MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Computer Science & Engineering (AI&ML)
Scheme of Instruction and Examination
(Choice Based Credit System)
For the batches admitted with effect from the academic year 2021-2022

V Semester

S. No.	Course Code	Course Title	Instructions Hours per work L	T	P/D	Examination Max. Marks CIE	SEE	Duration of SEE in Hours	Credits
1	CS503PC	Design and Analysis of Algorithms	3	0	0	30	70	3	3
2	CS505PC	Machine Learning	3	0	0	30	70	3	3
3	CS508PC	Compiler Design	3	0	0	30	70	3	3
4	CS510PC	Computer Networks	3	0	0	30	70	3	3
5	--	Professional Elective-I	3	0	0	30	70	3	3
6	--	Professional Elective-II	3	0	0	30	70	3	3
7	MC503ES	Essence of Indian Knowledge Tradition Part-1	3	0	0	30	70	3	0
8	CS553PC	Machine Learning Lab	0	0	3	30	70	3	1.5
9	CS557PC	Computer Networks Lab	0	0	3	30	70	3	1.5
10	EN553HS	Advanced Communication Skills Lab	0	0	2	30	70	3	1
11	MC501HS	Intellectual Property Rights	3	0	0	30	70	3	0
Total Hours/Marks/Credits			**24**	**0**	**8**	**330**	**770**	**-**	**22**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical **CIE** - Continuous Internal Evaluation **SEE** - Semester End Examination

VI Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week L	T	P/D	Examination Max. Marks CIE	SEE	Duration of SEE in Hours	Credits
1	CS603PC	Artificial Intelligence	3	1	0	30	70	3	4
2	CS607PC	DevOps	3	1	0	30	70	3	4
3	CS609PC	Natural Language Processing	3	1	0	30	70	3	4
4	--	Professional Elective – III	3	0	0	30	70	3	3
5	--	Open Elective - I	2	0	0	30	70	3	2
6	MC602ES	Cyber security	3	0	0	30	70	3	0
7	MA654BS	Finishing Schools-IV (Quantitative Aptitude and Analytical Ability)	0	0	2	30	70	3	1
8	CS653PC	Artificial Intelligence and Natural Language Processing Lab	0	0	3	30	70	3	1.5
9	CS655PC	DevOps Lab	0	0	3	30	70	3	1.5
10	--	Professional Elective - III Lab	0	0	2	30	70	3	1
Total Hours/Marks/Credits			**17**	**3**	**10**	**300**	**700**	**-**	**22**
11	MC601ESC	Environmental Science (for lateral entry students)	3	0	0	30	70	3	0

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VII Semester

Sl. No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	CS701PC	Neural Networks & Deep Learning	3	0	0	30	70	3	3
2	CS705PC	Reinforcement Learning	3	0	0	30	70	3	3
3	--	Professional Elective - IV	3	0	0	30	70	3	3
4	--	Professional Elective - V	3	0	0	30	70	3	3
5	--	Open Elective - II	2	0	0	30	70	3	2
6	CS753PC	Deep Learning Lab	0	0	2	30	70	3	1
7	CS755PC	Industrial Oriented Mini Project/ Summer Internship	0	0	4	-	100	-	2
8	CS756PC	Seminar	0	0	2	100	-	-	1
9	CS758PC	Project Stage - I	0	0	6	30	70	-	3
Total Hours/Marks/Credits			**14**	**0**	**14**	**310**	**590**	**--**	**21**

L: Lecture   **T**: Tutorial   **D**: Drawing   **P**: Practical   **CIE** - Continuous Internal Evaluation   **SEE** - Semester End Examination

VIII Semester

S. No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MS802HS	Organizational Behaviour	3	0	0	30	70	3	3
2	-	Professional Elective- VI	3	0	0	30	70	3	3
3	-	Open Elective -III	2	0	0	30	70	3	2
4	CS852PC	Project Stage-II	0	0	16	30	70	-	8
Total Hours/Marks/Credits			**8**	**0**	**16**	**120**	**280**	**12**	**16**

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*Note: Industry Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit a report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

MC- Environmental Science – should be registered by Lateral Entry Students Only.

MC- Satisfactory/ Unsatisfactory.

Professional Elective – I

CS515PE	Graph Theory
CS516PE	Introduction to Data Science
CS517PE	Web Programming
CS518PE	Image Processing

Professional Elective – II

CS519PE	Data Warehouse and Business Intelligence
CS523PE	Information Retrieval Systems
CS524PE	Pattern Recognition
CS525PE	Computer Vision and Robotics

Professional Elective – III

CS618PE	Internet of Things
CS622PE	Mobile Application Development
CS623PE	Data Mining
CS624PE	Cryptography and Network Security

Professional Elective – III LAB

CS663PE	Internet of Things Lab
CS666PE	Mobile Application Development Lab
CS667PE	Data Mining Lab
CS668PE	Cryptography and Network Security Lab

#Courses in PE-III and PE-III Lab must be in 1-1 correspondence.

Professional Elective – IV

CS716PE	Cloud Computing
CS721PE	Expert Systems
CS722PE	Game Theory
CS723PE	Mobile Computing

Professional Elective – V

CS728PE	Block Chain Technologies
CS730PE	Social Network Analysis
CS731PE	Augmented Reality & Virtual Reality
CS732PE	Ad-hoc & sensor Networks

Professional Elective – VI

CS823PE	Speech and Video Processing
CS824PE	Robotic Process Automation
CS825PE	Cognitive Computing
CS826PE	Semantic Web

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List of Open Electives offered:
Open Elective – I

CS521OE	Data Structures
CS522OE	Operating Systems
CS523OE	Database Management Systems

Open Elective – II

CS621OE	Computer Networks
CS622OE	Software Engineering
CS623OE	Java Programming

Open Elective – III

CS721OE	Python Programming
CS722OE	Internet of Things
CS723OE	Introduction to Machine Learning

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			Hours per work			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS503PC	Design and Analysis of Algorithms	3	0	0	30	70	3	3
2	CS505PC	Machine Learning	3	0	0	30	70	3	3
3	CS508PC	Compiler Design	3	0	0	30	70	3	3
4	CS510PC	Computer Networks	3	0	0	30	70	3	3
5	--	Professional Elective-I	3	0	0	30	70	3	3
6	--	Professional Elective-II	3	0	0	30	70	3	3
7	MC503ES	Essence of Indian Knowledge Tradition Part-1	3	0	0	30	70	3	0
8	CS553PC	Machine Learning Lab	0	0	3	30	70	3	1.5
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10	EN553HS	Advanced Communication Skills Lab	0	0	2	30	70	3	1
11	MC501HS	Intellectual Property Rights	3	0	0	30	70	3	0
Total Hours/Marks/Credits			**24**	**0**	**8**	**330**	**770**	**-**	**22**

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L	T	P	C
3	0	0	3

B.Tech V Semester

CS503PC: DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE, IT, CSE (AI & ML), CSE (Data Science))

Prerequisites:
1.   A course on "Computer Programming and Data Structures".
2.   A course on "Advanced Data Structures".

Course Objectives

To Learn
- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure of disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic Programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate
- Describes how to evaluate and compare different algorithms using worst-, average-, and best case analysis.
- Explains the difference between tractable and intractable problems, and introduces the Problems that are P, NP and NP complete

Course Outcomes

Student will be able to:

- Acquire the knowledge of algorithm analysis and its notations that are applied on the problems solved by divide and conquer paradigm.
- Use greedy approach to solve an appropriate problem for an optimal solution.
- Apply dynamic programming approach to solve suitable problems
- Apply the concept of backtracking, branch and bound paradigm for real time problems.
- Analyze the complexity of problems and differentiate that in terms of P and NP problems with examples.

Unit I :
Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation.

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

Unit II :

Sets and Disjoint Set Unions: Introduction, Union and Find Operations with algorithms.

Greedy method: General method, applications-Job sequencing with dead lines, knapsack problem, Minimum cost spanning trees-Prim's and kruskal's Algorithm, Single source shortest path problem.

Unit III :
Dynamic Programming: General method, applications- Multistage Graphs, Optimal binary search trees, 0/1   knapsack problem, All pairs shortest path problem, The Traveling sales person problem, Reliability design.

Unit IV :
Backtracking: General method, applications- The 8-Queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

Branch and Bound: General method, applications - 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling sales person problem,.

Unit V :

NP-Hard and NP-Complete problems: Basic concepts, Nondeterministic algorithms, The classes NP - Hard and NP-Complete, Cook's theorem, NP-Hard Graph Problems-Clique Decision Problem(CDP), Node cover decision problem.

Text Books:

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekharam, Fundamentals of Computer Algorithms, , Galgotia publications Pvt. Ltd, Second Edition, 2007.
2. Aho, Ullman and Hopcroft, Design and Analysis of algorithms, Pearson education, Reprint 2002.

Reference Books:

1. R.C.T.Lee, S.S.Tseng, R.C.Chang and T.T Sai, Introduction to Design and Analysis of Algorithms A strategic approach, Mc Graw Hill,2005.

2. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R.Tamassia, John Wiley and sons.

3. Introduction to Algorithms, 3rd Ed, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and Clifford Stein, PHI Pvt. Ltd., Pearson Education.

L	T	P	C
3	0	0	3

B.Tech V Semester

CS505PC: MACHINE LEARNING
(Common to CSBS, CSE (AI &ML) & CSE (Data Science))

Prerequisites:
1. Data Structures
2. Knowledge on statistical methods

Course Objectives
- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

Course Outcomes
- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

UNIT - I
Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning
Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias**.**
Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II
Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.
Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.
Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III
Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.
Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.
Instance-Based Learning- Introduction, *k*-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV
Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.
Reinforcement Learning – Introduction, the learning task, *Q*–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V
Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.
Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.
Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to   learning, using prior knowledge to initialize the hypothesis.

Suggested Readings:
1. Machine Learning – Tom M. Mitchell, - MGH

Reference Books:
1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

L	T	P	C
3	0	0	3

B.Tech V Semester

CS508PC : COMPILER DESIGN

Prerequisites
1.   A course on "Formal Languages and Automata Theory".
2.   A course on "Computer Organization and architecture".
3.   A course on "Computer Programming and Data Structures".

Course Objectives

- Introduce the major concepts of language translation and compiler design and impart the knowledge of practical skills necessary for constructing a compiler.
- Topics include phases of compiler, parsing, syntax directed translation, type checking use of symbol tables, code optimization techniques, intermediate code generation, code generation and data flow analysis.

Course Outcomes

- Demonstrate the ability to design a compiler given a set of language features.
- Demonstrate the the knowledge of patterns, tokens & regular expressions for lexical analysis.
- Acquire skills in using lex tool & yacc tool for developing a scanner and parser.
- Design and implement LL and LR parsers
- Design algorithms to do code optimization in order to improve the performance of a program in terms of space and time complexity.
- Design algorithms to generate machine code.

UNIT - I
Introduction: The structure of a compiler, the science of building a compiler, programming language basics
Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers.

UNIT - II
Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators.

