



Shri. Shamrao Patil(Yadravkar)Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)

NBA Accredited, Accredited by NAAC 'A' Grade ISO9001:2015

Teaching and Evaluation Scheme for TY B. Tech.

Department of Artificial Intelligence & Data Science Engineering
NEP Structure

(2024-25)

Semester: V





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Department: AI&DS

Rev: Course Structure/00/2023-24

Class: T.Y. B.Tech.

Semester: V

Sr. No.	Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
1	23AD3501	PCC	Data Science and Visualization	3	--	--	3	10	10	30	50	100	3
2	23AD3502	PCC	Advanced Java Programming	3	--	--	3	10	10	30	50	100	3
3	23AD3503	PCC	Design and Analysis of Algorithm	3	--	--	3	10	10	30	50	100	3
4	23AD3504	PEC	Program Elective Course I	3	--	--	3	10	10	30	50	100	3
5	23AD3505	PCC	Data Science and Visualization Laboratory	--	--	2	2	15	15	--	20	50	1
6	23AD3506	PCC	Advanced Java Programming Laboratory	--	--	2	2	15	15	--	20	50	1
7	23AD3507	PCC	Design and Analysis of Algorithm Laboratory	--	--	2	2	15	15	--	20	50	1
8	23AD3508	CEP	Mini Project – IV	--	--	2	2	25	25	--	--	50	1
9	23ADMDXX	MDM	Multidisciplinary Minor-III	3	--	--	3	10	10	30	50	100	3
10	23OEAD33	OE	Open Elective-III	3	--	--	3	10	10	30	50	100	3
11	23HSSM05	VEC	Aptitude Skills-III	1	--	--	1	25	25	--	--	50	Audit
12	23HSSM06	VEC	Language Skills-III	--	--	2	2	25	25	--	--	50	Audit
13	23AD3509	IFT	Industrial/Field Training-I	--	--	--	--	--	--	--	50	50	Audit
Total				19	--	10	29	180	180	180	410	950	22
Program Elective Course-I: 23AD3504A: Computer Networks and Security 23AD3504B: Optimization Techniques 23AD3504C: Data Warehousing and Mining				Open Elective III: 23OEAD33: Introduction to Data Science									

Multidisciplinary Minor-III

Basket	Finance & Management	Health Sciences/Science & Technology/Environment	Management & Entrepreneur Development
Semester V	Security Analysis and portfolio Management (23ADMDA3)	Medical data analytics (23ADMDB3)	Innovation, Business Models and Entrepreneurship (23ADMDC3)



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23AD3501	PCC	Data Science and Visualization	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Familiarity with Python, Basics of mathematics, Problem-solving and analytical thinking abilities

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the fundamental concepts of Data Science and Python programming used in the data science lifecycle.
CO2	Demonstrate data manipulation techniques using NumPy and Pandas.
CO3	Apply data preprocessing methods to prepare datasets for analysis.
CO4	Apply basic statistical and probability concepts on data
CO5	Make a use of Python libraries for data visualization.
CO6	Develop interactive visualizations for effective data storytelling.

Course Contents:

Unit I: Introduction to Data Science and Python Essentials Introduction to Data Science – Importance of Data Science, Real Life Example of Data Science, Applications of Data Science, Important Data Science Skills, Jobs and Career in Data Science, setting up Python Environment for Data Science, Data Types, Variables, Control Structures, and Functions in Python, Python Libraries Overview: NumPy, Pandas, Matplotlib, Working with Files (CSV, Excel), Simple Python Programming and Platform Overview	[6]
Unit II: Data Handling with NumPy and Pandas NumPy Arrays: Creation, Indexing, Slicing, Operations, Pandas Series and Data Frames: Creation, Indexing, Manipulation, Data Loading and Exporting (CSV, Excel) Data Inspection: Head, Tail, Info, Describe, Merging, Joining, and Concatenating Data Frames, Matrix Operations using NumPy, Introduction to Data Indexing & Alignment in Pandas	[6]




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Unit III: Data Preprocessing and Feature Engineering Data Pre-processing, Steps in Data Pre-processing, Uses of Data Pre-processing, Advantages/Disadvantages of Data Pre-processing, Data Cleaning, Handling Missing Data, Handling Outliers, Feature Selection, Feature Engineering, Splitting Data into Training and Testing Sets, Data Encoding (One-Hot, Label Encoding).	[6]
Unit IV: Statistical Analysis and Probability for Data Science Statistical Analysis, Importance of Statistical Analysis, Descriptive Statistics: Mean, Median, Mode, Variance, Std. Dev, Probability Concepts and Distributions, Correlation and Covariance, Data Sampling Techniques, Hypothesis Testing: Z-Test, T-Test, Chi-Square (Intro Level), Use of Scipy and Statsmodels, P-value and Significance Level, Statistical Correlation Matrix and Interpretation.	[6]
Unit V: Exploratory Data Analysis & Visualization with Matplotlib and Seaborn Introduction to Data Visualization, Line, Bar, Histogram, and Pie Charts using Matplotlib, Plot Customization: Titles, Labels, Legends, Subplots, Seaborn for Statistical Visualization: Boxplot, Violin, Countplot, Pairplot, Heatmaps and Visual Correlation Matrix, Saving and Exporting Visualizations, Introduction to EDA and its Workflow, Visualizing Relationships, Distributions, and Trends, basics of Time-Series Plots and Decomposition, Case Study on Real-World Datasets (e.g., Titanic, Iris)	[6]
Unit IV: Advanced Data Visualization Interactive time-series visualization, Interactive Plots using Plotly, Geographical Data Visualization using Folium, Word Clouds and Bubble Charts, Dashboards using Plotly/Bokeh Dash (Basic Overview), Creating Dashboards using Streamlit (Intro), Geographical Visualization using GeoPandas, Sentiment Analysis and Visualization (e.g., Tweets/Reviews), Data Storytelling Project (e.g., COVID-19 or IPL Dataset)	[6]
Text Books: - 1. Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking by Foster Provost and Tom Fawcett 2. The Art of Data Science by Roger D. Peng and Elizabeth Matsui 3. Data Preparation for Machine Learning by Jason Brownlee	
Reference Books: - 4. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic 5. Fundamentals of Data Visualization by Claus O. Wilke	




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23AD3502	PCC	Advanced JAVA Programming	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Java Programming.

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a GUI application using swing components.
CO2	Make use of event Handling concepts by using appropriate event classes, listener interfaces.
CO3	Construct applications that interact with relational databases using JDBC for data connectivity, manipulation, and retrieval.
CO4	Take part in Servlets with HTML forms and databases for dynamic content generation.
CO5	Make use of Java Server pages to implement dynamic web pages.
CO6	Design database-driven applications using Hibernate ORM framework by applying concepts of object-relational mapping, annotations.

Course Contents:

Unit I: GUI Programming Using Swing Introduction to JFC and Swing, Difference between AWT and Swing, Features of the Java Foundation Classes, Swing Components: Swing Classes Hierarchy, Commonly used Methods of Component class (add(), setSize(), setLayout(), and setVisible()), JApplet, JFrame, JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JComboBox, JMenu, Advanced Swing Components(JTabbedPane, JScrollPane, JTree, JTable, JProgressBar, JSlider, JDialog) Layout Management: Flow Layout, Border Layout, Card Layout, Box Layout, Grid Layout, Gridbag Layout	[6]
Unit II: Event Handling Event Handling: Introduction, Action Events, Key Events, Focus Events, Window Event, Mouse Event, Item Events, TextEvent, EventListener Interface: ActionListener, KeyListener, FocusListener, WindowListener, MouseListener, MouseMotionListener, ItemListener, Event Handling using Adapter Classes.	[6]
Unit III: JDBC Programming Two-Tier Database Design, Three-Tier Database Design JDBC- advantages and disadvantages, JDBC drivers, The JDBC API: The API components, Steps to Establish JDBC Connection (DriverManager, Connection, Statement), database operations like, CRUD(Create, Read, Update, Delete) operations using SQL Queries	[6]



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using Statement and PreparedStatement, Retrieving Data using ResultSet Develop java program using JDBC	
Unit IV: Servlet API and Overview Introduction to servlet, The life cycle of a servlet, Developing and deploying servlets, ServletRequest, ServletResponse Interfaces, Handling HTTP methods(GET, POST), Servlet config and Servlet context, Session Management using Cookies and HttpSession	[6]
Unit V: Java Server Pages Introduction to JSP: problem with Servlet, lifecycle of JSP, JSP Scripting elements (Scriptlets, Expressions, Declarations), JSP Directives (page, include, taglib), JSP Actions(Standard Actions), Implicit objects in JSP, Custom tags, Integrating JSP with Servlets	[6]
Unit VI: Hibernate Introduction to Hibernate, Exploring the architecture of Hibernate, Hibernate O/R mapping (ORM), Hibernate Annotation, CRUD operation using Hibernate API.	[6]
Text Books:- 1. "JAVA: The Complete Reference", Herbert Schildt, Ninth Edition, Oracle Press. 2. "Internet & Java Programming", R.Krishnamoorthy and S.Prabhu, New Age Publication.	
Reference Books:- 1. "Beginning JAVA", Ivor HortonWileyIndia. 2. "Java: The Complete Reference", Eleventh Edition by Herbert Schildt Oracle. 3. "JAVA 8 Programming: Black Book", DreamtechPress. 4. "Core Java Volume I - Fundamentals", Cay S. Horstmann, Gray Connell, Pearson. 5. "Core Java Volume II - Fundamentals", Cay S. Horstmann, Gray Connell, Pearson. 6. "Advanced Java Programming", Uttam K.Roy, Qxford. 7. "Java Persistence with Hibernate", Christian Bauer, Gavin King, Dreamtech Press	




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23AD3503	PCC	Design and Analysis of Algorithm	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of data structure

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand basics of algorithm and analyze performance of different algorithms using Divide and conquer.
CO2	Understand greedy Approach and Analyze the performance by taking different examples
CO3	Understand dynamic approach and Analyze the performance by taking different examples.
CO4	Design algorithm by applying backtracking technique.
CO5	Understand and Design NPHard and NPComplete Problems
CO6	Understand concepts of branch and bound, compare performance with backtracking.

