinear equations

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Lecture 11 - FOPDE's - General nonlinear equations 1 - Search for a characteristic direction

Lecture 12 - FOPDE's - General nonlinear equations 2 - Characteristic direction and characteristic strip

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Lecture 15 - First order Partial Differential Equations - Tutorial on General nonlinear equations

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Lecture 18 - Second Order Partial Differential Equations - Special Curves associated to a PDE

Lecture 19 - Second Order Partial Differential Equations - Curves of discontinuity

Lecture 20 - Second Order Partial Differential Equations - Classification

Lecture 21 - SOPDE's - Canonical form for an equation of Hyperbolic type

Lecture 22 - SOPDE's - Canonical form for an equation of Parabolic type

Lecture 23 - SOPDE's - Canonical form for an equation of Elliptic type

Lecture 24 - Second Order Partial Differential Equations - Characteristic Surfaces

Lecture 25 - SOPDE's - Canonical forms for constant coefficient PDEs

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Lecture 27 - Wave Equation in one space dimension - d'Alembert formula

Lecture 28 - Tutorial on One dimensional wave equation

Lecture 29 - Wave Equation in d space dimensions - Equivalent Cauchy problems via Spherical means

Lecture 30 - Cauchy problem for Wave Equation in 3 space dimensions - Poisson-Kirchhoff formulae

Lecture 31 - Cauchy problem for Wave Equation in 2 space dimensions - Hadamard's method of descent

Lecture 32 - Nonhomogeneous Wave Equation - Duhamel principle

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Lecture 36 - IBVP for Wave Equation - Separation of Variables Method

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Lecture 41 - Qualitative analysis of Wave equation - Uniqueness by Energy method

Lecture 42 - Qualitative analysis of Wave equation - Huygens Principle

Lecture 43 - Qualitative analysis of Wave equation - Generalized solutions to Wave equation

Lecture 44 - Qualitative analysis of Wave equation - Propagation of waves

Lecture 45 - Laplace equation - Associated Boundary value problems

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Lecture 48 - Laplace equation - Weak maximum principle and its applications

Lecture 49 - Laplace equation - Dirichlet BVP on a disk in $\mathbb{R}^2$ for Laplace equations

Lecture 50 - Tutorial 1 on Laplace equation

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Lecture 56 - Cauchy Problem for Heat Equation - 2

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Lecture 60 - Heat equation Subheading : Infinite speed of propagation, Energy, Backward Problem

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NPTEL : NOC:Point Set Topology (Mathematics)

Co-ordinators : Prof. Ronnie Sebastian

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Co-ordinators : Dr. S. Dharmaraja

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Co-ordinators : Prof. Nilladri Chatterjee

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[Lecture 35 - Unbiased Estimators](#)

[Lecture 36 - Standard Error of Estimators](#)

[Lecture 37 - Method of Moments](#)

[Lecture 38 - Maximum Likelihood Estimation](#)

[Lecture 39 - Invariance Principle; Confidence Intervals](#)

[Lecture 40 - Large Sample Confidence Intervals](#)

[Lecture 41 - Student's t-distribution](#)

[Lecture 42 - Tests of Hypotheses - 1](#)

[Lecture 43 - Tests of Hypotheses - 2](#)

[Lecture 44 - Tests For Population Means](#)

Lecture 1 - Introduction

Lecture 2 - Alphabet, Strings, Languages

Lecture 3 - Finite Representation

Lecture 4 - Grammars (CFG)

Lecture 5 - Derivation Trees

Lecture 6 - Regular Grammars

Lecture 7 - Finite Automata

Lecture 8 - Nondeterministic Finite Automata

Lecture 9 - NFA $\Leftrightarrow$ DFA

Lecture 10 - Myhill-Nerode Theorem

Lecture 11 - Minimization

Lecture 12 - RE $\Rightarrow$ FA

Lecture 13 - FA $\Rightarrow$ RE

Lecture 14 - FA $\Leftrightarrow$ RG

Lecture 15 - Variants of FA

Lecture 16 - Closure Properties of RL

Lecture 17 - Homomorphism

Lecture 18 - Pumping Lemma

Lecture 19 - Simplification of CFG

Lecture 20 - Normal Forms of CFG

Lecture 21 - Properties of CFLs

Lecture 22 - Pushdown Automata

Lecture 23 - PDA $\Leftrightarrow$ CFG

Lecture 24 - Turing Machines

Lecture 25 - Turing Computable Functions

Lecture 26 - Combining Turing Machines

Lecture 27 - Multi Input

Lecture 28 - Turing Decidable Languages

Lecture 29 - Variants of Turing Machines

Lecture 30 - Structured Grammars

Lecture 31 - Decidability

[Lecture 32 - Undecidability 1](#)