UNIT - III
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.
Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

UNIT - IV
Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.
Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

UNIT - V
Machine-Independent Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs.

Suggested readings:
1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman

References Books:
1. Lex & Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly Compiler Construction, Louden, Thomson.

L	T	P	C
3	0	0	3

B.Tech V Semester

CS510PC: COMPUTER NETWORKS
(Common to CSE, CSBS , CSE (AI&ML) & CSE(Data Science))

Prerequisites
1.   A course on "Programming for problem solving".
2.   A course on "Data Structures".

Course Objectives

- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Identify and analyze various routing algorithms, congestion control algorithms.
- Outline the transport layer protocols like TCP and UDP.
- List and examine the applications of HTTP, WWW, DNS, Email, FTP and the underlying protocols.

UNIT - I

Network Hardware: Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Internetwork.

Network software: Protocol Hierarchies, Design Issues for the Layers, Connection-Oriented and Connectionless Services.

Reference Models: OSI, TCP/IP Reference models, Comparison of OSI and TCP/IP Models

Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: Magnetic Media, Twisted pairs, Coaxial Cable, Fiber Optics, Unguided Transmission Media: Radiowaves, Microwaves, Infrared.

UNIT - II

Data link layer: Design issues, Framing: Character Count, Character Stuffing, Bit Stuffing

Error Detection and Correction: Block Codes, Simple Parity Check, LRC, Hamming Distance, Checksum, Hamming Code, CRC

Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

Sliding Window protocols: Pipelining, Piggybacking, A one-bit sliding window protocol, A

protocol using Go-Back-N, A protocol using Selective Repeat,   Example data link protocols: HDLC, PPP

Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols.Wireless LANs, Connecting devices at the data link layer.

UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Link State Routing,

Congestion Control Algorithms: Approaches to Congestion Control, Traffic aware routing, Admission Control, Traffic throttling, Load shedding.

Quality of Service: Traffic Shaping, Packet scheduling, Admission Control, Integrated services, Differentiated Services, Internetworking,

Network layer in the Internet: IPv4 protocol, IP Addresses, IPv6 protocol, Internet Control Protocols: ICMP, ARP, RARP, BOOTP, DHCP,

Internetwork Routing: OSPF, BGP, Internet Multicasting.

UNIT - IV

Transport Layer:

Transport Services: Services provided to Upper layer, Transport service primitives, Berkeley Sockets

Elements of Transport protocols: Addressing, Error and Flow Control, Multiplexing, Crash Recovery, Connection management.

Internet Transport Protocols: TCP: Service Model, TCP Protocol, Segment header, TCP Connection establishment and Release, TCP Connection management, TCP Sliding Window, Timer management, TCP Congestion Control.

UDP: Protocol, UDP Header

UNIT - V

Application Layer: Domain name system- DNS Name Space, Resource records, Name Servers. SNMP, Electronic Mail: Architecture and Services, User Agent, Message Formats, Message Transfer, Final Delivery.

World Wide Web: Architectural Overview, Static Web pages, Dynamic web pages and Web applications, HTTP, Mobile Web.

Streaming audio and video: Digital Audio, Digital Video, Streaming Stored media, Streaming Live media, Real Time Conferencing.

TEXT BOOK:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson
2. Education/PHI,2011.

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. "Data and Computer Communications" by William Stallings 9 th Edition, Pearson Education 2010.
3. "TCP/IP Illustrated" by W. Richard Stevens, Addison-Wesley Professional; 2nd edition 2011.

L	T	P	C
3	0	0	3

B.Tech V Semester

CS515PE: GRAPH THEORY (Professional Elective – I)

Prerequisites
1.   An understanding of Mathematics in general is sufficient.

Course Outcomes

- Know some important classes of graph theoretic problems;
- Be able to formulate and prove central theorems about trees, matching, connectivity, colouring and planar graphs;
- Be able to describe and apply some basic algorithms for graphs;
- Be able to use graph theory as a modelling tool.

UNIT - I

Introduction-Discovery of graphs, Definitions, Subgraphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Special graphs, Complements, Larger graphs from smaller graphs, Union, Sum, Cartesian Product, Composition, Graphic sequences, Graph theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.

UNIT - II

Connected graphs and shortest paths - Walks, trails, paths, cycles, Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Weighted graphs, Dijkstra"s shortest path algorithm, Floyd-Warshall shortest path algorithm.

UNIT - III

Trees- Definitions and characterizations, Number of trees, Cayley"s formula, Kirchoﬀ -matrix-tree theorem, Minimum spanning trees, Kruskal"s algorithm, Prim"s algorithm, Special classes of graphs, Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Fleury"s algorithm, Chinese Postman problem, Hamilton Graphs, Introduction, Necessary conditions and sufficient conditions.

UNIT - IV

Independent sets coverings and matchings – Introduction, Independent sets and coverings: basic equations, Matchings in bipartite graphs, Hall"s Theorem, K¨onig"s Theorem, Perfect matchings in graphs, Greedy and approximation algorithms.

UNIT - V

Vertex Colorings- Basic definitions, Cliques and chromatic number, Mycielski"s theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Introduction and Basics, Gupta-Vizing theorem, Class-1 and Class-2 graphs, Edge-coloring of bipartite graphs, Class-2 graphs, Hajos union and Class-2 graphs, A scheduling problem and equitable edge-coloring.

TEXT BOOKS:
1.   J. A. Bondy and U. S. R. Murty. Graph Theory, volume 244 of Graduate Texts in Mathematics. Springer, 1st edition, 2008.
2.   J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.

REFERENCE BOOKS:

1.   Lecture Videos**:** http://nptel.ac.in/courses/111106050/13.
2.   Introduction to Graph Theory, Douglas B. West, Pearson.
3.   Schaum's Outlines Graph Theory, Balakrishnan, TMH.
4.   Introduction to Graph Theory, Wilson Robin j, PHI.
5.   Graph Theory with Applications to Engineering and Computer Science, Narsing Deo, PHI.
6.   Graphs - An Introductory Approach, Wilson and Watkins.

L	T	P	C
3	0	0	3

B.Tech V Semester
CS516PE : INTRODUCTION TO DATA SCIENCE (Professional Elective – I)

Prerequisites

Course Objectives

- Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration
- Understand the basic types of data and basic statistics
- Identify the importance of data reduction and data visualization techniques

Course Outcomes

After completion of the course, the student should be able to

- Understand basic terms what Statistical Inference means.
- Identify probability distributions commonly used as foundations for statistical modelling. Fit a model to data
- describe the data using various statistical measures
- utilize R elements for data handling
- perform data reduction and apply visualization techniques.

UNIT - I

Introduction: 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 – Over fitting. **Basics of R:** Introduction, R- Environment Setup, Programming with R, Basic Data Types.

UNIT - II
Data Types & Statistical Description

Types of Data: Attributes and Measurement, What is an Attribute? The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Inter- quartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

UNIT - III

Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting, **Matrices:** Creating and Naming Matrices, Matrix Sub setting, Arrays, Class. **Factors and Data Frames:** Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, subsetting of Data Frames, Extending Data Frames, Sorting Data Frames.
Lists: Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

UNIT - IV
Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements. **Iterative Programming in R:** Introduction, While Loop, For Loop, Looping Over List. **Functions in R:** Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

UNIT - V
Data Reduction: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute

Subset Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation. **Data Visualization:** Pixel-Oriented

Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:
1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:
1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
2. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
4. Paul Teetor, "R Cookbook", O'Reilly, 2011.

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B.Tech V Semester

CS517PE: WEB PROGRAMMING (Professional Elective – I)
(Common to CSE (AI &ML) & CSE (Data Science))

Course Objectives

The student should be able to:
- Understand the technologies used in Web Programming.
- Know the importance of object-oriented aspects of Scripting.
- Understand creating database connectivity using JDBC.
- Learn the concepts of web-based application using sockets.

Course Outcomes

Upon Completion of the course, the students will be able to

- Design web pages.
- Use technologies of Web Programming.
- Apply object-oriented aspects to Scripting.
- Create databases with connectivity using JDBC.
- Build web-based application using sockets.

UNIT - I
SCRIPTING: Web page Designing using HTML, Scripting basics- Client side and server side scripting. Java Script- Object, names, literals, operators and expressions- statements and features- events - windows -documents - frames - data types - built-in functions- Browser object model - Verifying forms.- HTML 5-CSS3- HTML 5 canvas - Web site creation using tools.

UNIT – II
JAVA: Introduction to object-oriented programming-Features of Java – Data types, variables and arrays
–Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input/ Output – Files – Utility Classes – String Handling.

UNIT – III
JDBC: JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries. Networking– Inet Address class – URL class- TCP sockets – UDP sockets, Java Beans –RMI.

UNIT – IV
APPLETS: Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

UNIT – V
XML AND WEB SERVICES: Xml – Introduction-Form Navigation-XML Documents- XSL – XSLT- Web services-UDDI-WSDL-Java web services – Web resources.

TEXT BOOKS:
1.   Harvey Deitel, Abbey Deitel, Internet and World Wide Web: How To Program 5th Edition.
2.   Herbert Schildt, Java - The Complete Reference, 7th Edition. Tata McGraw- Hill Edition.
3.   Michael Morrison XML Unleashed Tech media SAMS.

REFERENCE BOOKS:
1.   John Pollock, Javascript - A Beginners Guide, 3rd Edition –- Tata McGraw-Hill Edition.
2.   Keyur Shah, Gateway to Java Programmer Sun Certification, Tata McGraw Hill, 2002.

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B.Tech V Semester

CS518PE: IMAGE PROCESSING (Professional Elective – I)
(Common to CSE (AI &ML) & CSE (Data Science))

Prerequisites
1. Students are expected to have knowledge in linear signals and systems, Fourier Transform, basic linear algebra, basic probability theory and basic programming techniques; knowledge of Digital Signal Processing is desirable.
2. A course on "Computational Mathematics"
3. A course on "Computer Oriented Statistical Methods"

Course Objectives

The student should be able to:
- Provide a theoretical and mathematical foundation of fundamental Digital Image Processing concepts.
- The topics include image acquisition; sampling and quantization; preprocessing; enhancement; restoration; segmentation; and compression.

Course Outcomes

Upon Completion of the course, the students will be able to

- Demonstrate the knowledge of the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
- Demonstrate the knowledge of filtering techniques.
- Demonstrate the knowledge of 2D transformation techniques.
- Demonstrate the knowledge of image enhancement, segmentation, restoration and compression techniques.

UNIT - I
Digital Image Fundamentals: Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

UNIT - II
Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

UNIT - III
Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT - IV
Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

UNIT - V
Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

TEXT BOOK:
1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2nd Ed, 2004.
REFERENCE BOOKS:
1. Fundamentals of Digital Image Processing: A. K. Jain, PHI.
2. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
3. Digital Image Processing: William K. Pratt, John Wilely, 3rd Edition, 2004.

B.Tech V Semester

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CS519PE: DATA WAREHOUSING AND BUSINESS INTELLIGENCE
(Professional Elective – II)
(Common to CSE (AI &ML) & CSE (Data Science)(PE-I))

Course Objectives

The student should be able to:
- This course is concerned with extracting data from the information systems that deal with the day-to-day operations and transforming it into data that can be used by businesses to drive high-level decision making
- Students will learn how to design and create a data warehouse, and how to utilize the process of extracting, transforming, and loading (ETL) data into data warehouses.