Course Contents:

Unit I: Divide and Conquer What is an algorithm, Algorithm Specification, Performance Analysis, and Randomized Algorithm, Divide and Conquer-The general method, Binary search finding the maximum and minimum, Merge sort, Quick sort, Selections or analysis of the algorithms	[6]
Unit II: Greedy Method The general method, Activity Selection Problem, Huffman Coding Knapsack problem, Job sequencing with deadlines Minimum-cost spanning trees-Prim's and Kruskal's Algorithms, Optimal storage on tapes, Optimal merge patterns analysis Single source shortest paths notations.	[6]
Unit III: Dynamic Programming Introduction, Characteristics of Dynamic Programming, Shortest paths: Bellman Ford, Floyd, Warshall, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, Reliability design, Traveling Salesperson problem.	[6]
Unit IV: Basic Traversal and Search Techniques and Backtracking Techniques for Binary Trees, Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, AND/OR graphs; Backtracking Concept, N-Queens Problem, Four-Queens Problem, Eight-Queens Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem.	[6]



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Unit V: NP-Hard and NP-Complete Problems Basic Concepts: NP Complete Problems, Hard Graph Problems.	[6]
Unit VI: Branch and Bound Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and dynamic programming, Comparisons between Backtracking and greedy programming, Branch and Bound.	[6]
Textbooks: - 1. Fundamentals of Computer Algorithms – Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press, Second Edition 2. Fundamentals of Algorithmics – Gilles Brassard, Paul Bratley (Pearson Education) 3. Computer Algorithms: Introduction to Design and Analysis – Sara Baase, Allen Van Gelder (Pearson Education / Addison-Wesley, 2nd Edition) 4. Introduction to Algorithms – Thomas H. Cormen et al., PHI Publication, 2nd Edition, 2002	
Reference Books: - 1. Mastering Algorithms with C – Kyle Loudon (O'Reilly) 2. Algorithm Design: Foundations, Analysis & Internet Examples – Michael Goodrich, Roberto Tamassia, Wiley Publication, 2nd Edition, 2006 3. Computer Algorithms: Introduction to Design and Analysis – Sara Baase, Addison-Wesley Publication, 2nd Edition (<i>This one is repeated in your list; keep it as a reference if already used as a textbook</i>)	



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Program Elective Course-I

23AD3504A	PEC	Computer Networks and Security	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Illustrate the fundamentals of computer networks.
CO2	Analyze the layered architecture of network protocols and compare the OSI and TCP/IP model, functionalities of key protocols across the Application, Transport, and Network layers
CO3	Explain Computer security and Information hazard in various situations.
CO4	Apply cryptographic algorithms to maintain security.
CO5	Analyze various authentication mechanisms.

Course Contents:

Unit I: Building Blocks of Computer Networks Fundamentals of Computer Network- Definition, Need of Computer Network, Network Benefits, Computer Network Classifications, Network Topologies - Introduction, Definition, Types of Topologies, Network Control Devices - Need of Network Control devices, Role of Network Control devices in a Network.	[6]
Unit II: Layered Network Architecture: OSI and TCP/IP Models Protocol Hierarchies- Layered Approach, -Interfaces, Services. Protocols and Packets, -Design issues for layering-OSI reference Model: Layers and their functions. TCP/IP Protocol: Layers and their functions, -OSI Model Vs. TCP/IP	[7]
Unit III: Core Network Protocols Application layer name system (DNS), Dynamic Host Configuration Protocol (DHCP), File Transfer Protocol (FTP), Hypertext Transfer Protocol(HTTP), Simple Mail Transfer Protocol (SMTP).Transport layer-TCP, UDP. Network Layer- IP, ICMP, ARP, RARP.	[5]
Unit IV: Introduction to Computer Security Introduction, The Need for Security, Principles of Security-Confidentiality, Integrity, Availability, Authentication, Non-repudiation, Access Control. Types of Attacks-Passive attacks, Active attacks.	[6]



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Unit V: Cryptography Introduction: Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption. Substitution Techniques, Transposition Techniques. Steganography: Symmetric and Asymmetric cryptography- Introduction to Symmetric Encryption, Asymmetric key cryptography- Digital Signature.	[7]
Unit VI: User Authentication Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Biometrics Authentication, Kerberos.	[5]
Text Books: - 1. Cryptography and Network Security-Atul Kahate 2. Cyber Laws And IT Protection-Harish Chander	
Reference Books: - 1. Computer Networks- Andrew S. Tanenbaum 2. Cryptography and Network Security- S.Bose, P.Vijayakumar	




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Program Elective Course-I

23AD3504B	PEC	Optimization Techniques	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic knowledge of mathematics, calculus, and linear algebra.

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand the fundamental concepts of optimization techniques.
CO2	Identify and apply different types of optimization methods.
CO3	Implement optimization techniques in real-world AI & Data Science problems.
CO4	Compare heuristic and metaheuristic approaches for problem-solving.
CO5	Apply optimization algorithms in machine learning and deep learning models.
CO6	Analyze the impact of optimization technique in various domains.

Course Contents:

Unit I: Introduction to Optimization Basics of optimization —Definition and Scope of Optimization, how to formulate the problem, Applications in AI & Data Science Types of Optimization Problems: Linear vs. Nonlinear, Constrained vs. Unconstrained Mathematical Background: Functions, Gradients, and Hessians	[6]
Unit II: Classical Optimization Techniques Unconstrained Optimization: Gradient Descent, Newton's Method, Constrained Optimization: Lagrange Multipliers, Kuhn-Tucker Conditions, Convex vs Non-Convex Optimization, Examples from Regression and Neural Networks	[6]
Unit III: Heuristic and Metaheuristic Optimization Introduction to Heuristics: Hill Climbing, Simulated Annealing, Genetic Algorithms (GA) and Evolutionary Computation, Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO), Comparison of Heuristic vs Exact Methods	[6]
Unit IV: Optimization in Machine Learning and Deep Learning Optimization in Training Neural Networks, Gradient-Based Optimization: SGD, Adam, RMS Prop, Hyperparameter Optimization: Grid Search, Random Search, Bayesian Optimization, Reinforcement Learning, and Policy Optimization	[6]



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Unit V: Real-World Applications of Optimization Optimization in AI and Data Science Applications, Portfolio Optimization in Finance, Supply Chain and Logistics Optimization, Optimization in Natural Language Processing (NLP)	[6]
Unit VI: Advanced Optimization Techniques and Future Trends Quantum Optimization & Evolutionary Strategies, Swarm Intelligence & Deep Reinforcement Learning Optimization, Multi-Objective Optimization Case Studies: Optimization in Robotics and Healthcare	[6]
Text Books: - 1. Fundamentals of Optimization, Author: Olvi L.Mangasarian, Edition:2nd Edition (2008), Publisher: Springer 2. Numerical Optimization, Author: Jorge Nocedal and Stephen J. Wright, Edition: 2nd Edition (2006), Publisher: Springer 3. Introduction to Evolutionary Algorithms, Author: A. E. Eiben, J. E. Smith, Edition: 1st Edition (2003), Publisher: Springer	
Reference Books: - 1. Introduction to Optimization, Author: Pablo Pedregal, Edition:2ndEdition (2014), Publisher: Springer, 2. Optimization for Machine Learning, Author: Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright, Edition: 1st Edition (2011), Publisher: MIT Press. 3. Handbook of Optimization in Complex Networks, Author: Mostafa H. El-Nashar, Yang Shi, Edition:1st Edition (2021), Publisher: Wiley-IEEE Press. 4. Swarm Intelligence, Author: Eric Bonabeau, Marco Dorigo, and Guy Theraulaz, Edition:1st Edition (1999), Publisher: Oxford University Press	




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Program Elective Course-I

23AD3504C	PEC	Data Warehousing and Mining	3-0-0	3Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs./week	CA 1: 10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Statistics, Database Management:

Course Outcomes:

CO1	Demonstrate Data warehouse and modeling.
CO2	Develop Data warehouse design, usage, and Implementation.
CO3	Demonstrate Data mining concepts.
CO4	Analyze the concept of association-based rules technique and usage of association algorithm.
CO5	Analyze the concept of classification algorithms.
CO6	Analyze the concept of clustering and clustering algorithm.

Course Contents:

Unit I: Data Warehouse: Basic Concepts and Modeling. Basic Concepts: Introduction, A multitier Architecture, Data Warehouse. Models: Enterprise warehouse, data mart, and virtual warehouse, Extraction, Transformation, and Loading, Metadata Repository. Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP operations, Star net Query Model for Querying multidimensional databases.	[6]
Unit II: Data Warehouse: Design, Usage, Implementation. Design, Usage: A Business Analysis Framework for data warehouse design, Data warehouse design process, Data warehouse usage for information processing, Online analytics processing to multidimensional data Mining. Implementation: Efficient. Data cube Computation: An Overview, Indexing OLAP Data: Bitmap Index and Join Index, Efficient Processing of OLAP Queries, OLAP server architectures: ROLAP versus MOLAP versus HOLAP.	[6]
Unit III: Data Mining Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity,	[6]



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Unit IV: Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.	[6]
Unit V: Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.	[6]
Unit VI: Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms.	[6]
Text Books: - 1. Jiawei Han, Micheline Kamber, Jian Pei (2012), Data Mining: Concepts and Techniques, 3 rd edition, Elsevier, United States of America.	
Reference Books: - 1. Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2nd edition, Pearson Education, New Delhi, India. 2. Amitesh Sinha (2007), Data Warehousing, Thomson Learning, India. 3. Xingdong Wu, Vipin Kumar (2009), The Top Ten Algorithms in Data Mining, CRC Press, UK.	




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23AD3505	PCC	Data Science and Visualization Laboratory	0-0-2	1 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 2hr/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Basics of Python Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Demonstrate the ability to perform statistical analysis
CO2	Experiment comprehensive exploratory data analysis,
CO3	Demonstrate the capability to integrate data science and visualization techniques
CO4	Develop interactive data dashboards using tools like Dash

List of Experiments:

- Any 10 experiments.

