NSCB Memorial Govt. Degree College Hamirpur

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Department of Mathematics

Name of Teacher : **Dr. Nirmal Singh**

Designation : **Assistant Professor**

B.Sc. (Mathematics) Third Year

Course Code : **MATH304TH**

Name of the Course : **Numerical Methods**

Course Learning Outcomes: On successful completion of this course, the student will be able to

CO1. Understand numerical techniques to find the roots of non-linear equations and solution of system of linear equations.

CO2. Understand the difference operators and the use of interpolation.

CO3. Understand numerical differentiation and integration and numerical solutions of ordinary and partial differential equations.

CO4. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.

CO5. Apply numerical methods to obtain approximate solutions to mathematical problems

CO6. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations

CO7. Analyse and evaluate the accuracy of common numerical methods

Plan of Teaching the Subject According to Syllabus

Lecture 1 Introduction to Syllabus and some basic concepts required for it

Lecture 2 Introduction to Algorithm

Lecture 3 Order of Convergence of various methods

Lecture 4 Bisection method for solving polynomial equations

Lecture 5-7 Examples based on Bisection method

Lecture 8 Explanation of working of False position method

Lecture 9-11 Examples based on False position method

Lecture 12 Explanation of working of Fixed point iteration method

Lecture 13-14 Examples based on Fixed point iteration method

Lecture 15 Explanation of working of Newton's method

Lecture 16-17 Examples based on Newton's method

Lecture 18 Explanation of working of Secant method

Lecture 19 Examples based on Secant method

Lecture 20 Explanation of working of LU decomposition

Lecture 21-22 Examples based on LU decomposition

Lecture 23 Class test of Unit 1

Lecture 24 Explanation of working of Gauss-Jacobi

Lecture 25 Examples based on Gauss-Jacobi

Lecture 26 Explanation of working of Gauss-Siedel

Lecture 27 Examples based on Gauss-Siedel

Lecture 28 Explanation of working of SOR iterative methods

Lecture 29 Examples based on SOR iterative methods

Lecture 30 Explanation of working of Newton Forward and backward interpolation formulas

Lecture 31-32 Examples based on Newton Forward and backward interpolation formulas

Lecture 33 Explanation of working of Newton divided interpolation formula

Lecture 34-35 Examples based on Newton divided interpolation formula

Lecture 36 Explanation of working of Lagrange interpolation formula

Lecture 37-38 Examples based on Lagrange interpolation formula

Lecture 39 Class test of Unit 2

Lecture 40 Explanation of working of Finite difference operators

Lecture 41 Explanation of working of Numerical differentiation: Newton's forward difference and backward difference method

Lecture 42-44 Examples based on Numerical differentiation: Newton's forward difference and backward difference method

Lecture 45 Explanation of working of Sterling's Central difference method

Lecture 46-48 Examples based on Sterling's Central difference method.

Lecture 49 Class test of Unit 3

Lecture 50 Explanation of working of Trapezoidal rule

Lecture 51 Examples based on Trapezoidal rule

Lecture 52 Explanation of working of Simpson's rule 1/3 and 3/8

Lecture 53-54 Examples based on Simpson's rule 1/3 and 3/8

Lecture 55 Explanation of working of Euler's method and modified Euler's method

Lecture 56-58 Examples based on Sterling's Euler's method and modified Euler's method

Lecture 59 Class test of Unit 4

Lecture 60 Discussion about Annual Exams & preparation techniques.

B.Sc. (Mathematics) Third Year

Course Code : MATH317TH

Name of the Course : Transportation And Game Theory

Course Learning Outcomes:

After the successful completion of this course, it is indented that a student will be able to:

CO1. To develop formulation skills in transportation models and finding solutions

CO2. To understand the basics in the field of game theory and assignment problems

CO3. Interpret the transportation models' solutions and infer solutions to the real-world problems

CO4. Recognize and solve game theory and assignment problems.

CO5. Knowledge of drawing project networks for quantitative analysis of projects

CO6. Know when simulation and dynamic programming can be applied in real world problems

Plan of Teaching the Subject According to Syllabus

Lecture 1 Introduction to Transportation problem

Lecture 2 Mathematical formulation of Transportation problem

Lecture 3 Mathematical formulation of Transportation problem with Examples

Lecture 4 Mathematical formulation of Transportation problem with Examples

Lecture 5 Northwest-corner method mathematical working

Lecture 6 Northwest-corner method mathematical working explanation with examples

Lecture 7-8 Northwest-corner method mathematical working explanation with examples

Lecture 9 Least cost method mathematical working

Lecture 10 Least cost method mathematical working explanation with examples

Lecture 11-12 Least cost method mathematical working explanation with examples

Lecture 13-14 Discussion about various problems in Unit 1.

Lecture 15 Class test of Unit 1.