Course Outcomes

Upon Completion of the course, the students will be able to

- Understand architecture of data warehouse and OLAP operations.
- Understand Fundamental concepts of BI and Analytics
- Application of BI Key Performance indicators
- Design of Dashboards, Implementation of Web Analytics
- Understand Utilization of Advanced BI Tools and their Implementation.
- Implementation of BI Techniques and BI Ethics.

UNIT - I

DATA WAREHOUSE: Data Warehouse-Data Warehouse Architecture- Multidimensional Data Model- Data cube and OLAP Technology-Data Warehouse Implementation -DBMS schemas for Decision support - Efficient methods for Data cube computation.

UNIT - II

Business Intelligence: Introduction – Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle. Data for BI - Data Issues and Data Quality for BI.

UNIT - III

BI Implementation - Key Drivers, Key Performance Indicators and Performance Metrics, BI Architecture/Framework, Best Practices, Business Decision Making, Styles of BI-vent-Driven alerts-A cyclic process of Intelligence Creation. The value of Business intelligence -Value driven and Information use.

UNIT - IV

Advanced BI – Big Data and BI, Social Networks, Mobile BI, emerging trends, Description of different BI-Tools (Pentaho, KNIME)

UNIT - V

Business intelligence implementation-Business Intelligence and integration implementation-connecting in BI systems-Issues of legality- Privacy and ethics- Social networking and BI.

TEXT BOOKS:
1.　　　Data Mining – Concepts and Techniques - JIAWEI HAN & MICHELINE KAMBER, Elsevier.
2.　　　Rajiv Sabherwal "Business Intelligence" Wiley Publications, 2012.

REFERENCE BOOKS:

1. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009.
2. David Loshin, Business Intelligence - The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.
3. Philo Janus, Stacia Misner, Building Integrated Business Intelligence Solutions with SQL Server, 2008 R2 & Office 2010, TMH, 2011.
4. Business Intelligence Data Mining and Optimization for decision making [Author: Carlo-Verellis] [Publication: (Wiley)]
5. Data Warehousing, Data Mining & OLAP- Alex Berson and Stephen J. Smith- Tata McGraw- Hill Edition, Tenth reprint 2007
6. Building the Data Warehouse- W. H. Inmon, Wiley Dreamtech India Pvt. Ltd.
7. Data Mining Introductory and Advanced topics –MARGARET H DUNHAM, PEA.

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B.Tech V Semester
CS523PE: INFORMATION RETRIEVAL SYSTEMS (Professional Elective – II)
(Common to, CSE (AI &ML) & CSE (Data Science))

Prerequisites
Data Structures.

Course Objectives

The student should be able to:
●   To learn the important concepts and algorithms in IRS
●   To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems

Course Outcomes

Upon Completion of the course, the students will be able to
●   Ability to apply IR principles to locate relevant information large collections of data
●   Ability to design different document clustering algorithms
●   Implement retrieval systems for web search tasks.
●   Design an Information Retrieval System for web search tasks.

UNIT - I
Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.
Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities.

UNIT - II
Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.
Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

UNIT - III
Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.
Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.

UNIT - IV
User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.
Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

UNIT - V
Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.
Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.

TEXT BOOK:
1.   Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer

REFERENCE BOOKS:
1.   Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2.   Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
3.   Modern Information Retrieval By Yates and Neto Pearson Education.

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B.Tech V Semester

CS524PE: PATTERN RECOGNITION (Professional Elective – II)

Prerequisites
●   Students are expected to have knowledge basic linear algebra, basic probability theory and basic programming techniques;
●   A course on "Computational Mathematics"
●   A course on "Computer Oriented Statistical Methods"

Course Objectives

The student should be able to:
●   This course introduces fundamental concepts, theories, and algorithms for pattern recognition and machine learning.
●   Topics include: Pattern Representation, Nearest Neighbor Based Classifier, Bayes Classifier, Hidden Markov Models, Decision Trees, Support Vector Machines, Clustering, and an application of hand-written digit recognition.

Course Outcomes

Upon Completion of the course, the students will be able to

●   Understand the theory, benefits, inadequacies and possible applications of various machine learning and pattern recognition algorithms
●   Identify and employ suitable machine learning techniques in classification, pattern recognition, clustering and decision problems.

UNIT - I:
Introduction: What is Pattern Recognition, Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition. Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction, Feature Selection, Evaluation of Classifier, Evaluation of Clustering.

UNIT - II:
Nearest Neighbor Based Classifier: Nearest Neighbor Algorithm, Variants of the NN Algorithm use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection. Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naïve Bayes Classifier, Bayesian Belief Network.

UNIT - III:
Hidden Markov Models: Markov Models for Classification, Hidden Morkov Models, Classification using HMMs. Decision Trees: Introduction, Decision Tree for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Examples of Decision Tree Induction.

UNIT - IV:
Support Vector Machines: Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification. Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.

UNIT - V:
Clustering: Why is Clustering Important, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets. An Application-Hand Written Digit Recognition: Description of the Digit Data, Preprocessing of Data, Classification Algorithms, Selection of Representative Patterns, Results.

TEXT BOOK:
1. Pattern Recognition: An Algorithmic Approach: Murty, M. Narasimha, Devi, V. Susheela, Spinger Pub, 1st Ed.

REFERENCE BOOKS:
1.   Machine Learning - Mc Graw Hill, Tom M. Mitchell.
2.   Fundamentals Of Speech Recognition: Lawrence Rabiner and Biing- Hwang Juang. Prentice- Hall Pub.

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B.Tech V Semester

CS525PE: COMPUTER VISION AND ROBOTICS (Professional Elective – II)
(Common to CSE (AI &ML) & CSE (Data Science))

Prerequisites
● UG level Course in Linear Algebra and Probability.

Course Objectives

The student should be able to:
● To understand the Fundamental Concepts Related To sources, shadows and shading.
● To understand the The Geometry of Multiple Views.

Course Outcomes

Upon Completion of the course, the students will be able to
● Implement fundamental image processing techniques required for computer vision.
● Implement boundary tracking techniques.
● Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
● Apply 3D vision techniques and Implement motion related techniques.
● Develop applications using computer vision techniques.

UNIT - I

CAMERAS: Pinhole Cameras.

Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases.

Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models.
Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT - II

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates.
Edge Detection: Noise, Estimating Derivatives, Detecting Edges.

Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT - III

The Geometry of Multiple Views: Two Views

Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras **Segmentation by Clustering:** What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT - IV

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness

Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice.

Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT - V

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations.
Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization.
Model-Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

TEXT BOOKS:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCE BOOKS:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008.
3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

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B.Tech V Semester

MC503ES: Essence of Indian Knowledge Tradition Part-1

Course Objective: The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific worldview, and basic principles of Yoga and holistic health care system. Course Outcome: Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

Course Outcome: Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

Course Content:

- Basic structure of Indian Knowledge System: अ ा Tदिशिव4ा T -४वा द,४उपवा द (आया व द, धनव द, गा‌णव ‌वा द, 3थापÆ िआद) ६वा दा ा ग (ि‌ा शाा‌ा T, क¾, ि‌ा न7ª, ा ाकरण, ¾ा ि‌ा तष, छा द) ४ उपाडा ग (धम शाा™, मीमा ा सा, पा राण, तक शाा™)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

REFERENCE BOOKS:
1. Knowledge traditions and practices of India, CBSE Publication.
2. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.
3. Swami Jitatmanand, Modern Physics and Vedantharatiya Vidya Bhavan.
4. Swami Jitatmanand, Holistic Science and Vedantharatiya Vidya Bhavan.
5. Fritzof Capra, Tao of Physics.
6. Fritzof Capra, The Wave of life.
7. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam.
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
9. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakashan, Delhi 2016. 11. P B Sharma (English translation), Shodashang Hridayan Pedagogy: Problem based learning, group discussions, collaborative mini projects

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

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B.Tech V Semester

CS553PC: MACHINE LEARNING LAB

Course Objectives

The student should be able to:
- The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

Course Outcomes

Upon Completion of the course, the students will be able to

- understand complexity of Machine Learning algorithms and their limitations;
- understand modern notions in data analysis-oriented computing;
- be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
- Be capable of performing experiments in Machine Learning using real-world data.

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)
2. Extract the data from database using python
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k- means clustering with 3 means (i.e., 3 centroids)

```
VAR1   VAR2    CLASS
1.713  1.586   0
0.180  1.786   1
0.353  1.240   1
0.940  1.566   0
1.486  0.759   1
1.266  1.106   0
1.540  0.419   1
0.459  1.799   1
0.773  0.186   1
```

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

   medium   skiing design   single   twenties no -> highRisk
   high   golf   trading married forties yes -> lowRisk
   low   speedway transport married thirties yes -> medRisk
   medium football banking   single thirties yes -> lowRisk
   high   flying media   married fifties yes -> highRisk
   low   football security single twenties no -> medRisk
   medium golf   media   single thirties yes -> medRisk
   medium golf   transport married forties yes -> lowRisk high
   skiing banking   single thirties yes -> highRisk
   low   golf   unemployed married forties yes -> highRisk

   Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

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B.Tech V Semester

CS557PC: COMPUTER NETWORKS LAB
(Common to CSE, CSE (AI & ML) & CSE (Data Science))

Course Objectives

The student should be able to:
- To understand the working principle of various communication protocols.
- To understand the network simulator environment and visualize a network topology and observe its performance
- To analyze the traffic flow and the contents of protocol frames.

Course Outcomes

Upon Completion of the course, the students will be able to

- Implement data link layer farming methods
- Analyze error detection and error correction codes.
- Implement and analyze routing and congestion issues in network design.
- Implement Encoding and Decoding techniques used in presentation layer
- To be able to work with different network tools

List of Experiments
1. Write a program to implement framing.
 i. Fixed framing, ii. Variable framings
2. Write a program to implement stuffing techniques.
 i. Bit-stuffing ii. Character stuffing
3. Write a program to implement checksum
4. Write a program to compute CRC code for the polynomial CRC-12
5. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
6. Write a program to implement classful addressing.
7. Write a program to implement classless addressing.
8. Write a program to implement Dijsktra's algorithm to compute the shortest path through a network
9.   Write a program to divide a given network into n-sub networks.
10. Implement distance vector routing algorithm for obtaining routing tables at each   node.
11. Write a program to implement Link state routing
12. Write a program for congestion control using Leaky bucket algorithm
13. Implement data encryption and data decryption.

TEXT BOOK:
1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI,2011.
2. Data Communications and Networking – Behrouz A. Forouzan. Fifth Edition TMH, 2017.

REFERENCE BOOKS:
1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. "Data and Computer Communications" by William Stallings 9 th Edition, Pearson Education 2010.
3. "TCP/IP Illustrated" by W. Richard Stevens,Addison-Wesley Professional; 2nd edition 2011.