1. To study basics of data science. Load a dataset (e.g., CSV, Excel) and perform basic data exploration (head, tail, info, describe).
2. Handle missing data by applying different strategies (mean/mode/median imputation, dropping rows/columns).
3. Perform data normalization/standardization.
4. Perform data transformation (log transformation, one-hot encoding, etc.).
5. Compute basic statistical measures (mean, median, mode, standard deviation, and variance) for a given dataset.
6. Perform hypothesis testing (t-test, chi-square test) on a sample dataset.
7. Explore correlations between different features using a correlation matrix.
8. Create basic plots (line plot, bar chart, histogram) using Matplotlib/Seaborn.
9. Visualize distributions using box plots, violin plots, and pair plots.
10. Create a heatmap to visualize correlations between variables.
11. Use Plotly or Bokeh to create interactive visualizations.
12. Perform a complete EDA on a real-world dataset (e.g., Titanic, Iris) using Pandas, Seaborn, and Matplotlib.
13. Perform Statistical Analysis and Matrix Operations Using NumPy.
14. Create a time-series plot and perform time-series decomposition.
15. Use Geopandas/Folium to create geographical visualizations.
16. Create a dashboard using Dash or Streamlit to visualize multiple aspects of a dataset.



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| 17. Choose a real-world dataset and perform end-to-end data analysis, from data cleaning to visualization. |
| 18. Analyze sentiment in text data (e.g., tweets, reviews) and visualize the sentiment distribution. |




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23AD3506	PCC	Advanced Java Programming Laboratory	0-0-2	1Credit
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Teaching Scheme	Evaluation Scheme
Practical:2hrs/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Java Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a GUI application using swing components.
CO2	Make use of event-handling concepts by using appropriate event classes, listener interfaces.
CO3	Construct applications that interact with relational databases using JDBC for data connectivity, manipulation, and retrieval.
CO4	Take part in Servlets with HTML forms and databases for dynamic content generation.
CO5	Make use of Java Server pages to implement dynamic web pages.
CO6	Design database-driven applications using Hibernate ORM framework by applying concepts of object-relational mapping, annotations.

List of Experiment:

1.	Develop a program to create login form using Swing Components.
2.	Develop a program to demonstrate a progressbar showing progress value in percentage by using set values.
3.	Develop a program to Implement Traffic signal(Red, Green and Yellow) by using Swing components (Using JFrame, JRadioButton, ItemListener etc.)
4.	Develop a program to mouse motion adapter class to implement only one method, mouse dragged.
5.	Develop a program using JDBC to display student's record (Enroll No, Name, Address, Mobile No,and Email-ID) into table 'StuRec'
6.	Develop a program using JDBC to edit (insert, update, delete) Student's profile stored in the database
7.	Develop a program simple servlet to display "Welcome to Servlet Programming".
8.	Develop a program servlet that handles GET and POST methods differently.
9.	Develop a servlet for demonstrating the concept of session and cookies.
10.	Create a form that accepts the user's name and age. Display the submitted data on the next JSP page
11.	Develop a JSP page that demonstrates the use of declaration, scriptlet, and expression.



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12.	Develop an application to store, update, fetch and delete data of Employee (NAME, AGE, SALARY and DEPARTMENT) using Hibernate CRUD operations.
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23AD3507	PCC	Design and Analysis of Algorithm Laboratory	0-0-2	1 Credit
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Teaching Scheme	Evaluation Scheme
Practical: 2hrs/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites:

Course Outcomes:

CO1	Design and implement algorithm by taking simple problems.
CO2	Implement the algorithm on greedy Approach and Analyze the performance.
CO3	Develop an algorithm on dynamic approach and Analyze the performance.
CO4	Implement algorithm by applying backtracking technique.
CO5	Design and Implement algorithm on NP Hard and NP Complete Problems
CO6	Implement algorithm on branch and bound technique.

List of Experiments:

1	Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements.
2	Implement Quick Sort algorithm and determine the time required to sort the elements
3	Implement Insertion Sort algorithm and determine the time required to sort the elements
4	Implement Heap Sort algorithm and determine the time required to sort the elements
5	From a given vertex in a weighted connected graph, find the shortest paths to other vertices using Dijkstra's algorithm
6	Find the Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm
7	Implement the All-Pairs Shortest Paths Problem using Floyd's algorithm.
8	Implement 0/1 Knapsack problem using Dynamic Programming.
9	Implement N Queens problem using Backtracking.



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23AD3508	CEP	Mini Project - IV	0-0-2	1 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 2hrs/week	CA-I: - 25Marks CA-II: -25Marks

Pre-Requisites: Mini Project, Mini Project II
About Hackathon

The project is a part of addressing societal and industrial needs. Hackathon is one of the platforms where students will solve real world challenges. This Course focuses on the selection of methods/engineering tools/analytical techniques for problem solving.

Through this course, students will gain the understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills and responsibility

Course Outcomes: At the end of the course, students will be able to:

CO1	Select the appropriate method for solving the problem
CO2	Make use of various engineering techniques and tools to give a solution
CO3	Justify the methods /tools used to develop the solution
CO4	Design / simulate the model/ project work
CO5	Describe the solution with help of a project report and presentation
CO6	Conclude the outcomes of project.

Course Contents:

Week 1: Survey Design-1 - Ensure case study group students have made necessary communication and done a preparatory visit. - Watch the lecture on survey design and study the notes. - Prepare a questionnaire and try it out with your group members as mock.	[2]
Week 2: Survey Design-2 - Review survey questionnaire prepared by case study groups. - Decide sampling strategy. - Prepare a detailed schedule for fieldwork	[2]



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Week 3: Fieldwork • Data Collection: Collect quantitative data (e.g., statistics, usage metrics) and qualitative data (e.g., user stories, testimonials). • Use data collection tools like questionnaires, observation checklists, and digital analytics. • Ensure data accuracy and reliability through proper sampling and recording methods. • 25% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 4: Trails and Experimentation-1 • Initial Setup and Configuration • Concept Validation • Feasibility Testing	[2]
Week 5: Trails and Experimentation-2 • Prototyping • Functionality Testing	[2]
Week 6: Trails and Experimentation-3 • Bug Identification and Fixing • Integration Testing • Security Testing • 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 7: Results • Coordinator has to check and verify below points in term of result: • Functional Performance • Accuracy and Precision • Efficiency • Safety	[2]
Week 8: Validation • Coordinator has to check and verify below points in term of validation: • Testing and Verification • Compliance with Standards • 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 9: Integration Testing • Validate that the hardware integrates seamlessly with other systems or components as intended • Perform compatibility tests with software, other hardware, and network systems.	[2]
Week 10: Documentation and Reporting • Maintain comprehensive documentation of design, development, testing, and validation processes • Provide detailed reports on test results, issues found, and corrective actions taken.	[2]



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Week 11: Final Presentation • 100% Presentation has to be conducted by mentor/guide based on above activity. • Prototype/Final Software solution is mandatory at the time of final presentation along with report	[2]
Week 12: Exhibition • Mini project exhibition will be scheduled with interdepartmental evaluation.	[2]




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Multidisciplinary Minor-III

23ADMDA3	MDM	Security Analysis and Portfolio Management	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2:10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand the Basics of Security Analysis
CO2	Interpret Fundamental Analysis for Investment Decision-Making
CO3	Understand Technical Analysis for Market Trends and Trading Strategies
CO4	Understand and Manage Investment Portfolios Using AI & ML
CO5	Understand and Manage Risk Using Derivatives & AI Techniques
CO6	Understand Ethical, Legal, and Compliance Aspects in Finance

Course Contents:

UNIT I: Introduction to Security Analysis 1 Basics of Investment, Speculation, and Gambling 2 Financial Markets: Stock Market, Bond Market, Forex, and Derivatives 3 Types of Securities: Equity, Debt, Mutual Funds, ETFs, Derivatives 4 Risk & Return Concepts: Measuring Investment Performance 5 Market Efficiency & Behavioral Finance Basics	[6]
UNIT II: Fundamental Analysis 1 Understanding Financial Statements (Balance Sheet, Income Statement, Cash Flow) 2 Ratio Analysis: Profitability, Liquidity, and Solvency Ratios 3 Economic Analysis: Macroeconomic Factors & Business Cycles 4 Industry & Sector Analysis: Growth vs. Value Investing 5 Valuation Models: DCF (Discounted Cash Flow), P/E Ratio, Price-to-Book Ratio 6 AI-based Fundamental Analysis & Sentiment Analysis	[6]
UNIT III: Technical Analysis 1 Introduction to Technical Analysis & Market Psychology 2 Chart Patterns: Candlestick, Head & Shoulders, Double Top/Bottom 3 Technical Indicators: Moving Averages, RSI, MACD, Bollinger Bands 4 Trend Analysis & Momentum Indicators 5 Algorithmic Trading & AI-based Technical Analysis	[6]



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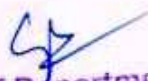


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6 High-Frequency Trading & Machine Learning in Market Predictions	
UNIT IV: Portfolio Management 1 Portfolio Theory: Diversification & Modern Portfolio Theory (MPT) 2 Risk-Return Tradeoff & Efficient Frontier 3 Capital Asset Pricing Model (CAPM) & Beta Analysis 4 Factor Models: Arbitrage Pricing Theory (APT) 5 Portfolio Performance Evaluation: Sharpe Ratio, Treynor Ratio, Jensen's Alpha 6 AI & Machine Learning in Portfolio Optimization	[6]
UNIT V: Derivatives & Risk Management 1 Introduction to Derivatives: Futures, Options, Swaps 2 Options Pricing Models: Black-Scholes Model & Binomial Model 3 Hedging & Speculation Using Derivatives 4 Value-at-Risk (VaR) & Risk Assessment Models 5 AI-driven Risk Management & Predictive Analytics in Finance 6 Case Studies on AI-powered Financial Risk Management.	[6]
UNIT VI: Ethical & Legal Aspects of Investment & Trading 1 Ethical Considerations in Investment & Trading 2 Insider Trading & Market Manipulation 3 SEBI Regulations & Compliance in Indian Financial Markets 4 AI in Fraud Detection & Financial Security 5 ESG (Environmental, Social, Governance) Investing 6 Future Trends in AI & Data Science for Finance	[6]
Text Books: 1. "Security analysis and portfolio management", Kevin S. Edition: third edition 2. "Technical Analysis of the Financial Markets" by John J. Murphy 3. "Modern Portfolio Theory and Investment Analysis" by Edwin J. Elton, Martin J. Gruber, Stephen J. Brown, and William N. Goetzmann	
Reference Books: - 1. "Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk" by Richard C. Grinold and Ronald N. Kahn 2. "Artificial Intelligence in Financial Markets: Cutting Edge Applications for Risk Management, Portfolio Optimization, and Economics" edited by Christian L. Dunis, Peter W. Middleton, Andreas Karathanasopolous, and Konstantinos Theofilatos	




