Counselling Code : VBIT

VIGNANA BHARATHI Institute of Technology®

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

DEPARTMENT

OF

COMPUTER SCIENCE AND ENGINEERING

(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

IV B. Tech

COURSE STRUCTURE & SYLLABUS

(R22)

IV YEAR I- SEMESTER

Sl.No	Course Code	Course Title	category	L	T	P	C
1	22AM4111	Natural Language processing	PC	3	-	-	3
	22AM4112	Genetic Algorithms & Fuzzy Logic	PC	3	-	-	3
2	**Professional Elective – III**			3	-	-	3
	22AM4171	Internet of Things	PE				
	22AM4172	Reinforcement Learning	PE				
	22AM4173	Scripting Languages	PE				
	22AM4174	Predictive Analytics	PE				
3	**Professional Elective – IV**			3	-	-	3
	22AM4175	Quantum Computing	PE				
	22AM4176	Expert Systems	PE				
	22AM4177	Semantic Web	PE				
	22AM4178	Mobile Computing	PE				
4		**Open Elective – II**	OE	3	-	-	3
PRACTICAL							
5	22AM4151	Natural Language processing Lab	PC	-	-	2	1
6	22AM4152	Power BI	PC	-	-	2	1
7	22AM4181	**Internship**	PW	-	-	2	1
8	22AM4182	**Project Stage – I**	PW	-	-	4	2
Total Credits				**15**	**0**	**10**	**20**

IV YEAR II-SEMESTER

Sl.No	Course Code	Course Title	Category	L	T	P	C
1	**Professional Elective – V**			3	-	-	3
	22AM4271	Social Network Analysis	PE				
	22AM4272	Federated Machine Learning	PE				
	22AM4273	Augmented Reality & Virtual Reality	PE				
	22AM4274	Web Security	PE				
	Professional Elective – VI			3	-	-	3
2	22AM4275	Speech and Video Processing	PE				
	22AM4276	Robotic Process Automation	PE				
	22AM4277	Randomized Algorithms	PE				
	22AM4278	Cognitive Computing	PE				
3		**Open Elective – III**	OE	3	-	-	3
4	22AM4281	Project Phase- II Including Seminar	PW	-	-	22	11
Total Credits				**9**	**0**	**22**	**20**

IV YEAR – SEM-I

22AM4111: Natural Language Processing

IV Year I Sem. **L T P C**
3 - - 3

Prerequisites:

1. Data structures, finite automata and probability theory.
2. Knowledge on basics of Machine Learning.

Course Objectives:

1. Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.
2. Introduce to NLP problems and solutions relation to linguistics and statistics.
3. Introduce to Regular expression and probabilistic model with n-grams.
4. Introduce to Recognizing Speech and parsing with grammar.
5. To learn basics of semantic analysis and discourse analysis.

Course Outcomes:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
4. Able to design, implement, and analyze NLP algorithms
5. 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, Tree banks: 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, WordSense 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 Cross lingual Language Modeling

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice–Daniel M.Bikel and Imed Zitouni, Pearson Publication, 2012.

2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwar, 2008.

REFERENCE BOOKS:

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

2. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MIT press, 1999

22AM4112: Genetic Algorithms & Fuzzy Logic

IV Year I Sem. **L T P C**
3 - - 3

COURSE OBJECTIVES:

1. To understand , basic terminology of Genetic Algorithms and fuzzy logic.
2. To understand Genetic Algorithm Operators
3. To know about the components and building block hypothesis of Genetic algorithm
4. To study the fuzzy logic components.
5. To gain insight onto Neuro Fuzzy modeling and control.

COURSE OUTCOMES

At the end of the course, student will be able to:

1. Apply Genetic Operations on Binary Strings
2. Perform various operations of genetic algorithms
3. Understand fuzzy logic and reasoning to handle and solve engineering problems
4. Analysis genetic programming
5. Analyze fuzzy applications

UNIT – I

Basic Ideas and Concepts: Introduction , Definition and Terminology, Architecture of Fuzzy Logic
systems, Characteristics of Fuzzy Logic Systems, A Simple Class of GAs-Genetic Operation on Binary
Strings, and Examples-An Oscillating One Dimensional and Two Dimensional Functions

UNIT – II

GENETIC ALGORITHMS

Introduction, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator

UNIT - III

GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem), Differences & similarities between GA & other traditional methods, Applications of GA.

