माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
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NAAC ACCREDITED WITH A++ GRADE

DEPARTMENT OF INFORMATION TECHNOLOGY

DATA SCIENCE USING PYTHON

2160512

L	T	P	Total Credits
3	-	2	4

COURSE OBJECTIVES

- To provide fundamental knowledge of Data Science.
- To present the basic representation and exploratory data analysis used in Data Science.
- To understand the working of techniques used in Data Science.

Unit-I

Basics of Python Tool, Introduction to Data Science, Various Fields of Data Science, Impact of Data Science, Data Analytics Life Cycle, Data Science Toolkit, Version Controlling.

Unit-II

Understanding data, Types of data: Numeric, Categorical, Graphical, High Dimensional Data, Classification of Digital Data: Structured, Semi-Structured and Unstructured, Source of Data: Time Series, Transactional Data, Biological Data, Special Data, Social Network Data, Data Evolution.

Unit-III

Data Acquisition and Data wrangling: Accessing Database, CSV and JSON Data, Data Cleaning and Transformation using Pandas and Sklearn, Data Visualization, Missing Value Analysis, Correction Matrix, Outlier Detection Analysis, Feature Engineering.

Unit -IV

Descriptive Statistics: Measures of Center and Spread, Estimation Distributions, Inferential Statistics: Sampling Distributions, Hypothesis Testing, Probability Theory, Conditional Probability, Maximizing and Minimizing Algebraic Equations, Matrix Manipulation and Multiplication.

Unit -V

Supervised Learning: Regression, classification, decision trees, random forest, Unsupervised Learning: PCA, Clustering. Application of Data Science, Use Case:

Consumer Product usage Analysis, Search Engines, Targeting Recommendation, Gaming etc.

RECOMMENDED BOOKS

- Introduction to linear algebra - by gilbert strang
- Applied statistics and probability for engineers – by douglas montgomery
- Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing, and Presenting Data – EMC Education
- Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython – Wes McKinney.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. define the fundamentals of data science and its importance.

CO2. contrast the basics of python and libraries related to data science

CO3. classify different types of data analytics

CO4. organize the data collected from various sources

CO5. analyze pre-processing and data reduction strategies.

CO6. create the graphical representation of the data through visualization tool on various applications.

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DEPARTMENT OF INFORMATION TECHNOLOGY

COMPILER DESIGN
2160513

L	T	P	Total Credits
2	1	2	4

COURSE OBJECTIVES

- To learn finite state machines and context free grammar.
- To learn, various phases of compiler
- To understand process of compiler implementation.

Unit-I

Overview of Translation Process: Introduction to Compiler, Translator, Interpreter and Assembler, Overview and use of Linker and Loader, Major Data Structures in Compiler, Other Issues in Compiler Structure, BOOT Strapping and Porting, Compiler Structure: Analysis-Synthesis Model of Compilation, Various Phases of a Compiler, Tool Based Approach to Compiler Construction.

Unit-II

Lexical Analysis: Input Buffering, Symbol Table, Token, Recognition of Tokens, Lexeme and Patterns, Difficulties in Lexical Analysis, Error Reporting and Implementation. Regular Grammar & Language Definition, Transition Diagrams, Design of a Typical Scanner using LEX.

Unit-III

Syntax Analysis: Context Free Grammars (CFGs), Ambiguity, Basic Parsing Techniques: Top Down Parsing, Recursive Descent Parsing, Transformation on the Grammars, Predictive Parsing LL(1) Grammar, Bottom-UP Parsing, Operator Precedence Parsing, LR Parsers (SLR, CLR, LALR), Design of a Typical Parser Using YACC.

Unit-IV

Semantic Analysis and Intermediate code: Syntax-Directed Translation Schemes, Implementation of Syntax-Directed Translators, Compilation of Expression, Control, Structures, Conditional Statements, Various Intermediate Code Forms, Memory Allocation and Symbol Table Organizations, Static and Dynamic Array Allocation,

String Allocation, Structure Allocation etc., Error Detection Indication and Recovery, Routines or Printing Various Lexical, Syntax and Semantic Errors.

Unit-V

Code Generation and Code Optimization: Issues, Basic Blocks and Flow Graphs, Register Allocation, Code Generation, DAG Representation of Programs, Code Generation from DAGS, Peep-hole Optimization, Code Generator Generators, Specification of Machine. Code Optimization: Source of Optimizations, Optimization of Basic Blocks, Loops, Global Data Flow Analysis, Solution to Iterative Data Flow Equations, Code Improving Transformations, Dealing with Aliases, Data Flow Analysis of Structured Flow Graphs.