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Multidisciplinary Minor-III

23ADMDB3	MDM	Medical Data Analytics	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the data science processing
CO2	Explain the healthcare data analytics with machine learning and deep learning algorithms for health data analysis
CO3	Apply the data management techniques for healthcare data
CO4	Analyze the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
CO5	Evaluate health data analytics for real time applications
CO6	Design emergency care system using health data analysis

Course Contents:

Unit I: Introduction to data science Introduction to Data Science- Evolution of Data Science –Data Science process, Data Collection and Data Pre-Processing- Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning and Munging, Exploratory Data Analysis- Descriptive Statistics – Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis	[6]
Unit II: Introduction to healthcare data analytics Overview -History of Healthcare Analysis Parameters on medical care systems, Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning, Bayes Theorem, Weighted sum approach, Electronic Health Records– Components of EHR, Benefits of EHR	[6]
Unit III: Analytics on machine learning Machine Learning– Pre-processing, Visualization, Feature Selection – Training model parameter – Evaluation model: Sensitivity, Specificity, PPV, NPV, FPR, Accuracy, ROC, Precision, Recall Curves, Python: Variables and types, Data Structures, Pandas Data Frame: Operations, Scikit –Learn: Pre-processing, Feature Selection.	[6]
Unit IV: Healthcare Management IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical	[6]

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Prediction Models – Visual Analytics for Healthcare.	
Unit V: Healthcare and deep learning Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.	[6]
Unit VI: Advanced data analytics for healthcare Review of clinical trials, Prediction Models. Statistical Prediction Models, Alternative Clinical Prediction Models, Survival Models, Predictive Models for Integrating Clinical and Genomic Data, Data Analytics for Pervasive Health, Fraud Detection in Healthcare, Pharmaceutical Discoveries and Clinical Decision Support Systems.	[6]
Text Books: 1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015. 2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018. 3. Introducing Data Science Big Data, Machine Learning, And More, Using Python Tools Davy Cielen, Arno D. B. Meysman, Mohamed Ali	
References Book: 1. Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018 2. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016. 3. Kulkarni, Siarry, SinghAbraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.	




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Multidisciplinary Minor-III

23ADMDC3	MDM	Innovation, Business Models and Entrepreneurship	3-0-0	3Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CAI:10marks CAII:10marks Mid Semester Exam:30marks End Semester Exam:50marks

Course Outcomes: At the end of the course, students will be able to:

CO1	Discuss the concepts of Innovation
CO2	Analyze the best practices of Innovation and Entrepreneurship
CO3	Apply concepts of innovation and entrepreneurship for business decision-making.

Course Contents:

Unit I: An Introduction, Innovation in Current Environment, Types of Innovation, School of Innovation, Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent Vs Convergent Thinking, Levers of Idea Management	[6]
Unit II: Experimentation in Innovation Management, Idea Championship, Participation for Innovation, Co-creation for Innovation, Prototyping to Incubation. What is a Business Model, who is an Entrepreneur, Social Entrepreneurship, Blue Ocean Strategy-I, Blue Ocean Strategy-II	[6]
Unit III: Marketing of Innovation, Technology Innovation Process, Technological Innovation Management Planning, Technological Innovation Management Strategies, Technology Forecasting	[6]
Unit IV: Sustainability Innovation and Entrepreneurship, Types of Sustainable Entrepreneurship, Conditions for Sustainable Innovation, Exploration of business models for material efficiency services.	[6]
Unit V: Management of Innovation, creation of IPR, Management of Innovation, creation of IPR, Types of IPR, Patents in India, Copyrights and other important IP	[6]
Unit VI: Business Models and value proposition, Business Model Failure: Reasons and Remedies, Incubators: Business Vs Technology, Managing Investor for Innovation,	[6]



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Future markets and Innovation needs for India.	
Text Books: 1. 8 Steps to Innovation: Going from Jugaad to Excellence- Book by Rishikesha T. Krishnan and Vinay Dabholkar 2. Innovation and Entrepreneurship Book by Peter Drucker 3. HBS series on Innovation and Entrepreneurship	
Reference Books: 1. "Managing Innovation: Integrating Technological, Market and Organizational Change", by Joe Tidd & John Bessant, Wiley publications 2. "The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators", by Jeff Dyer, Hal Gregersen, and Clayton M. Christensen, Harvard Business Review Press.	




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23HSSM05	VEC	Aptitude Skills-III	1-0-0	Audits
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Teaching Scheme	Evaluation Scheme
Lecture:1hrs/week	CA I: 25marks CAII: 25mark

Pre-Requisites: Aptitude Skills I and II

Course Outcomes:

CO1	Solve the problems on system of equation
CO2	Solve the problems on seating arrangement
CO3	Solve the logical reasoning problems
CO4	Solve the critical analysis problems
CO5	Solve the problems of Data interpretation
CO6	Solve the problems, permutations, and combinations

Course Contents:

Unit I: System of equations Quadratic equations, Surds and indices, solution of equations, Ages,	[2]
Unit II: Seating Arrangements Linear seating Arrangement, Circular seating arrangement, Complex seating arrangement	[2]
Unit III: Logical Reasoning Numerical based on sense of direction, Blood relations, odd man out	[2]
Unit IV: Critical analysis Clocks and Calendar based problems, Cryptarithmic, heights and distances	[2]
Unit V: Data Interpretation Table form, Bar form, Line for Pi chart form	[2]
Unit VI: Permutation and Combination Permutations and combinations	[2]

Text Books:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Evaluation", S.Chand Publisher,2016 edition.
2. Quantitative Aptitude for CATTMH Publications
Vedic Math's Made Easy By Dhaval Bhatiya, Jaico Publication House.



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Reference Books:

1. Rao N.D.V. Prasada, Wren & Martin High School English Grammar and Composition Book, S Chand Publishing, 2017
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press; Second edition
3. RS Aggarwal, Objective General English, S. Chand Publisher; 2016 edition




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23HSSM06	VEC	Language Skills-III	0-0-2	Audits
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Teaching Scheme	Evaluation Scheme
Lecture:2hrs/week	CAI: 25 marks CAII: 25 marks

Pre-Requisites: Language Skill I & II

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a program to read input and return output.
CO2	Develop a program using data types, Strings and variables
CO3	Develop a program using Unary, Binary and Ternary operator
CO4	Develop a program using Conditional and Logical statements.

Course Contents:

1. Write a Python program to print "Hello, World!" o Objective: Understand basic syntax, indentation, and output.	[2]
2. Write a program to demonstrate the use of different types of comments in Python. o Objective: Single-line and multi-line comments.	[2]
3. Write a Python program that declares different types of variables and displays their data types using the type() function. o Objective: Variables, data types, and type identification.	[2]
4. Write a program to demonstrate type casting and type conversion between int, float, and string. o Objective: Type conversion, casting functions.	[2]
5. Write a Python script to perform string operations such as slicing, concatenation, upper(), lower(), and len(). o Objective: String manipulation and built-in functions.	[2]
6. Write a program to demonstrate the use of all arithmetic, logical, and bitwise operators. o Objective: Operator functionality.	[2]
7. Write a Python program to use membership and identity operators with examples. o Objective: in, not in, is, is not.	[2]
8. Write a Python program using a ternary operator to find the larger of two numbers. o Objective: Conditional (inline) expressions.	[2]




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9. Write a program that takes user input for age and prints whether the person is a child, teenager, adult, or senior citizen using if-elif-else. ○ Objective: Conditional statements and user input.	[2]
10. Write a program to find the sum of the first 10 natural numbers using a while loop. ○ Objective: Looping with while.	[2]
11. Write a Python script to display the multiplication table of a number using a for loop. ○ Objective: Looping with for and range().	[2]
12. Write a program that uses break, continue, and pass statements in appropriate looping scenarios. ○ Objective: Loop control statements.	[2]
Text Books: 1. Python Projects (Author: Laura Cassell, Alan Gault) Wrox publication 2. Murach's Python Programming. UT.: Michael Urban, Joel Murach, Murach's Publication.	
Reference Books: 1. Fundamentals of Python (First Program) Cengage MINDTAP Publication 2nd Edition. Author: K.A. Kambert	




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23AD3509	IFT	Industrial/Field Training- I	0-0-0	Audit
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Teaching Scheme	Evaluation Scheme
Lecture: NA	End Semester Exam: 50 marks

Course Contents:

Course Description
Internship / Training is educational and career development opportunity, providing practical experience in a field or discipline. At the end of the fourth semester, every student should undergo practical training in an industry / professional organization / Research laboratory with the prior approval of the HoD/TPO/Principal of the college and submit the report along with the completion certification from the Industry/ Organization. The report will be evaluated during the fifth semester by the department.
Course Learning Outcomes: -
After successful completion of the course, students will be able to
1. Verify the Technical knowledge in real industrial situations.
2. Develop interpersonal communication skills.
3. Discuss activities and functions of the industry in which the Internship/training has done.
4. Write the technical report.
Prerequisite: - Basics of Programme Engineering, Good written and Oral Communication.
Guideline for Students: -
1. Arrive at work as per schedule, ready to work and stay for the agreed upon time.
2. Present yourself in a professional manner at all times, including being appropriately dressed at workplace.
3. Communicate any concerns with your supervisor and the internship/Training coordinator in a timely manner and respectfully.
4. Demonstrate enthusiasm and interest in what you are doing, ask questions, and take the initiative as appropriate.
5. Complete and submit assigned tasks by designated timelines. Meet all deadlines.
Student's Diary/ Daily Log
The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.
The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor.