UNIT – IV

FUZZY LOGIC

Introduction to fuzzy logic & crisp logic, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations
Membership Functions, Fuzzy Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems
Fuzzy Decision Making, Applications of Fuzzy logic systems – A brief overview

UNIT – V

NEURO-FUZZY MODELING:

Adaptive Neuro-Fuzzy Inference Systems - ANFIS architecture, Hybrid learning algorithm, Coactive Neuro-Fuzzy Modeling Frame work and neuron functions., Analysis of adaptive learning capacity, Classification and Regression Trees, Data Clustering Algorithms: K-means
Fuzzy C-means, Mountain and subtractive clustering, Rulebase Structure Identification - organization

TEXT BOOKS

1. Ulrich Bodenhofer **, " Genetic Algorithms Theory and Applications "**Lecture Notes Third Edition—Winter 2003/2004"
2. Cahier technique no 191,fuzzy logic by F. Chevrie F. Guély

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.

2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer-Verlag Berlin Heidelberg, 2005.

3. S. N. Sivanandam & S. N. Deepa, "Principles of Soft Computing", 2nd edition, Wiley India, 2008.

4. . David E. Goldberg, "Genetic Algorithms-In Search, optimization and Machine learning", Pearson Education.

5. J. S. R. Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education, 2004.11. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication

22AM4171: INTERNET OF THINGS
(Professional Elective-III)

IV Year I Sem **L T P C**
3 - - 3

Course Objectives

1. Understand the concepts of Internet of Things and able to build IoT applications
2. Learn the programming and use of Arduino and Raspberry Pi boards.
3. Known about data handling and analytics in SDN.
4. Learn about the sensors and actuators.
5. Able to realize the revolution of Internet in Mobile Devices, Sensor Networks

Course Outcomes

1. To know basic protocols in sensor networks.
2. To write Program and configure Arduino boards for various designs.
3. To write Python programming and interfacing for Raspberry Pi.
4. To Design IoT applications in different domains.
5. To Understand SDN for IOT

UNIT I

Introduction to Internet of Things: Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT II

Machine-to-Machine Communications: Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino,

UNIT III

Introduction to Python programming: - Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

UNIT IV

Introduction to Raspberry Pi:- Interfacing Raspberry Pi with basic peripherals Implementation of IoT with Raspberry Pi.

UNIT V

Introduction to Software defined Network (SDN):-SDN for IoT, Industrial IoT, and Case Study: Agriculture, Healthcare, and Activity Monitoring.

TEXT BOOKS:

1. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. “Make sensors”: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media, 2014.
3. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

REFERENCES:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013.
4. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013, ISBN: 978-1-118-43062-0
5. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”. 2013, ISBN 0989973700

22AM4172: REINFORCEMENT LEARNING

IV Year I Sem **L T P C**
3 - - 3

Prerequisites:

1. Linear algebra
2. Real analysis and calculus
3. Probability
4. Machine Learning
5. Artificial Intelligence

Course Objectives: The course will explain in depth:

1. Knowledge on fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks.
2. Formalize problems as Markov Decision Processes and bellman equations
3. Knowledge on value functions, as a general-purpose tool for optimal decision-making
4. How to implement dynamic programming as an efficient solution approach to an industrial control problem
5. Characterize and differentiate between different fundamental approaches to Reinforcement Learning.

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

1. Understand basics of RL tasks and the core principles behind the RL, including policies, value functions.
2. Understand RL Framework and Markov Decision-Process, deriving Bellman equations.
3. Analyze the use of Dynamic Programming and Monte Carlo.
4. UnderstandBootstrappingandTemporal-Differencelearningmethods(TD(0),SARSA,Q-Learning)
5. Understand TD(λ)algorithm, policy-based methods and implement Case Studies.

UNIT-I

Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sublinear 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," FirstEdition,Sutton,RichardS., and Andrew G. Barto, MIT press 2020.
2. "Statisticalreinforcementlearning:modernmachinelearningapproaches,"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.

22AM4173: Scripting Languages

IV Year I Sem **L T P C**

3 - - 3

Prerequisites:

1. Computer Programming and Data Structures
2. Object Oriented Programming Concepts

Course Objectives:

1. Understand Master scripting fundamentals across Ruby, Perl, and TCL, focusing on syntax, control structures, and data manipulation.
2. Understand web development techniques using Ruby, including CGI scripting, cookies, SOAP, and web services.
3. Extend programming capabilities in Ruby by integrating C and working with RubyGems and custom extensions.
4. Develop advanced scripting skills in Perl and TCL, including working with packages, modules, error handling, and security considerations.
5. Create interactive and internet-aware applications using Tk and event-driven programming across multiple languages.