RECOMMENDED BOOKS

- Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. D. Ullman, Pearson Education.
- Compiler Construction: Principles and Practice, K.C. Louden, Cengage Learning.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. describe the concepts of finite automata and context-free grammar.

CO2. build the concept of working of the compiler.

CO3. analyze various parsing techniques.

CO4. design different phases of the compiler.

CO5. compare code generation and code optimization techniques.

CO6. analyze diverse tools and techniques for designing a compiler.

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DEPARTMENT OF INFORMATION TECHNOLOGY

SOFT COMPUTING TECHNIQUES
2160514

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- To provide the student with the basic understanding of neural networks and fuzzy logic fundamentals, Program the related algorithms and Design the required and related systems.
- To understand the fundamental theory and concepts of neural networks, several neural network paradigms and its applications.
- To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Unit-I

Introduction to Soft Computing: Soft Computing v/s Hard Computing, Basic models of Artificial Neural Networks, Terminologies of ANNs McCulloch-Pitts Neurons, Linear Separability, Hebb Network, Supervised Learning Networks: Introduction, Perceptron Networks, Back Propagation Networks, Radial Basis Function Networks, Hopefield networks.

Unit-II

Fuzzy Set Theory: Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Fuzzy rules, Fuzzy Reasoning, Defuzzification: Lembda-Cuts for Fuzzy sets (Alpha-Cuts), Lembda-Cuts for Fuzzy Relations. Fuzzy Inference System: Introduction, Mamdani Fuzzy Model, Takagi-Sugeno Fuzzy Model.

Unit-III

Evolutionary Algorithm: Traditional optimization and Search Techniques, Basic Terminologies in GA, Operators in Genetic Algorithm, Stopping Condition for Genetic Algorithm Flow, Classification of Genetic Algorithm, Comparison with Evolutionary algorithm, Application of Genetic algorithm.

Unit-IV

Introduction to Nature-Inspired Optimization Algorithms: Particle Swarm Optimization (PSO) Algorithm, Differential Evolution (DE) Algorithm, Artificial Bee Colony (ABC) Algorithm, Ant Colony Optimization (ACO) Algorithm, Cuckoo Search (CS), Firefly Algorithm (FA), Immune Algorithm (IA), Grey Wolf Optimization (GWO), Spider Monkey Optimization.

Unit-V

Hybrid Soft Computing Techniques: Introduction, Neuro-fuzzy Hybrid system, Adaptive Neuro fuzzy inference system(ANFIS), Genetic Neuro Hybrid system, Application of Soft Computing Techniques.

RECOMMENDED BOOKS

- Principles of Soft Computing, S. N. Sivanandam and S. N. Deepa , Wiley Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications- S. Rajasekaran & G.A. Vijayalakshmi Pai, PHI.
- Introduction to Soft Computing Neuro-Fuzzy and Genetic Algorithms, Samir Roy and Udit Chakraborty, Pearson.
- Neural Networks and Learning Machines-Simon Haykin PHI.
- Fuzzy Logic and Engineering Application, Tomthy Ross, TMH.
- Evolutionary Optimization Algorithms, D. Simon (2013), Wiley.
- Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications, L. N. de Castro (2006), CRC Press.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. define basic concepts of neural network and fuzzy systems.

CO2. compare solutions by applying various soft computing approaches on a given problem.

CO3. develop and train different supervised and unsupervised learning.

CO4. classify various nature inspired algorithms according to their application aspect.

CO5. compare the efficiency of various hybrid systems.

CO6. design a soft computing model for solving real world problems.

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DEPARTMENT OF INFORMATION TECHNOLOGY

CLOUD COMPUTING
2160515

L	T	P	Total Credits
3	-	-	3

COURSE OBJECTIVES

- To understand Cloud Computing concepts, technologies, architecture and applications.
- To understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization.
- To understand different cloud programming platforms and tools to develop and deployapplications on cloud.

Unit-I

Cloud Architecture and Model: Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models: Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public vs Private Cloud, Cloud Solutions Cloud ecosystem, Service management,Computing on demand.

Unit-II

Virtualization: Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices. Virtual Clusters and Resource management, Virtualizationfor Data-center Automation.

Unit-III

Cloud Infrastructure: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources.

Unit-IV

Programming Model: Parallel and Distributed Programming Paradigms-MapReduce,Twister and Iterative MapReduce, Hadoop Library from Apache, Google

App Engine (GAE), Amazon Web Service (AWS), Smart Cloud, Public Clouds and Service Offerings, Microsoft Windows Azure.

Unit-V

Security in the Cloud: Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, VirtualMachine Security, Identity Management and Access Control.

RECOMMENDED BOOKS

- Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
- John W. Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
- Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
- Kumar Saurabh, " Cloud Computing — insights into New-Era Infrastructure", Wiley India,2011
- George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
- James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. define various basic concepts related to cloud computing.