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Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the SITCOE immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

Internship Report

After completing the internship, the student should prepare a comprehensive report to indicate what he/she has observed and learned in the training period. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The competent authority should sign the training report. The Internship report should be evaluated on the basis of following criteria:

- i. Originality.
- ii. Adequacy and purposeful write-up.
- iii. Organization, format, drawings, sketches, style, language etc.
- iv. Variety and relevance of learning experience.
- v. Practical applications, relationships with basic theory and concepts taught in the course.

Evaluation of Internship/Training

The student should be evaluated based on his training report and presentation, before an expert committee constituted by the concerned department as per norms. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report




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Teaching and Evaluation Scheme for TY B. Tech.
Department of Artificial Intelligence & Data Science Engineering
NEP Structure
(2024-25)
Semester: VI





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Department: AI&DS

Rev: Course Structure/00/2023-24

Class: T.Y. B.Tech.-

Semester: VI

Sr. No.	Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
1	23AD3601	PCC	Machine Learning	3	--	--	3	10	10	30	50	100	3
2	23AD3602	PCC	Web Technology	3	--	--	3	10	10	30	50	100	3
3	23AD3603	PEC	Program Elective Course-II	3	--	--	3	10	10	30	50	100	3
4	23AD3604	PEC	Program Elective Course-III	3	--	--	3	10	10	30	50	100	3
5	23AD3605	PCC	Machine Learning Laboratory	--	--	2	2	15	15	--	20	50	1
6	23AD3606	PCC	Web Technology Laboratory	--	--	2	2	15	15	--	20	50	1
7	23AD3607	VSEC	Advanced-Data Visualization	--	--	4	4	15	15	--	20	50	2
8	23AD3608	PROJ	Capstone Project Phase-I	--	--	4	4	25	25	--	50	100	2
9	23ADMDXX	MDM	Multidisciplinary Minor-IV	3	--	--	3	10	10	30	50	100	3
10	23HSSM07	VEC	Aptitude Skills-IV	1	--	--	1	25	25	--	--	50	Audit
11	23HSSM08	VEC	Language Skills-IV	--	--	2	1	25	25	--	--	50	Audit
Total				16		14	29	170	170	150	360	850	21
Program Elective Course-II: 23AD3603A: Software Modelling and Architecture 23AD3603B: Cognitive Computing and NLP 23AD3603C: Big Data Analytics				Program Elective Course-III 23AD3604A: Blockchain Management for AI 23AD3604B: Computer Vision 23AD3604C: Distributed System									



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Course Category	PCC	OE	PEC	MDM	CEP	VSEC	Project	VEC	Total
Cumulative Credits	20	3	9	6	1	2	2	-	43
NEP Guideline	18-22	2	12	6	-	2	2	-	40-44

Multidisciplinary Minor-IV

Basket	Finance& Management	Health Sciences/Science & Technology/Environment	Management &Entrepreneur Development
Sem VI	Data Science for business (23ADMDA4)	Medical image processing (23ADMDB4)	Engineering Econometrics (23ADMDC4)



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23AD3601	PCC	Machine Learning	3-0-0	3 Credits
Teaching Scheme		Evaluation Scheme		
Lecture:3hrs/week		CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks		

Pre-Requisites: Linear Algebra, Probability and Statistics

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the fundamental concepts of Machine Learning.
CO2	Make use of supervised and unsupervised learning algorithms for solving the problems.
CO3	Infer suitable hypotheses using the foundations of Computational Learning Theory
CO4	Solve problems using concepts of neural networks.

Course Contents:

Unit I: Introduction to Machine Learning Well-posed learning problems, types of learning, hypothesis space and inductive bias, Machine Learning Lifecycle, Basic ML concepts- labels, training/testing sets, Evaluation & Performance Metrics, Cross-validation, Applications of Machine Learning.	[6]
Unit II: Supervised Learning I Basics of supervised learning, Simple & Multiple Linear Regression, Decision Tree, K-Nearest Neighbor, Overfitting, Underfitting.	[6]
Unit III: Supervised Learning II Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM, Probability and Bayes learning.	[6]
Unit IV: Unsupervised Learning Basics of unsupervised learning, Clustering- K-Means Clustering, Hierarchical Clustering, DBSCAN, Dimensionality Reduction- Principal Component Analysis (PCA), Recommendation System.	[6]
Unit V: Computational Learning Theory Definition and significance of Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.	[6]
Unit VI: Introduction to Deep Neural Networks Structure of a Neural Network, Perceptron, Importance of weights, biases, and activation functions, Multilayer Networks and Back Propagation, Deep Neural Networks-Introduction to CNN and RNN.	[6]



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Text Books:

1. Machine Learning, Tom Mitchell, First Edition, McGraw Hill, 1997.
2. Introduction to Machine Learning, Second Edition Ethem Alpaydm, The MIT Press
Cambridge, Massachusetts London, England

Reference Books:

1. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, The MIT Press
Cambridge, Massachusetts London, England
2. Machine Learning for Absolute Beginners: A Plain English Introduction, Third
Edition, Oliver Theobald




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23AD3602	PCC	Web Technology	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database Management Systems, Computer Networks and Security

Course Outcomes: At the end of the course, students will be able to:

CO1	Implement and analyze the behavior of web pages using HTML and CSS
CO2	Apply the client-side technologies for web development
CO3	Analyze the concepts of Servlet and JSP
CO4	Analyze the Web services and frameworks
CO5	Apply the server-side technologies for web development
CO6	Create the effective web applications for business functionalities using latest web Development platforms.

Course Contents:

Unit I- Web Essentials and Markup language-HTML The Internet, basic internet protocols, the World Wide Web, HTTP Request message, HTTP response message, web clients, web servers. HTML: Introduction, history and versions. HTML elements: headings, paragraphs, line break, colors and fonts, links, frames, lists, tables, images, and forms, Difference between HTML and HTML5. CSS: Introduction to Style Sheet, CSS features, CSS core syntax, Style sheets and HTML, Style rule cascading and inheritance, text properties. Bootstrap.	[6]
Unit II- Client-Side Technologies: JavaScript and DOM JavaScript: Introduction to JavaScript, JavaScript in perspective, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built-in objects, JavaScript debuggers. DOM: Introduction to Document Object Model, DOM history and levels, intrinsic event Handling, modifying element style, the document tree, DOM event handling, jQuery, Overview of Angular JS.	[6]
Unit III- Servlet and XML Servlet: Servlet architecture overview, A "Hello World" servlet, Servlets generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, other Servlet capabilities, data storage, Servlets concurrency, databases(MySQL), and JavaServlets.	[6]



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XML: XML documents and vocabularies, XML declaration, XML Namespaces, DOM-based XML processing, transforming XML documents, DTD: Schema, elements, attributes.	
Unit IV- JSP and Web Services JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-view-controller paradigm, JSP related technologies. Web Services: Web Service concepts, Writing a Java Web Service, Writing a Java web service client, Describing Web Services: WSDL, Communicating Object data: SOAP. Struts: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.	[6]
Unit V- Server Side Scripting Languages PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling, files, cookies, session tracking, using MySQL with PHP, WAP and WML. ASP.NET: Introduction, Overview of the .NET Framework, Overview of C#, Introduction To ASP.NET, ASP.NET Controls, Web Services. Overview of Node JS.	[6]
Unit VI-Ruby and Rails Introduction to Ruby: Origins & uses of Ruby, scalar types and their operations, simple input and output, control statements, fundamentals of arrays, hashes, methods, classes, code blocks and iterators, pattern matching. Introduction to Rails: Overview of Rails, Document Requests, Processing Forms, Rails Applications and Databases, Layouts, Rails with Ajax. Introduction to EJB.	[6]
Text Books: 1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035. 2. Robert W. Sebesta, "Programming the World Wide Web", 4th Edition, Pearson Education, 2008.	
Reference Books: - 1. Marty Hall, Larry Brown, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930. 2. H. M. Deitel, P. J. Deitel and A. B. Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429. 3. Chris Bates, "Web Programming Building Internet Applications", 3 rd Edition, Wiley India, 2006. Xue Baietal, "The Web Warrior Guide to Web Programming", Thomson, 2003.	



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Program Elective Course-II

23AD3603A	PEC	Software Modeling and Architecture	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Java Programming

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain Software Modeling Concepts
CO2	Understand Static Modeling Techniques
CO3	Interpret Dynamic Modeling Techniques
CO4	Describe Software Architecture and Quality Attributes
CO5	Understand Architectural Design and Documentation
CO6	Identify and Explain Design Patterns

Course Contents:

Unit I-Concepts of Software Modeling Software Modeling: Introduction to Software Modeling, Advantages of modeling, Principles of modeling. Evolution of Software Modeling and Design Methods: Object oriented analysis and design methods, Concurrent, Distributed Design Methods and Real-Time Design Methods, Model Driven Architecture (MDA), 4+1 Architecture, Introduction to UML, UML building Blocks, COMET Use Case-Based Software Life Cycle. Requirement Study: Requirement Analysis, SRS design, Requirements Modeling. Use Case: Actor and Use case identification, use case relationship (Include, Extend, Use case Generalization, Actor Generalization), Use case template.	[6]
Unit II-Static Modeling Study of classes (analysis level and design level classes). Methods for identification of classes: RUP (Rational Unified Process), CRC (Class, Responsibilities and Collaboration), Use of Noun Verb analysis (for identifying entity classes, controller classes and boundary classes). Class Diagram: Relationship between classes, Generalization/Specialization Hierarchy, Composition and Aggregation Hierarchies, Associations Classes, Constraints. Object diagram, Package diagram, Component diagram, Composite Structure diagram, Deployment Diagram.	[6]