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B.Tech V Semester

EN553HS: ADVANCED COMMUNICATION SKILLS LAB
(Common to CSE, CSE (AI &ML) & CSE (DS))

INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

● Gathering ideas and information to organize ideas relevantly and coherently.
● Engaging in debates.
● Participating in group discussions.
● Facing interviews.
● Writing project/research reports/technical reports.
● Making oral presentations.
● Writing formal letters.
● Transferring information from non-verbal to verbal texts and vice-versa.
● Taking part in social and professional communication.

OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

● To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
● Further, they would be required to communicate their ideas relevantly and coherently in writing.
● To prepare all the students for their placements.

SYLLABUS

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1.   **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2.   **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3.   **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4.   **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/e- mails/assignments etc.
5.   **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

● Spacious room with appropriate acoustics.
● Round Tables with movable chairs
● Audio-visual aids

- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

SUGGESTED SOFTWARE:
The software consisting of the prescribed topics elaborated above should be procured and used.
- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:
1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCE BOOKS:
1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

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B.Tech V Semester

MC501HS: INTELLECTUAL PROPERTY RIGHTS
(Common to CSE, CSE (AI &ML) & CSE (Data Science))

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT & REFERENCE BOOKS:
1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Computer Science & Engineering (AI&ML)
Scheme of Instruction and Examination
(Choice Based Credit System)
For the batches admitted with effect from the academic year 2021-2022
VI Semester

S.No.	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	CS603PC	Artificial Intelligence	3	1	0	30	70	3	4
2	CS607PC	DevOps	3	1	0	30	70	3	4
3	CS609PC	Natural Language Processing	3	1	0	30	70	3	4
4	--	Professional Elective – III	3	0	0	30	70	3	3
5	--	Open Elective - I	2	0	0	30	70	3	2
6	MC602ES	Cyber security	3	0	0	30	70	3	0
7	MA654BS	Finishing Schools-IV (Quantitative Aptitude & Analytical Ability)	0	0	2	30	70	3	1
8	CS653PC	Artificial Intelligence and Natural Language Processing Lab	0	0	3	30	70	3	1.5
9	CS655PC	DevOps Lab	0	0	3	30	70	3	1.5
10	--	Professional Elective - III Lab	0	0	2	30	70	3	1
Total Hours/Marks/Credits			**17**	**3**	**10**	**300**	**700**	**-**	**22**
11	MC601ESC	Environmental Science (for lateral entry students)	3	0	0	30	70	3	0

L: Lecture   **T**: Tutorial   **D**: Drawing   **P**: Practical   **CIE** - Continuous Internal Evaluation   **SEE** - Semester End Examination

L	T	P	C
3	1	0	4

VI Semester Syllabus
CS603PC: ARTIFICIAL INTELLIGENCE

Prerequisites:
1.   A course on "Computer Programming and Data Structures"
2.   A course on "Advanced Data Structures"
3.   A course on "Design and Analysis of Algorithms"
4.   A course on "Mathematical Foundations of Computer Science"
5.   Some background in linear algebra, data structures and algorithms, and probability will all be helpful

Course Objectives

To Learn
- To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes

- Ability to formulate an efficient problem space for a problem expressed in natural language.
- Select a search algorithm for a problem and estimate its time and space complexities.
- Possess the skill for representing knowledge using the appropriate technique for a given problem.
- Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.

UNIT - I
Problem Solving by Search-I: Introduction to AI, Intelligent Agents

Problem Solving by Search –II: Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching wih Partial Observations, Online Search Agents and Unknown Environment .

UNIT - II
Problem Solving by Search-II and Propositional Logic

Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions.
Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.
Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

UNIT - III
Logic and Knowledge Representation

First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic. **Inference in First-Order Logic:** Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.
Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

UNIT - IV
Planning

Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

UNIT - V
Uncertain knowledge and Learning

Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use,

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

TEXT BOOK:
1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:
1. Artificial Intelligence, 3rd Edn, E. Rich and K.Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

L	T	P	C
3	1	0	4

VI Semester Syllabus
CS607PC: DevOps

Course Objectives

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

Course Outcomes

- Identify components of Devops environment.
- Describe Software development models and architectures of DevOps.
- Apply different project management, integration, testing and code deployment tool.
- Investigate different DevOps Software development models.
- Assess various Devops practices.
- Collaborate and adopt Devops in real-time projects.

UNIT - I
Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT - II
Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. **DevOps influence on Architecture:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

UNIT - III
Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT - IV
Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT - V
Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development
Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXT BOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN- 10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOK:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

L	T	P	C
3	1	0	4

VI Semester Syllabus
CS609PC : NATURAL LANGUAGE PROCESSING

Prerequisites

1.   Data structures, finite automata and probability theory.

Course Objectives

- Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Course Outcomes

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms
- Able to design different language modeling Techniques.

UNIT - I
Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT - II
Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

UNIT - III
Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT - IV
Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT - V
Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure **Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Crosslingual Language Modeling

TEXT BOOKS:
1. Multilingual natural Language Processing Applications: From Theory to Practice –   Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOK:
1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

L	T	P	C
3	0	0	3

VI Semester Syllabus
CS618PE: INTERNET OF THINGS
(Professional Elective – III)
[Common to CSE (for PE-II), CSBS & CSE (AI &ML))]

Prerequisites

Course Objectives

- To introduce the terminology, technology and its applications
- To introduce the concept of M2M (machine to machine) with necessary protocols
- To introduce the Python Scripting Language which is used in many IoT devices
- To Introduce Programming Raspberry Pi with Python.
- To introduce the hardware and working principles of various sensors used for IoT.

Course Outcomes

- Understand the concepts of Internet of Things.
- Design IoT applications in different domain and be able to analyze their performance.
- Able to know the Language features of Python.
- Able to know about working of Raspberry Pi
- Able to know the working of various Sensors.

Unit I: Introduction to Internet of Things

Introduction, Definition and Characteristics of IoT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT communication models, IoT Communication APIs. **IoT Enabling Technologies** — Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Deployment Templates- IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6.

Unit II: Domain Specific IoT
Introduction , Home Automation- Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Smart Cities- Smart Parking, Smart lighting, Smart roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment- Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection, Energy- Smart Grids, Renewable Energy Systems, Prognostics, Retail- Inventory Management, Smart Payments, Smart Vending Machines, Logistics- Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics, Agriculture- Smart Irrigation, Green House Control, Industry- Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle- Health & Fitness Monitoring, Wearable Electronics. IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software Defined Networking, Network Function Virtualization

Unit III:

IoT Systems - Logical Design using Python- Introduction, Python Data Types & Data Structures-

Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Control Flow- if, for, while, range, break/continue, pass

Functions, Modules, Packages, File Handling, Date/Time Operations, Classes, Python Packages of Interest for IoT- JSON, XML, HTTPLib, URLLib, SMTPLib

Unit IV:

IoT Physical Devices and Endpoints - What is an IoT Device- Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces - serial, SPI, I2C,

Programming Raspberry Pi with Python- Controlling LED with Raspberry Pi, interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi.

Unit V:

Buzzer- Function of a Buzzer, Two Kinds of Buzzer, **Relays**- What is a Relay, Its Working, Relay Uses, Why Relay is used in Motor Control, Relay Module.
Sensors: What is an IoT Sensor, **IoT Sensors Types**- Pressure Sensors, Light Sensors, Temperature & Humidity Sensors, **Working with Camera Module.**

TEXT BOOKS:
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

   Reference Books:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
2. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
3. A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors) 1st
4. Edition, Kindle Edition by Volker Ziemann 2018.

L	T	P	C
3	0	0	3

VI Semester Syllabus
CS622PE: MOBILE APPLICATION DEVELOPMENT
(Professional Elective – III)
[Common to CSBS, CSE (AI &ML) & CSE (DS)]

Prerequisites
- Acquaintance with JAVA programming.
- A Course on DBMS.

Course Objectives

The student should be able to:
- To demonstrate their understanding of the fundamentals of Android operating systems.
- To improves their skills of using Android software development tools.
- To demonstrate their ability to develop software with reasonable complexity on mobile platform.
- To demonstrate their ability to deploy software to mobile devices.
- To demonstrate their ability to debug programs running on mobile devices.

Course Outcomes

Upon Completion of the course, the students will be able to

- Student understands the working of Android OS Practically.
- Student will be able to develop Android user interfaces
- Student will be able to develop, deploy and maintain the Android Applications.

UNIT - I

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT - II

Android User Interface: Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components – Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

UNIT - III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT - IV

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT - V

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

TEXT BOOKS:

1.   Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2.   Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.

REFERENCE BOOK:

1.   Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

L	T	P	C
3	0	0	3

VI Semester Syllabus
CS623PE: DATA MINING (Professional Elective – III)

Prerequisites
- A course on "Database Management Systems"
- Knowledge of probability and statistics

Course Objectives
- It presents methods for mining frequent patterns, associations, and correlations.
- It then describes methods for data classification and prediction, and data–clustering approaches.
- It covers mining various types of data stores such as spatial, textual, multimedia, streams.

Course Outcomes
- Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
- Apply pre-processing methods for any given raw data.
- Extract interesting patterns from large amounts of data.
- Discover the role played by data mining in various fields.
- Choose and employ suitable data mining algorithms to build analytical applications
- Evaluate the accuracy of supervised and unsupervised models and algorithms.

UNIT - I
Data Mining: Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining–Data Pre-processing.

UNIT - II
Association Rule Mining: Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM.

UNIT - III
Classification: Classification and Prediction – Basic concepts–Decision tree induction–Bayesian classification, Rule–based classification, Lazy learner.

UNIT - IV
Clustering and Applications: Cluster analysis–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

UNIT - V
Advanced Concepts: Basic concepts in Mining data streams–Mining Time–series data—Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia–Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

TEXT BOOKS:
1.   Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2.   Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

REFERENCE BOOK:
1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.

L	T	P	C
3	0	0	3

VI Semester Syllabus
CS624PE: CRYPTOGRAPHY AND NETWORK SECURITY
(Professional Elective - III)
[Common to CSE (AI &ML) & CSE (Data Science)]

Prerequisites

Course Objectives

The student should be able to:
- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec
- Understand Intrusions and intrusion detection
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e- mail message.
- Discuss Web security and Firewall

Course Outcomes

Upon Completion of the course, the students will be able to

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

UNIT - I
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security **Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT - II
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.
Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT - III
Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.
Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

UNIT - IV
Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH)
Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

UNIT - V

E-Mail Security: Pretty Good Privacy, S/MIME **IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange
Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

TEXT BOOKS:
1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: AtulKahate, McGraw Hill, 3rd Edition

REFERENCE BOOKS:
1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: ForouzanMukhopadhyay, McGraw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

L	T	P	C
3	0	0	0

VI-Semester
MC602ES: CYBER SECURITY
(Common to all Branches)

Course objectives:
- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Course Outcomes:
The students will be able
- To understand various cyber-attacks and cybercrimes.
- Knowledge about cyber laws and cyber forensics.
- Summarize cybercrimes in mobile and wireless devices, how to protect them
- Knowledge about IPR issues in cyber space and cyber terrorism.