Lecture 16 Vogel approximation method for determination of starting basic solution explanation

Lecture 17-19 Examples of Vogel approximation method for determination of starting basic solution

Lecture 20 Explanation of algorithm for solving transportation problem

Lecture 21-24 Examples on algorithm for solving transportation problem

Lecture 25 Class test of Unit 2

Lecture 26 Explanation of Assignment problem and its mathematical formulation

Lecture 27-28 Examples on Assignment problem and its mathematical formulation

Lecture 29 Explanation of Hungarian method for solving assignment problem

Lecture 30-34 Examples on Hungarian method for solving assignment problem

Lecture 35 Class test on Unit 3

Lecture 36 Explanation of formulation of two person zero sum games

Lecture 37-40 Explanation and Example on solving two person zero sum games

Lecture 41-43 Explanation and Example on games with mixed strategies

Lecture 44-45 Explanation and Example on graphical solution procedure for games

Lecture 46 Class test of Unit 4

Lecture 47 Discussion about Annual Exams & preparation techniques.

M.Sc. (Mathematics) First Semester

Course Code : M-102

Name of the Course : Advanced Algebra I

Course Learning Outcomes: On completion of the course, students shall be able to

CO1 Develop the understanding about the importance of group actions on sets.

CO2 Describe the normal series, solvable groups, nilpotent groups and their applications to characterize some classes of groups.

CO3 Have the broad idea about direct sum and direct product of groups.

CO4 Have the knowledge about finitely generated Abelian groups which are decomposable as a finite direct sum of cyclic groups which enables the students to find the number of non-isomorphic Abelian groups of given order.

CO5 Understand the Sylow Theorems and their applications: in particular, the existence of a simple group of a given order.

CO6 Provide the comprehensive understanding of ring theory and some special classes of rings such as Quotient rings, Euclidean rings, ring of Gaussian integers and Polynomial rings over the Rational fields and Commutative rings.

CO7 Have knowledge of the concept of Modules, free modules, completely reducible modules and Quotient modules.

Plan of Teaching the Subject According to Syllabus

Lecture 1 Introduction to Syllabus and benefits of learning it

Lecture 2 Conjugacy and G-Sets

Lecture 3 Normal Series

Lecture 4 Solvable Groups

Lecture 5 Nilpotent Groups

Lecture 6 Direct Products

Lecture 7-8 Finitely Generated Abelian Groups

Lecture 9 Least cost method mathematical working

Lecture 10 Invariants of a Finite abelian Groups

Lecture 11-12 Sylow Theorems

Lecture 13-14 Groups of Orders p_2, pq

Lecture 15 Class test of Unit 1.

Lecture 16 Definition and Examples of Rings

Lecture 17-19 Some Special Classes of Rings

Lecture 20 Homomorphisms

Lecture 21-24 Ideals and Quotient Rings

Lecture 21-24 More Ideals and Quotient Rings and The Field of Quotients of an Integral Domain.

Lecture 25 Euclidean Rings, a Particular Euclidean Ring

Lecture 26 , Polynomial Rings

Lecture 27-28 Polynomials over the Rational Field

Lecture 29 Polynomial Rings over Commutative Rings

Lecture 35 Class test on Unit 3

Lecture 36 Definition and examples, Submodules and direct sums

Lecture 37-40 , homomorphisms and quotient modules

Lecture 41-43 Completely reducible modules

Lecture 44-45 Free modules

Lecture 46 Class test of Unit 3

Lecture 47 Discussion about Annual Exams & preparation techniques.

M.Sc. (Mathematics) Second Semester

Course Code : M-202

Name of the Course : Field Theory

Course Learning Outcomes: On completion of the course, students shall be able to

CO1 Develop the understanding about the reducible and irreducible polynomials and their roots.

CO2 Identify the relations of one field to another (known as the concept of field extension).

CO3 Have the knowledge of field extensions, Algebraic extensions, Normal extensions, algebraically closed fields and Splitting fields.

CO4 Have a broad idea of some special types of fields such as Prime fields, finite fields, roots of unity and cyclotomic polynomials. In particular, the representation of elements of finite fields.

CO5 Understand the Galois Theory which creates a bridge to move from a field to a group, and make some remarkable observations using group theory.

CO6 Have a knowledge of separable extensions, automorphism group and fixed fields fundamental theorems of Galois theory and algebra.

Plan of Teaching the Subject According to Syllabus

Lecture 1 Introduction to Syllabus and benefits of learning it

Lecture 2 Irreducible polynomials and Eisenstein criterion

Lecture 3 Adjunction of roots

Lecture 4 Algebraic extensions

Lecture 5 Algebraically closed fields

Lecture 6 Splitting fields

Lecture 7-8 Normal extensions

Lecture 9-10 Multiple roots

Lecture 12 Class test of Unit 1.

Lecture 13 Prime Fields

Lecture 14-16 Finite fields

Lecture 17 Roots of Irreducible Polynomials

Lecture 18-19 Roots of unity and cyclotomic polynomials

Lecture 20-22 Representation of Elements of Finite Fields

Lecture 23-24 Order of Polynomials and Primitive Polynomials

Lecture 25 Irreducible Polynomials

Lecture 26 Class test on Unit 2

Lecture 27 Separable extensions

Lecture 28-29 Automorphism groups and fixed fields

Lecture 30-33 Fundamental theorem of Galois theory

Lecture 34-35 Fundamental theorem of algebra

Lecture 36 Class test of Unit 3

Lecture 37 Discussion about Annual Exams & preparation techniques.