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Unit III-Dynamic Modeling Activity diagram: Different Types of nodes, Control flow, Activity Partition, Exception handler, Interruptible activity region, Input and output parameters, Pins. Interaction diagram: Sequence diagram, Interaction Overview diagram, State machine diagram, Advanced State Machine diagram, Communication diagram, Timing diagram.	[6]
Unit IV-Software Architecture and Quality Attributes Introduction to Software Architecture, Importance of Software Architecture, Architectural Structure and Views. Architectural Pattern: common module, Common component-and-connector, Common allocation. Quality Attributes: Architecture and Requirements, Quality Attributes and Considerations.	[6]
Unit V-Architectural Design and Documentation Architecture in the Life Cycle: Architecture in Agile Projects, Architecture and Requirements, Designing and Architecture. Documenting Software Architecture: Notations, Choosing and Combining views, Building the documentation Package, Documenting Behavior, Documenting Architecture in an Agile Development Project.	[6]
Unit VI-Design Patterns Design Patterns: Introduction, Different approaches to select Design Patterns. Creational patterns: Singleton, Factory, Structural patterns: Adapter, Proxy. Behavioral Patterns: Iterator, Observer Pattern with applications.	[6]
Text Books: 1. Jim Arlow, Ila Neustadt, "UML 2 and the unified process –practical object-oriented analysis and design", Addison Wesley, Second edition, ISBN 978-0201770605. 2. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Second Edition, Pearson, ISBN 978-81-775-8996-2 3. Erich Gamma, "Design Patterns", Pearson, ISBN 0-201-63361-2.	
Reference Books: 1. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures", Cambridge University Press, 2011, ISBN 978-0-521-76414-8 2. Gardy Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education, Second edition, 2008, ISBN 0-321-24562 3. Ian Sommerville, "Software Engineering", Addison-Wesley, ISBN 0-13-703515-2	



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Program Elective Course-II

23AD3603B	PEC	Cognitive Computing and NLP	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture: 3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Python programming, ML Libraries

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand the fundamental concepts of cognitive computing and natural language processing.
CO2	Understand the architecture and workflow of cognitive systems using NLP techniques.
CO3	Make use of Advanced Analytics with cognitive computing
CO4	Understand the business implications of cognitive computing
CO5	Develop a prototype solution using cognitive and big data technologies.

Course Contents:

Unit 1: Foundation of Cognitive Computing Cognitive computing as a new generation, the uses of cognitive systems, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, and understanding cognition. Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into the cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.	[6]
Unit 2: Fundamentals of Natural Language Processing Introduction to NLP: Basic concepts of Natural Language Processing. NLP Techniques: Text processing, tokenization, stemming, lemmatization. Language models: N-grams, Bag of Words, TF-IDF, Part-of-Speech (POS) tagging, Named Entity Recognition (NER)	[6]
Unit 3: Natural Language Processing in support of a Cognitive System Role of NLP in a cognitive system, semantic web, Applying Natural Language Technologies to Business problems. Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.	[6]



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Unit 4: Relationship between Big Data and Cognitive Computing Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion, and streaming data, integration of big data with traditional data. Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open-source tools on advanced analytics.	[6]
Unit 5: The Business Implications of Cognitive Computing Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business-specific solutions, making cognitive computing a reality, cognitive application changing the market.	[5]
Unit 6: The process of building a cognitive application Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing. Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, building on a foundation of big data analytics, cognitive applications across the health care ecosystem, starting with a cognitive application for healthcare.	[7]
Text Books: 1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data" (O'Reilly) 2. Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Stanford University	
Reference Books: 1. Vijay V. Raghavan, Heikki Topi, "Cognitive Computing: Theory and Applications", Elsevier. 2. Peter Fingar, "Cognitive Computing: A Brief Guide for Game Changers", Meghan-Kiffer Press	




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Program Elective Course-II

23AD3603C	PEC	Big Data Analytics	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database Management System, Data Structures

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline big data with challenges and nature of data.
CO2	Explain data streaming and sampling with its process.
CO3	Demonstrate different case studies in big data.
CO4	Summarize framework Hadoop to store and process big data.
CO5	Illustrate the applications of big data using MapReduce.
CO6	Illustrate the applications of big data using Pig and Hive.

Course Contents:

Unit I: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent Data Analysis, Nature of Data.	[6]
Unit II: Analytic Processes and Tools - Analysis vs. Reporting, Introduction To Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments.	[6]
Unit III: Counting Oneness in a Window, Decaying Window Real Time Analytics Platform (RTAP) Applications - Case Studies -Real Time Sentiment Analysis- Stock Market Predictions.	[6]
Unit IV: Introduction of Hadoop- the Hadoop Distributed File System, Components of Hadoop, Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS Java interfaces to HDFS Basics- Developing a Map Reduce Application.	[6]
Unit V: How Map Reduce Works-Anatomy of a Map Reduce Job run- Failures- Job Scheduling- Shuffle and Sort – Task execution - Map Reduce Types and Formats-Map Reduce Features Hadoop environment.	[6]



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Unit VI: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zoo Keeper	[6]
Text Book: - 1. "Big Data: Principles and Paradigms" By Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi (Morgan Kaufmann / Elsevier) 2. "Big Data Analytics" By Seema Acharya & Subhashini Chellappan (Wiley India) 3. "Big Data Fundamentals: Concepts, Drivers & Techniques" By Thomas Erl, Wajid Khattak, Paul Buhler (Prentice Hall)	
Reference Books: - 1) Frank J Ohl horst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, 2013. 2) Colleen McCue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier, Second Edition, 2015. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007.	




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Program Elective Course-III

23AD3604A	PEC	Blockchain Management for AI	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: knowledge of cryptography, distributed systems, and computer networks.

Course Outcomes: At the end of the course, students will be able to:

CO1	Interpret the fundamentals and basic concepts in Blockchain
CO2	Compare the working of different blockchain platforms
CO3	Use a Crypto wallet for cryptocurrency-based transactions
CO4	Analyze the importance of blockchain in finding the solution to real-world problems.
CO5	Illustrate the Ethereum public blockchain platform
CO6	Identify a relative application where blockchain technology can be effectively used and implemented.

Course Contents:

Unit I: Mathematical Foundation for Blockchain Cryptography: Symmetric Key Cryptography and Asymmetric Key Cryptography, Elliptic Curve Cryptography (ECC), Cryptographic Hash Functions: SHA256, Digital Signature Algorithm (DSA), Merkel Trees. Case Studies: Compare the Symmetric and Asymmetric Cryptography algorithms	[6]
Unit II: Feature Engineering History, Centralized Vs. Decentralized Systems, Layers of Blockchain: Application Layer, Execution Layer, Semantic Layer, Propagation Layer, Consensus Layer, Why is Block chain important? Limitations of Centralized Systems, Blockchain Adoption So Far. Case Studies: Study of a research paper based on Blockchain.	[6]
Unit III: Blockchain Platforms and Consensus in Blockchain Types of Blockchain Platforms: Public, Private, and Consortium, Bitcoin, Ethereum, Hyperledger, IoTa, Corda, R3. Consensus in Blockchain: Consensus Approach, Consensus Elements, Consensus Algorithms, Proof of Work, Byzantine Generals Problem, Proof of Stake, Proof of Elapsed Time, Proof of Activity, Proof of Burn. Case Studies: Compare different consensus algorithms used in Blockchain Technology.	[6]
Unit IV: Cryptocurrency– Bitcoin and Token Introduction, Bitcoin and the cryptocurrency, Cryptocurrency Basics, Types of	[6]



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Cryptocurrencies, Cryptocurrency Usage, Crypto wallets: MetaMask, Coinbase, Binance. Case Studies: Create your own wallet for cryptocurrency using any of the Blockchain Platforms.	
Unit V: Blockchain in Ethereum Platform using Solidity What is Ethereum, Types of Ethereum Networks, EVM(Ethereum Virtual Machine), Introduction to smart contracts, Purpose and types of Smart Contracts, Implementing and deploying smart contracts using Solidity, Swarm (Decentralized Storage Platform), Whisper (Decentralized Messaging Platform) Case Studies: Study Truffle Development Environment.	[6]
Unit V: Blockchain Case Studies Blockchain Applications, Retail, Banking and Financial Services, Government Sector, Healthcare, IOT, Energy and Utilities, Blockchain Integration with other Domains. Case Studies: Study use cases of Blockchain and write a detailed report on every aspect implemented in the same	[6]
Text Books: - 1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Blockchain Technology: Cryptocurrency and Applications, Oxford University Press, 2019. 2. Melanie Swan, "Blockchain: Blueprint for a New Economy, "O'Reilly, 2015. 3. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.	
Reference Books: - 1. Daniel Drescher, "Blockchain Basics", Apress;1st Edition, 2017. 2. Anshul Kaushik, "Blockchain and Crypto Currencies", Khanna Publishing House, Delhi. 3. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.	




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Program Elective Course-III

23AD3604B	PEC	Computer Vision	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Python, Linear Algebra, Digital Image Processing, ML

Course Outcomes: At the end of the course, students will be able to:

CO1	Understanding and explaining the fundamentals of computer vision, including image formation, sensing, and pre-processing techniques.
CO2	Understanding of image formation fundamentals and transformations.
CO3	Applying key features to images and understanding key point detection algorithms
CO4	Understanding and applying image segmentation techniques for identifying regions and objects.
CO5	Applying clustering algorithms for pattern analysis and recognizing patterns in images.
CO6	Applying basic morphological operations such as erosion, dilation, and transformations.

Course Contents:

Unit I- Foundation of Computer Vision Computer Vision Overview - Computer Imaging Systems – Lenses - Image Formation and Sensing - Image Analysis - Pre-processing and Binary Image Analysis - Mathematical morphology.	[6]
Unit II-Image Formation and Processing Fundamentals of Image Formation - Transformation: Orthogonal – Euclidean – A fine and Projective. Edge Detection - Edge Detection Performance - Corner Detection - Fourier Transform - Convolution and Filtering - Image Enhancement - Restoration - Histogram Processing.	[6]
Unit III-Feature Extraction Edges - Canny - LOG, Line Detectors (Hough Transform), Corners - Harris and Hessian A fine, Orientation Histogram - SIFT, HOG, SURF, Scale - Space Analysis - Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Case study: Human Iris location - Generalized Hough Transform (GHT) - Spatial Matched Filtering - GHT for ellipse detection - GHT for feature collation	[6]




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Unit IV-Image Segmentation Region Growing - Edge Based approaches to segmentation - Graph-Cut - Mean Shift - MRFs, Texture Segmentation - Object detection - 3D object recognition - 3D reconstruction - Introduction to Motion - Parametric motion – Spline-based motion.	[6]
Unit V-Pattern Analysis Clustering: Clustering: K-Means - K-Medoids - Mixture of Gaussians - Classification: Discriminant Function, Supervised - Unsupervised - Semi supervised; Classifiers: Bayes – KNN - ANN models; Dimensionality Reduction: PCA – LDA – ICA - Non-parametric methods.	[6]
Unit VI- Morphological Image Processing Preliminaries, Erosion and Dilation, opening and closing, Hit-or-miss transform, and some basic morphological algorithms. Feature Extraction: Background, Boundary preprocessing (Boundary following & Chain codes only). Image pattern Classification: Background, Patterns, and classes, Pattern classification by prototype matching (Minimum distance classifier only).	[6]
Text Books: 1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2011. 2. 2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003	
Reference Books: - 1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004 2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990. 3. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.	