Course Outcomes:

1. Demonstrate proficiency in writing, debugging, and optimizing scripts in Ruby, Perl, and TCL.
2. Develop web-based applications using Ruby and Perl for handling user requests, cookies, and web services.
3. Extend and optimize Ruby by integrating it with C code, and managing packages with RubyGems.
4. Utilize advanced Perl and TCL concepts for real-world problem-solving, including system integration and internet-aware applications.
5. Design GUI-based applications with Tk and handle events effectively to create interactive user interfaces.

Unit-1

Introduction:

Ruby, Rails, The structure and Excution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and webservices
RubyTk – Simple Tk Application, widgets, Binding events, Canvas, scrolling

Unit-2

Extending Ruby:

Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interperter.

Unit-3

Introduction to PERL and Scripting

Scripts and Programs, Origin of Scripting, Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL-Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

Unit-4

Advanced perl

Finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Isses.

Unit-5

TCL

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface

Tk

Tk-Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl-Tk.

TEXT BOOKS:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly
3. "Programming Ruby" The Pragmatic Programmers guide by Dabve Thomas Second edition

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J. Lee and B. Ware (Addison Wesley) Pearson Education.
2. Perl by Example, E. Quigley, Pearson Education.
3. Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.
4. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
5. Perl Power, J. P. Flynt, Cengage Learning

22AM4174: PREDICTIVE ANALYTICS

IV Year I Sem **L T P C**

3 - - 3

Prerequisites:

1. Database Management Systems
2. Datawarehousing and Data mining

Course Objectives:

1. Exposure to various linear methods for Regression and Classification
2. Mostly used for classification and regression analysis.
3. Analyze historical data with the goal of identifying trends or patterns
4. The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.
5. To advice on when and how to use each model. Also learn how to combine two ormore models to improve prediction

Course Outcomes

1. Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictivemodels for a various business application.
2. Compare the underlying predictive modeling techniques.
3. Select appropriate predictive modeling approaches to identify cases to progress with.
4. Learn model assessment and validation.
5. Understand the basics of statistical approaches for predictive analytics.

UNIT - I

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

UNIT – II

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, conditional or expected test error.

UNIT – III

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data).

UNIT – IV

Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest – Neighbour classifiers (Image Scene Classification).

UNIT – V

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

TEXT BOOKS:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-DataMining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.

REFERENCE BOOKS:

1. C.M.Bishop –Pattern Recognition and Machine Learning, Springer, 2006.
2. L. Wasserman-All of statistics.
3. Gareth James. Daniela Witten. Trevor Hastie Robert Tibshirani. An Introduction toStatisticalLearning with Applications in R.

22AM4175: QUANTUM COMPUTING

(Professional Elective – IV)

IV Year I Sem **LT PC**

3 - - 3

Prerequisites:

1. Linear Algebra

Course Objectives: The objective of this course is to:

1. To introduce the fundamentals of quantum computing
2. To introduce problem-solving approach using finite dimensional mathematics
3. To learn the basic quantum logical operations and algorithms for processing quantum information.
4. To learn the basic knowledge about the practical use of quantum algorithms and quantum programming skills.
5. To learn the basic quantum logical operations and algorithms for processing quantum information.

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

1. To Understand basics of quantum computing
2. To Understand physical implementation of Qubit
3. To Understand Quantum algorithms and their implementation
4. To Understand the Impact of Quantum Computing on Cryptography
5. To Understand simple quantum algorithms and information channels in the quantum circuit model

UNIT – I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. Complex Numbers: Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers.

UNIT – II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

UNIT – III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. Quantum Hardware: Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT – IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT – V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve.

The Impact of Quantum Computing on Cryptography:

Asymmetric Cryptography, Specific Algorithms, Specific Applications.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

22AM4176: **EXPERT SYSTEMS**
(Professional Elective–IV)

IV Year I Sem.	**LT PC**
	3 - - 3

Prerequisites:

1. Linear algebra
2. Real analysis and calculus
3. Probability
4. Machine Learning
5. Artificial Intelligence

Course Objectives: The course will explain in depth:

1. The basic techniques of artificial intelligence.
2. The different knowledge representation techniques.
3. The architecture of Expert systems
4. The expert system tools and building the expert system.
5. How to identify the pitfalls in developed expert systems

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

1. Apply the basic techniques of artificial intelligence.
2. Develop knowledge-based systems with proper representation schemes.
3. Understand the architecture of an expert system and its tools.
4. Understand the importance of building expert systems.
5. 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 –Bestfirst–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.

