**B.Tech. in COMPUTER SCIENCE AND ENGINEERING (AI & ML)**
**COURSE STRUCTURE & SYLLABUS (SR24 Regulations)**
**Applicable from AY 2024-25 Batch**

**IV YEAR I SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | S24AM701PC | Deep Learning | 3 | 0 | 0 | 3 |
| 2 | S24AM702PC | Nature Inspired Computing | 2 | 0 | 0 | 2 |
| 3 | | Professional Elective-III | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective-IV | 3 | 0 | 0 | 3 |
| 5 | | Open Elective-II | 3 | 0 | 0 | 3 |
| 6 | S24AM703PC | Professional Practice, Law & Ethics | 2 | 0 | 0 | 2 |
| 7 | | Professional Elective-III Lab | 0 | 0 | 2 | 1 |
| 8 | | Project Stage-I | 0 | 0 | 6 | 3 |
| | *MC706 | Universal Human Values | 3 | 0 | 0 | 0 |
| | | **Total Credits** | **19** | **0** | **8** | **20** |

**Universal Human Values in IV Yr I Sem should be Registered by Lateral Entry Students Only.**

**IV YEAR II SEMESTER**

| S. No. | Course Code | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | | Professional Elective-V | 3 | 0 | 0 | 3 |
| 2 | | Professional Elective-VI | 3 | 0 | 0 | 3 |
| 3 | | Open Elective-III | 3 | 0 | 0 | 3 |
| 4 | S24AM801PC | Project Stage-II including Seminar | 0 | 0 | 22 | 11 |
| | | **Total Credits** | **9** | **0** | **22** | **20** |

***MC – Satisfactory/Unsatisfactory**

**Professional Elective-III**

| | |
|---|---|
| S24AM731PE | Internet of Things |
| S24AM732PE | Data Mining |
| S24AM733PE | Scripting Languages |
| S24AM734PE | Mobile Application Development |
| S24AM735PE | Cloud Computing |
| S24AM736PE | Predictive Analytics |

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

**Professional Elective-IV**

| | |
|---|---|
| S24AM741PE | Quantum Computing |
| S24AM742PE | Expert Systems |
| S24AM743PE | Semantic Web |
| S24AM744PE | Game Theory |
| S24AM745PE | Mobile Computing |
| S24AM746PE | Principles of Gamification in Engineering |

**Professional Elective-V**

| | |
|---|---|
| S24AM851PE | Social Network Analysis |
| S24AM852PE | Federated Machine Learning |
| S24AM853PE | Augmented Reality & Virtual Reality |
| S24AM854PE | Web Security |
| S24AM855PE | Ad-hoc & Sensor Networks |

**Professional Elective–VI**

| | |
|---|---|
| S24AM861PE | Speech and Video Processing |
| S24AM862PE | Robotic Process Automation |
| S24AM863PE | Randomized Algorithms |
| S24AM864PE | Cognitive Computing |
| S24VAM865PE | Conversational AI |

**Open Elective II:**

1. S24AM721OE: Introduction to Natural Language Processing
2. S24AM722OE: AI applications

**Open Elective III:**

1. S24AM831OE: Chatbots
2. S24AM832OE: Evolutionary Computing

## S24AM701PC: DEEP LEARNING

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To understand deep Learning algorithms and their applications in real-world data

**Course Outcomes:**

- Understand machine learning basics and neural networks
- Understand optimal usage of data for training deep models
- Apply CNN and RNN models for real-world data
- Evaluate deep models
- Develop deep models for real-world problems

**UNIT - I**

**Machine Learning Basics**

Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning

**Deep Feedforward Networks** Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

**UNIT - II**

**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 Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier, Optimization for Training Deep Models, Learning vs Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates

**UNIT - III**

**Convolutional Networks**

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features

**UNIT - IV**

**Recurrent and Recursive Nets**

Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory

**UNIT - V**

**Practical Methodology:** Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data**,** Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition

**Applications:** Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

**TEXT BOOK:**

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

**REFERENCE BOOKS:**

1. The Elements of Statistical Learning. Hastie, R. Tibshirani, and J. Friedman, Springer.
2. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.
3. Bishop. C.M., Pattern Recognition and Machine Learning, Springer, 2006.
4. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
5. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
6. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

## S24AM702PC: NATURE INSPIRED COMPUTING

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:**

- Knowledge on significance of evolutionary computing, neuro computing and swarm intelligence

**Course Outcomes:**

- Familiar with Evolutionary Computing algorithms
- Understand scope of neurocomputing
- Compare different Ant Colony Optimization algorithmic models.
- Understand the scope of artificial immune systems
- Tackle different real world problems

