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Autonomous College
Affiliated to Osmania University

PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Abstract Algebra

COURSE CODE: HDS321 **PPW: 5L+1T**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 5**

Effective from academic Year 2024-25

(75 Hours)

COURSE OBJECTIVE: This course is aimed at familiarising students with concepts in Abstract Algebra.

Course Objectives:

This course is aimed at familiarising students with concepts in Abstract Algebra

COb1: To learn basic algebraic structures like groups.

COb2: To acquire knowledge about Permutation Groups and Factor groups.

COb3: To explain the concepts of Homomorphisms, Isomorphism and Rings.

COb4: To analyse various concepts of Rings and Fields.

UNIT-I GROUPS-I (20Hrs)

Groups: Definition and Examples of Groups, Elementary Properties of Groups, Finite Groups Subgroups -Terminology and Notation, Subgroup Tests, Examples of Subgroups.Cyclic Groups: Properties of Cyclic Groups, Classification of Subgroups Cyclic Groups.

UNIT-II GROUPS-II (20Hrs)

Permutation Groups: Definition and Notation, Cycle Notation, Properties of Permutations, A Check Digit Scheme Based on D5.Cosets and Lagrange's Theorem: Properties of Cosets, Lagrange's Theorem and Consequences, An Application of Cosets to Permutation Groups, The Rotation Group of a Cube and a Soccer Ball. Normal Subgroups and Factor Groups: Normal Subgroups, Factor Groups, Applications of Factor Groups

UNIT- III: GROUPS III & RINGS I (20Hrs)

Group Homomorphisms: Definition and Examples, Properties of Homomorphisms, The First Isomorphism Theorem, Cayley's Theorem Isomorphisms, Automorphisms

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Introduction to Rings: Motivation and Definition, Examples of Rings, Properties of Rings, Subrings

UNIT- IV: RINGS II (15Hrs)

Integral Domains: Definition and Examples, Fields, Characteristics of a Ring.
Ideals and Factor Rings: Ideals, Factor Rings, Prime Ideals and Maximal Ideals.
Ring Homomorphisms: Definition and Examples, Properties of Ring, Homomorphisms.

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Prescribed Text Book:

"Contemporary Abstract Algebra", Joseph A Gallian, Cengage learning publishers, 9th edition.

Unit 1-Chapters: 2, 3 & 4
Unit 2-Chapters: 5, 7 & 9
Unit 3-Chapters: 10, 6 &12
Unit 4-Chapters: 13,14 &15

Reference Books:

1. B.S.c Second Year Mathematics, Algebra, SEM IV Telugu Academy, Edition2021.
2. A First Course in Abstract Algebra, Fraleigh J.B, Pearson publications,7th Edition.
3. Topics in Algebra, Herstein, I.N, Wiley India Pvt. Limited, 2nd Edition.
4. Basic Abstract Algebra, Robert B. Ash, Dover Publications, 1st Edition.
5. Finite Group Theory, I Martin Isaacs, American Mathematical Soc., 1st Edition.
6. Advanced Modern Algebra, Joseph J Rotman, American Mathematical Soc,2nd Edition.
7. Basic Abstract Algebra, Bhattacharya, P.B Jain, S.K; and Nagpaul, S.R, Cambridge University Press, 2nd Edition.

Course Outcomes:

After completion of the course students will be able to

MT421 CO1: Interpret properties of basic Algebraic structures.

MT421 CO2: Compute and calculate permutations and factor groups

MT421 CO3: Evaluate Homomorphisms, Isomorphism and Rings.

MT421 CO4: Summarise and synthesise the concepts in Ring Theory

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Inferential Statistics

COURSE CODE: HDS322 **PPW: 4**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 4**

Effective from academic Year 2024-25

(60 Hours)

COURSE OBJECTIVE: This course aims to provide students with a broad knowledge of mathematical statistics and a conceptual foundation in Inferential Statistics, emphasizing practical aspects of the interpretation of data.

UNIT-WISE COURSE OBJECTIVES:

COb1: Recognize the characteristics of a sampling distribution and estimation theory and hypothesis testing.
COb2: Demonstrate the use of large sample tests and its applications.
COb3: Demonstrate the use of exact Sampling distributions tests and its applications.
COb4: To learn and apply non-parametric techniques in real life problems.

UNIT-I: **15 Hrs**

Sampling distribution: Concept – Population, Sample, parameter, statistic, sampling distribution and standard error. Exact sampling distributions-definitions and properties of chi-square, t and F distributions.

Estimation: Point Estimation and Interval estimation, Concept of Unbiasedness, Consistency, Efficiency and Sufficiency (only Conceptual frame work) – Statement of Neyman's Factorization theorem. Maximum likelihood estimation (MLE) and their properties – Simple problems on MLE – Method of moments – Simple illustrations.

Hypothesis and General Test Procedures: Concepts and basic definitions of statistical hypotheses, Neyman - Pearson's fundamental lemma (Statement and Proof). Computation of two types of errors and Power of the test (Problems).

UNIT-II: **15 Hrs**

Large Sample Tests: Large sample tests for attributes and variables; confidence intervals for mean(s), proportion(s), and correlation coefficient(s).

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UNIT-III: **15 Hrs**

Small Sample Tests: Tests of significance based on χ^2, t and F. χ^2-test for goodness of fit, Single variance and test for independence of attributes. t – test for test for single mean, two means(independent and dependent). F- test for difference of variances.

UNIT-IV: **15 Hrs**

Non-Parametric Tests: Their advantages and disadvantages, comparison with parametric tests. One sample run test, sign test and Wilcoxon-signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Wolfowitz's run test.

PRESCRIBED BOOKS:

1. Gupta, S. C., & Kapoor, V. K., Fundamentals of mathematical statistics, Sultan Chand & Sons, 2000.
2. Sanjay Arora and Bansi Lal. New mathematical Statistics, Satya Prakashan, New Delhi, 1989.
3. Hogg and Craig, Introduction to Mathematical Statistics, Printis Hall, 2019.
4. Parimal Mukhopadhyay, Mathematical Statistics, New Central Book Agency, 2000.

REFERENCE BOOKS:

1. Goon A M, Gupta M K, Das Gupta B, Fundaments of Statistics, Vol-II, The World Press Pvt. Ltd., Kolakota, 1976.
2. Hoel P.G, Introduction to Mathematical Statistics, Asia Publishing House, 1971.
3. Hogg,Tanis,Rao, Probability and Statistical Inference, Pearson, 7th edition, 2005.
4. William Feller, Introduction to Probability theory and its applications, Vol- I, Wiley Publication, 1968.
5. Sanjay Arora and BansiLal, New mathematical Statistics, Satya Prakashan, New Delhi, 1989.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Interpret point and interval estimation techniques to estimate the population mean, proportion and variance and testing procedures to real life problems.

CO2: Acquire the knowledge of large sample tests and their applications in real-life business situations.

CO3: Acquire the knowledge of inferential statistics and their applications in real-life business situations.

CO4: Acquire the knowledge of Nonparametric tests for solving various statistical problems.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Optimization Methods for Analytics

COURSE CODE: HDS323 **PPW: 4**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 4**

Effective from academic Year 2024-25

(60 Hours)

COURSE OBJECTIVE: This course aims to develop knowledge in optimization techniques and understand, formulate & tackle the difficulties of optimization problems.