TEXTBOOKS:

1. ElainRichandKevinKnight,"ArtificialIntelligence",TataMcGraw-Hill,NewDelhi.
2. Waterman D.A.,"A Guide to Expert Systems", Addison Wesley Longman.
3. J.Giarratano and G.Riley, "Expert Systems –Principles and Programming", 4th Edition, PWS Publishing Company
4. Peter Jackson, "Introduction to Expert Systems", Addison Wesley Longman

REFERENCEBOOKS:

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.

22AM4177: SEMANTIC WEB

(Professional Elective – VI)

IV Year I Sem

L	T	P	C
3	-	-	3

Course Objectives:

1. To learn Web Intelligence.
2. To learn Knowledge Representation for the Semantic Web.
3. To learn concepts of XML and XSL.
4. To learn Ontology Engineering.
5. To learn Semantic Web Applications, Services and Technology.

Course Outcomes:

1. Understand the characteristics of Semantic Web.
2. Apply SOAP and UDDI to web services.
3. Handle multiple web services using Orchestration.
4. Create documents using XML.
5. 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, XQuery, XLink, XPointer, XInclude, XMLBase, XHTML, XForms, 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 IndexSearch, TAP, Swoogle.

TEXT BOOK:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley Interscience.
2. Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith, “The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management”, Fourth Edition, Wiley Publishing, 2003.
3. John Davies, Rudi Studer, and Paul Warren John, “Semantic Web Technologies: Trends and Research in Ontology-based Systems”, Wiley and Son’s, 2006.

REFERENCE BOOKS:

1. Semantic Web and Semantic Web Services - Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
2. Information sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen,Springer Publications.
3. Programming the Semantic Web, T.Segaran, C.Evans,J.Taylor, O'Reilly,SPD.

22AM4178: MOBILE COMPUTING
(Professional Elective–IV)

IV Year I Sem	**L T P C**
	3 - - 3

Prerequisites: Computer Networks, Distributed Systems / Distributed Operating Systems

Course Objectives: The Objective of this Course is to

1. Make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2. Understand the typical mobile networking infrastructure through a popular GSM protocol
3. Understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
4. Understand the database issues in mobile environments & data delivery models.
5. Understand the adhoc networks and related concepts.

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

1. Understand the concept of mobile computing paradigm, its novel applications and limitations.
2. Analyze and develop new mobile applications
3. Understand the protocols and platforms related to mobile environment
4. Classify data delivery mechanisms
5. Understand IP and TCP layers of Mobile Communication.

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, Java Card, Palm OS, Windows CE, Symbian OS, Linux for Mobile Devices, Android.

TEXTBOOKS:

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

REFERENCEBOOK:

1. Asoke K Talukder, Hasan Ahmed, Roopa Yavagal Mobile Computing: Technology, Applications and Service Creation, Mc GrawHill Education.
2. Wireless Communications & Networks, Second Edition,William Stallings by Pearson
3. TCP/IP Protocol Suite by Behrouz A Forouzan, Third Edition, TMH

22AM4151: Natural Language Processing Lab

IV Year I Sem

L	T	P	C
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Prerequisites:

1. Knowledge on Programming languages, Data structures.
2. Knowledge on finite automata and probability theory.

Course Objectives:

1. Knowledge on basic Language processing features
2. Knowledge on design and innovative application using NLP components.

Course Outcomes:

1. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
2. Able to design, implement and analyze NLP algorithms.

List of Experiments

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 Kleinand Edward Loper,―Natural Language Processing with Python, First Edition, O'Reilly Media,2009.

REFERENCEBOOK:

1. Breck Baldwin,―Language Processing with Java and LingPipe Cook book, Atlantic Publisher, 2015
2. Introduction to Natural Language Processing – Jacob Einstein, MIT Press

22AM4152: POWER BI

IV Year I Sem. **L T P C**

- - 2 1

Course Objectives:

1. Effective use of Business Intelligence(BI) technology(Tableau) to apply data visualization
2. To discern patterns and relationships in the data.
3. To build Dashboard applications.
4. To communicate the results clearly and concisely.
5. To be able to work with different formats of data sets.

Course Outcomes: At the end of the course a student should be able to

1. Understand How to import data into Tableau.
2. Understand Tableau concepts of Dimensions and Measures.
3. Develop Programs and understand how to map Visual Layouts and Graphical Properties.
4. Create a Dashboard that links multiple visualizations.
5. Use graphical user interfaces to create Frames for providing solutions to real world problems.