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Program Elective Course-III

23AD3604C	PEC	Distributed System	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database Management Systems, Computer Networks, and Security

Course Outcomes: At the end of the course, students will be able to:

CO1	Summarize the theoretical aspects of distributed database systems
CO2	Construct queries using SQL in database creation and interaction
CO3	Construct algorithms for Transaction and Deadlock management
CO4	Experiment with Distributed and Parallel Database
CO5	Analyze Distributed Object Database Management Systems and Object-Oriented Data Model
CO6	Elaborate current Trends in distributed databases

Course Contents:

Unit I: Introduction Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture, Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	[6]
Unit II: Query processing and decomposition Query processing and decomposition: Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms	[6]
Unit III: Transaction Management Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	[6]
Unit IV: Distributed DBMS Reliability Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning.	[6]



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Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	
Unit V: Distributed object Database Management Systems Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. Object Oriented Data Model: Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	[6]
Unit VI: Current Trends in Distributed Database Data Delivery Alternatives Data Warehousing World Wide Web Push-based Technologies Mobile Databases. Real Application Clusters(RAC) Cloud based databases	[6]
Text Book:- 1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001. 2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.	
Reference Book:- 1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition	




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23AD3605	PCC	Machine Learning Laboratory	0-0-2	1 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 2hr/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Python Programming, Data Science

Course Outcomes: At the end of the course, students will be able to:

CO1	Make use of supervised learning algorithms to build Machine Learning Models.
CO2	Build Machine Learning Model using clustering technique.
CO3	Design a recommendation system by extracting and analyzing item features.
CO4	Design and implement a simple neural network using backpropagation for classification tasks.

List of Experiments:

1.	Develop Machine Learning model using Linear Regression.
2.	Develop Machine Learning model using Decision Tree.
3.	Develop Machine Learning model using K-Nearest Neighbor.
4.	Build Machine Learning classifier using Logistic Regression.
5.	Develop Machine Learning model using Support Vector Machine.
6.	Construct a Machine Learning Model using the Naïve Bayes Algorithm.
7.	Use K-Means Algorithm for performing clustering task.
8.	Develop a Recommendation system.
9.	Develop a Machine Learning model using Ensemble Learning.
10.	Build a simple neural network using backpropagation.




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23AD3606	PCC	Web Technology Laboratory	0-0-2	1 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 2hr/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Database Management Systems, Computer Networks, and Security

Course Outcomes: At the end of the course, students will be able to:

CO1	Implement and analyze behavior of web pages using HTML and CSS
CO2	Apply the client-side technologies for web development
CO3	Analyze the concepts of Servlet and JSP
CO4	Analyze the Web services and frameworks
CO4	Apply the server-side technologies for web development
CO5	Create the effective web applications for business functionalities using latest web development platforms.

List of Experiments:

1	Create a simple web page using HTML that includes: Headings, Paragraphs, Line breaks, Colors (background, text), Fonts, Links, Images and Tables.
2	Create a simple form with input fields, radio buttons, and a submit button.
3	Add CSS to style a button and apply hover effects.
4	Create a simple web page layout using Bootstrap.
5	Design and implement a simple calculator using JavaScript for operations like addition, multiplication, subtraction, division, square of a number, etc.
6	Write a simple servlet that prints "Hello World" when accessed through a browser.
7	Write a program that uses DOM (Document Object Model) to parse an XML document and extract data.
8	Create a simple JSP page that displays a message.
9	Write a simple PHP program to demonstrate variables, data types, and basic arithmetic operations.
10	Write a program of conditional statements using Ruby.




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23AD3607	VSEC	Advanced Data Visualization	0-0-4	2 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 4hr/week	CA I: 15 Marks CA II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites:

Course Outcomes:

CO1	Understand Power BI fundamentals and data visualization concepts.
CO2	Apply ETL techniques in Power BI for data transformation.
CO3	Apply data modeling techniques and basic DAX expressions in Power BI.
CO4	Design and develop interactive data visualizations in Power BI.
CO5	Apply dashboard design and storytelling techniques in Power BI.
CO6	Apply Power BI Service features for report publishing and collaboration.

List of Experiment:

1	Introduction to Power BI Interface and Data Loading
2	Importing and Transforming Data using Power Query Editor
3	Creating Basic Visualizations: Bar, Column, and Pie Charts
4	Designing Interactive Dashboards using Slicers and Filters
5	Working with Time Series Data: Line and Area Charts
6	Visualizing Geographical Data using Map Visuals
7	Creating Hierarchies and Implementing Drill-Down Features
8	Using DAX to Create Calculated Columns and Measures
9	Building KPIs and Summary Cards for Business Insights
10	Publishing and Sharing Reports on Power BI Service




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23AD3608	PROJ	Capstone Project Phase I	0-0-4	2 Credits
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Teaching Scheme	Evaluation Scheme
Practical: 4hr/week	CA I: 25 Marks CA II: 25 Marks End Semester Exam: 50 Marks

Pre-Requisites: All courses

Course Outcomes: At the end of the course, students will be able to:

CO1	State the exact title of the project and problem definition.
CO2	Explain the motivation, objectives and scope of the project.
CO3	Review the literature related to the selected topic of the project.
CO4	Design the mechanism, components of the system and prepare detailed drawings.
CO5	Evaluate the cost considering different materials/manufacturing processes.

Course Contents:

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work, the submission of the report and assessment should be done at the end of VII Sem.

The project work should consist of any of the following or appropriate combination:

1. A comprehensive and up-to-date survey of literature related to study of a phenomenon or product.
2. Design of any equipment and / or its fabrication and testing.
3. Critical Analysis of any design or process for optimizing the same.
4. Experimental verification of principles used in applications related to various specializations related to Mechanical Engineering.
5. Software development for particular applications.
6. A combination of the above.

It is expected that the students should complete at least 50% of the total project work in VI Semester. The objective is to prepare the students to examine any design or process or phenomenon from all angles, to encourage the process of independent thinking and working and to expose them to industry. The students may preferably select the project works from their opted elective subjects. The students should submit the report in a prescribed format, before the end of VII semester. The report shall be comprehensive and presented typed on A+ size sheets and bound. Number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.



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Multidisciplinary Minor-IV

23ADMDA4	MDM	Data Science for Business	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database Management Systems, Computer Networks and Security

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand Fundamental Concepts of Data Science
CO2	Apply Data Science in Business Decision-Making
CO3	Summarize Business Data Collection, Storage, and Preprocessing
CO4	Evaluating Business Analytics & Descriptive Analytics
CO5	Outline Prescriptive Analytics & Optimization Techniques.
CO6	Demonstrate Ethical, Privacy, and Responsible AI Considerations

Course Contents:

UNIT I: Introduction to Data Science Definition of Data Science- Big Data and Data Science hype – and getting past the hype - Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model – Overfitting. Basics of R: Introduction, R Environment Setup, Programming with R, Basic Data Types.	[6]
Unit II: Introduction to Data Science for Business 1 Fundamentals of Data Science & Business Intelligence 2 Role of AI & ML in Business Decision-Making 3 Data-Driven vs. Rule-Based Decision-Making 4 Case Studies: How Businesses Leverage AI & Data Science 5 Key Challenges in Business Data Science Implementation 6 Industry Applications: Finance, Retail, Healthcare & Marketing	[6]
Unit III: Business Data Collection, Storage & Preprocessing 1 Business Data Sources (CRM, ERP, Web, IoT, social media, etc.) 2 Data Warehousing & Data Lake Concepts 3 Data Cleaning: Handling Missing, Duplicate & Noisy Data 4 Feature Engineering: Creating Business-Relevant Features 5 Structured vs. Unstructured Data Handling (SQL vs. NoSQL) 6 Cloud-Based Data Storage & Management (AWS, Google Cloud, Azure)	[6]



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Unit IV: Business Analytics & Descriptive Analytics 1 Key Performance Indicators (KPIs) & Business Metrics 2 Customer Behavior Analytics & Market Basket Analysis 3 Financial Data Analysis & Forecasting for Business Decision-Making 4 Dashboards & Reports for Business Intelligence 5 Customer Lifetime Value (CLV) & Retention Analysis 6 Sentiment Analysis for Brand Reputation & Customer Insights	[6]
Unit V: Prescriptive Analytics & Optimization for Business 1 Prescriptive Analytics: From Insights to Business Actions 2 Decision Trees & Random Forests for Business Strategies 3 Optimization Techniques for Business Resource Allocation 4 AI-driven Pricing Strategies & Dynamic Pricing Models	[6]
Unit VI: Ethics, Privacy, and Responsible AI in Business Data Science 1 Ethical Considerations in Business AI & Data Science 2 Data Privacy Laws: GDPR, CCPA & Business Compliance 3 Bias & Fairness in AI Decision-Making for Business 4 AI Explain ability & Interpretability for Business Models 5 Cyber security Challenges in Business AI Systems 6 Ethical AI Governance & Risk Management	[6]
Text Books: - 1. "Data Science for Business" – Foster Provost & Tom Fawcett 2. "Business Analytics: Data Analysis & Decision Making" – S. Christian Albright, Wayne L. Winston 3. "Artificial Intelligence in Business: Creating Value with Machine Learning" – Ajay Agrawal, Joshua Gans, Avi Goldfarb	
Reference Books: - 1. "Data Science for Marketing Analytics" – Mirza Rahim Baig, Gururajan Govindan 2. "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst" – Dean Abbott	




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Multidisciplinary Minor-IV

23ADMDB4	MDM	Medical Image Processing	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database Management Systems, Computer Networks and Security