CO2. identify the architecture, infrastructure and delivery models of cloud computing.

CO3. apply suitable virtualization concepts.

CO4. choose the appropriate programming models and public cloud platforms.

CO5. analyse various security issues in cloud computing.

CO6. compose virtualization, security and programming modules in cloud computing solutions.

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DEPARTMENT OF INFORMATION TECHNOLOGY

DATA SCIENCE USING PYTHON
2160512

LIST OF PROGRAMS

1. Explore python built-in modules such as os, random, math,scipy and statistics.
2. Write a python program to perform descriptive statistics such as Central Tendency Measures (Mean, Median and Mode), Measure of Dispersion (Variance, Standard Deviation), Skewness and Kurtosis.
3. Study of data science libraries such as Numpy, Pandas etc. for Numerical computations and data manipulation.
4. Explore about data visualization libraries such as Matplotlib, Seaborn etc. in python.
5. Write a python script to draw Correlation matrix, Box plot (show Outliers), Heat map, histogram and Distribution Plot for any Dataset.
6. Write a program to implement Simple Linear Regression model for any Dataset in Python.
7. Write a program to implement Logistic Regression model over any Dataset in Python.
8. With the help of classification algorithm, classify any suitable dataset available over the trusted repository.
9. Implementation of Decision tree using sklearn and its parameter tuning
10. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

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DEPARTMENT OF INFORMATION TECHNOLOGY

COMPILER DESIGN LAB
2160513
LIST OF PROGRAMS

1. Write a program to convert NFA to DFA.
2. Write a program to minimize DFA.
3. Develop a lexical analyzer to recognize a few patterns.
4. Write a program to parse using Brute force technique of Top down parsing.
5. Develop LL (1) parser (Construct parse table also).
6. Develop an operator precedence parser (Construct parse table also).
7. Develop a recursive descent parser.
8. Write a program for generating for various intermediate code forms.
   i. Three address code
   ii. Polish notation
9. Write a program to simulate Heap storage allocation strategy.
10. Generate Lexical analyzer using LEX.
11. Generate YACC specification for a few syntactic categories.
12. Given any intermediate code form implement code optimization techniques.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. implement various parsing techniques.

CO2. demonstrate different types of compiler tools

CO3. develop programs for implementing code optimization techniques.

CO4. build symbol table and intermediate codes.

CO5. analyze the functionalities of different phases of the compilation process.

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DEPARTMENT OF INFORMATION TECHNOLOGY

SOFT COMPUTING TECHNIQUES LAB
2160514
LIST OF PROGRAMS

1. Perform Union, Intersection and Complement Operations
2. Implementation of De-Morgan's Law
3. Plotting Various Membership Functions
4. Fuzzy Set Operations
5. Implementation of Fuzzy Inference System
6. Modeling tips value based on quality and service of food using fuzzy toolbox
7. Design a Fuzzy logic controller to determine the wash-time of a domestic washing machine using two inputs i.e Dirt and Grease on cloths
8. Generation of ANDNOT function using McCulloch-Pitts neural net
9. Generation of XOR function using back propagation algorithm
10. Implementation of Genetic algorithm to find optimal solution
11. Implementation of Particle swarm optimization algorithm to find optimal solution

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COURSE OUTCOMES:

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

CO1. illustrate the various mathematical and logical operations involved in soft computing techniques.

CO2. implement the concepts of fuzzy logic comprising fuzzy sets, knowledge representation using fuzzy rules, and fuzzy inference systems, to design intelligent systems.

CO3. analyze the neural network architectures and their applications in real-life classification problems.

CO4. formulate objective function and determine optimal solution using Genetic Algorithm (GA) and Particle swarm optimization (PSO).

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LIST OF PROJECT

List of Micro Projects:

1. Create a Python script to demonstrate how to read different types of data sets (.txt, .csv, etc.) from a website or disk.
2. Design a Python program to calculate the variance of a dataset.
3. Design a script to create a normal distribution curve using Python.
4. Create a bar plot and pie plot for any dataset using Python.
5. Develop a program in Python to join two data frames.
6. Create a Python program to find NaN and Null values in a dataset and replace them with a specified number.
7. Design a Python program to calculate the Interquartile Range (IQR) of a dataset.
8. Analyze the correlation coefficient between two variables.
9. Create a data frame using a list of elements in Python.
10. Evaluate the Z-Score for any dataset in Python.