UNIT-WISE COURSE OBJECTIVES:

COb1: To impart knowledge in concepts and tools of Operations Research.
COb2: Determining the Optimum solution to the LPP by using Big –M method, Dual simplex method and its extensions to dual LPP.
COb3: Model formulation and applications that are used in solving Transportation problems.
COb4: Describe the theoretical workings of the solution methods for assignment problems and demonstrate their working by hand and solver.

UNIT-I: **15 Hrs**

Linear Programming: Introduction to OR, Convex sets and their properties, Nature, Scope, Functions, Formulation of LPP - Solving the LPP by graphical method. Fundamental theorem of LPP (Only Statement). Solving the LPP by simplex method, Two - phase simplex method.

UNIT-II: **15 Hrs**

Big - M Method: Solution to LPP using Big – M method (Penalty Method) and Concept of degeneracy and resolving it.

Duality: Concept of duality, duality as LPP, Dual-Primal relationship, solving the LPP by Dual simplex method.

UNIT-III: **15 Hrs**

Transportation Problem: Definition of transportation problem, TP as a special case of LPP, Initial basic feasible solutions by North-West Corner Rule, Matrix minimum methods and VAM. Optimal solution through MODI method and stepping stone method for balanced and unbalanced.

Transportation problem, Maximization in TP, Degeneracy in TP and resolving it, Concept of Transhipment problem.

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UNIT-IV: **15 Hrs**

Assignment Problem: Concept, Mathematical Formulation, Assignment problem as special case of TP and LPP Solution, Optimal solution using Hungarian method for Balanced and Unbalanced problems, Travelling Salesman Problem.

PRESCRIBED BOOKS:

1. Kranti Swaroop, P.K. Gupta andManMohan, Operations Research, 8th Revised Edition, Sultan Chand & Sons, New Delhi, India, 2000.
2. S D Sharma, Operations Research, Kedarnath Ramnath & Co. Meerut, 2017.
3. Handy A. Taha, Operations Research: An Introduction, 10th Edition, Pearson Education Limited, 2018.

REFERENCE BOOKS:

1. Gass, Linear Programming Methods and Application, 5th Edition Paper back, Mc Graw Hill, 2011.
2. J. K. Sharma, Operation Research: theory and applications, 6th Edition, India Trinity Press, 2016.
3. K V Mittal and C Mohan, Optimizations methods in operations research and systems analysis, India New Age International, 2016.
4. Pradeep Prabhakar Pai, Operations research: principles and practice, India Oxford, 2012.
5. Wayne L. Winston, Operations Research, 4thEdition, Thomson Press, India, 2004.
6. K Rajagopal, Operations Research, India PHI learning Private Limited, 2012.
7. Frederick S. Hiller, Introduction to Operations research, India Tata McGraw Hill Education Pvt Ltd, 2010.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Identify and express a decision problem in mathematical form and solve it graphically and by Simplex method.
CO2: Explain the relationship between a linear program and its dual, including strong duality and complementary slackness.
CO3: Recognize and formulate transportation problems and drive their optimal solution.
CO4: Recognize and formulate Assignment problems and drive their optimal solution.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Data Analysis Practical using Python and TORA I

COURSE CODE: HDS322P **PPW: 2**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 1**

Effective from academic Year 2024-25

COURSE OBJECTIVE: This course aims to provide students with a broad overview of the goals, assumptions, and modes of performing Statistical Inference& Optimization techniques to interpret data using Statistical software.

COb1: Perform inference on testing of hypothesis for solving real-life problems using Python.
COb2: Optimization model and its applications are demonstrated for solving problems using TORA.

1. Test for single proportion using Python.
2. Test for difference between proportions using Python.
3. Test for single mean using Python.
4. Test for difference between means using Python.
5. Test for correlation coefficient using Python.
6. χ^2 tests for goodness of fit using Python.
7. χ^2 tests for independence of attributes using Python.
8. Solution of LP problem by Graphical method using TORA.
9. Solution of LP problem by simplex method using TORA.
10. Solution of LP problem by Big-M method using TORA.
11. Solution of LP problem by Two – phase method using TORA.
12. Determination of Optimum solution to TP using MODI algorithm using TORA.
13. Determination of Optimum assignment problem (Balanced and unbalanced) for all cases using TORA.

COURSE OUTCOMES:
At the end of the course students will be able to:

CO1: Understand the process of drawing conclusions about population or scientific truths from real-life problems.
CO2: Use classical optimization techniques and numerical methods of optimization problems using TORA.

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PROGRAM NAME: B.Sc (Honours) in Data Science

COURSE NAME: Data Engineering with Python
Effective from academic Year 2024-25

COURSE CODE: HDS324 **PPW: 4**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To equip students with the foundational knowledge and advanced techniques of data science using Python using NumPy, Pandas and Data Visualization.

UNIT-WISE COURSE OBJECTIVES:

COb1: To discuss the data science process and basics of Python.
COb2: To demonstrate the concepts of control statements, Strings and functions.
COb3: To acquire knowledge of lists, tuples, dictionaries and NumPy.
COb4: To be able to demonstrate the concepts of Pandas, Data Frames and Visualization.

UNIT-I: Introduction to Data Science process and Introduction to Python

Introduction to Data Science : Definition, Uses of Data Science, Facets of data The data science process: Overview of the data science process, defining research goals and creating a project charter retrieving data, cleaning-integrating and transforming data, Exploratory data analysis, Build the models, Presenting finding and building applications on top of them.

Introduction to Python: Python, Features of Python, Flavours of Python, Comparison between C and Python, Input and Output statements, Data types in python, Operators in Python.

UNIT-II: Control Statements, Strings and Functions

Control Statements: The if, the if-else, the if-elif-else statements, the while loop, the for loop.
Strings: Creating strings, length of a string, indexing in strings, slicing, repeating, concatenation, comparing, removing spaces, finding substring, Strings are immutable, string testing methods.
Functions: Defining a function, calling a function, Formal and Actual arguments, returning results from a function, returning multiple values from a function.

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UNIT- III: Lists and Tuples, Dictionaries, Introduction to NumPy

Lists and Tuples: Creating lists using range() function, Functions to process lists, Creating tuples, Functions to process tuples.
Dictionaries: Operations on Dictionaries, Dictionary functions.
Introduction to NumPy: The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations: min, max, and Everything in Between, Computation on Arrays: Broadcasting, Comparisons, Masks, and Boolean Logic

UNIT -IV: Data Manipulation with Pandas and Data science using Python

Data Manipulation with Pandas: Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data.
Data science using Python: Data Frame – creating Data Frame from an Excel spreadsheet, .csv files, Python Dictionary, List of Tuples and Operations on Data Frame, Data Visualization: Bar Graph, Histogram, Pie Chart, Line Graph

Prescribed Book:

1. Introducing Data Science (Big data, Machine learning and More, using Python Tools), Davy Cielen Arno D. B. Meysman Mohamed A1|2020
2. Core Python Programming, Dr.R.Nageswara Rao, Dreamtech Press, Second Edition, 2019.
3. Jake VanderPlas, "Python Data Science Handbook - Essential Tools for Working with Data", 1st edition, O'Reilly Publishers, 2017.