Course Outcomes: At the end of the course, students will be able to:

CO1	Recall basic medical imaging modalities and data formats
CO2	Explain image enhancement and filtering methods used in medical imaging
CO3	Understand different segmentation approaches in medical images
CO4	Describe feature representation and basic classification concepts in medical image analysis
CO5	Understand the role of AI and ML in medical diagnosis
CO6	Interpret basic case studies and current trends in medical image processing

Course Contents:

Unit I: Introduction to Medical Imaging History and applications of medical image processing, Types of imaging modalities (X-ray, CT, MRI, PET, Ultrasound), Basics of image acquisition and DICOM format, Image resolution, intensity, contrast, Challenges in handling medical images	[6]
Unit II: Image Preprocessing & Enhancement Types of noise in medical images, Noise reduction: Mean, Median, Gaussian filtering, Contrast enhancement: Histogram equalization, CLAHE, Geometric corrections and resizing.	[6]
Unit III: Image Segmentation Role of segmentation in diagnosis, Threshold-based segmentation, Region-based and edge-based segmentation, Introduction to watershed algorithm	[6]
Unit IV: Feature Representation & Classification Importance of features in classification, Basic shape, intensity, and texture features, Introduction to ML-based classification (overview only), Concepts of training/testing and accuracy.	[6]
Unit V: AI in Medical Imaging Role of AI in diagnosis (overview), Applications in cancer, pneumonia, brain imaging, Common tools and frameworks (basic idea), Ethics, privacy, and data bias in healthcare AI.	[6]

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Unit VI: Case Studies and Research Trends Examples from open-source datasets: NIH Chest X-ray, BraTS, Use of tools: 3D Slicer, ITK-SNAP (demo-level knowledge), Overview of recent papers in AI for imaging, Federated learning and current research highlights.	[6]
Text Books: 1. Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, Academic Press, 2nd Edition, 2008. 2. Rafael C. Gonzalez and Richard E. Woods, <i>Digital Image Processing</i>, Pearson Education, 4th Edition, 2018. 3. S. Jayaraman, S. Esackirajan, T. Veerakumar, <i>Digital Image Processing</i>, Tata McGraw Hill, 1st Edition, 2009.	
Reference Books: 1. Deepak L. V., Suresh Chandra Satapathy, <i>Medical Image Processing and Machine Learning</i>, Springer, 2021. 2. M. Sonka, V. Hlavac, R. Boyle, <i>Image Processing, Analysis, and Machine Vision</i>, Cengage Learning, 4th Edition, 2014. 3. K. Doi, <i>Computer-Aided Diagnosis in Medical Imaging: Historical Review, Current Status and Future Potential</i>, Computerized Medical Imaging and Graphics, Elsevier. 4. Recent IEEE, Elsevier, Springer conference/journal articles related to AI in Medical Imaging.	




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Multidisciplinary Minor-IV

23ADMDC4	MDM	Engineering Econometrics	3-0-0	3 Credits
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Teaching Scheme	Evaluation Scheme
Lecture:3hrs/week	CA 1: 10 Marks CA 2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Database Management Systems, Computer Networks, and Security

Course Outcomes: At the end of the course, students will be able to:

CO1	Build adequate competency in the frontier areas of economic theory and methods.
CO2	Apply basic econometric estimation techniques such as Ordinary Least Squares to estimate bivariate and multivariate regression models.
CO3	Examine about the statistical significance of individual explanatory variable and also over all model.
CO4	Estimation of panel data models, generalized method of moments, discrete response models, censored regression models and estimation of average treatment effects.

Course Contents:

Unit I: Nature of Econometrics and Economic Data Definition of Econometrics – Steps in Empirical Economic Analysis - Econometric Model –The Role of Measurement in Economics – The Structure of Economic Data: Cross-Sectional data, Time Series data, Pooled Cross-Section data, Panel Data.	[6]
Unit II: Simple Regression Model Two Variable Linear Regression Model: Assumptions, Estimation of Parameters, Tests of Significance and Properties of Estimators – Functional forms of Regression models – Loglinear models, Semi-log models and Reciprocal models – Choice of Functional Form.	[6]
Unit III: The General Linear Model Review of Assumptions, Estimation and Properties of Estimators: Un-biasness, BLUEs and Tests of significance of estimates – Analysis of Variance - Dummy variables - Nature of Dummy variables – Use of Dummy Variables – Errors in Variables and its consequences.	[6]
Unit IV: Auto-regressive and Distributed Lag Models Introduction – Types of Lag schemes - Koyck's lag model, Almon's Lag scheme, Partial. Adjustment and Expectations models - Causality in Economics – The Granger Causality Test.	[6]



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Unit V: Simultaneous Equation Models Specification – Simultaneous Bias – Inconsistency of OLS Estimators - The concept of Identification, Rank and Order conditions for Identification – Indirect Least Squares - Two-stage Least Squares (without proof), Problems.	[6]
Unit VI: Time series econometrics Stochastic processes, spurious regression, test of stationarity, unit root test, transforming non stationary time series, economic forecasting; AR, MR and ARIMA modeling of time series data, Box- Jenkins methodology, vector auto regression (VAR), testing causality using VAR: the Granger causality test, impulse response function, measuring volatility in financial time series; the ARCH and GARCH models.	[6]
Text Books: - 1. Jeffrey M. Wooldridge (2012), Introductory Econometrics: A Modern Approach, 4/e (Paperback), Cengage Learning India. 2. William H. Greene (2003), Econometric Analysis 5/e (Paperback), Pearson Education.	
Reference Books: - 1. Jeffrey M. Wooldridge (2010), Econometric Analysis of Cross Section and Panel Data, 2/e, Cambridge, MA: MIT Press. 2. Dougherty, Christopher (2011), Introduction to Econometrics. Fourth Edition. 3. James D. Hamilton (1994), Time Series Analysis, Princeton University Press. 4. Maddala, G. S. (1997), Econometrics, McGraw-Hill, New York.	




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23HSSM07	VEC	Aptitude Skills-IV	1-0-0	Audits
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Teaching Scheme	Evaluation Scheme
Lecture: 1 hrs/week	CA I: 25marks CAII: 25mark

Pre-Requisites: Aptitude Skills I, II, and III

Course Outcomes: At the end of the course, students will be able to:

CO1	Solve the questions on ordering of words & Parts of Speech
CO2	Organize contents of Business Communications such as CV, emails, and letters.
CO3	Solve the questions based on jumbled paragraphs and reading comprehension.
CO4	Solve the questions on spotting errors and sentence correction.
CO5	Summarize proceedings of any event or conference.
CO6	Discuss about current and critical issues during group discussion.

Course Contents:

Unit I: Parts of Speech, Punctuation Word Family (Using the same word as different Parts of Speech)	[4]
Unit II: Analogy, Letter Writing (Formal), E-Mail Writing, CV Writing	[2]
Unit III: Reading Comprehension, Paragraph Jumbles	[2]
Unit IV: Spotting Errors (in different parts of sentence), Subject-Verb Agreement Sentence Correction, Sentence Completion	[4]
Unit V: One Word Substitution, Narrating Events/Reports, Summary/Precis Writing	[2]
Unit VI: Dialogue writing, Group Discussion, Interview Skills (Using formal notations & gestures, etc.)	[2]
Text Books: 1. Raymond Murphy, Essential English Grammar with Answers, Murphy 2. Objective General English by R.S.Aggarwal, S Chand Publishing; Revised edition(15March2017)	



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Reference Books:

1. Raoand, D, V, Prasada, Wren& Composition Book, S Chand Publishing, 2017
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press; Second edition



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23HSSM08	VEC	Language Skills-IV	0-0-2	Audit
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Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA I:25marks CAII:25mark

Pre-Requisites: Language Skills I, II, and III

Course Outcomes: At the end of the course, students will be able to:

CO1	Make use of Function in Python Programming.
CO2	Make use of Python collections.
CO3	Make use of classes and their objects in Python.
CO4	Make use of file and its handling functions.

Course Contents:

1. Write a Python program to define a user-defined function that takes a number as input and returns whether it is even or odd. Call the function and display the result. ○ Concepts: Function definition, arguments, return value.	[2]
2. Create a Python program to define and call a function with default arguments and keyword arguments. ○ Concepts: Function calling, argument types.	[2]
3. Write a Python program using a lambda function to compute the square, cube, and factorial of a given number. ○ Concepts: Lambda function basics	[2]
4. Write a Python program to demonstrate list operations such as creation, adding items, removing an item, slicing, and sorting. ○ Concepts: List constructor, change, remove, sort, list comprehension	[2]
5. Write a Python program to demonstrate the use of tuples and sets. Perform operations such as checking membership, adding/removing elements (set), and iterating. ○ Concepts: Tuple immutability, set operations.	[2]
6. Write a Python program to create a dictionary of employees with their ID as key and name as value. Perform operations like adding a new entry, updating existing, and deleting one. ○ Concepts: Dictionary operations, loop through dictionary.	[2]



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7. Write a Python program to create a class Student with attributes name, roll_no, and a method display(). Create an object and access its members. ○ Concepts: Class, object, method access.	[2]
8. Create a class with an __init__() constructor to initialize data members and a destructor to display a message when the object is deleted. ○ Concepts: Constructor, destructor.	[2]
9. Write a program to demonstrate single inheritance where a class Vehicle is inherited by a class Car. Use super() to access base class methods. ○ Concepts: Inheritance, super().	[2]
10. Write a Python program to open a text file in write mode and write your personal information (name, age, department). Then, read and display the content of the file. ○ Concepts: File open, write, read, file modes.	[2]
11. Write a program to read a file line by line using readline() and count the number of characters in each line. ○ Concepts: File reading, character offset.	[2]
12. Create a program to open a file in append mode and add new content. Use exception handling to manage file not found or access errors. ○ Concepts: File handling with exception management.	[2]
Text Books: 1. Python Projects (Author: Laura Cassell, Alan Gauld) Wrox publication 2. Murach's Python Programming. Aut.: Michael Urban, Joel Murach, Murach's Publication.	
Reference Books: 1. Fundamentals of Python (First Program) Cengage MINDTAP Publication 2 nd Edition. Author: K.A. Kambert	




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