[Lecture 33 - Undecidability 2](#)

[Lecture 34 - Undecidability 3](#)

[Lecture 35 - Time Bounded Turing Machines](#)

[Lecture 36 - P and NP](#)

[Lecture 37 - NP-Completeness](#)

[Lecture 38 - NP-Complete Problems 1](#)

[Lecture 39 - NP-Complete Problems 2](#)

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[Lecture 41 - Chomsky Hierarchy](#)

NPTEL : Complex Analysis (Mathematics)

Co-ordinators : Prof. P.A.S. Sree Krishna

Lecture 1 - Introduction

Lecture 2 - Introduction to Complex Numbers

Lecture 3 - de Moivre's Formula and Stereographic Projection

Lecture 4 - Topology of the Complex Plane - Part-I

Lecture 5 - Topology of the Complex Plane - Part-II

Lecture 6 - Topology of the Complex Plane - Part-III

Lecture 7 - Introduction to Complex Functions

Lecture 8 - Limits and Continuity

Lecture 9 - Differentiation

Lecture 10 - Cauchy-Riemann Equations and Differentiability

Lecture 11 - Analytic functions; the exponential function

Lecture 12 - Sine, Cosine and Harmonic functions

Lecture 13 - Branches of Multifunctions; Hyperbolic Functions

Lecture 14 - Problem Solving Session I

Lecture 15 - Integration and Contours

Lecture 16 - Contour Integration

Lecture 17 - Introduction to Cauchy's Theorem

Lecture 18 - Cauchy's Theorem for a Rectangle

Lecture 19 - Cauchy's theorem - Part-II

Lecture 20 - Cauchy's Theorem - Part-III

Lecture 21 - Cauchy's Integral Formula and its Consequences

Lecture 22 - The First and Second Derivatives of Analytic Functions

Lecture 23 - Morera's Theorem and Higher Order Derivatives of Analytic Functions

Lecture 24 - Problem Solving Session II

Lecture 25 - Introduction to Complex Power Series

Lecture 26 - Analyticity of Power Series

Lecture 27 - Taylor's Theorem

Lecture 28 - Zeroes of Analytic Functions

Lecture 29 - Counting the Zeroes of Analytic Functions

Lecture 30 - Open mapping theorem - Part-I

Lecture 31 - Open mapping theorem - Part-II

[Lecture 32 - Properties of Mobius Transformations - Part-I](#)

[Lecture 33 - Properties of Mobius Transformations - Part-II](#)

[Lecture 34 - Problem Solving Session III](#)

[Lecture 35 - Removable Singularities](#)

[Lecture 36 - Poles Classification of Isolated Singularities](#)

[Lecture 37 - Essential Singularity & Introduction to Laurent Series](#)

[Lecture 38 - Laurent's Theorem](#)

[Lecture 39 - Residue Theorem and Applications](#)

[Lecture 40 - Problem Solving Session IV](#)

Lecture 1 - Introduction to Financial Markets and Bonds

Lecture 2 - Introduction to Stocks, Futures and Forwards and Swaps

Lecture 3 - Introduction to Options

Lecture 4 - Interest Rates and Present Value

Lecture 5 - Present and Future Values, Annuities, Amortization and Bond Yield

Lecture 6 - Price Yield Curve and Term Structure of Interest Rates

Lecture 7 - Markowitz Theory, Return and Risk and Two Asset Portfolio

Lecture 8 - Minimum Variance Portfolio and Feasible Set

Lecture 9 - Multi Asset Portfolio, Minimum Variance Portfolio, Efficient Frontier and Minimum Variance Line