Lab Problems:

1. Understanding Data,What is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?

2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts(line, bar charts, Tree maps),Using the Show me panel.

3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.

4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.

5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.

6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.

7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.

8. Creating Dashboards & Story telling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.

9. Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing and Exporting.

10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

REFERENCEBOOKS:

1. Microsoft PowerBI cook book, Brett Powell, 2nd edition.
2. R Programming for Data Science by Roger D. Peng (References)
3. The Art of R Programming by Norman Matl off Cengage Learning India.

22AM4181: INTERNSHIP

IV Year I Sem.

L	T	P	C
-	-	2	1

22AM4182: PROJECT STAGE-I

IV Year I Sem

L	T	P	C
-	-	4	2

IV YEAR II SEMESTER

22AM4271: SOCIAL NETWORK ANALYSIS
(Professional Elective–V)

IV Year II Sem. **L T P C**
3 - - 3

Prerequisites

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

Course Objectives:

1. It introduces the concepts of social media
2. It introduces the fundamentals of social media and social networks, exploring their significance in modern communication and collaboration.
3. It provides the mechanisms for social network analysis
4. Includes the concepts that allow for better visualization and analysis of widely used services such as email, Wikis, Twitter, flickr, YouTube, etc.
5. It fosters critical thinking and analytical abilities in interpreting digital communication and content networks.

Course Outcomes: At the end of the course a student should be able to

1. Construct social network maps easily
2. Gain skills in tracking the content flow through the social media
3. Use NodeXL to perform social network analysis
4. Apply filtering, clustering, and metric calculations to extract insights from large-scale network data.
5. Evaluate network structures and communication flows, enabling them to identify patterns of collaboration, influence, and content dissemination.

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 life blood of Modern Communication**. Thread Networks:** Mapping Message Boards and Email Lists. **Twitter:** Conversation, Entertainment and Information.

UNIT-IV:

CASE STUDIES-II: Visualizing and Interpreting Face book 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.

TEXTBOOKS:

1. Hansen, Derek, Ben Sheider man, Marc Smith, Analyzing Social Media Networks with NodeXL: In sights 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.
2. **"Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More"**, *Author:* Matthew A. Russell, *Publisher:* O'Reilly Media, Edition 3

22AM4272: FEDERATED MACHINE LEARNING

(Professional Elective–V)

IV Year II Sem. **L T P C**
3 - - 3

Prerequisites: The prerequisite knowledge for this course includes machine learning, basic computer systems and basic programming skills.

Course Objectives: The course aims to:

1. Provide foundational knowledge of Federated Learning (FL) and its role in privacy-preserving machine learning.
2. Introduce Distributed Machine Learning (DML) concepts, including scalability and security techniques.
3. Explain different Federated Learning architectures (Horizontal, Vertical, and Transfer Learning) and their optimization techniques.
4. Explore privacy-preserving techniques, including differential privacy, secure multi-party computation, and homomorphic encryption.
5. Discuss real-world applications of Federated Learning in Computer Vision, NLP, Recommendation Systems, and Reinforcement Learning.

Course Outcomes: After completing this course, students will be able to:

1. Understand the fundamentals, categories, and research challenges in Federated Learning.
2. Apply privacy-preserving techniques to secure Distributed Machine Learning models.
3. Analyze and implement Horizontal and Vertical Federated Learning architectures.
4. Evaluate the Federated Transfer Learning (FTL) framework and its security aspects.
5. Develop Federated Learning models for applications in Computer Vision, NLP, and Reinforcement Learning.

UNIT-I

Introduction: Motivation, Federated Learning as a Solution, The Definition of Federated Learning, Categories of Federated Learning, Current Development in Federated Learning, Research Issues in Federated Learning, Open-Source Projects, Standardization Efforts, The Federated AI Ecosystem Back ground: Privacy-Preserving Machine Learning, PPML and Secure ML, Threat and Security Models, Privacy Threat Models, Adversary and Security Models, Privacy Preservation Techniques, Secure Multi-Party Computation, Homo morphic Encryption, Differential Privacy.

UNIT-II

Distributed Machine Learning: Introduction to DML, The Definition of DML, DML Platforms, Scalability – Motivated DML, Large- Scale Machine Learning, Scalability-Oriented DML Schemes, Privacy-Motivated DML, Privacy-Preserving Decision Trees, Privacy-Preserving Techniques, Privacy-Preserving DML Schemes, Privacy-Preserving Gradient Descent, Vanilla Federated Learning, Privacy-Preserving Methods.