UNIT-I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIATriad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, IP spoofing, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Comprehensive Cyber Security Policy.

UNIT-II
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace.
Introduction,HistoricalbackgroundofCyberforensics,DigitalForensicsScience,TheNeed for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT-III
Cybe crime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations.

UNIT-IV
Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing.
Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cybercriminals.

UNIT-V
Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial, etc.

TEXTBOOKS:
1. Nina God bole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, India 2012.
2. B.B.Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, andPerspectives,CRCPress,ISBN9780815371335,2018.

REFERENCES:
1.   Mark F. Grady, Fransesco Parisi, " The Law and Economics of Cyber security", Cambridge University Press,2006.
2.   Cyber Security Essentials, James Graham, Richard Howard and RyanOtson, CRC Press, 2016.
3.   Introduction to Cyber Security, Chwan - Hwa (john)Wu, J.David Irwin, CRCPress T&F Group.

L	T	P	C
0	0	2	1

VI Semester
MA654BS: Finishing School-IV
(Quantitative Aptitude & Analytical Ability)
(Common to CSE, IT, CSBS, CSE(AI&ML) & CSE(Data Science))

Course Objectives:

This is a foundation course and aims to enhance employability skills in students.

- Students will be introduced to higher order thinking skills and problem-solving on the following areas - Arithmetic ability, Numerical ability and General reasoning.
- Students will be trained to work systematically with speed and accuracy while solving problems.

Course Outcomes:

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

- Solve questions on the above-mentioned areas using shortcut and smart methods
- Understand the fundamental concepts of Aptitude skills
- Perform calculations with speed and accuracy

UNIT 1: QUANTITATIVE APTITUDE - NUMERICAL ABILITY
- Number system
- Divisibility Rules
- Square root
- Cube root
- Problems on numbers
- LCM and HCF

UNIT 2: QUANTITATIVE APTITUDE- ARITHMETIC ABILITY-I
- Percentage
- Ratio proportions
- Averages
- Profit, loss and discounts
- Simple and Compound interest

UNIT3: QUANTITATIVE APTITUDE- ARITHMETIC ABILITY-II

- Pipes and Cisterns
- Ages
- Time- Work-Speed-Distance
- Clocks & Calendars
- Venn diagrams
- Tables and graphs

UNIT 4: REASONING ABILITY – GENERAL REASONING-I
- Coding decoding
- Directions
- Series completions - Letter, Number & Element Series
- Seating arrangements
- Symbols and Notations

UNIT 5: REASONING ABILITY- GENERAL REASONING -II

- Analogies
  - Alphabet Analogy
  - Numerical Analogy
- Classification
  - Alphabet Classification
  - Word Classification
  - Miscellaneous Classification
- Alphabet test
  - Arranging words in Alphabetical Order
  - Problems based on Letter-Word
  - Problems based on Alphabetical Quibble
- Blood Relations

REFERENCES:

1. R.S. Aggarwal - Quantitative Aptitude for Competitive Examinations.
2. Arun Sharma - Quantitative Aptitude for CAT.
3. Arihant Publications - Fast Track Objective Arithmetic.
4. Sarvesh K.-Quantitative aptitude
5. A New Approach to Reasoning Verbal & Non-Verbal, Book by B.S. Sijwalii and InduSijwali
6. A Modern Approach to Logical Reasoning, Book by AgarwalaVikas and R.S. Aggarwal

L	T	P	C
0	0	3	1.5

VI Semester Syllabus
CS653PC: ARTIFICIAL INTELLIGENCE AND
NATURAL LANGUAGE PROCESSING LAB

Prerequisites

Course Objectives

The student should be able to:
- Become familiar with basic principles of AI toward problem solving, knowledge representation, and learning.
- Knowledge on basic Language processing features, design an innovative application using NLP components

Course Outcomes

Upon Completion of the course, the students will be able to

- Apply basic principles of AI in solutions that require problem solving, knowledge representation, and learning.
- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
- Able to design, implement, and analyze NLP algorithms

List of Experiments (AI)
1) Write a program in prolog to implement simple facts and Queries
2) Write a program in prolog to implement simple arithmetic
3) Write a program in prolog to solve Monkey banana problem
4) Write a program in prolog to solve Tower of Hanoi
5) Write a program in prolog to solve 8 Puzzle problems
6) Write a program in prolog to solve 4-Queens problem
7) Write a program in prolog to solve Traveling salesman problem
8) Write a program in prolog for Water jug problem

List of Experiments (NLP)
1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing

TEXT BOOKS:
1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010. Pearson Education, Inc. ISBN: 978-0-13-604259-4
2. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
3. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition
4. O'Reilly Media, 2009.

REFERENCE BOOK:
1. Breck Baldwin, ―Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.

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VI Semester Syllabus
CS655PC: DEVOPS LAB

Course Objectives

The student should be able to:
- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in
- DevOps and related methods to reach a continuous delivery capability
- Implement automated system update and DevOps lifecycle

Course Outcomes

Upon Completion of the course, the students will be able to

- Identify components of Devops environment
- Apply different project management, integration, testing and code deployment tool
- Investigate different DevOps Software development, models
- Demonstrate continuous integration and development using Jenkins.

List of Experiments:

1. Write code for a simple user registration form for an event.
2. Explore Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code written in exercise 1.
4. Jenkins installation and setup, explore the environment.
5. Demonstrate continuous integration and development using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.
8. Integrate Kubernetes and Docker
9. Automate the process of running containerized application developed in exercise 7 using Kubernetes.
10. Install and Explore Selenium for automated testing.
11. Write a simple program in JavaScript and perform testing using Selenium.
12. Develop test cases for the above containerized application using selenium.

TEXT BOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOKS / LEARNING RESOURCES:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley
2. Edureka DevOps Full Course - https://youtu.be/S_0q75eD8Yc

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VI Semester Syllabus
CS663PE: INTERNET OF THINGS LAB
(PE – III LAB)
(Common to CSE (PE-II) , CSE(AI&ML))

Course Objectives:

- Will be able to write and test on a Raspberry Pi, but not limited this only.
- Will be able to do some Python programs on Raspberry Pi

Course Outcomes: On successful completion of the course, the student will:

- Able to understand the applications areas of IOT.
- Able to realize the revolution of Internet and Mobile devices, cloud and Sensors networks.
- Working with Raspberry Pi.

List of Experiments:

1. Start Raspberry Pi and try various Linux commands in command terminal window:
   ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc.
2. Run some python programs on Pilike:
   Read your name and print Hello message with name
   Read two numbers and print their sum, difference, product and division. Word and character count of a given string
   Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input
   Print a name 'n' times, where name and n are read from standard input, using for and while loops.
   Handle Divided by Zero Exception.
   Print current time for 10 times with an interval of 10 seconds. Read a file line by line and print the word count of each line.
3. Light an LED through Pythonprogram
4. Get input from two switches and switch on correspondingLEDs
5. Flash an LED at a given on time and off time cycle, where the two times are taken froma file.
6. Flash an LED based on cron output (acts as analarm)
7. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to aload.
8. Working with Camera Module.
9. a. A Python program to check the presence of light using **LDR Sensor Module** on Pi
   b. A Python program to measure the intensity of light using **LDR Sensor Module** on Pi

Text Books:

1. InternetofThings-AHands-onApproach,ArshdeepBahgaandVijayMadisetti, Universities Press, 2015, ISBN:9788173719547
2. A Hands-On Course in Sensors Using the Arduino and Raspberry Pi (Series in Sensors) **1st** Edition, Kindle Edition by Volker Ziemann.

Reference Books:

1. Getting Started with RaspberryPi, Matt Richardson & Shawn Wallace, O'Reilly(SPD), 2014, ISBN: 9789350239759
2. RaspberryPi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895
3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

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VI Semester Syllabus
CS666PE: MOBILE APPLICATION DEVELOPMENT LAB
(PE – III Lab)
(Common to CSE (AI &ML) & CSE (Data Science))

Course Objectives

The student should be able to:
- To learn how to develop Applications in android environment.
- To learn how to develop user interface applications.
- To learn how to develop URL related applications.

Course Outcomes

Upon Completion of the course, the students will be able to

- Student understands the working of Android OS Practically.
- Student will be able to develop user interfaces.
- Student will be able to develop, deploy and maintain the Android Applications

List of Experiments

1. Create an Android application that shows Hello + name of the user and run it on an emulator.
   (b) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use
   (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.
3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.
6. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.
7. Create a user registration application that stores the user details in a database table.
8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.
9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.
10. Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.
11. Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.
12. Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.
13. Create an application that shows the given URL (from a text field) in a browser.

TEXT BOOKS:
1.   Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2.   Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013
REFERENCE BOOK:
1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

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VI Semester Syllabus
CS667PE: DATA MINING LAB
(PE – III LAB)

Prerequisites
- A course on "Database Management System.

Course Objectives

The student should be able to:
- The course is intended to obtain hands-on experience using data mining software.
- Intended to provide practical exposure of the concepts in data mining algorithms.

Course Outcomes

Upon Completion of the course, the students will be able to

- Apply preprocessing statistical methods for any given raw data.
- Gain practical experience of constructing a data warehouse.
- Implement various algorithms for data mining in order to discover interesting patterns from large amounts of data.
- Apply OLAP operations on data cube construction.

LIST OF EXPERIMENTS:

Experiments using Weka & Python

1.   Data Processing Techniques:
(i)   Data cleaning   (ii) Data transformation – Normalization   (iii) Data integration
2.   Implementation of Attribute oriented induction algorithm
3.   Implementation of apriori algorithm
4.   Implementation of FP – Growth algorithm
5.   Implementation of Decision Tree Induction
6.   Calculating Information gain measures
7.   Classification of data using Bayesian approach
8.   Classification of data using K – nearest neighbor approach
9.   Implementation of K – means algorithm
10.   Implementation of BIRCH algorithm
11.   Implementation of PAM algorithm
12.   Implementation of DBSCAN algorithm

TEXT BOOKS:
1.   Data Mining – Concepts and Techniques - JIAWEI HAN &MICHELINE KAMBER, Elsevier.
2.   Data Warehousing, Data Mining &OLAP- Alex Berson and Stephen J. Smith- Tata McGraw-Hill Edition, Tenth reprint 2007.
REFERENCE BOOK:
1.   Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Anuj Karpatne, Introduction to Data Mining, Pearson Education.

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VI Semester Syllabus
CS668PE: CRYPTOGRAPHY AND NETWORK SECURITY LAB
(PE – III Lab)
(Common to CSE (AI &ML) & CSE (Data Science))

Course Objectives

The student should be able to:
● Explain the objectives of information security
● Explain the importance and application of each of confidentiality, integrity, authentication and availability
● Understand various cryptographic algorithms.

Course Outcomes

● Upon Completion of the course, the students will be able to
● Understand basic cryptographic algorithms, message and web authentication and security issues.
● Identify information system requirements for both of them such as client and server.
● Understand the current legal issues towards information security.