List of Macro Projects:

1. Apply the normalization and standardization in a given dataset.
2. Identify the missing value in any dataset and how to handle and replace it.
3. Design a program to show binary hot encoding in any dataset.
4. Design a program to show multiclass encoding in any dataset.
5. Create a python program to count the frequency of occurrence of a word (Frequency distributions) in a body of text.
6. Developed a python program to draw correlation matrix.
7. Create a program to draw residual Plot for any data.
8. Apply a program to show various distributions of Data over any Dataset.
9. Design a program to compute weighted averages in Python either defining your own functions or using Numpy.
10. Develop a program to plot a scatter plot and Pivot table of a given data.

List of Mini Projects:

1. Design an anomaly detection system for monitoring equipment using time-series data from multiple sensors

2. Analyze customer behavior to improve marketing strategies
3. Create a python application to collect, process, and store data from IOT devices in real-time
4. Design an application to handle large csv files by processing data in chunks and computing summary statistics
5. Develop a linear regression model to predict house prices based on various features
6. Develop a machine learning model to classify emails as spam or not spam
7. Perform exploratory data analysis (EDA) to understand customer purchasing behavior and identify trends
8. Create a python application to segment customers based on purchasing behavior using the RFM (recency, frequency, monetary) model
9. Analyze a dataset of student performance to understand key statistics about scores in different subjects
10. Design the descriptive statistical analysis on sales data to summarize the company's performance and identify patterns

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COMPILER DESIGN LAB
2160513

LIST OF PROJECTS

List of Micro Projects:

1. Study of JFLAP (Java Formal Languages and Automata Package) tools.
2. Design a Program to recognize constant.
3. Design a Program to recognize keyword.
4. Design a Program to recognize identifier.
5. Design a Program to recognize operator.
6. Design a program to recognize identifier.
7. Design a Program to recognize a delimiter/punctuators.

Note: Use JFLAP (Java Formal Languages and Automata Package) tools.

List of Macro Projects:

1. Convert finite automata to regular expression.
2. Convert regular expression to finite automata.
3. Convert CFG to PDA (LL).
4. Convert CFG to PDA (LR).
5. Convert Regular Grammar to FSA
6. Build LL(1) parsing table.
7. Build SLR(1) parsing table.

Note: Use JFLAP (Java Formal Languages and Automata Package) tools.

List of Mini Projects:

1. Design a Lexical scanner to recognize keyword, identifier and its total count presented in source program.
2. Design a Lexical scanner to identify operators, digits (0-9) and numbers (like integer, floating point, fractional and exponential) in source program.
3. Design a Lexical scanner to count no. of words, character, small characters, capital characters and capital words within source program.
4. Design a Lexical analyzer to ignore comments, redundant spaces, tabs and new lines form input source program.

5. Design a Lexical scanner to recognize and count the number of vowels and consonants in a sentence.
6. Design a YACC analyzer to implement a Calculator and recognize a valid Arithmetic expression.
7. Design a YACC analyzer to recognize string with grammar $\{a^n b^n \mid n>=0\}$ and $\{ a^n b \mid n>=5\}$.
8. Design a YACC that accepts strings that starts and ends with Zero or One.

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SOFT COMPUTING TECHNIQUES LAB
2160514

LIST OF PROJECTS

List of Micro Projects:

1. Study Different types of Neural Networks
2. Implementation of different activation functions to train Neural Network.
3. Implementation of different Learning Rules.
4. Implementation of Perceptron Networks.

List of Macro Projects:

1. How the weight & bias values effect the output of neurons.
2. How the weight and biased value are able to present a decision boundary in the feature space.
3. How the Perceptron Learning rule works for Linearly Separable problem.
4. How the Perceptron Learning rule works for Non-Linearly Separable problem.

List of Mini Projects:

1. Chronic diseases detection using soft computing model
2. Prediction of monthly electricity demand and bill estimation using Fuzzy Logic
3. Development of intelligent financial credit scoring system using Neural Network
4. Early-stage cancer detection system for improved diagnosis and treatment using Artificial neural network and fuzzy logic
5. Optimal solution for economic load dispatch problem in power system using Genetic algorithm (GA)
6. Nutritional requirement recommendation system for the deficiency diseases patients using Fuzzy logic model
7. Rainfall prediction system based on historical meteorological data using Artificial neural network
8. Solar power generation forecasting using Artificial neural network and fuzzy logic based model
9. Wind power generation forecasting using Artificial neural network and fuzzy logic based model

10. Fault detection and classification in power distribution network using Artificial neural network and Particle swarm optimization
11. Optimization of hyper-parameters of neural network using PSO for heart disease prediction dataset.
12. Implement a movie recommendation system using any algorithm over the dataset from trusted repository.
13. Drowsiness detection of driver using machine learning
14. Design and implementation of animal kingdom classification using Convolutional Neural Network (CNN)