Reference Books:

1. Introduction to Data Science A Python Approach to Concepts, Techniques and Applications, Laura Igual · Santi Seguí, Springer Publications
2. Python for Beginners, Harsh Bhasin, New Age International (P) Ltd. Publishers, 1st Edition, 2019.
3. Learning Python, Mark Lutz, Davis Ascher, O'Reilly Media Inc, Second Edition, 2003.
4. The complete reference Python, Brown Martin C, McGraw Hill Education India, 4thEdition, 2018.

COURSE OUTCOMES: At the end of the course students will be able to

CO1: Understand the data science process and basics of Python
CO2: Write control statements, Strings and functions using Python.
CO3: Implement lists, tuples, dictionaries and NumPy.
CO4: Apply the concepts of Pandas, Data Frames and Visualization.

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PROGRAM NAME: B.Sc (Honours) in Data Science

COURSE NAME: Data Engineering with Python Lab
Effective from academic Year 2024-25

COURSE CODE: HDS324P **PPW: 2**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 1**

COURSE OBJECTIVE: To impart knowledge on Python Programming using NumPy, Pandas and Data Visualization.

COb1: To implement Python programs for Control Statements, List, Tuples and Dictionaries.
COb2: To implement Python programs for NumPy, Pandas and Data Visualization.

1. Python program to demonstrate if…else, elif.
2. Python program to demonstrate while loop.
3. Python program to demonstrate for loop.
4. Python program to demonstrate range () function.
5. Python program to demonstrate user-defined function.
6. Python program to demonstrate nested loops.
7. Python program to split the array and add the first part to the end.
8. Python program to demonstrate operations on dictionaries.
9. Python program to demonstrate functions to process lists.
10. Python program to demonstrate functions to process tuples.
11. Python program to demonstrate operations on NumPy.
12. Python program to add two matrices.
13. Write a NumPy program to create a vector with values from 0 to 20 and change the sign of the numbers in the range from 9 to 15.
14. Python program to demonstrate Aggregation functions in NumPy.
15. Python program to demonstrate Arithmetic operators implemented in NumPy.
16. Python program to demonstrate trigonometric functions and Exponents.
17. Python program to demonstrate Working with Boolean Arrays and Boolean arrays as masks.
18. Python program to demonstrate Constructing DataFrame Objects in different ways.
19. Python code to make a Pandas DataFrame with two-dimensional list.
20. Python code to demonstrate creating DataFrame from the dictionary of narray and lists.
21. Python code to demonstrate creating a Pandas Dataframe using the list of tuples.
22. Python code to demonstrate different operations to handle missing values in pandas.
23. Python program to demonstrate various operations on Data Frames.

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24. Python code to demonstrate creating Bar graph and Histogram using employee details.
25. Python code to demonstrate creating a Pie chart and Line graph using employee details.

COURSE OUTCOMES: At the end of the practical course students will be able to

CO1: Execute Python programs for Control Statements, List, Tuples, and Dictionaries..
CO2: Execute Python programs for NumPy, Pandas and Data Visualization.

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PROGRAM NAME: B Sc (Honours) Data Science

COURSE NAME: Data Structures

Effective from academic Year 2025-26
(60 Hours)

COURSE CODE: HDS325 **PPW: 4**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 4**

COURSE OBJECTIVE: To familiarize the students with concepts of Data structures algorithms.

UNIT-WISE COURSE OBJECTIVES:

CObj1: To explain the concepts of Searching and Sorting.
CObj2: To acquire knowledge of Stacks and Queues.
CObj3: To be able to demonstrate the operations on Linked Lists.
CObj4: To illustrate the concepts of Trees and Graphs.

UNIT-I: Introduction to Data Structures and Algorithms, Searching and Sorting

Introduction to Data Structures and Algorithms: Basic Terminology: Elementary Data Structure Organization, Classification of Data Structures, Operations on Data Structures.
Searching and Sorting: Introduction to Searching, Linear Search, Binary Search, Interpolation Search. Introduction to Sorting, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort.

UNIT- II: Stacks and Queues

Stacks: Introduction to Stacks, Array representation of Stacks, Operations on a Stack: Push, Pop, Peek operations, Applications of Stacks: Reversing a list, Conversion of an Infix expression into a Postfix expression, Recursion.
Queues: Introduction to Queues, Array representation of Queues, Types of Queues: Circular Queues, Priority Queues, Deques, Applications of Queues.

UNIT -III: Linked Lists, Doubly Linked Lists, Circular Linked Lists

Linked Lists: Introduction, Basic Terminologies, Linked Lists versus Arrays, Singly Linked Lists: Traversing a Linked List, Searching for a value in a Linked List, Inserting a new node in a Linked List, Deleting a node from a Linked List.
Doubly Linked Lists: Inserting a New node in a Doubly Linked List, Deleting a Node from a Doubly Linked List.
Circular Linked Lists: Inserting a New Node in a Circular Linked List, Deleting a Node from a Circular Linked List.

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UNIT-IV: Trees, Graphs

Trees: Introduction-Basic Terminology, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree: Pre-order, In-order, Post-order, Applications of Trees, Binary Search Trees, Operations on Binary Search Trees: Searching for a Node in a Binary Search Tree, Inserting a new Node in a Binary Search Tree, Deleting a Node from a Binary Search Tree.
Graphs: Introduction, Graph Terminology, Directed Graphs: Terminology of a Directed Graph, Representation of Graphs: Adjacency Matrix Representation, Adjacency List Representation, Graph Traversal Algorithms: Breadth-First Search algorithm, Depth-First Search algorithm.

Prescribed Book:

1. Data Structures and Algorithms in Java, Robert Lafore, 2nd Edition, 2002
2. Data Structures Using C, Reema Thareja, OXFORD University Press, Second Edition, 2014.

Reference Books:

1. Data Structures & Algorithms in Java, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Sixth Edition, Wiley, 2014.
2. Data Structures using Java, Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson, First Edition, 2003.
3. Data Structures Using Java ,William Ford, William Topp, 3rd Edition (2022)
4. Data Structures in Java for the Principled Programmer Authors- Duane A. Bailey Edition: 3rd Edition (2022)

COURSE OUTCOMES: At the end of the course students will be able to

CO1: Write searching and sorting programs.
CO2: Implement all the operations of Stacks and Queues.
CO3: Implement Singly Linked Lists, Doubly Linked lists and Circular Linked Lists.
CO4: Implement all the operations of Trees and Graphs.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Statistical Quality Control
Skill Enhancement Course (SEC I)

COURSE CODE: HDS326A **PPW: 2**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 2**
Effective from academic Year 2024-25

COURSE OBJECTIVE: This course aims to provide the concepts of modern quality control techniques, including the design of statistical process control systems and acceptance sampling plans.

UNIT-WISE COURSE OBJECTIVES:

CObl: To learn various statistical tools of quality monitoring.
CObl: To learn the statistical and economical design issues associated with the monitoring tools.

UNIT – I: **15 Hrs**

Statistical Quality Control: Importance of SQC in industry. Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p, np, and c- charts with fixed and varying sample sizes). Interpretation of control charts.

UNIT – II: **15 Hrs**

Acceptance sampling plans: Concept of AQL and LTPD. Producers risk and consumer's risk Single and Double sampling plans for attributes and their OC and ASN functions. Design of single and double sampling plans for attributes using Binomial and Poisson distributions.