**UNIT - I**

**Evolutionary Computing**

Problem Solving as a Search Task, Hill Climbing and Simulated Annealing, Evolutionary Biology, Evolutionary Computing, The Other Main Evolutionary Algorithms, From Evolutionary Biology to Computing, Scope of Evolutionary Computing

**UNIT - II**

**Neurocomputing**

The Nervous System, Artificial Neural Networks, Typical ANNS and Learning Algorithms, From Natural to Artificial Neural Networks, Scope of Neurocomputing

**UNIT - III**

**Swarm Intelligence**

Ant Colonies, Swarm Robotics, Social Adaptation of Knowledge

**UNIT - IV**

**Immunocomputing**

The Immune System, Artificial Immune Systems, Bone Marrow Models, Negative Selection Algorithms, Clonal Selection and Affinity Maturation, Artificial Immune Networks, From Natural to Artificial Immune Systems, Scope of Artificial Immune Systems

**UNIT - V**

**Case Studies-** Bioinformatics, Information Display

**TEXT BOOKS:**

1. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006

**REFERENCE BOOKS:**

1. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: The oriesethods, and Technologies" IT Press, 2008
2. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi, 2005
3. Vinod Chandra S S, Anand H S - "Machine Learning: A Practitioner's Approach", Prentice Hall of India, New Delhi, 2020

## S24AM731PE: INTERNET OF THINGS (Professional Elective – III)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-Requisites:** Computer organization, Computer Networks

**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 the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of web-based services on IoT devices

**Course Outcomes:**

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Identify the applications of IoT in Industry.

**UNIT - I**

**Introduction to Internet of Things** –Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates

**Domain Specific IoTs** – Home automation, Environment, Agriculture, Health and Lifestyle

**UNIT - II**

**IoT and M2M** – M2M, Difference between IoT and M2M, SDN and NFV for IoT,

**IoT System Management with NETCOZF, YANG-** Need for IoT system Management, Simple Network management protocol, Network operator requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG

**UNIT - III**

**IoT Systems – Logical design using Python-**Introduction to Python – Python Data types & Data structures, Control flow, Functions, Modules, Packaging, File handling, Data/Time operations, Classes, Exception, Python packages of Interest for IoT

**UNIT - IV**

**IoT Physical Devices and Endpoints** - Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry PI with Python, Other IoT devices.

**IoT Physical Servers and Cloud Offerings –** Introduction to Cloud Storage models and communication APIs, WAMP-AutoBahn for IoT, Xively Cloud for IoT, Python web application framework –Django, Designing a RESTful web API

**UNIT V**

**Case studies-** Home Automation, Environment-weather monitoring-weather reporting- air pollution monitoring, Agriculture.

**TEXT BOOK:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.

**REFERENCE BOOK:**

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

**S24AM732PE: DATA MINING (Professional Elective – III)**

**B.Tech. IV Year I Sem.** **L T P C**
**3 0 0 3**

**Pre-Requisites:**
1. Database Management System
2. Probability and Statistics

**Course Objectives:**
- Students will become acquainted with both the strengths and limitations of various data mining techniques like Association, Classification, Cluster and Outlier analysis.

**Course Outcomes:**
- Understand the need of data mining and pre-processing techniques.
- Perform market basket analysis using association rule mining.
- Utilize classification techniques for analysis and interpretation of data.
- Identify appropriate clustering and outlier detection techniques to handle complex data.
- Understand the mining of data from web, text and time series data.

**UNIT - I**
**Introduction to Data Mining:**
What Data mining? Kinds of Data, Knowledge Discovery process, Data Mining Functionalities, Kinds of Patterns, Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity, Data Pre-processing**:** Major Tasks in Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

**UNIT - II**
**Association Analysis:** Basic Concepts, Market Basket Analysis, Apriori Algorithm, FP-growth, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel Associations and Multidimensional Associations.

**UNIT - III**
**Classification:** Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Multilayer Feed-Forward Neural Network, Support Vector Machines, k-Nearest-Neighbor Classifiers.

**UNIT - IV**
**Cluster Analysis:** Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods-k-Means, k-Medoids, Hierarchical Methods-AGENES, DIANA, BIRCH, Density-Based Method-DBSCAN, Outlier Analysis: Types of Outliers, Challenges of Outlier Detection, and Overview of Outlier Detection Methods

**UNIT - V**
**Advanced Concepts:** Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining, Spatial Mining- Spatial Data Overview, Spatial Data Mining Primitives, Spatial Rules, Spatial Classification Algorithm, Spatial Clustering Algorithms, Temporal Mining- Modeling Temporal Events, Time Series, Pattern Detection, Sequences, Temporal Association Rules.

