Annexure-6

Syllabi of
Departmental Courses (DC) Courses
B.Tech V Semester
For batch admitted 2020-21
(Computer Science and Engineering)
Under Flexible Curriculum
[Item-9]

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

Department of Computer Science and Engineering

DATA SCIENCE
150511

COURSE OBJECTIVES:

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

Unit – I:

Introduction to Data Science: Introduction, Definition, applications of Data Science, Impact of Data Science, Data Analytics Life Cycle, role of Data Scientist.

Basics of Python: Essential Python libraries, Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set, Type Conversion- Operators. Decision Making: Looping-Loop Control statement, Math and Random number functions. User defined functions, function arguments & its types.

Unit – II:

Vectorized Computation: The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing, Boolean Indexing, Transposing Arrays. Universal Functions: Fast Element, Wise Array Functions, Mathematical and Statistical Methods – Sorting Unique and Other Set Logic.

Unit – III:

Data Analysis: Series, DataFrame, Essential Functionality: Dropping Entries, Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis. Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

Unit – IV:

Inferential Statistics in Data Science: Types of Learning, Linear Regression- Simple Linear Regression, Implementation, plotting and fitting regression line. Multiple Linear Regression, Introduction, implementation, comparison with simple linear regression, Correlation Matrix, F-Statistic, Identification of significant features. Polynomial regression.

Unit – V:

Exploratory Data Analysis and Visualisation: Handling Missing Data, Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers, Functions in pandas.

Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

RECOMMENDED BOOKS:

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
3. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
4. 4. Pattern Recognition and Machine Learning, Christopher M. Bishop

COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Define basic concepts of Data Sciences.
CO2: Illustrate various concepts of python that are used in data sciences.
CO3: Identify various methods for the representation and manipulation of vectors.
CO4: Analysis the data for applying various statistical modelling approaches.
CO5: Identify hidden patterns in data and transform it using data science techniques.
CO6: Apply regression techniques to solve real world problems.

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PROGRAM LIST

1. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set
2. Solve problems using decision and looping statements.
3. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem
4. Handle numerical operations using math and random number functions.
5. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
6. Computation on NumPy arrays using Universal Functions and Mathematical methods.
7. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
8. Create Pandas Series and DataFrame from various inputs.
9. Import any CSV file to Pandas DataFrame and perform the following:
    1. Visualize the first and last 10 records
    2. Get the shape, index and column details
    3. Select/Delete the records(rows)/columns based on conditions.
    4. Perform ranking and sorting operations.
    5. Do required statistical operations on the given columns.
    6. Find the count and uniqueness of the given categorical values.
    7. Rename single/multiple columns.
10. Import any CSV file to Pandas DataFrame and perform the following:
    1. Handle missing data by detecting and dropping/ filling missing values.
    2. Transform data using different methods.
    3. Detect and filter outliers.
    4. Perform Vectorized String operations on Pandas Series.
    5. Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
11. Use the scikit-learn package in python to implement the regression model and its related methods.

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SKILL BASED MINI-PROJECTS

Implement the below mentioned models using python programming and related libraries:

- Health Insurance Cost Prediction model.
- Salary Prediction model.
- Loan Amount Prediction model.
- Crop Yield Prediction Model.
- Stock Prediction Model.

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Networking with TCP/IP
150512

COURSE OBJECTIVES

- To understand TCP/IP Internetworking and Addressing.
- To understand framing, Routing, Address resolution and Error reporting mechanism used in the Internet
- To understand the working of Application layer protocols
- To Troubleshoot networking issues

Unit-1 TCP/IP model, Addressing- Physical, logical and port addressing, IPv4 addresses: Classful addressing, Classless addressing. Special addresses, DHCP and NAT. Subnetting and Supernetting, IPv6 addressing.

Unit-2 IP Datagram- format, options, fragmentations, checksum, IPsec. Address Resolution Protocol (ARP), Reverse address resolution protocol (RARP). Internet Control message protocol (ICMP).