Lecture 10 - Minimum Variance Line (Continued), Market Portfolio

Lecture 11 - Capital Market Line, Capital Asset Pricing Model

Lecture 12 - Performance Analysis

Lecture 13 - No-Arbitrage Principle and Pricing of Forward Contracts

Lecture 14 - Futures, Options and Put-Call-Parity

Lecture 15 - Bounds on Options

Lecture 16 - Derivative Pricing in a Single Period Binomial Model

Lecture 17 - Derivative Pricing in Multiperiod Binomial Model

Lecture 18 - Derivative Pricing in Binomial Model and Path Dependent Options

Lecture 19 - Discrete Probability Spaces

Lecture 20 - Filtrations and Conditional Expectations

Lecture 21 - Properties of Conditional Expectations

Lecture 22 - Examples of Conditional Expectations, Martingales

Lecture 23 - Risk-Neutral Pricing of European Derivatives in Binomial Model

Lecture 24 - Actual and Risk-Neutral Probabilities, Markov Process, American Options

Lecture 25 - General Probability Spaces, Expectations, Change of Measure

Lecture 26 - Filtrations, Independence, Conditional Expectations

Lecture 27 - Brownian Motion and its Properties

Lecture 28 - Itô's Integral and its Properties

Lecture 29 - Itô's Formula, Itô's Processes

Lecture 30 - Multivariable Stochastic Calculus, Stochastic Differential Equations

Lecture 31 - Black-Scholes-Merton (BSM) Model, BSM Equation, BSM Formula

[Lecture 32 - Greeks, Put-Call Parity, Change of Measure](#)

[Lecture 33 - Girsanov Theorem, Risk-Neutral Pricing of Derivatives, BSM Formula](#)

[Lecture 34 - MRT and Hedging, Multidimensional Girsanov and MRT](#)

[Lecture 35 - Multidimensional BSM Model, Fundamental Theorems of Asset Pricing](#)

[Lecture 36 - BSM Model with Dividend-Paying Stocks](#)

Lecture 1 - Probability space and their properties, Random variables

Lecture 2 - Mean, variance, covariance and their properties

Lecture 3 - Linear regression; Binomial and normal distribution; Central Limit Theorem

Lecture 4 - Financial markets

Lecture 5 - Bonds and stocks

Lecture 6 - Binomial and geometric Brownian motion (gBm) asset pricing models

Lecture 7 - Expected return, risk and covariance of returns

Lecture 8 - Expected return and risk of a portfolio; Minimum variance portfolio

Lecture 9 - Multi-asset portfolio and Efficient frontier

Lecture 10 - Capital Market Line and Derivation of efficient frontier

Lecture 11 - Capital Asset Pricing Model and Single index model

Lecture 12 - Portfolio performance analysis

Lecture 13 - Utility functions and expected utility

Lecture 14 - Risk preferences of investors

Lecture 15 - Absolute Risk Aversion and Relative Risk Aversion

Lecture 16 - Portfolio theory with utility functions

Lecture 17 - Geometric Mean Return and Roy's Safety-First Criterion

Lecture 18 - Kataoka's Safety-First Criterion and Telser's Safety-First Criterion

Lecture 19 - Semi-variance framework

Lecture 20 - Stochastic dominance; First order stochastic dominance

Lecture 21 - Second order stochastic dominance and Third order stochastic dominance

Lecture 22 - Discrete time model and utility function

Lecture 23 - Optimal portfolio for single-period discrete time model

Lecture 24 - Optimal portfolio for multi-period discrete time model; Discrete Dynamic Programming

Lecture 25 - Continuous time model; Hamilton-Jacobi-Bellman PDE

Lecture 26 - Hamilton-Jacobi-Bellman PDE; Duality/Martingale Approach

Lecture 27 - Duality/Martingale Approach in Discrete and Continuous Time

Lecture 28 - Interest rates and bonds; Duration

Lecture 29 - Duration; Immunization

Lecture 30 - Convexity; Hedging and Immunization

Lecture 31 - Quantiles and their properties

[Lecture 32 - Value-at-Risk and its properties](#)