UNIT-III

Horizontal Federated Learning: The Definition of HFL, Architecture of HFL, The Client-Server Architecture, The Peer-to-Peer Architecture, Global Model Evaluation, The Federated Averaging Algorithm, Federated Optimization, The Fed Avg Algorithm, The Secured FedAvg Algorithm,

Improvement of the FedAvg Algorithm, Communication Efficiency, Client Selection Vertical Federated Learning: The Definition of VFL, Architecture of VFL, Algorithms of VFL, Secure Federated Linear Regression, Secure Federated Tree-Boosting.

UNIT-IV

Federated Transfer Learning: Heterogeneous Federated Learning, Federated Transfer Learning, The FTL Framework, Additively Homomorphic Encryption, The FTL Training Process, The FTL Prediction Process, Security Analysis, Secret Sharing-Based FTL Incentive Mechanism Design for Federated Learning: Paying for Contributions, Profit-Sharing Games, Reverse Auctions, A Fairness-Aware Profit Sharing Framework, Modeling Contribution, Modeling Cost, Modeling Regret, Modeling Temporal Regret, The Policy Orchestrator, Computing Pay off Weightage.

UNIT-V

Federated Learning for Vision, Language, and Recommendation: Federated Learning for Computer Vision, Federated CV, Federated Learningfor NLP, Federated NLP, Federated Learning for Recommendation Systems, Recommendation Model, Federated Recommendation System

Federated Reinforcement Learning: Introduction to Reinforcement Learning, Policy, Reward, Value Function, Model of the Environment, RL Background Example, Reinforcement Learning Algorithms, Distributed Reinforcement Learning, Asynchronous Distributed Reinforcement Learning, Synchronous Distributed Reinforcement Learning, Federated Reinforcement Learning, Background and Categorization.

TEXTBOOK:

1. Federated Learning, QiangYang,YangLiu,YongCheng,YanKang, Tianjian Chen, and HanYu-SynthesisLectureson ArtificialIntelligenceandMachineLearning2019.

REFERENCE BOOKS:

1. Advances and Open Problems in Federated Learning - Peter Kairouz, Foundations and Trends® in Machine Learning.

2. Federated Learning Systems, Muhammad Habib, Springer

22AM4273: AUGMENTED REALITY AND VIRTUAL REALITY

(Professional Elective – V)

IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisites

1. Programming for problem Solving.
2. Object-Oriented Programming (OOP) concepts.
3. Linear Algebra

Course objectives:

1. To gain the knowledge of historical and modern overviews and perspectives on virtual reality.
2. To learn the fundamentals of sensation, perception, and perceptual training.
3. To have the scientific, technical, and engineering aspects of augmented and virtual reality syst ems.
4. To learn the Evaluation of virtual reality from the lens of design.
5. To learn the technology of augmented reality and implement it to have practical knowledge.

Course Outcomes:

1. Identify, examine, and develop software that reflects fundamental techniques for the design an d deployment of VR and AR experiences.
2. Describe how VR and AR systems work.
3. Choose, develop, explain, and defend the use of particular designs for AR and VR experiences .
4. Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body.
5. Identify and examine state-of-the-art AR and VR design problems and solutions from the indu stry and academia.

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 andAlan 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,WilliamR 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.

Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

22AM4274: WEB SECURITY

(Professional Elective – V)

IV Year II Sem.	L	T	P	C
	3	-	-	3

Prerequisites :

Web Technologies

Course Objectives:

1. To Understand and discover security vulnerabilities in browser side security threats
2. To Understand and discover vulnerabilities in server side security threats
3. To Understand and discover mitigation techniques to reduce the risk of cyber-attacks on web applications
4. To Understand and discover security vulnerabilities in Networked Systems, Protocols, the Internet
5. To Understand and discover security vulnerabilities in Wireless LAN and defense mechanisms against such vulnerabilities

Course outcomes

1. Security architecture of World Wide Web, Security Architecture of Web Servers, and Web Clients
2. Web Application Security – Cross Site Scripting Attacks, Cross Site Request Forgery, SQL Injection Attacks
3. Content Security Policies (CSP) in web
4. Session Management and User Authentication, Session Integrity
5. Https, SSL/TLS

UNIT - I

The Web Security, The Web Security Problem, Risk Analysis and Best Practices.

Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification.

UNIT - II

The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

UNIT - III

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.

UNIT - IV

Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities and Future Trends.