PRESCRIBED BOOKS:

1. Gupta, S. C., & Kapoor, V. K., Fundamentals of mathematical statistics, Sultan Chand & Sons, New Delhi, 2000.
2. D. C. Montgomery, Introduction to Statistical Quality Control, John Wiley & Son, 2009.

REFERENCE BOOKS:

1. L. S. Srinath, Reliability Engineering, Affiliated East-West Press 2005.
2. Parimal Mukhopadhyay, Applied Statistics, New Central Book Agency 2000.
3. R.C.Gupta, Statistical Quality Control& Quality Management, 9th Edition, Khanna Publisher 1998.
4. Ramesh Gulati, Maintenance and Reliability Best Practices, Industrial Press2013.
5. M Mahajan, Statistical Quality Control, Dhanpat Rai & Co.(P) Limited 2016.

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6. Eugene Grant and Richard Leavenworth, Statistical Quality Control, McGraw Hill Education 2017.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Understand the philosophy and basic concepts of quality improvement, demonstrate the ability to design and interpret control charts for variables and attributes.

CO2: Perform analysis of process capability and measurement system capability.

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PROGRAM NAME: B.Sc (Honours) in Data Science

COURSE NAME: ADVANCED EXCEL
Effective from academic Year 2024-25

COURSE CODE: HDS326B **PPW: 2**
YEAR/SEMESTER: II/III **NO. OF CREDITS: 2**

COURSE OBJECTIVE: Students will be able to learn MS Excel Features and how data can be analyzed and presented effectively and efficiently using MS Excel.

COb1: To illustrate MS-Excel data manipulation techniques, functions, charts and explore the advance features as conditional formatting, data filtering, pivot tables, and pivot charts
COb2: To understand Excel Functions & VBA Concepts

UNIT-1 : Data Manipulation & Pivot Tables **15Hrs**

Introduction, Basic Elements of MS-Excel. Short Cuts in Excel , Functions and Charts-Mathematical and Statistical Functions –Date And time Functions ,Logical Functions ,Conditional Formatting –Applying Several Conditional Formatting Rules to one Cell/Table ,Filtering Data –Advanced Filters , Pivot Tables , Pivot Charts, Protecting Excel Worksheets and Workbooks

UNIT-2: Functions and VBA: **15 Hrs**

Mastering MS Excel Functions: Working with Excel's Conditional Functions, Lookup Functions, Excel's Text Based Functions, and Mastering Excel's "What If?" Tools.
Working with VBA: VBA Concepts, Preparing and Clearing UP Data with a Little VBA, Using VBA to Automate Excel Formulas, Working with Excel VBA User Forms, and Importing Data from Text files.

CO1: To acquire skills required to perform data manipulation, Functions Pivot Tables & Charts using MS Excel
CO2: To Familiarize with Excel Functions & VBA Concepts

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Prescribed Books:

1. Mastering Advanced Excel, Ritu Arora, BPB Publications
2. MS Office: Sanjay Saxena. Vikas Publishing House
3. Microsoft Office Excel 2007 step by step: Frye, Phi

Reference Books:

1. Fundamentals of Computers by Reema Thareja, Second Edition, Oxford higher Education.
2. 200+ Excel Formulas and Functions Prof. Michael McDonald Paperback_BPB Publications.
3. Advanced Excel Success, A Practical Guide to Mastering Excel- by Alan Murray. Publisher- Apress Berkeley, CA

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PROGRAM NAME: B Sc (Honours) Data Science

COURSE NAME: Linear Algebra

Effective from academic Year 2025-26

(75 Hours)

COURSE CODE: HDS421 **PPW: 5L+1T**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 5**

COURSE OBJECTIVE: This course is aimed at familiarising students with concepts in modern mathematical subject.

UNIT-WISE COURSE OBJECTIVES:

COb1: To learn concepts in Vector Space and Subspace.
COb2: To acquire knowledge about Row space, Column space, Null space and matrix of Linear Transformation.
COb3: To explain the concepts of Eigen vectors and Eigen values.
COb4: To analyse various concepts of Inner Product and orthogonality.

Unit-I: VECTOR SPACES I

Vector Space and Subspace, Linear combinations, Subspace spanned by a set, Linearly Independent and dependent sets, Basis, The co-ordinate system(No Graphical representation of coordinates, coordinate mapping and change of coordinates), The dimension of a vector space. (Chapter 4.1 ,4.3, 4.4 & 4.5)

Unit-II: VECTOR SPACES II

Null space, Column space and Row space of a matrix, Basis and dimensions of Null space, Column space and Row space of a matrix, Rank and rank theorem, Linear Transformations, Kernel and range of Linear Transformations, Matrix of a Linear Transformations. (Chapter 4.2, 4.6 & 5.4)

Unit-III: EIGEN VALUES AND EIGEN VECTORS

Eigen Values, Eigen Vectors, The characteristic Equation, Diagonalization, Complex Eigen values. (Chapter 5.1, 5.2, 5.3 & 5.5)

Unit-IV: INNER PRODUCT OF VECTORS

Inner Product, Length and Orthogonality, Orthogonal set, Gram-Schmidt Process only problems (QR Factorization not included), Orthonormal Basis. (Chapter 6.1 to 6.4)

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PRESCRIBED BOOK:

1. *David C Lay*, Linear Algebra and its Applications, Pearson Publications, 4th Edition, 2012.

REFERENCE BOOKS:

1. Introduction to Linear Algebra, S Lang, Springer Publications, 2nd Edition, 1980.
2. Linear Algebra and its Applications, Gilbert Strang, Cengage Learning5thEdition, 2014.
3. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence; Pearson India Publications,4th Edition, 2011.
4. Linear Algebra, Kuldeep Singh; Oxford University Press. ISBN-13:1stEdition, 2013.
5. Linear Algebra, Sheldon Axler; Springer Publications,3rd Edition, 2016.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Interpret properties of Vector Space and Subspace.
CO2: Compute and calculate Rank and Nullity.
CO3: Evaluate eigenvectors and Eigen values.
CO4: Summarise and synthesise the concepts in Inner Product spaces.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Linear Algebra Practicals

COURSE CODE: HDS421P **PPW: 2**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 1**

Effective from academic Year 2024-25

COURSE OBJECTIVE: Linear Algebra course will enable students to acquire further skills in the techniques as well as understanding of the principles underlying the subject.

COb1: To analyse the solutions of systems of equations using the matrix methods.

COb2: To acquire knowledge on matrices with linear transformations, Eigen values and Eigen vectors.