Unit-3 TCP: TCP Reliable data transfer, Connection Establishment & Release, TCP Frame, Header Checksum, Sliding Window Concept for error control, congestion control and TCP timers.

UDP: Format, Pseudo header, Encapsulation, Checksum, Multiplexing & Demultiplexing. Stream Control Transmission Protocol

Unit-4 Routing Protocols- RIP, OSPF and BGP, Application Layer: DNS, FTP, TFTP, Mail Transfer protocols, TELNET, HTTP, Voice over IP.

Unit- 5 Troubleshooting Principles, Ping, Traceroute, nslookup and Netstat, Study of network packet analyzer tools: Wireshark, CISCO packet Tracer etc. Scanner Tools: Nmap, Nessus etc.

Reference Books:-

- Data and Computer Communication - W. Stalling, Pearson
- Internetworking with TCP/IP - Vol. - I - D.E. Comer, PHI
- Data Communication & Networking -B.A. Forouzan
- ISDN and Broad band ISDN with Frame Relay & ATM - W. Stalling
- LANs - Keiser

COURSE OUTCOMES

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

CO1. Outline of the basic functionality of TCP/IP layers.

CO2. Analyze various addressing mechanism used in the internet

CO3. Elaborate the framing, Routing and Address translation mechanism used in the internet

CO4. Analyze the working of Application layer protocols

CO5. Simulate network protocols & Topologies

CO6. Install, maintain and troubleshoot a TCP/IP Network

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INFORMATION SECURITY

150513

COURSE OBJECTIVES

- To provide conceptual understanding of Information security principles, issues, challenges and mechanisms.
- To understand how to apply encryption techniques to secure data in transit across data networks.

Unit-I

Security: Principles and Attacks, Basic Number Theory, Fundamentals of Cryptography, Steganography, Cryptanalysis, Code Breaking, Block Ciphers and Steam Ciphers, Substitution Ciphers, Transposition Ciphers, Caesar Cipher, Play-Fair Cipher, Hill Cipher

Unit-II

Cryptography: Symmetric Key Cryptography, Public Key Cryptography, Principles of Public Key Cryptosystem, Classical Cryptographic Algorithms: RC4, RSA, Distribution of Public Keys and Key Management, Diffie-Hellman Key Exchange.

Unit-III

Hash Functions: Hash Functions, One Way Hash Function, SHA (Secure Hash Algorithm). Authentication: Requirements, Functions, Kerberos, Message Authentication Codes, Digital Signatures, Digital Certificates.

Unit -IV

IP & Web Security Overview: SSL (Secure Socket Layer), TLS (Transport Layer Security), SET (Secure Electronic Transaction). IDS (Intrusion detection system), Firewalls: Types, Functionality and Polices.

Unit -V

Phishing: Attacks and its Types, Buffer Overflow Attack, Session Hijacking, Hacker: Hacking and Types of Hackers, Foot Printing, Scanning: Types: Port, Network, Vulnerability), Sniffing in Shared and Switched Networks, Sniffing Detection & Prevention, Spoofing.

RECOMMENDED BOOKS

- Cryptography and Network Security, William Stallings, Pearson Education.
- Cryptography and Network Security, Atul Kahate, McGraw Hill Education.
- Incident Response and Computer Forensics, Kevin Mandia, Chris Prosise, Tata McGraw Hill.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. explain attacks, hash algorithms and authentication mechanisms.
CO2. illustrate fundamentals of number theory and security principles.
CO3. Apply various algorithms to achieve principles of network security.
CO4. analyse the cause for various existing network attacks and describe the working of available security controls.
CO5. examine the vulnerabilities in IT infrastructure.
CO6. predict the attacks and controls associated with IP, transport-level, web and e-mail security.