UNIT - V

Privacy in Database Publishing: A Bayesian Perspective, Privacy-enhanced Location-based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

TEXT BOOKS:

1. Web Security, Privacy and Commerce Simson G Arfinkel, Gene Spafford, O'Reilly.
2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia

REFERENCE BOOKS:

1. The Web Application Hacker's Handbook", **Authors:** Dafydd Stuttard & Marcus Pinto, **Edition:** 2nd (2011)
2. **Web Application Security: Exploitation and Countermeasures for JavaScript Apps",** Author: ***Andrew Hoffman,*** Edition: ***1st (2020)***

22AM4275: SPEECH AND VIDEO PROCESSING

(Professional Elective – VI)

IV Year II Sem.	L	T	P	C
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Course Objectives:

1. To understand the underlying mechanisms of speech processing concepts to analyse and manipulate speech signals.
2. Explore the theoretical foundations of speech recognition and Gaussian Mixture models for effective speech recognition.
3. Gain proficiency in the principles of video formation, perception, and representation
4. Master motion estimation criteria, ranging from optical flow to pixel-based and gradient-based methods.
5. Develop expertise in advanced video analysis techniques and object tracking, while also understanding the concepts of compensation for enhanced video processing.

Course Outcomes:

1. Describe the mechanisms of human speech production systems and methods for speech feature extraction.
2. Understand basic algorithms of speech analysis and speech recognition.
3. Explain basic techniques in digital video processing, including imaging characteristics and sensors.
4. Apply motion estimation and object tracking algorithms on video sequence.
5. Employ diverse techniques in object tracking and segmentation to contribute to real-world video analysis and applications.

UNIT - I:

Speech processing concepts: The speech production mechanism, Discrete time speech signals, Pole-Zero modeling 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 Predictionanalysis 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, Approximationof 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. Motionanalysis 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 processingseries.
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, PearsonEducation.

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

22AM4276: ROBOTIC PROCESS AUTOMATION
(Professional Elective- VI)

IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisites:

- Programming Concepts Basics ,Understanding the application,
- Basic Web Concepts, Protocols, Email Clients, Data Structures

Course Objectives

1. To understand the Basics of Robotic Process Automation.
2. Identify the intensity of Design Robotic Process Automation.
3. To comprehend the installation process of RPA Tools.
4. To understand the control structure to design RPA Application.
5. To know the way of interaction of Robotic Process Automation with external Applications.

Course Outcomes: After the completion of the course student should be able to

1. Provide knowledge on Robotic Process Automation.
2. Compare RPA with Non Automation process.
3. Skills to Design RPA with Internal interactions.
4. Skills to Design RPA with External Application interaction.
5. Knowledge on implement RPA using Exception Handling mechanism.

UNIT - I

Processes, Software Design, SDL C: Programming Concepts Basics – 2 : Scripting, .Net Framework, .Net ,Fundamentals, Control structures and functions, XML, HTML, CSS, Variables& Arguments.

RPA Basics: History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, and Workloads, which can be automated.

UNIT - II

RPA Advanced Concepts: Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team. Process Design Document/Solution Design Document, Industries best suited for RPA, Risks, & Challenges with RPA, RPA and emerging ecosystem.

Installation: Installing Studio community edition, The User Interface, Keyboard Shortcuts, About Updating, About Automation Projects, Introduction to Automation Debugging, Managing Activation Packages, Reusing Automations Library, Installing the Chrome Extension, Installing the Firefox Extension, Connecting your project to a source control system, Activities Guide.

Variables : Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables ,Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces.

UNIT - III

Control Flow: Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity.

Data Manipulation :Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data.

Recording and Advanced UI Interaction :Recording Introduction, Basic and Desktop Recording, Web Recording, Input / Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques.

Selectors: Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge.

UNIT- IV

Advanced Automation concepts and techniques: Image, Text & Advanced Citrix Automation: Introduction to Image &Text, Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps.

Excel Data Tables &PDF: Data Tables in RPA, Excel and Data Table basics, Data Manipulationin excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.

Email Automation: Email Automation, Incoming Email automation, Sending Email automation.

UNIT- V

Exceptional Handling & Best Practice: Debugging and Exception Handling: Debugging Tools, Strategies for solving issues, Catching errors.

Introduction to Orchestrator: Tenants, Authentication, Users, Roles, Robots, Environments, Queues & Transactions, Schedules.

Emerging and Future Trends in IT: Emerging and Future Trends in IT: Artificial Intelligence, Machine Learning, Agent awareness, Natural Language Processing, Computer Vision.