[Lecture 33 - Average Value-at-Risk and its properties](#)

[Lecture 34 - Asset allocation](#)

[Lecture 35 - Portfolio optimization](#)

[Lecture 36 - Portfolio optimization with constraints, Value-at-Risk: Estimation and backtesting](#)

Lecture 1 - Review of Basic Probability - I

Lecture 2 - Review of Basic Probability - II

Lecture 3 - Review of Basic Probability - III

Lecture 4 - Stochastic Processes

Lecture 5 - Definition of Markov Chain and Transition Probabilities

Lecture 6 - Markov Property and Chapman-Kolmogorov Equations

Lecture 7 - Chapman-Kolmogorov Equations: Examples

Lecture 8 - Accessibility and Communication of States

Lecture 9 - Hitting Time - I

Lecture 10 - Hitting Time - II

Lecture 11 - Hitting Time - III

Lecture 12 - Strong Markov Property

Lecture 13 - Passage Time and Excursion

Lecture 14 - Number of Visits

Lecture 15 - Class Property

Lecture 16 - Transience and Recurrence of Random Walks

Lecture 17 - Stationary Distribution - I

Lecture 18 - Stationary Distribution - II

Lecture 19 - Stationary Distribution - III

Lecture 20 - Limit Theorems - I

Lecture 21 - Limit Theorems - II

Lecture 22 - Some Problems - I

Lecture 23 - Some Problems - II

Lecture 24 - Time Reversibility

Lecture 25 - Properties of Exponential Distribution

Lecture 26 - Some Problems

Lecture 27 - Order Statistics

Lecture 28 - Poisson Processes

Lecture 29 - Poisson Thinning - I

Lecture 30 - Poisson Thinning - II

Lecture 31 - Conditional Arrival Times

[Lecture 32 - Independent Poisson Processes](#)

[Lecture 33 - Some Problems](#)

[Lecture 34 - Compound Poisson Processes](#)

NPTEL : NOC:Introduction to Queueing Theory (Mathematics)

Co-ordinators : Prof. N. Selvaraju

- Lecture 1 - Queueing Systems, System Performance Measures
- Lecture 2 - Characteristics of Queueing Systems, Kendall's Notation
- Lecture 3 - Little's Law, General Relationships
- Lecture 4 - Laplace and Laplace-Stieltjes Transforms, Probability Generating Functions
- Lecture 5 - An Overview of Stochastic Processes
- Lecture 6 - Markov Chains: Definition, Transition Probabilities
- Lecture 7 - Classification Properties of Markov Chains
- Lecture 8 - Long-Term Behaviour of Markov Chains
- Lecture 9 - Exponential Distribution and its Properties, Poisson Process
- Lecture 10 - Poisson Process and its Properties, Generalizations
- Lecture 11 - Continuous-Time Markov Chains, Generator Matrix, Kolmogorov Equations
- Lecture 12 - Stationary and Limiting Distributions of CTMC, Balance Equations, Birth-Death Processes
- Lecture 13 - Birth-Death Queues: General Theory, M/M/1 Queues and their Steady State Solution
- Lecture 14 - M/M/1 Queues: Performance Measures, PASTA Property, Waiting Time Distributions
- Lecture 15 - M/M/c Queues, Erlang Delay Formula
- Lecture 16 - M/M/c/K Queues
- Lecture 17 - Erlang's Loss System, Erlang Loss Formula, Infinite-Server Queues
- Lecture 18 - Finite-Source Queues, Engset Loss System, State-Dependent Queues, Queues with Impatience
- Lecture 19 - Transient Solutions: M/M/1/1, Infinite-Server and M/M/1 Queues, Busy Period Analysis
- Lecture 20 - Queues with Bulk Arrivals
- Lecture 21 - Queues with Bulk Service
- Lecture 22 - Erlang and Phase-Type Distributions
- Lecture 23 - Erlangian Queues: Erlangian Arrivals, Erlangian Service Times
- Lecture 24 - Nonpreemptive Priority Queues
- Lecture 25 - Nonpreemptive and Preemptive Priority Queues
- Lecture 26 - M/M/1 Retrial Queues
- Lecture 27 - Discrete-Time Queues: Geo/Geo/1 (EAS), Geo/Geo/1 (LAS)
- Lecture 28 - Introduction to Queueing Networks, Two-Node Network
- Lecture 29 - Burke's Theorem, General Setup, Tandem Networks
- Lecture 30 - Queueing Networks with Blocking, Open Jackson Networks