List of Experiments:
1.   Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2.   Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3.   Write a Java program to perform encryption and decryption using the following algorithms
a.   Ceaser cipher b. Substitution cipher c. Hill Cipher
4.   Write a C/JAVA program to implement the DES algorithm logic.
5.   Write a C/JAVA program to implement the Blowfish algorithm logic.
6.   Write a C/JAVA program to implement the Rijndael algorithm logic.
7.   Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8.   Write a Java program to implement RSA algorithm.
9.   Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.

TEXT BOOKS:
1.   Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2.   Cryptography and Network Security: Atul Kahate, McGraw Hill, 3rd Edition

REFERENCE BOOKS:
1.   Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2.   Cryptography and Network Security: Forouzan Mukhopadhyay, McGraw Hill, 3rd Edition
3.   Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4.   Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5.   Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6.   Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

L	T	P	C
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B.Tech. VI - Semester Syllabus
MC601ESC: Environmental Science
(Common to all branches)

Course Objectives:

- To understand the natural resources and their conservation.

- To understand the importance of ecosystem, biodiversity and ecological balance for sustainable development.

- To gain knowledge about environmental pollution, effects and controlling measures.

- To study about global environmental problems and global issues.

- To understand the environmental policies, regulations and sustainable development.

Course Outcomes:

-
- **After completing the course, the student will be able to:**
- Learn about different types of natural resources and take up the measures to protect the resources.

- Get the information about ecosystem, biodiversity and their usage and conservation.

- Get the information about the types of pollution, understand their effects and controlling measures.

- Gain the knowledge about current global environmental issues and initiations to be taken to protect the environment.

- Gain the knowledge about environmental acts, EIA, sustainable development and follow the rules and regulations.

UNIT I : NATURAL RESOURCES (12 hours)

Classification - Renewable and Non-renewable resources.

Forest resources - Uses, deforestation- causes, effects and preventive measures.

Water Resources - Uses and over utilization of ground water, rain water harvesting, dams - benefits and problems. Causes, effects and management of floods and drought.

Mineral resources - Uses and Impacts of mining.

Energy resources - Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources.

UNIT II: ECOSYSTEM AND BIODIVERSITY (12 hours)

Ecosystem: Concept of ecosystem - Structure and functions of ecosystem. Food chain, food web and ecological pyramids - significance. Primary and Secondary production - Energy flow models: universal and single channel. Biogeochemical Cycles: Carbon cycle and Nitrogen cycle.

Biodiversity: Definition, Levels of Biodiversity, Values of biodiversity, Hotspots of biodiversity, Threats to biodiversity, Conservation of biodiversity: In-Situ and Ex-situ conservation methods.

UNIT III: ENVIRONMENTAL POLLUTION (12 hours)

Pollution - Definition and classification.

Air pollution: Definition, sources, causes, effects and control measures. Ambient air quality parameters, case Study.

Water pollution: Definition, sources, causes, effects and control measures. Waste water treatment. Case study (Namami Ganga Project)

Soil pollution: Sources, Land degradation - Soil erosion – effects and control measures. Impacts of modern agriculture on soil. Biomagnification and Bioaccumulation (Minamata disease).

Noise pollution: Sources, effects and control measures.

Solid Waste: E-Waste and Municipal solid waste management.

UNIT IV: GLOBAL ENVIRONMENTAL ISSUES AND GLOBAL EFFORTS (12 hours)

Global warming: Greenhouse effect - definition, sources and effects of greenhouse gases. Ozone layer depletion - Importance of ozone layer, Ozone depleting substances - sources and effects. Acid rain -causes and effects. Climate change - National Action Plan on Climate Change (NAPCC) – Government of India Initiatives. International conventions/protocols: The Earth summit, Kyoto Protocol and Montreal Protocol. Carbon credits - Emission trading, Green Chemistry Principles. Biodiesel-concept - transesterification and advantages.

UNIT V: ENVIRONMENTAL ACTS, EIA & SUSTAINABLE DEVOLOPMENT (12 hours)

Environmental Protection Act - **Legal aspects**: Air (Prevention and Control of pollution) Act 1981, Water (Prevention and control of pollution) Act -1974, Wildlife (Protection) Act – 1972, Biodiversity Act - 2002. Environmental Impact Assessment – Concept, structure and flow chart of EIA. Concept of sustainable development - Environmental education, Concept of green building, Ecological foot print, Low carbon life style, Life cycle assessment (LCA) and Clean development mechanisms.

Project Work: Related to Current environmental issues.

Text Books:

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Grants Commission, Universities Press, 3rd Edition.
2. Kaushik A., Kaushik C.P., Text Book of Environmental Studies, New age International Publishers, 4th Edition.

Reference Books:

1. Anji Reddy M ., Textbook of Environmental Sciences and Technology, BS Publication.
2. Rajagopalan R., Environmental Studies, Oxford University Press, 3rd Edition
3. Raghavan Nambiar K., Text Book of Environmental Studies, SciTech Publications 2nd Edition.

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Computer Science & Engineering (AI&ML)
Scheme of Instruction and Examination
(Choice Based Credit System)
For the batches admitted with effect from the academic year 2021-2022
VII Semester

Sl. No.	Course Code	Course Title	Instruction			Examination		Duration of SEE in Hours	Credits
			Hours Per Week			Max. Marks			
			L	T	P/D	CIE	SEE		
1	CS701PC	Neural Networks & Deep Learning	3	0	0	30	70	3	3
2	CS705PC	Reinforcement Learning	3	0	0	30	70	3	3
3	--	Professional Elective - IV	3	0	0	30	70	3	3
4	--	Professional Elective - V	3	0	0	30	70	3	3
5	--	Open Elective - II	2	0	0	30	70	3	2
6	CS753PC	Deep Learning Lab	0	0	2	30	70	3	1
7	CS755PC	Industrial Oriented Mini Project/ Summer Internship	0	0	4	-	100	-	2
8	CS756PC	Seminar	0	0	2	100	-	-	1
9	CS758PC	Project Stage - I	0	0	6	30	70	-	3
Total Hours/Marks/Credits			**14**	**0**	**14**	**310**	**590**	**--**	**21**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical **CIE** - Continuous Internal Evaluation **SEE** - Semester End Examination

L	T	P	C
3	0	0	3

B.Tech VII Semester
CS701PC: NEURAL NETWORKS AND DEEP LEARNING

Course Objectives

To Learn
- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Artificial Neural Networks
- To gain knowledge to apply optimization strategies.

Course Outcomes

After learning the contents of this paper, the student must be able to
- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems
- Ability to use an efficient algorithm for Deep Models
- Ability to apply optimization strategies for large scale applications.

UNIT-I
Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT-II
Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT - III
Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

UNIT - IV
Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

UNIT - V
Optimization for Train Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second- Order Methods, Optimization Strategies and Meta-Algorithms
Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing

TEXT BOOKS:
1. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

L	T	P	C
3	0	0	3

B.Tech VII Semester

CS705PC: REINFORCEMENT LEARNING

Course Objectives

The main objectives of this course are to:
- Knowledge on fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks.

Course Outcomes

- Understand basics of RL.
- Understand RL Framework and Markov Decision Process.
- Analyzing through the use of Dynamic Programming and Monte Carlo.
- Understand TD(0) algorithm, TD(λ) algorithm.

UNIT - I

Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sub linear regret, UCB algorithm, KL-UCB, Thompson Sampling.

UNIT - II

Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration & policy iteration

UNIT - III

The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation

UNIT - IV

Bootstrapping; TD(0) algorithm; Convergence of Monte Carlo and batch TD(0) algorithms; Model-free control: Q-learning, Sarsa, Expected Sarsa.

UNIT - V

n-step returns; TD(λ) algorithm; Need for generalization in practice; Linear function approximation and geometric view; Linear TD(λ). Tile coding; Control with function approximation; Policy search; Policy gradient methods; Experience replay; Fitted Q Iteration; Case studies.

TEXT BOOKS:
1. "Reinforcement learning: An introduction," First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020.
2. "Statistical reinforcement learning: modern machine learning approaches," First Edition, Sugiyama, Masashi. CRC Press 2015.

REFERENCE BOOKS:
1. "Bandit algorithms," First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
2. "Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.
3. Alexander Zai and Brandon Brown "Deep Reinforcement Learning in Action," First Edition, Manning Publications 2020.

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B.Tech VII Semester

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CS716PE: CLOUD COMPUTING
(PROFESSIONAL ELECTIVE – IV)
(Common to CSE, IT, CSE (AI & ML) & CSE (DS- PE-V))

</div>

Prerequisites:
1. Courses on Computer Networks, Operating Systems, Distributed Systems.

Course Objectives

- To know the basics of cloud computing and its advantages.
- To analyze the components of cloud computing and its business perspective.
- To understand various cloud service/deployment models.
- To evaluate the various cloud development tools
- To study various cloud service provider services. .

Course Outcomes

Students would be able to
- Ability to understand the fundamentals of cloud computing.
- Understand the architecture of cloud computing model.
- Ability to understand various service and deployment models of cloud.
- Understand the concept of virtualization and its types.
- Understanding cloud service providers and cloud based applications..

UNIT – I
Cloud Computing Fundamentals: Motivation for Cloud Computing, Basic Principles of Cloud computing. Five Essential Characteristics, Four Cloud Deployment Models, Three service Offering Models, Requirements for Cloud Services - Cloud Ecosystem, Cloud Application - Virtualization-approaches and types

UNIT – II
Cloud Computing Architecture and Management: Cloud architecture Layers, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Networking Technologies, Applications on the Cloud, Managing the Cloud application, Migrating Application to Cloud- Phases of Cloud Migration - Approaches for Cloud Migration

UNIT – III
Cloud Deployment Models: Private Cloud, Public cloud, Community Cloud and Hybrid Cloud – Characteristics, Suitability, Issues, Advantages and Disadvantages.
Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service - Characteristics, Suitability, Pros and Cons and Summary.

UNIT – IV
Virtualization technology
Virtual Machine Technology - Types of virtualization - System virtual machines- Virtual machines and elastic computing, Virtual machine migration - Virtualization Applications In Enterprises- Security through virtualization, Desktop virtualization, Server consolidation, Automating infrastructure management, Pitfalls Of Virtualization.

UNIT – V
Cloud Service Providers and Applications: Amazon Web Services, Amazon Elastic Compute Cloud, Google Cloud Platform, Google App Engine, Microsoft Azure, Windows Azure, IBM Cloud Models – Cloud Security issues – Case studies in Cloud Computing and its applications.

Suggested Reading:
1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014.
2. "Enterprise Cloud Computing Technology Architecture Applications", Gautam Shroff, Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

Reference Books:
1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg   and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

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B.Tech VII Semester

CS721PE: EXPERT SYSTEMS
(Professional Elective – IV)

Course Objectives

- Understand the basic techniques of artificial intelligence.
- Understand the Non-monotonic reasoning and statistical reasoning.

Course Outcomes

- Apply the basic techniques of artificial intelligence.
- Discuss the architecture of an expert system and its tools.
- Understand the importance of building an expert systems.
- Understand various problems with an expert systems.

UNIT - I

Introduction to AI programming languages, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game tress, Min- max algorithms, game playing – Alpha-beta pruning.