TEXT BOOKS:

1. Learning Robotic Process Automation by Alok Mani Tripathi, Published by Packt Publishing Ltd.
2. Robotic Process Automation Succinctly By Ed Freitas Foreword by Daniel Jebara

REFERENCES:

1. Robotic Process Automation by Nividous
2. Robotic Process Automation NICE Special Edition by NICE RPA team with Steve Kaelble, Published by: John Wiley & Sons, Ltd., The Atrium, Southern Gate.

22AM4277: RANDOMIZED ALGORITHMS

(Professional Elective – VI)

IV Year II Sem.	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**

Prerequisites:

- Probability and Statistics

Course Objective:

1. To introduce the power of randomization in the design and analysis of algorithms.
2. To introduce fundamentals of probabilistic analysis and its applications in randomized algorithms.
3. To improvise students for designing of randomized algorithms for different problems.
4. To understand concepts of data structures and implement on problems for solving.
5. To implement randomized and deterministic algorithms for given problems and make empirical evaluation of their correctness and efficiency.

Course Outcomes:

1. Appreciate the fundamentals of randomized algorithm design.
2. Understand the fundamentals of Markov chains and the Monte Carlo method.
3. Apply high probability analysis to selected randomized algorithms.
4. Understand the Comparison of Fingerprinting Techniques and Pattern Matching
5. Implement randomized algorithm in chosen programming language

UNIT - I

Introduction, A Min – Cut algorithm, Las Vegas and Monte Carlo, Binary Planar Partitions, A Probabilistic Recurrence. Game – Theoretic Techniques: Game Tree Evaluation, The Minimax Principle

UNIT - II

Moments and Deviations: Occupancy Problems, The Markov and Chebyshev Inequalities, Randomized Selection. Markov Chains and Random Walks: A 2-SAT example, Markov Chains, Random Walks on Graphs, Graph Connectivity

UNIT - III

Algebraic Techniques: Fingerprinting and Freivald's Technique, Verifying Polynomial Identities, Perfect Matching in Graphs, Verifying Equality of Strings, A Comparison of Fingerprinting Techniques, PatternMatching

UNIT - IV

Data Structures: The Fundamental Data-structuring Problem, Random Treaps, Skip Lists, Hashtables, Hashing with O(1) Search Time. Graph Algorithms: All Pairs Shortest Paths, The Min- Cut Problem, Minimum Spanning Trees

UNIT - V

Geometric Algorithms: Randomized Incremental Construction, Convex Hulls in the Plane, Duality, Half- Space Intersections, Dalaunay Triangulations, Trapezoidal Decompositions. Parallel and Distributed Algorithms: The PRAM Model, Sorting on a PRAM, Maximal Independent Sets, Perfect Matchings

TEXT BOOKS:

1. Randomized Algorithms: Rajeev Motwani, Prabhakar Raghavan.
2. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms andData Analysis by Eli Upfal and Michael Mitzenmacher.

REFERENCE BOOK:

1. Computational Geometry: Algorithms and Applications, by Mark de Berg, Otfried Cheong, Marc van Kreveld, and Mark Overmars, 3rd edition, Springer-Verlag, 2008.
2. Algorithmic and Analysis Techniques in Property Testing, by Dana Ron. Found. Trends Theor. Comput. Sci. 5, 2 (February 2010), 73-205.
3. Mining of Massive Datasets, by Leskovec, Rajaraman, and Ullman, available at http://www.mmds.org.

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22AM4278: COGNITIVE COMPUTING

(Professional Elective – VI)

IV Year II Sem. **L T P C**

3 - - 3

Prerequisites: Probability theory

Course Objectives:

1. To provide an understanding of the central challenges in realizing aspects ofhuman cognition.
2. To provide a basic exposition to the goals and methods of human cognition.
3. To develop algorithms that use AI and machine learning along with human interactionand feedback to help humans make choices/decisions.
4. To support human reasoning by evaluating data in context and presenting relevantfindings along with the evidence that justifies the answers.
5. Cognitive-based systems can help because they build knowledge and learn, understand natural language, and reason and interact more naturally with human beings than traditional programmable systems.

Course Outcomes:

1. Understand what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and develop the business implications of cognitive computing.
5. Enable to create a pace with volume, complexity and unpredictability of information and systems in the modern world.

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, OpenCog, CopyCat, Memory Networks.

UNIT - V

DeepQA 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.), CambridgeUniversity Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, CambridgeUniversity Press.

REFERENCE BOOKS:

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

22AM4281: Project Stage- II Including Seminar

IV Year II Sem.

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