UNIT I

1. Let H be the set of all vectors of the form $\begin{bmatrix} -2t \\ 5t \\ 3t \end{bmatrix}$. Find a vector V in R^3 such that H=span {V}.Why does this show that H is a subspace of R^3?
2. For what values of h is V_3 in the span$\{v_1,v_2\}$. Also find for what value of $\{v_1,v_2,v_3\}$ is linearly dependent. Justify your answer.
$$v_1=\begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix}, v_2=\begin{bmatrix} -3 \\ 9 \\ -6 \end{bmatrix}, v_3=\begin{bmatrix} 5 \\ -7 \\ h \end{bmatrix}$$
3. Find the value of h for which the vectors $v_1=\begin{bmatrix} 1 \\ -2 \\ -4 \end{bmatrix}, v_2=\begin{bmatrix} -3 \\ 7 \\ 6 \end{bmatrix}, v_3=\begin{bmatrix} 2 \\ 1 \\ h \end{bmatrix}$ are linearly dependent.
4. Let $v_1=\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}, v_2=\begin{bmatrix} -2 \\ 7 \\ -9 \end{bmatrix}$. Determine if the set $\{v_1, v_2\}$ is a basis for R^3. Is it a basis for R^2?
5. The set $B=\{1+t^2, t+t^2, 1+2t+t^2\}$ is a basis for P_2. Find the coordinate vector of $P(t)=1+4t+7t^2$ relative to the basis B.
6. Find the dimension of the subspace H of R^2 spanned by $\begin{bmatrix} 1 \\ -5 \end{bmatrix}, \begin{bmatrix} -2 \\ 10 \end{bmatrix}, \begin{bmatrix} -3 \\ 15 \end{bmatrix}$

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UNIT II

7. Find bases and dimensions of Nul A and Col AFor :A=$\begin{bmatrix} 1 & 2 & 3 & -4 & 8 \\ 1 & 2 & 0 & 2 & 8 \\ 2 & 4 & -3 & 10 & 9 \\ 3 & 6 & 0 & 6 & 9 \end{bmatrix}$

8. Find bases and dimensions of Nul A and Col A

For A=$\begin{bmatrix} 2 & -1 & 1 & -6 & 8 \\ 1 & -2 & -4 & 3 & -2 \\ -7 & 8 & 10 & 3 & -10 \\ 4 & -5 & -7 & 0 & 4 \end{bmatrix}$

9. Explain your answer while solving the following:
   (i) If a 7X5 matrix A has rank 2, find dim NulA, dim Row A and rank A^T.
   (ii) If A is a 7X5 or 5X7 matrix what is the largest possible rank A?
   (iii) Could a 6X9 matrix have a two dimensional null space?
   (iv) If A is a 3X7 matrix, what is the smallest possible dimension of Nul A?

10. Define T: $P_2 \rightarrow R^2$ by $T(p)=\begin{bmatrix} p(0) \\ p(1) \end{bmatrix}$. (a) Show that T is a linear transformation.
    b) Find a polynomial p in P_2 that spans the kernel of T. (c) Describe the Range of T.

11. Define T: $P_2 \rightarrow R^3$ by $T(p)=\begin{bmatrix} p(-1) \\ p(0) \\ p(1) \end{bmatrix}$

    a) Find the image of $p(t) = 5+3t$
    b) Show that T is a linear transformation.
    c) Find the matrix for T relative to the basis $\{1, t, t^2\}$ for P_2 and the standard basis of R^3

12. a) Find $T(a_0+a_1t+a_2t^2)$, if T is the linear transformation from P_2 to P_2 whose matrix relative to $B=\{1, t, t^2\}$ is:

$$[T]_B = \begin{bmatrix} 3 & 4 & 0 \\ 0 & 5 & -1 \\ 1 & -2 & 7 \end{bmatrix}$$

    b) Let $B=\{b_1, b_2, b_3\}$ be a basis for a vector space V. Find $T(4b_1-3b_2)$ when T is a linear transformation from V to V whose matrix relative to B is : $[T]_B = \begin{bmatrix} 0 & 0 & 1 \\ 2 & 1 & -2 \\ 1 & 3 & 1 \end{bmatrix}$

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UNIT III

13. a) If $\lambda = 5$ is an Eigen value of $A = \begin{bmatrix} 0 & -3 & 1 \\ 3 & 0 & 5 \\ 2 & 2 & 6 \end{bmatrix}$

b) Is $\begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$ an Eigen vector of $A = \begin{bmatrix} -4 & 3 & 3 \\ 2 & -3 & -2 \\ -1 & 0 & -2 \end{bmatrix}$?

If so find the Eigen Value.

14. a) Is $\lambda = 4$ an Eigen value of $A = \begin{bmatrix} 3 & 0 & -1 \\ 2 & 3 & 1 \\ -3 & 4 & 5 \end{bmatrix}$?

If so find the corresponding Eigen vector.

b) Is $\lambda = 3$ an Eigen value of $A = \begin{bmatrix} 4 & 0 & -1 \\ 3 & 0 & 3 \\ 2 & -2 & 5 \end{bmatrix}$?

If so find the corresponding Eigen vector.

15. Find the characteristic equation and Eigen values of $A = \begin{bmatrix} 5 & -2 & 6 & -1 \\ 0 & 3 & -8 & 0 \\ 0 & 0 & 5 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$.

16. If $A = PDP^{-1}$ and $P = \begin{bmatrix} 5 & 7 \\ 2 & 3 \end{bmatrix}$, $D = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$ find A^4.

17. Diagonalize the matrix $A = \begin{bmatrix} 2 & -2 & -2 \\ 3 & -3 & -2 \\ 2 & -2 & -2 \end{bmatrix}$

18. Find the Eigen values and a basis for each eigen space in C^2 for the following: $A = \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$.Also find an invertible matrix P and a matrix C such that $A = PCP^{-1}$

UNIT IV

19. If $w = \begin{bmatrix} 3 \\ -1 \\ -5 \end{bmatrix}$, $x = \begin{bmatrix} 6 \\ -2 \\ 3 \end{bmatrix}$ then compute w.w,x.w, $\left(\frac{x.w}{w.w}\right)w$, and $\left(\frac{w.x}{x.x}\right)x$.

20. Let $u = \begin{bmatrix} 2 \\ -5 \\ -1 \end{bmatrix}$ and $v = \begin{bmatrix} -7 \\ -4 \\ 6 \end{bmatrix}$ compute and compare u.v, $\|u\|^2, \|v\|^2, \|u+v\|^2$

21. For vectors u,v in R^n find i) $\|u+v\|^2 + \|u-v\|^2$ ii) $\|u+v\|^2 - \|u-v\|^2$.

22. Determine which of the following sets of vectors are orthogonal:

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i) $\begin{bmatrix}-1\\4\\-3\end{bmatrix}, \begin{bmatrix}5\\2\\1\end{bmatrix}, \begin{bmatrix}3\\-4\\-7\end{bmatrix}$ ii) $\begin{bmatrix}3\\-2\\1\\3\end{bmatrix}, \begin{bmatrix}-1\\3\\-5\\4\end{bmatrix}, \begin{bmatrix}3\\8\\7\\0\end{bmatrix}$

23. Show that $u_1=\begin{bmatrix}1\\0\\1\end{bmatrix}$, $u_2=\begin{bmatrix}-1\\4\\1\end{bmatrix}$, $u_3=\begin{bmatrix}2\\1\\-2\end{bmatrix}$ is an orthogonal basis of R^3. Express $x=\begin{bmatrix}8\\-4\\-3\end{bmatrix}$ as a linear combination of u_1, u_2, u_3.
24. Let $y=\begin{bmatrix}2\\6\end{bmatrix}$ and $u=\begin{bmatrix}7\\1\end{bmatrix}$. Write y as the sum of a vector in span {u} and a vector orthogonal to u.

COURSE OUTCOMES:
At the end of the course students will be able to:

CO1: Demonstrate principle of matrix algebra to linear transformations.
CO2: Evaluate computational procedures involving Linear Algebra.