LIST OF EXPERIMENTS:

1. Perform encryption, decryption using the following substitution techniques I. Ceaser cipher II. Hill Cipher
2. Perform encryption and decryption using following transposition techniques Rail fence - Row & Column Transformation
3. Implement Playfair Cipher with key entered by user.
4. Implement polyalphabetic Cipher
5. Implement AutoKey Cipher
6. Implement Hill Cipher.
7. Implement Rail fence technique
8. Implement Simple Columner Transposition technique
9. Implement Simple Columner Transposition technique
10. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

SKILL BASED MINI PROJECTS

1. Email monitoring
2. Web application firewall
3. Log Analyzer
4. Malware Analysis Sandbox
5. Encryption Software
6. Caesar code Decoder
7. User authentication system
8. Image Steganography system
9. Anomaly detection, intrusion and its prevention

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COMPILER DESIGN

150514

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, 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, Compiler Design Tools.

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: Compilation of Expression, Control, Structures, Conditional Statements, Various Intermediate Code Forms, Syntax Directed Translation, Memory Allocation and Symbol Table Organizations, Static and Dynamic Array Allocation, String Allocation, Structure Allocation etc., Error Detection Indication and Recovery, 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, 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. Define the concepts of finite automata and context free grammar.

CO2. Build the concept of working of compiler.

CO3. Examine various parsing techniques and their comparison.

CO4. Compare various code generation and code optimization techniques.

CO5. Analyze different tools and techniques for designing a compiler.

CO6. Design various phases of compiler.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Syllabus: Artificial Intelligence(150515)

Course Objectives:

1. To acquire knowledge on intelligent systems and agents.
2. Formalization of knowledge, reasoning with, machine learning, Fuzzy Logic and Applications at a basic level.

Unit: 1

Introduction: Need and Scope of Artificial Intelligence, History, Definition of Artificial Intelligence, Task and Objectives of Artificial Intelligence, Techniques of Artificial Intelligence. Artificial Intelligence Problems: Problems Definition, Problem Spaces and Production System. Characteristics of Production Systems, Types of Production System. Control Strategies, Example: water-jug, 8 – Puzzle, Cannibals & Missionaries problems.

Unit: 2

Agent: Introduction, Types of Agent, Searching techniques: Informed search and Uninformed search, Breadth search and Depth first search, Best First Search, Heuristic search. Heuristic estimation and evaluation, Hill climbing and their Problems.

Unit: 3

Knowledge Representation: Introduction, Definition and importance Of Knowledge, Approaches to knowledge Representation, Issues in Knowledge Representation, Procedural and Declarative Knowledge, Knowledge Representation Techniques: Logics, Prepositional Logic, Predicate Logic, Semantic networks.

Unit: 4

Learning Algorithms: Introduction of algorithms, characteristic of algorithm, Introduction of Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning.

Logical reasoning: Fuzzy Logic, operations of fuzzy logic. Forward Versus Backward Reasonings. Artificial Intelligence in Mathematics: Statistical concept (Mean, mode, median, standard deviation), Bayes theorem.

Unit: 5

Applications of Artificial Intelligence: Emerging fields of Artificial Intelligence, Introduction of Data science, Natural Language Processing, Speech Recognition, Computer Vision and robotics.,Smart Assistants, Game Playing, Puzzles. Expert System: Expert System Definition and its components.

COURSE OUTCOMES:

After successful completion of the course, the learners would be able to:

1. Understand concepts & applications of Artificial Intelligence and different types of intelligent agents.
2. Formulate problems as state space search problem & efficiently solve them.

3. Understand the working of various informed, uninformed and heuristics searching algorithms.
4. Understand the concept of knowledge representation techniques.
5. Evaluate the various learning algorithms for solving problems.

Reference Books:-

- Artificial Intelligence–Rich & Knight
- Artificial Intelligence and Expert System–Dan. W. Patterson
- Principles of Soft Computing, S. N. Sivanandam and S. N. Deepa , Wiley