[Lecture 31 - Waiting Times and Multiple Classes in Open Jackson Networks](#)

[Lecture 32 - Closed Jackson Networks](#)

[Lecture 33 - Closed Jackson Networks, Convolution Algorithm](#)

[Lecture 34 - Mean-Value Analysis Algorithm](#)

[Lecture 35 - Cyclic Queueing Networks, Extensions of Jackson Networks](#)

[Lecture 36 - Renewal Processes](#)

[Lecture 37 - Regenerative Processes, Semi-Markov Processes](#)

[Lecture 38 - M/G/1 Queues, The Pollaczek-Khinchin Mean Formula](#)

[Lecture 39 - M/G/1 Queues, The Pollaczek-Khinchin Transform Formula](#)

[Lecture 40 - M/G/1 Queues: Waiting Times and Busy Period](#)

[Lecture 41 - M/G/1/K Queues, Additional Insights on M/G/1 Queues](#)

[Lecture 42 - M/G/c, M/G/∞ and M/G/c/c Queues](#)

[Lecture 43 - G/M/1 Queues](#)

[Lecture 44 - G/G/1 Queues: Lindley's Integral Equation](#)

[Lecture 45 - G/G/1 Queues: Bounds](#)

[Lecture 46 - Vacation Queues: Introduction, M/M/1 Queues with Vacations](#)

[Lecture 47 - M/G/1 Queues with Vacations](#)

Lecture 1 - Coordinates Systems 2-D and 3-D

Lecture 2 - Vector Algebra $\mathbb{R}^n$

Lecture 3 - Euclidean space $\mathbb{R}^n$ and some of its properties

Lecture 4 - Sequences in $\mathbb{R}^n$

Lecture 5 - Functions of Several Variables and Concept of Limit

Lecture 6 - Properties of Limit, Iterated Limit and Double limit

Lecture 7 - Concept of Continuity and Some of Its Properties

Lecture 8 - Properties of Continuous Functions

Lecture 9 - Concept of Differentiability for Vector-valued Functions

Lecture 10 - Properties of Differentiable Functions, Chain Rule

Lecture 11 - Applications of Differentiability

Lecture 12 - Concept of Partial Derivates, Examples and Properties

Lecture 13 - Higher order Partial Derivatives and notion of Directional Derivatives

Lecture 14 - Concept of Total Derivative and related properties

Lecture 15 - Gradient Vector and Necessary condition for Differentiability

Lecture 16 - Sufficient condition for Differentiability and Chain rule

Lecture 17 - Applications: Tangent Plane and Normal Line for a Surface

Lecture 18 - Mixed Partial Derivatives and Examples

Lecture 19 - Mixed Derivative Theorem and Examples

Lecture 20 - Concept of Mean Value Theorem

Lecture 21 - Notion of Hessian

Lecture 22 - Taylor's theorem and Linear approximation

Lecture 23 - Maxima, Minima and Saddle point

Lecture 24 - Necessary condition for extremum and quadratic forms

Lecture 25 - Hessian matrix, Method to find the extremum values of f

Lecture 26 - Global extrema, Constrained extrema

Lecture 27 - The method of Lagrange multipliers, Exact differentials

Lecture 28 - Definition of Double integrals in terms of Upper and Lower sums

Lecture 29 - Definition of Double integrals in terms of Riemann Sum and Properties

Lecture 30 - Iterated integral and Fubini's theorem

Lecture 31 - Double integral on simple regions and Fubini's theorem

[Lecture 32 - Change of Variables in a Double Integral and Applications](#)

[Lecture 33 - Definition of Triple integrals as Riemann Integral and Examples](#)

[Lecture 34 - Triple integral on simple regions and Fubini's theorem](#)

[Lecture 35 - More on Triple integral on simple regions and Fubini's theorem](#)

[Lecture 36 - Change of Variables in Triple Integral and Examples](#)