NOTE: Use MATLAB for Practicals in Unit III and Unit IV

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Applied Statistics

COURSE CODE: HDS422 **PPW: 4**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 4**

Effective from academic Year 2024-25

(60 Hours)

COURSE OBJECTIVE: This course aims to understand how to design experiments and conduct surveys efficiently for practical applications in their current or future employment.

UNIT-WISE COURSE OBJECTIVES:

COb1: To learn techniques in survey sampling with Simple Random Sampling practical applications in daily life this would be beneficial for the further research.

COb2: To learn techniques in survey sampling with Stratified and Systematic Random Sampling practical applications in daily life this would be beneficial for the further research.

COb3: Demonstrate an application of one - way and two - way analysis of variance.

COb4: Obtain the knowledge about application of Design of Experiments.

UNIT-I:

Sampling: Census and sample survey design. Non-probability sampling methods- uses and limitations, sampling frames, sampling fraction. Simple random sampling - Estimators of means and variances by SRSWR and SRSWOR. Merits and Demerits of Simple Random Sampling.

UNIT-II:

Stratified Random Sampling- Estimators of means and variances. Cost functions. Proportional and optimal allocations. Comparison of Stratified Random Sampling with SRSWOR. Gain in efficiency due to stratification. Limitations of stratified sampling.

Systematic Sampling - Estimators for means and variances. Merits and Demerits of Systematic sampling. Description of cluster sampling and of multi-stage sampling. Limitations.

UNIT-III:

Analysis of Variance (ANOVA): Concept of Gauss-Mark off linear model with examples, statement of Cochran's theorem,ANOVA – one-way, two-way classifications with one observation per cell. Expectation ofVarious sums of squares and their Statistical analysis.

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UNIT-IV:

Design of Experiments: Importance and applications of design of experiments. Principles of experimentation. Analysis of Completely Randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of the above designs.

PRESCRIBED BOOKS:

1. V. K. Kapoor and S. C. Gupta, Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi, 2000.
2. V.K.Rohatgi and A.K.Md.Ehsanes Saleh, An Introduction to probability and statistics, Wiley series, 2001.
3. Parimal Mukhopadhyay, Mathematical Statistics, New Central Book agency, 2000.

REFERENCE BOOKS:

1. Hoel P. G., Introduction to mathematical statistics, Asia Publishing house, 1966.
2. Sanjay Arora and Bansi Lal, New Mathematical Statistics, Satya Prakashan, NewDelhi, 1989.
3. Hogg and Craig, Introduction to Mathematical statistics, Printis Hall, 2019.
4. Siegal S. and Sidney, Non-parametric statistics for Behavioral Science, McGraw Hill, 1956.
5. GibbonsJ.D and Subhabrata Chakraborti, Nonparametric Statistical Inference, Marcel Dekker, 2003.
6. Conover, Practical Nonparametric Statistics, Wiley series, 1998.
7. Mood AM, Graybill F A, Boe's DC., Introduction to theory of statistics, TMH, 1974.
8. Paramiteya mariyua parameteyaparikshalu. Telugu Academy.
9. K.V.S. Sarma, Statistics Made simple do it yourself on PC, PHI, 2010.
10. Gerald Keller, Applied Statistics with Microsoft excel, Duxbury, Thomson Learning, 2001.
11. Levin, Stephan, Krehbiel, Berenson, Statistics for Managers using Microsoft Excel, 4thedition. Pearson Publication, 2005.
12. Hogg, Tanis, Rao. Probability and Statistical Inference, 7th edition, Pearson Publication, 2005.
13. Milton and Arnold (fourth Edition), Introduction to Probability and statistics, Tata McGraw Hill Publication, 2014.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Understand distinctive features of Simple Random Sampling schemes and its applications in real life.

CO2: Understand distinctive features of Stratified and Systematic Random Sampling schemes and its applications in real life.

CO3: Assess ANOVA for one-way, two –way classification, fixed effect models with equal, number of observations per cell in real time problems.

CO4: Analyze and interpret the data using Design of Experiments.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Advanced Optimization Methods for Analytics
COURSE CODE: HDS423 **PPW: 4**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 4**
Effective from academic Year 2024-25
(60 Hours)

COURSE OBJECTIVE: This course aims to provide the students with knowledge on applying various optimization techniques, which can help make decisions for practical problems in industries.

UNIT-WISE COURSE OBJECTIVES:

COb1: Understand the sequence of jobs on machines and simulation.
COb2: Understand the development of project network diagram - work out numerical problems.
COb3: To understand probabilistic models are employed in countless applications in all areas of science.
COb4: Analyze the possible outcomes of situations ranging from card games and sports to strategic price fixing, negotiation, group cooperation.

UNIT-I:

Sequencing: Processing n Jobs through 2 and 3 Machines, Processing n Jobs through m Machines and Processing 2 Jobs on n Machines.

Simulation: process of simulation, applications of simulation to different real time problems,Monte- Carlo method of simulation and Applications to queuing problems.

UNIT-II:

Network Analysis: Network fundamentals – scheduling the Activities – Fulkerson's rule – CPM earliest and latest times – determination of ES and EF in the forward pass – LS and LF in backward pass determination of critical path.

PERT- probabilistic models, calculation of CP, resources analysis and allocation.

UNIT-III:

Queuing theory: concepts of queue/ waiting line – general structure of a queuing system – operating characteristics of queues, deterministic queuing models – probabilistic queuing model single channel queuing model – Poisson arrival and exponential service times with finite and infinity population.

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UNIT-IV:

Game Theory : Concepts, Saddle point, Dominance, Zero-sum game, Two, three and more persons games, analytical method of solving two-persons zero sum game, graphical solutions for (m x 2) and (2 x n) games. Linear Programming approach for Game Theory.

PRESCRIBED BOOKS:

1. Kranti Swaroop, P.K.Gupta and ManMohan, Operations Research, 8th Revised Edition, Sultan Chand & Sons , New Delhi, India : 2000.
2. S D Sharma, Operations Research, Kedarnath Ramnath & Co. Meerut 2017.
3. Hamdy A. Taha, Operations Research: An Introduction, 10th Edition, Pearsons Education Limited 2018.

REFERENCE BOOKS:

1. Gass, Linear Programming Methods and Applications, 5th Edition Paper back, Mc Graw Hill 2011.
2. J. K. Sharma, Operation Research: theory and applications, 6th Edition, India Trinity Press 2016.
3. K V Mittal and C Mohan, Optimizations methods in operations research and systems analysis, India New Age International 2016.
4. Pradeep Prabhakar Pai, Operations research : principles and practice, India Oxford 2012.
5. Wayne L. Winston, Operations Research, 4th Edition, Thomson Press, India 2004.
6. K Rajagopal, Operations Research, India PHI learning Private Limited 2012.
7. Frederick S. Hiller, Introduction to Operations research, India Tata McGraw Hill Education Pvt Ltd 2010.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Understand the usage of Sequencing Jobs and Simulation for Solving Business Problems.

CO2: Formulate Network models for service and manufacturing systems and apply operations research techniques and algorithms to solve these Network problems.