M.Sc. (Mathematics) Third Semester

Course Code : M-303

Name of the Course : Topology

Course Learning Outcomes: On completion of the course, students shall be able to

CO1 Develop the understanding about the partial ordered relations and lattices.

CO2 Understand some elementary concepts in metric spaces and topological spaces such as open bases, open subbases, weak topology and the function algebras.

CO3 Identify the open sets, closed sets, convergence and continuity in metric/topological spaces.

CO4 Have a broad idea of compactness and various separation axioms in a topological space using some remarkable theorems such as Tychonoff's theorem, the Urysohn imbedding theorem, Ascoli's theorem, Urysohn's lemma and Tietze's theorem.

CO5 Understand connectedness in topological spaces, connected components, locally connected spaces and totally disconnected spaces.

CO6 Have a knowledge of The Weierstrass approximation theorem used to approximate a real valued continuous function by a real polynomial

Plan of Teaching the Subject According to Syllabus

Lecture 1 Introduction to Syllabus and benefits of learning it

Lecture 2 Partial ordered sets and lattices.

Lecture 3 Open sets

Lecture 4 closed sets

Lecture 5 Algebraically closed fields

Lecture 6 Convergence

Lecture 7 Completeness

Lecture 8 Baire's category theorem

Lecture 9 Continuity

Lecture 10 The definition and some examples

Lecture 11 Completeness

Lecture 12 Elementary concepts, Open bases and open subbases

Lecture 13 Weak topologies

Lecture 14 the function algebras C (X, R) and C (X, C)

Lecture 15 Class test of Unit 1.

Lecture 16 Compact spaces

Lecture 17 Products of spaces

Lecture 18 Tychonoff's theorem and locally compact spaces

Lecture 19 Compactness for metric spaces

Lecture 20 Ascoli's theorem

Lecture 21 T1-spaces and Hausdorff spaces

Lecture 22 Completely regular spaces and normal spaces

Lecture 23 Urysohn's lemma and Tietze's extension theorem

Lecture 24 The Urysohn imbedding theorem

Lecture 25 The Stone-Cech compactification.

Lecture 26 Class test on Unit 2

Lecture 27 Connected spaces

Lecture 28 The components of a space

Lecture 29 Totally disconnected spaces

Lecture 30 Locally connected spaces.

Lecture 31 The Weierstrass approximation theorem

Lecture 32 Class test of Unit 3

Lecture 33 Discussion about Annual Exams & preparation techniques.

M.Sc. (Mathematics) Fourth Semester

Course Code : M-401

Name of the Course : Functional Analysis

Course Learning Outcomes: On completion of the course, students shall be able to

CO1 Develop the understanding about the Normed linear spaces and Banach spaces.

CO2 Have the knowledge of continuous linear transformations between normed linear spaces and the concept of dual spaces, double dual and reflexive spaces.

CO3 Have a broad idea of some important results such as The Hahn-Banach theorem, the open mapping theorem, the closed graph theorem and the Uniform Boundedness theorem.

CO4 Understand Hilbert spaces, its conjugate space, adjoint of an operator, self-adjoint, normal and unitary operators and projections.

CO5 Describe the spectral theory in normed spaces, spectral properties of Bounded linear operators, Banach algebra and its properties.

CO6 Apply the knowledge of Complex Analysis in Spectral theory

Plan of Teaching the Subject According to Syllabus

Lecture 1 Introduction to Syllabus and benefits of learning it

Lecture 2 The definition and some examples

Lecture 3 Continuous linear transformations

Lecture 4-5 The Hahn- Banach Theorem

Lecture 6-7 The Open Mapping Theorem

Lecture 8 The Closed Graph Theorem

Lecture 9-10 Uniform Boundedness Theorem

Lecture 11-12 The natural embedding of N in N**

Lecture 13 Reflexivity

Lecture 14 Class test of Unit 1

Lecture 15 The definition and some simple properties

Lecture 16 Orthogonal complements

Lecture 17 Orthonormal sets

Lecture 18 Conjugate space H*

Lecture 19 The adjoint of an operator

Lecture 20-21 Self-adjoint normal and unitary operators

Lecture 22-23 Projections

Lecture 24 Class test on Unit 2

Lecture 25 Spectral Theory in Finite Dimensional Normed Spaces

Lecture 26 Spectral Properties of Bounded Linear Operators

Lecture 27-28 Further Properties of Resolvent and Spectrum

Lecture 29-30 Use of Complex Analysis in Spectral Theory.

Lecture 31 Further Properties of Banach Algebras

Lecture 32 Class test of Unit 3

Lecture 33 Discussion about Annual Exams & preparation techniques.