[Lecture 37 - Definition of Vector Fields and visualization of them by arrows](#)

[Lecture 38 - Integral curves of Vector Fields, conservative and non-conservative vector fields, Gradient](#)

[Lecture 39 - Necessary and sufficient conditions for a conservative/gradient vector field](#)

[Lecture 40 - Concept of Divergence and Curl](#)

[Lecture 41 - Curl, rotational vector field, Divergence of curl, Laplace operator](#)

[Lecture 42 - Recall of Curves, Smooth Curves, Piecewise Smooth Curves](#)

[Lecture 43 - Definition of Scalar Line Integral, Some examples and properties](#)

[Lecture 44 - Orientation of smooth curve and definition of Vector Line Integral](#)

[Lecture 45 - Definition of Vector Line Integral, Examples, Properties and Applications](#)

[Lecture 46 - Definition of surfaces, smooth surfaces, and parametrization of surfaces](#)

[Lecture 47 - Definition of scalar surface integral and some examples](#)

[Lecture 48 - Oriented surfaces and the definition of vector surface integral](#)

[Lecture 49 - Vector surface integral and some examples](#)

[Lecture 50 - Recall the definition of curves, orientation of curves, Jordan curve theorem](#)

[Lecture 51 - Statement, and proof of Green's theorem on a simply connected region](#)

[Lecture 52 - Application of Green's theorem and Green's theorem for multiply connected regions](#)

[Lecture 53 - Application of Green's theorem for multiply connected regions and Examples](#)

[Lecture 54 - Recall the definition of surfaces, smooth surfaces, and orientation of surfaces](#)

[Lecture 55 - Oriented surfaces, Stokes theorem on smooth surfaces with examples](#)

[Lecture 56 - Stokes theorem on smooth surfaces with finitely many holes, Gauss Divergence theorem and examples](#)

[Lecture 57 - Gauss Divergence theorem, Application of Divergence theorem and examples](#)

Lecture 1 - Prologue

Lecture 2 - Basic concepts on multivariate distribution

Lecture 3 - Basic concepts on multivariate distribution

Lecture 4 - Multivariate normal distribution – I

Lecture 5 - Multivariate normal distribution – II

Lecture 6 - Multivariate normal distribution – III

Lecture 7 - Some problems on multivariate distributions – I

Lecture 8 - Some problems on multivariate distributions – II

Lecture 9 - Random sampling from multivariate normal distribution and Wishart distribution - I

Lecture 10 - Random sampling from multivariate normal distribution and Wishart distribution - II

Lecture 11 - Random sampling from multivariate normal distribution and Wishart distribution - III

Lecture 12 - Wishart distribution and its properties - I

Lecture 13 - Wishart distribution and its properties - II

Lecture 14 - Hotelling's T^2 distribution and its applications

Lecture 15 - Hotelling's T^2 distribution and various confidence intervals and regions

Lecture 16 - Hotelling's T^2 distribution and Profile analysis

Lecture 17 - Profile analysis - I

Lecture 18 - Profile analysis - II

Lecture 19 - MANOVA - I

Lecture 20 - MANOVA - II

Lecture 21 - MANOVA - III

Lecture 22 - MANOVA & Multiple Correlation Coefficient

Lecture 23 - Multiple Correlation Coefficient

Lecture 24 - Principal Component Analysis

Lecture 25 - Principal Component Analysis

Lecture 26 - Principal Component Analysis

Lecture 27 - Cluster Analysis

Lecture 28 - Cluster Analysis

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Lecture 30 - Cluster Analysis

Lecture 31 - Discriminant Analysis and Classification

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[Lecture 41 - Cannonical Correlation Analysis](#)

[Lecture 42 - Cannonical Correlation Analysis](#)

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NPTEL : Calculus of Variations and Integral Equations (Mathematics)

Co-ordinators : Dr. Malay Banerjee, Prof. D. Bahuguna

[Lecture 1 - Calculus of Variations and Integral Equations](#)

[Lecture 2 - Calculus of Variations and Integral Equations](#)

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[Lecture 40 - Calculus of Variations and Integral Equations](#)