CO3: Understand basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

CO4: Demonstrate solution methods including graphs and linear programming to analyze and solve the Two-person, zero-sum games.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Data Analysis Practical using Python and TORA II
COURSE CODE: HDS422P **PPW: 2**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 1**
Effective from academic Year 2024-25

COURSE OBJECTIVE: This course aims to provide analytical knowledge to apply the design of experiments and optimization techniques for solving large-scale problems using Statistical Softwares.

COb1: Perform inference on the design of the experimental model using Python.
COb2: Enumerate the fundamental knowledge of solving networking models, game theory, and queuing theory problems using TORA Software.

1. ANOVA for One Way using Python.
2. ANOVA for Two Way using Python.
3. Completely Randomized Design using Python.
4. Randomized Block Design using Python.
5. Network Analysis -Shortest Route using TORA.
6. Project Planning using TORA.
7. Queuing Analysis using TORA.
8. Zero-sum game theory problems using TORA.

COURSE OUTCOMES:
At the end of the course students will be able to:

CO1: Understand the process of writing code to solve the design of the experiment's real-life problems using Python.
CO2: Understand how numerical optimization techniques can be used in data modelling and how those models can be implemented in TORA.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Big Data Analytics

COURSE CODE: HDS424 **PPW: 4**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 4**

Effective from academic Year 2024-25

(60 Hours)

COURSE OBJECTIVE: To impart knowledge in students with the concepts of big data, handling huge data for analytics.

UNIT-WISE COURSE OBJECTIVES:

COb1: To inculcate knowledge on big data and technologies for handling big data.
COb2: To demonstrate the concepts of Hadoop ecosystem and NoSQL database.
COb3: To inculcate knowledge on MapReduce fundamentals, HBase and big data stack.
COb4: To illustrate the concepts of big data analytics usage in social media and text mining.

UNIT – I: Getting an overview of Big Data and Introducing Technologies for Handling Big Data

Getting an overview of Big Data: Introduction to Big Data, Structuring Big Data, Types of Data, Elements of Big Data, Big Data Analytics, Advantages of Big Data Analytics.
Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Introducing Hadoop, HDFS and MapReduce, Hadoop Functionality, Cloud Computing and Big Data, Features of Cloud Computing, Cloud Deployment Models, Cloud Services for Big Data, Cloud Providers in Big Data Market.

UNIT – II: Understanding Hadoop Ecosystem and NoSQL Data Management

Understanding Hadoop Ecosystem: Hadoop Ecosystem, Hadoop Distributed File System, HDFS Architecture, Concept of Blocks in HDFS Architecture, Namenodes and Datanodes, Features of HDFS. MapReduce. Introducing HBase - HBase Architecture, Regions, Storing Big Data with HBase, Combining HBase and HDFS, Features of HBase. Hive, Pig and Pig Latin, Sqoop, Zookeeper, Flume, Oozie.
NoSQL Data Management: Introduction to NoSQL, Benefits and Challenges of NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL Data Models, Key Value Data Model, Column-Oriented Data Model, Document Data Model, Graph Databases, Schema-Less Databases, Materialized Views, Distribution Models, CAP Theorem,Sharding.

UNIT- III: Understanding MapReduce Fundamentals and HBase, Understanding Big Data Technology Foundations

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework, Exploring the features of MapReduce, Working of MapReduce, Techniques to optimize

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MapReduce Jobs, Hardware/Network Topology, Synchronization, File system, Uses of MapReduce, Role of HBase in Big Data Processing- Characteristics of HBase.
Understanding Big Data Technology Foundations: Exploring the Big Data Stack, Data Sources Layer, Ingestion Layer, Storage Layer, Physical Infrastructure Layer, Platform Management Layer, Security Layer, Monitoring Layer, Visualization Layer, Virtualization and Big Data, Virtualization Approaches.

UNIT – IV: Understanding Analytics and Big Data, Social Media Analytics and Text Mining

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Reporting, Analysis, Analytic Process, Types of Analytics-Basic Analytics, Advanced Analytics, Operationalized Analytics, Monetized Analytics, Characteristics of Big Data Analytics, Points to consider during Analysis- Frame the Problem Correctly, Statistical Significance or Business Importance, Making Inferences versus Computing Statistics, Developing an Analytic Team- Skills Required for an Analyst, Convergence of IT and Analytics. Understanding Text Analytics.
Social Media Analytics and Text Mining: Introducing social media, Key elements of social media, Text Mining, Understanding Text Mining Process, Sentiment Analysis.

PRESCRIBED BOOK:

1. BIG DATA, Black BookTM, DT Editorial Services, DreamTech Press, 1st Edition ,2016.

REFERENCE BOOKS:

1. BIG DATA and ANALYTICS, Seema Acharya, Subhashini Chellappan, Wiley publications, 2nd Edition, 2015.
2. BIG DATA- Principles and Best Practices of Scalable Real-Time Systems, Nathan Marz and James Warren, 1st Edition, 2015.

COURSE OUTCOMES:
At the end of the course students will be able to:

CO1: Acquire knowledge on big data and technologies for handling big data.
CO2: Acquire knowledge on Hadoop ecosystem and NoSQL database.
CO3: Comprehend MapReduce fundamentals, HBase and big data stack.
CO4: Acquire knowledge on the usage of big data analytics in social media and text mining.

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PROGRAM NAME: B Sc (Honours) Data Science

COURSE NAME: Big Data Analytics Lab

Effective from academic Year 2025-26

(30 Hours)

COURSE CODE: HDS424P **PPW: 2**

YEAR/SEMESTER: II/IV **NO. OF CREDITS: 1**

COURSE OBJECTIVE: To familiarize the students with concepts of Data structure algorithms.

UNIT-WISE COURSE OBJECTIVES:

COb1: To explain the concepts of Searching and Sorting.
COb2: To acquire knowledge of Stacks and Queues.
COb3: To be able to demonstrate the operations on Linked Lists.
COb4: To illustrate the concepts of Trees and Graphs.

COURSE OBJECTIVE: To impart knowledge on Hadoop ecosystem and the usage of Basic operations on MongoDB.

COb1: To inculcate knowledge on the installation of Hadoop Pig Latin scripts and Hive.
COb2: To apply CRUD operations on MongoDB.

1. Installation of Hadoop.
2. Creating a directory in HDFS at given path(s).
3. List the contents of a directory.
4. Upload and Download a file in HDFS.
5. See contents of a file.
6. Copy file from source to destination.
7. Move file from source to destination.
8. Remove a file or directory in HDFS.
9. Display last few lines of a file.
10. Installing and running Pig, practice some Pig commands.
11. Pig Latin scripts to sortgroup, join, project and filter data.
12. Write Pig Latin scripts using eval functions to analyze your data.
13. Write Pig Latin scripts using math functions to analyze your data.
14. Write Pig Latin scripts using string functions to analyze your data.
15. Installing and running Hive, practice some Hive commands.
16. Hive to create Databases and Tables.
17. Hive to create Views, Functions and Indexes.
18. Create a new database on MongoDB
19. Create a collection using the createCollection() database method

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Computer Networks

COURSE CODE: HDS425 **PPW: 4**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 4**

Effective from academic Year 2024-25

(60 Hours)

COURSE OBJECTIVE: To familiarize the students with concepts of Computer Networks.