UNIT - II

Knowledge representation issues predicate logic – logic programming Semantic nets- frames and inheritance, constraint propagation; Representing Knowledge using rules, Rules-based deduction systems.

UNIT - III

Introduction to Expert Systems, Architecture of expert systems, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.

UNIT - IV

Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems.

UNIT - V

Building an Expert System: Expert system development, Selection of the tool, Acquiring Knowledge, Building process. Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain experts, difficulties during development.

TEXT BOOKS:
1. Elain Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, New Delhi.
2. Waterman D.A., "A Guide to Expert Systems", Addison Wesley Longman.

REFERENCE BOOKS:
1. Stuart Russel and other Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice- Hall.
2. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley.
3. Patterson, Artificial Intelligence & Expert System, Prentice Hall India, 1999.
4. Hayes-Roth, Lenat, and Waterman: Building Expert Systems, Addison Wesley.
5. Weiss S.M. and Kulikowski C.A., "A Practical Guide to Designing Expert Systems", Rowman & Allanheld, New Jersey.

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B.Tech VII Semester

CS722PE : GAME THEORY
(Professional Elective – IV)

Course Objectives

- The course will explain in depth the standard equilibrium concepts (such as Nash equilibrium, Subgame-Perfect Nash Equilibrium, and others) in Game Theory.

Course Outcomes

After completion of the course, the student should be able to
- Understand the basic concepts of game theory and solutions
- Understand different types of equilibrium interpretations
- Understand and analyze knowledge and solution concepts
- Analyze extensive games with perfect information

UNIT - I
Introduction- Game Theory, Games and Solutions Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation. Nash Equilibrium- Strategic Games, Nash Equilibrium Examples Existence of a Nash Equilibrium, Strictly Competitive Games, Bayesian Games: Strategic Games with Imperfect Information.

UNIT - II
Mixed, Correlated, and Evolutionary Equilibrium - Mixed Strategy Nash Equilibrium, Interpretations of Mixed Strategy Nash Equilibrium, Correlated Equilibrium, Evolutionary Equilibrium, Rationalizability and Iterated Elimination of Dominated Actions -Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions.

UNIT - III
Knowledge and Equilibrium -A Model of Knowledge Common Knowledge, Can People Agree to Disagree? Knowledge and Solution Concepts, The Electronic Mail Game.

UNIT - IV
Extensive Games with Perfect Information -Extensive Games with Perfect Information Subgame Perfect Equilibrium Two Extensions of the Definition of a Game The Interpretation of a Strategy, Two Notable Finite Horizon Games, Iterated Elimination of Weakly Dominated, Strategies Bargaining Games - Bargaining and Game Theory, A Bargaining Game of Alternating Offers Subgame Perfect Equilibrium Variations and Extensions.

UNIT - V
Repeated Games - The Basic Idea Infinitely Repeated Games vs.\ Finitely Repeated Games, Infinitely Repeated Games: Definitions Strategies as Machines Trigger Strategies: Nash Folk, Theorems Punishing for a Limited Length of Time: A Perfect Folk Theorem for the Limit of Means Criterion Punishing the Punisher: A Perfect Folk Theorem for the Overtaking Criterion, Rewarding Players Who Punish: A Perfect Folk Theorem for the Discounting Criterion The Structure of Subgame Perfect Equilibria Under the Discounting Criterion Finitely Repeated Game.

TEXT BOOKS:
1. A course in Game Theory, M. J. Osborne and A. Rubinstein, MIT Press
2. Game Theory, Roger Myerson, Harvard University Press
3. Game Theory, D. Fudenberg and J. Tirole, MIT Press

REFERENCE BOOKS:
1. Theory of Games and Economic Behavior, J. von Neumann and O. Morgenstern, New York: John Wiley & Sons.
2. Games and Decisions, R.D. Luce and H. Raiffa, New York: John Wiley and Sons.
3. Game Theory, G. Owen, 2nd Edition, New York: Academic Press.

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B.Tech VII Semester

CS723PE: MOBILE COMPUTING
(Professional Elective – IV)

Prerequisites
1. Computer Networks, Distributed Systems / Distributed Operating Systems

Course Objectives

The student should be able to:
- To make the student understand the concept of mobile computing paradigm, its novel applications and limitations, the typical mobile networking infrastructure through a popular GSM protocol, the issues and solutions of various layers of mobile networks.

Course Outcomes

Upon Completion of the course, the students will be able to
- Understand the concept of mobile computing paradigm, its novel applications and limitations.
- Analyze and develop new mobile applications
- Understand the protocols and platforms related to mobile environment
- Classify data delivery mechanisms

UNIT - I
Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.
GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT –II
(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11) **Mobile Network Layer:** IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT - III
Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.
Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process & QoS Issues.

UNIT - IV
Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

UNIT - V
Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery. **Protocols and Platforms for Mobile Computing:** WAP, Bluetooth, XML, J2ME, JavaCard, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.

TEXT BOOKS:
1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

REFERENCE BOOK:
1. Asoke K Talukder, Hasan Ahmed, Roopa Yavagal Mobile Computing: Technology, Applications and Service Creation, McGraw Hill Education.

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B.Tech VII Semester

CS728PE: BLOCK CHAIN TECHNOLOGIES
Professional Elective – V)
(COMMON TO CSBS, CSE(AI&ML)

Prerequisites:
1. Knowledge insecurity and applied cryptography.
2. Knowledge in distributed databases

Course Objectives

- To Introduce block chain technology and Crypto currency.

Course Outcomes

Students would be able to
- Learn about research advances related to one of the most popular technological areas today.
- Understand Extensibility of Block chain concepts.
- Understand and Analyze Blockchain Science.
- Understand Technical challenges, Business model challenges.

UNIT-I
Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowd funding.

UNIT-II
Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digitalart, Blockchain Environment.

UNIT-III
Block chain Science: Grid coin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

UNIT-IV
Currency, Token, Tokenizing, Campus coin, Coin drop as a strategy for Public ad option, Currency Multiplicity, Demurrage currency.

UNIT-V
Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

Suggested Reading:
1. Melanie Swan, Block chain Blueprint for Economy, O'reilly.

Reference Books:
1. Building Block chain Apps, Michael Juntao Yuan, Pearson Education
2. DanielDrescher,BlockchainBasics:ANon-TechnicalIntroductionin25Steps1stEdition
3. BradleyLakeman,BlockchainRevolution:UnderstandingtheCryptoEconomyoftheFuture.ANon-TechnicalGuidetotheBasicsofCryptocurrencyTradingandInvesting,ISBN:1393889158.

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B.Tech VII Semester

CS730PE: SOCIAL NETWORK ANALYSIS
(Professional Elective – V)

Prerequisites
1. A course on "Web Technologies".
2. A course on "Computer Networks".
3. A course on "Data Warehousing and Data Mining".

Course Objectives

The student should be able to:
- It introduces the concepts of social media
- It provides the mechanisms for social network analysis
- Includes the concepts that allow for better visualization and analysis of widely used services such as email, Wikis, Twitter, flickr, YouTube, etc.

Course Outcomes

Upon Completion of the course, the students will be able to
- Ability to construct social network maps easily
- Gain skills in tracking the content flow through the social media
- Use Node XL to perform social network analysis

UNIT - I:
Introduction: Social Media and Social Networks**. Social Media:** New Technologies of Collaboration.
Social Network Analysis: Measuring, Mapping, and Modeling collections of Connections.

UNIT - II:
NodeXL, Layout, Visual Design, and Labeling, Calculating and Visualizing Network Metrics, Preparing Data and Filtering, Clustering and Grouping.

UNIT - III:
CASE STUDIES - I:
Email: The lifeblood of Modern Communication**. Thread Networks:** Mapping Message Boards and Email Lists.
Twitter: Conversation, Entertainment and Information.

UNIT - IV:
CASE STUDIES - II: Visualizing and Interpreting Facebook Networks, WWW Hyperlink Networks

UNIT-V:
CASE STUDIES - III:
You Tube: Contrasting Patterns of Content Interaction, and Prominence**. Wiki Networks:** Connections of Creativity and Collaboration.

TEXT BOOKS:
1. Hansen, Derek, Ben Sheiderman, Marc Smith, Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.
2. Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability, Sybex, 2009.

REFERENCE BOOK:
1. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1st Edition, MGH, 2011.

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B.Tech VII Semester

CS731PE : AUGMENTED REALITY AND VIRTUAL REALITY
(Professional Elective – V)

Course Objectives

The student should be able to:
- The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices.
- To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

Course Outcomes

Upon Completion of the course, the students will be able to
- Describe how AR systems work and list the applications of AR.
- Understand and analyze the hardware requirement of AR.
- Describe how VR systems work and list the applications of VR.
- Understand the design and implementation of the hardware that enables VR systems to be built.

UNIT - I:

Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

UNIT - II:

AR Devices & Components: AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene. AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems.

UNIT - III:

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality

UNIT - IV:

Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Case Study: GHOST (General Haptics Open Software Toolkit) software development toolkit.

UNIT - V:

Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information, Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.

TEXT BOOKS:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494

REFERENCE BOOKS:
1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381.
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0.
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

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B.Tech VII Semester

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CS732PE : AD-HOC & SENSOR NETWORKS
(Professional Elective - V)

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Prerequisites
1. A course on "Computer Networks"
2. A course on "Mobile Computing"

Course Objectives

The student should be able to:
- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for ad hoc networks
- To understand the security of sensor networks
- To understand the applications of adhoc and sensor networks

Course Outcomes

Upon Completion of the course, the students will be able to
- Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks
- Ability to solve the issues in real-time application development based on ASN.
- Ability to conduct further research in the domain of ASN.

UNIT - I
Introduction to Ad Hoc Networks – Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.
Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology- based routing algorithms-**Proactive**: DSDV; **Reactive**: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-**Location Services**-DREAM, Quorum-based; **Forwarding Strategies:** Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

UNIT - II
Data Transmission - Broadcast Storm Problem, **Rebroadcasting Schemes**-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting: Tree-based:** AMRIS, MAODV; **Mesh-based:** ODMRP, CAMP; **Hybrid:** AMRoute**,** MCEDAR.

UNIT - III
Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR**.** TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT - IV
Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

UNIT - V
Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

TEXT BOOKS:
1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981–256–681–3.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman).

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B.Tech VII Semester

CS753PC: DEEP LEARNING LAB

Course Objectives

The student should be able to:
- To Build the Foundation of Deep Learning.
- To Understand How to Build the Neural Network.
- To enable students to develop successful machine learning concepts.

Course Outcomes

Upon Completion of the course, the students will be able to
- Upon the Successful Completion of the Course, the Students would be able to:
- Learn the Fundamental Principles of Deep Learning.
- Identify the Deep Learning Algorithms for Various Types of Learning Tasks in various domains.
- Implement Deep Learning Algorithms and Solve Real-world problems.

LIST OF EXPERIMENTS:
1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification on MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
7. Applying the Autoencoder algorithms for encoding the real-world data
8. Applying Generative Adversial Networks for image generation and unsupervised tasks.