NPTEL : Linear programming and Extensions (Mathematics)

Co-ordinators : Prof. Prabha Sharma

Lecture 1 - Introduction to Linear Programming Problems

Lecture 2 - Vector space, Linear independence and dependence, basis

Lecture 3 - Moving from one basic feasible solution to another, optimality criteria

Lecture 4 - Basic feasible solutions, existence & derivation

Lecture 5 - Convex sets, dimension of a polyhedron, Faces, Example of a polytope

Lecture 6 - Direction of a polyhedron, correspondence between bfs and extreme points

Lecture 7 - Representation theorem, LPP solution is a bfs, Assignment 1

Lecture 8 - Development of the Simplex Algorithm, Unboundedness, Simplex Tableau

Lecture 9 - Simplex Tableau & algorithm ,Cycling, Bland's anti-cycling rules, Phase I & Phase II

Lecture 10 - Big-M method, Graphical solutions, adjacent extreme pts and adjacent bfs

Lecture 11 - Assignment 2, progress of Simplex algorithm on a polytope, bounded variable LPP

Lecture 12 - LPP Bounded variable, Revised Simplex algorithm, Duality theory, weak duality theorem

Lecture 13 - Weak duality theorem, economic interpretation of dual variables, Fundamental theorem of duality

Lecture 14 - Examples of writing the dual, complementary slackness theorem

Lecture 15 - Complementary slackness conditions, Dual Simplex algorithm, Assignment 3

Lecture 16 - Primal-dual algorithm

Lecture 17 - Problem in lecture 16, starting dual feasible solution, Shortest Path Problem

Lecture 18 - Shortest Path Problem, Primal-dual method, example

Lecture 19 - Shortest Path Problem-complexity, interpretation of dual variables, post-optimality analysis-changes in the cost vector

Lecture 20 - Assignment 4, postoptimality analysis, changes in b, adding a new constraint, changes in $\{a_{ij}\}$, Parametric analysis

Lecture 21 - Parametric LPP-Right hand side vector

Lecture 22 - Parametric cost vector LPP

Lecture 23 - Parametric cost vector LPP, Introduction to Min-cost flow problem

Lecture 24 - Mini-cost flow problem-Transportation problem

Lecture 25 - Transportation problem degeneracy, cycling

Lecture 26 - Sensitivity analysis

Lecture 27 - Sensitivity analysis

Lecture 28 - Bounded variable transportation problem, min-cost flow problem

Lecture 29 - Min-cost flow problem

Lecture 30 - Starting feasible solution, Lexicographic method for preventing cycling ,strongly feasible solution

Lecture 31 - Assignment 6, Shortest path problem, Shortest Path between any two nodes, Detection of negative cycles

[Lecture 32 - Min-cost-flow Sensitivity analysis Shortest path problem sensitivity analysis](#)

[Lecture 33 - Min-cost flow changes in arc capacities , Max-flow problem, assignment 7](#)

[Lecture 34 - Problem 3 \(assignment 7\), Min-cut Max-flow theorem, Labelling algorithm](#)

[Lecture 35 - Max-flow - Critical capacity of an arc, starting solution for min-cost flow problem](#)

[Lecture 36 - Improved Max-flow algorithm](#)

[Lecture 37 - Critical Path Method \(CPM\)](#)

[Lecture 38 - Programme Evaluation and Review Technique \(PERT\)](#)

[Lecture 39 - Simplex Algorithm is not polynomial time- An example](#)

[Lecture 40 - Interior Point Methods](#)

NPTEL : Convex Optimization (Mathematics)

Co-ordinators : Dr. Joydeep Dutta

[Lecture 1 - Convex Optimization](#)

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NPTEL : Foundations of Optimization (Mathematics)

Co-ordinators : Dr. Joydeep Dutta

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Co-ordinators : Prof. A. Goswami, Dr. Debjani Chakraborty

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NPTEL : Probability and Statistics (Mathematics)

Co-ordinators : Prof. Somesh Kumar

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Co-ordinators : Prof. S. Lakshmivarahan

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Co-ordinators : Prof. Amit Kulshrestha

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Co-ordinators : Prof. Krishna Hanumanthu

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