UNIT-WISE COURSE OBJECTIVES:

COb1: To discuss the concepts of OSI/ISO reference model and TCP /IP reference model and IP addressing system.
COb2: To demonstrate Transmission Media, Multiplexing and Error Detection.
COb3: To explain the concepts of Data Link Control, HDLC Protocol, and Local Area Networks.
COb4: To illustrate the concepts of Switching, Networking & Internetworking Devices and Routing Algorithms.

UNIT–I: Introduction and IP Addressing System

Introduction: Data Communication Components, Line Configuration, Topologies, Transmission Mode, Categories of Networks, OSI/ISO Reference Model–Layered Architecture, Functions of Layers, TCP/IP Reference Model.
IP Addressing System: Class A, Class B, Class C, Class D & Class E (Range and Usage).

UNIT–II: Transmission Media, Multiplexing and Error Detection

Transmission Media: Guided Media–Twisted Pair Cable, Coaxial Cable, Optical Fiber, Unguided Media– Satellite Communication, and Cellular Telephony.
Multiplexing: Frequency–Division Multiplexing, Time–Division Multiplexing.
Error Detection: Types of Errors, VRC, LRC, CRC, Checksum.

UNIT – III: Data Link Control, HDLC Protocol and Local Area Networks

Data Link Control: Line Discipline–ENQ/ACK, Poll/Select, Flow Control–Stop-and-Wait, Sliding Window, Error Control–Stop-and-Wait ARQ, Sliding Window ARQ, Go-Back-n ARQ, Selective-Reject ARQ.
HDLC Protocol: HDLC and HDLC Frame Structure.
Local Area Networks: Introduction to IEEE 802, Ethernet- CSMA/CD, Implementation, Token Ring,-Token Passing, Implementation.

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UNIT–IV: Switching, Networking and Internetworking Devices, Routing Algorithm

Switching: Circuit Switching, Packet Switching, Message Switching.
Networking and Internetworking Devices: Repeaters, Bridges, Routers, Gateways, Brouters, Switches.
Routing Algorithms: Distance Vector Routing Algorithm, Link State Routing Algorithm.

PRESCRIBED BOOK:

1. Data Communication and Networking (2e Update), Behrouz A. Forouzan, 2002.

REFERENCE BOOKS:

1. Data and Computer Communications, WilliamStallings, Prentice Hall, 8th Edition,2006.
2. Computer Networks, S.S. Shinde,New Age International (P) LtdPublishers,2nd Edition, 2009.
3. Computer Networks, Andrew S. Tanenbaum, David J Wetherall,Pearson Education, 5th Edition, 2012.

COURSE OUTCOMES:
At the end of the course students will be able to:

CO1: Comprehend concepts of OSI/ISO reference model and TCP /IP reference model and IP addressing system.
CO2: Decipher the Transmission Media, Multiplexing and Error Detection.
CO3: Elucidate the concepts of Data Link Control, HDLC Protocol, and Local Area Networks.
CO4: Exemplify the concepts of Switching, Networking & Internetworking Devices and Routing Algorithms.

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Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE
OF SCIENCE, HUMANITIES AND COMMERCE
(Reaccredited with 'A' grade by NAAC)
Autonomous College
Affiliated to Osmania University

PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Six Sigma and Reliability Theory
Skill Enhancement Course (SEC II)

COURSE CODE: HDS426A **PPW: 2**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 2**

Effective from academic Year 2024-25

COURSE OBJECTIVE: This course aims to provide how Six Sigma and Reliability theory can be effectively applied in manufacturing industries to improve the process and product quality.

UNIT-WISE COURSE OBJECTIVES:

COb1: Ability to put the knowledge of the Six Sigma concepts to process improvement.
COb2: Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability.

UNIT – I:

Six Sigma: Introduction, Six Sigma History and Application, Basic Six Sigma Concepts, Overview, basic Six Sigma Concepts, Quality- Critical to Quality Characteristics, Roles and responsibilities in Six Sigma Implementation, DMAIC / DMDAV methodology, Design for Six Sigma. Natural tolerance limits and specification limits, process capability index.

UNIT – II:

Reliability: Introduction. Hazard function, Exponential distribution as life model, its memory-less property, Reliability function and its estimation, System reliability - series, parallel and k out of n systems and their reliabilities.

PRESCRIBED BOOKS:

1. Michael L. George, John Maxey, The Lean Six Sigma Pocket Tool book, McGraw Hill Publication, 2005.
2. S.K.Sinha, Reliability and life testing, Wiley Eastern, 1987.
3. Michael L. George, David Rowlands, Bill Kastle, What is Lean Six Sigma, 1st Edition, McGraw Hill Education, 2005.

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REFERENCE BOOKS:

1. Thomas Pyzdek, The Six Sigma Handbook, The Complete Guide for Greenbelts, Blackbelts, and Managers at All Levels, Revised and Expanded Edition 5th Edition, 2018.
2. Thomas Pyzdek, The Six Sigma Handbook Revised and Expanded, McGraw Hill 2003.
3. Mario Vianello, PRODUCT RELIABILITY DESIGN 6, Managerial considerations and Six Sigma, Kindle Edition 2017.
4. Howard S. Gitlow , Richard J. Melnyck , David M. Levine, A Guide to Six Sigma and Process Improvement for Practitioners and Students: Foundations, DMAIC, Tools, Cases, and Certification Hardcover, Second Edition, 2015.
5. L.S.Srinath, Reliability Engineering, Affiliated East-West Press 2005.
6. Ramesh Gulati, Maintenance and Reliability Best Practices, Industrial Press, 2013.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Develop conceptual and practical understanding of six sigma, benefits/ requirements and tools used.

CO2: Attain the basic techniques of quality improvement, fundamental knowledge of reliability theory.

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PROGRAM NAME: B.Sc (Honours) in Data Science
COURSE NAME: Web Programming
Skill Enhancement Course (SEC II)

COURSE CODE: HDS426B **PPW: 2**
YEAR/SEMESTER: II/IV **NO. OF CREDITS: 2**

Effective from academic Year 2024-25

COURSE OBJECTIVE: To familiarize the students with concepts of web Programming.

UNIT-WISE COURSE OBJECTIVES:

COb1: To discuss HTML tags.
COb2: To implement the concepts of JavaScript.

UNIT-I: HTML Tags

HTML Introduction, Structure of HTML, Tags, Physical and Logical Tags, Text Formatting Tags, Image Tag, Multimedia Tags, Heading Tags, Lists Tag, Hyperlink Tag, Table Tags, Form Tags, Frame Tags.

UNIT-II: Basics of JavaScript

JavaScript Introduction, JavaScript benefits, JavaScript Basics, Data Types, Dialog Boxes, Statements, Arrays, Built-in Objects (String, Math, Document, Navigator and Window).

PRESCRIBED BOOK:

1. Web Programming Building Internet Applications, Chris Bates, Wiley, Second Edition, 2007.

REFERENCE BOOKS:

1. Internet and World Wide Web: How toprogram,Harvey M.Dietel, Paul J.Dietel, T.R.Nieto, Pearson,5th edition, 2012.
2. HTML Black Book, comprehensive problem solver, Steven Holzer –Dream Tech Press, Reprint Edition, 2008.

COURSE OUTCOMES:

At the end of the course students will be able to:

CO1: Apply HTML tags.
CO2: Elucidate concepts of JavaScript.

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