TEXT BOOKS:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCES:
1. Bishop, C.M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.H., and Van Loan, C.F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw Hill Education, 2004.

EXTENSIVE READING:
1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Computer Science & Engineering (AI&ML)
Scheme of Instruction and Examination
(Choice Based Credit System)
For the batches admitted with effect from the academic year 2021-2022
VIII Semester

S. No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MS802HS	Organizational Behaviour	3	0	0	30	70	3	3
2	-	Professional Elective- VI	3	0	0	30	70	3	3
3	-	Open Elective -III	2	0	0	30	70	3	2
4	CS852PC	Project Stage-II	0	0	16	30	70	-	8
		Total Hours/Marks/Credits	8	0	16	120	280	12	16

L: Lecture   **T**: Tutorial   **D**: Drawing   **P**: Practical   **CIE** - Continuous Internal Evaluation   **SEE** - Semester End Examination

L	T	P	C
3	0	0	3

B.Tech VIII Semester

MS802HS: ORGANIZATIONAL BEHAVIOUR
(Common to CSE(Data Science), CSE (AI&ML))

Course Objective: The objectives of the course are:

- To understand the perception and attribution concepts in organizational and external environmental context.
- To discuss the concepts and theories of personality, attitudes and Motivation
- To understand the decision making and communication process in interpersonal and their intrapersonal context.
- To familiarize the students with the basic understanding of individual behavior and explore issues of power and empowerment.
- To discuss the concepts of High performance, Learning and Leadership.

Course Outcomes: After the completion of the subject, the student will be able to

- Analyze the concepts of perception and attribution of individuals and groups in organizations in terms of the key factors that influence organizational behavior
- Acquire knowledge of personality and attitudes of individuals in applying motivational theories to resolve problems of employees.
- Apply group dynamics and skills required for working in groups and identify the processes used in developing communication and decision making to overcome stress and conflicts.
- Analyze organizational behavioral issues in the context of, power, and empowerment issues.
- Acquire the knowledge of learning concepts and leadership styles to achieve high performance levels

Unit I:

Introduction, Perception and Attribution

Introduction to OB - Definition, Nature and Scope – Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organisational Behaviour

Cognitive Process I: Perception and Attribution: Meaning of Perception, Nature and importance of Perception — Sensation versus Perception - Perceptual selectivity and organization – Social perception.

Attribution: Meaning - Attribution Theories – Fritz heider's theory of attribution; Jones & Davis correspondent inference theory; Kelley's Covariation Model; and Weiner's Three-Dimensional Model - Locus of control –Attribution Errors – Impression Management – Types - Strategies of Impression Management.

Unit II:

Personality, Attitudes and Motivation

Cognitive Process II: Personality and Attitudes - Personality as a continuum –Meaning of personality, Personality Traits - Johari Window and Transactional Analysis.

Attitudes: Nature and Dimension of Attitudes - Job satisfaction and organizational commitment.
Motivation: Motivational needs and processes- Work-Motivation Approaches Theories of Motivation–
the content theories of motivation: Maslow's hierarchy of needs; Herzberg's two factor theory of
motivation; Alderfer's ERG theory – The process theories of work motivation: Vroom's expectancy
theory of motivation; the Porter-Lawler's model -Motivation across cultures -Positive organizational
behaviour: Optimism - Emotional intelligence - Self-Efficacy.

Unit III:
Communication, Decision-Making, Stress and Conflict
Dynamics of OB - I: Communication: Meaning and types - interactive communication in
organizations – barriers to communication and strategies to improve the flow of communication.
Decision Making: Participative decision-making techniques –creativity and group decision making.
Dynamics of OB – II: Stress and Conflict: Meaning and types of stress –Meaning and types of
conflict - Effect of stress and intra-individual conflict -strategies to cope with stress and conflict.

Unit IV:

Power and Empowerment

Dynamics of OB-III Power: Meaning -Types of power – Legitimate power, Coercive power, Expert
power, Informal power and Referent power.

Empowerment – Benefits, Process, Determinants, Techniques of Empowerment; Groups Vs. Teams –
Nature of groups –dynamics of informal groups – Dysfunctions of groups and teams –Teams in
modern work place.

Unit V:
High performance, Learning and Leadership
Leading High performance: Job design and Goal setting for High Performance-Quality of Work Life-
Socio technical Design and High-performance work practices -Behavioural performance management
Learning: Reinforcement and Punishment as principles of Learning – Process of Behavioural
modification
Leadership: Definition of leadership – Traits of effective leaders- Leadership behaviour Vs Traits –
Leadership skills – Leadership theories: Trait theories; Behavioural theories; Contingency approaches
to leadership – Leadership Styles- Autocratic Leadership style, Democratic Leadership style, Free rein
Leadership style, Activities and skills of Great leaders.

Text Books:
 1. Luthans, Fred: Organizational Behavior, McGraw-Hill, 10th Edition, 2009
 2. Robbins, P. Stephen, Timothy A. Judge: Organizational Behavior, PHI/Pearson, 12th Edition, 2009.
 3. Pareek Udai: Behavioral Process at Work: Oxford & IBH, New Delhi, 2009.

Reference Books:
 1. Schermerhorn: Organizational Behavior Wiley, 9th Edition, 2008.
 2. Michael A Hitt: Organizational Behavior, Wiley, 2008
 3. Aswathappa: Organizational Behavior, Himalaya, 2009

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B.Tech VIII Semester

CS823PE: SPEECH AND VIDEO PROCESSING
(Professional Elective – VI)

Course Objectives

The main objectives of this course are to:

- Knowledge on speech and video processing techniques.

Course Outcomes

- Describe the mechanisms of human speech production systems and methods for speech feature extraction.
- Understand basic algorithms of speech analysis and speech recognition.
- Explain basic techniques in digital video processing, including imaging characteristics and sensors.
- Apply motion estimation and object tracking algorithms on video sequence..

UNIT - I:
Speech Processing Concepts: The speech production mechanism, Discrete time speech signals, Pole-Zero modelling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and nonlinear filter banks, spectral estimation of speech using DFT. Linear Prediction analysis of speech.

UNIT - II:
Speech Recognition: Real and Complex Cepstrum, application of cepstral analysis to speech signal, feature extraction for speech, static and dynamic feature for speech recognition, robustness issues, discrimination in the feature space, feature selection, MFCC, LPCC, Distance measures, vector quantization models. Gaussian Mixture model, HMM.

UNIT - III:
Basics of Video Processing: Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two-dimensional motion models. Three-Dimensional Rigid Motion, Approximation of projective mapping.

UNIT - IV:
Motion Estimation Techniques: Optical flow, motion representation, motion estimation criteria, optimization methods, pixel-based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion. Motion analysis applications: Video Summarization, video surveillance.

UNIT - V:
Object Tracking and Segmentation: 2D and 3D video tracking, blob tracking, kernel based counter tracking, feature matching, filtering Mosaicing, video segmentation, mean shift based, active shape model, video shot boundary detection. Interframe compression, Motion compensation

TEXT BOOKS:

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.
3. Discrete-time speech signal processing: principles and practice, Thomas F. Quatieri, Coth.
4. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education.

REFERENCE BOOKS:

1. "Speech and Audio Signal Processing", B.Gold and N. Morgan, Wiley.
2. "Digital image sequence processing, Compression, and analysis", Todd R. Reed, CRC Press
3. "Handbook of Image and Video processing", Al Bovik, Academic press, second Edition

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B.Tech VIII Semester

CS824PE: ROBOTIC PROCESS AUTOMATION
(Professional Elective – VI)

Course Objectives

- Aim of the course is to make learners familiar with the concepts of Robotic Process Automation.

Course Outcomes

- Describe RPA, where it can be applied and how it's implemented.
- Identify and understand Web Control Room and Client Introduction.
- Understand how to handle various devices and the workload.
- Understand Bot creators, Web recorders and task editors.

UNIT - I

Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots.

UNIT - II

Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials).

UNIT - III

Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

UNIT - IV

Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command.

UNIT - V

Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.

REFERENCES:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

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B.Tech VIII Semester

CS825PE: COGNITIVE COMPUTING
(Professional Elective – VI)

Prerequisites
- Probability theory

Course Objectives

- To provide an understanding of the central challenges in realizing aspects of human cognition.
- To provide a basic exposition to the goals and methods of human cognition.
- To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
- To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

Course Outcomes

- Understand what cognitive computing is, and how it differs from traditional approaches.
- Plan and use the primary tools associated with cognitive computing.
- Plan and execute a project that leverages cognitive computing.
- Understand and develop the business implications of cognitive computing.

UNIT - I
Introduction to Cognitive Science: Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach to cognition.

UNIT - II
Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics.

UNIT - III
Cognitive Modeling: Modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making.

UNIT - IV
Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, Open Cog, Copy Cat, Memory Networks.

UNIT - V
Deep QA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems.

TEXT BOOKS:
1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), Cambridge University Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, Cambridge University Press.

REFERENCE BOOKS:
1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles Cognitive Computing and Big Data Analytics, Wiley
2. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, Cognitive Computing: Theory and   Applications: Volume 35 (Handbook of Statistics), North Holland.

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B.Tech VIII Semester

CS826PE: SEMANTIC WEB
(Professional Elective – VI)

Course Objectives

- To learn Web Intelligence.
- To learn Knowledge Representation for the Semantic Web.
- To learn Ontology Engineering.
- To learn Semantic Web Applications, Services and Technology.

Course Outcomes

After completion of the course, the student should be able to

- Understand the characteristics of Semantic Web.
- Apply SOAP and UDDI to web services.
- Handle multiple web services using Orchestration.
- Create documents using XML.
- Construct and use Ontologies.

UNIT - I
Introduction: Introduction to Semantic Web, the Business Case for the Semantic Web, XML and Its Impact on the Enterprise.

UNIT - II
Web Services: Uses, Basics of Web Services, SOAP, UDDI, Orchestrating Web Services, Securing Web Services, Grid Enabled and Semantic Web of Web Services.

UNIT - III
Resource Description Framework: Features, Capturing Knowledge with RDF.
XML Technologies: XPath, The Style Sheet Family: XSL, XSLT, and XSL FO, X Query, X Link, X Pointer, XInclude, XMLBase, XHTML, X Forms, SVG.

UNIT - IV
Taxonomies and Ontologies: Overview of Taxonomies, Defining the Ontology Spectrum, Topic Maps, Overview of Ontologies, Syntax, Structure, Semantics, and Pragmatics, Expressing Ontologies Logically, Knowledge Representation.

UNIT - V
Semantic Web Application: Semantic Web Services, e-Learning, Semantic Bioinformatics, Enterprise Application Integration, Knowledge Base. Semantic Search Technology: Search Engines, Semantic Search, Semantic Search Technology, Web Search Agents, Semantic Methods, Latent Semantic Index Search, TAP, Swoogle.

TEXT BOOK:
1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley Interscience.

REFERENCE BOOKS:

1. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management by Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, Wiley Publishing, Inc.
2. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R. Studer, P.Warren, John Wiley & Sons.
3. Semantic Web and Semantic Web Services - Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group)
4. Information Sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
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