**TEXT BOOKS:**
1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann/Elsevier, 2012.
2. Margaret H Dunham, Data Mining Introductory and Advanced Topics, 2nd Edition, Pearson Education, India, 2006.

**REFERENCE BOOKS:**
1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar, Introduction to Data Mining, 2nd Edition, Pearson Education India, 2021.
3. Amitesh Sinha, Data Warehousing, Thomson Learning, India, 2007.

**S24AM733PE: SCRIPTING LANGUAGES (Professional Elective – III)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:**

1. A course on "Computer Programming and Data Structures".
2. A course on "Object Oriented Programming Concepts".

**Course Objectives:**

- This course introduces the script programming paradigm
- Introduces scripting languages such as Perl, Ruby and TCL.
- Learning TCL

**Course Outcomes:**

1. Comprehend the differences between typical scripting languages and typical system and application programming languages.
2. Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem.
3. Acquire programming skills in scripting language

**UNIT - I**

**Introduction:** Ruby, Rails, The structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and web services

RubyTk - Simple Tk Application, widgets, Binding events, Canvas, scrolling

**UNIT - II**

**Extending Ruby:** Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter

**UNIT - III**

**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 - IV**

**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 Issues.

**UNIT - V**

**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 Pramatic Progammers 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.

**S24AM734PE: MOBILE APPLICATION DEVELOPMENT (Professional Elective – III)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites**

1. Acquaintance with JAVA programming
2. A Course on DBMS

**Course Objectives**

- 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**

- Understand the working of Android OS Practically.
- Develop Android user interfaces
- 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 BOOK:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.

**REFERENCE BOOKS:**

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

## S24AM735PE: CLOUD COMPUTING (Professional Elective – III)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Pre-requisites:**

1. A course on "Computer Networks".
2. A course on "Operating System".

**Course Objectives:**

- This course provides an insight into cloud computing.
- Topics covered include- Cloud Computing Architecture, Deployment Models, Service Models, Technological Drivers for Cloud Computing, Networking for Cloud Computing and Security in Cloud Computing.

**Course Outcomes:**

- Understand different computing paradigms and potential of the paradigms and specifically cloud computing
- Understand cloud service types, cloud deployment models and technologies supporting and driving the cloud
- Acquire the knowledge of programming models for cloud and development of software application that runs the cloud and various services available from major cloud providers
- Understand the security concerns and issues in cloud computing
- Acquire the knowledge of advances in cloud computing.

**UNIT - I**

Computing Paradigms, Cloud Computing Fundamentals, Cloud Computing Architecture and Management

**UNIT - II**

**Cloud Deployment Models, Cloud Service Models, Technological Drivers for Cloud Computing:** SOA and Cloud, Multicore Technology, Web 2.0 and Web 3.0, Pervasive Computing, Operating System, Application Environment

**UNIT - III**

**Virtualization, Programming Models for Cloud Computing:** MapReduce, Cloud Haskell, Software Development in Cloud

**UNIT - IV**

**Networking for Cloud Computing:** Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs, Cloud Service Providers

**UNIT - V**

Security in Cloud Computing, and Advanced Concepts in Cloud Computing

**TEXT BOOK:**

1. Chandrasekaran, K. *Essentials of cloud computing*. CRC Press, 2014

**REFERENCE BOOKS:**

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

**S24AM736PE: PREDICTIVE ANALYTICS (Professional Elective – III)**

**B.Tech. IV Year I Sem.** **L T P C**
**3 0 0 3**

**Course Objectives:** The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.

## Course Outcomes

1. Understand prediction-related principles, theories and approaches.
2. Learn model assessment and validation.
3. Understand the basics of predictive techniques and statistical approaches.
4. Analyze supervised and unsupervised algorithms.

**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 BOOK:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, 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 to Statistical Learning with Applications in R.

**S24AM741PE: QUANTUM COMPUTING (Professional Elective – IV)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- To introduce the fundamentals of quantum computing
- The problem-solving approach using finite dimensional mathematics

**Course Outcomes**

- Understand basics of quantum computing
- Understand physical implementation of Qubit
- Understand Quantum algorithms and their implementation
- Understand The Impact of Quantum Computing on Cryptography

**UNIT - I**

**History of Quantum Computing:** Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

**UNIT - II**

**Background Mathematics:** Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

**UNIT - III**

**Qubit:** Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

**UNIT - IV**

**Quantum Algorithms:** Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

**UNIT - V**

**Noise and error correction:** Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

**TEXT BOOK:**

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge.

**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. I: Basic Concepts, Vol II.
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

## S24AM742PE: EXPERT SYSTEMS (Professional Elective – IV)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**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 trees, 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.

## S24AM743PE: SEMANTIC WEB (Professional Elective – IV)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Introduce Semantic Web Vision and learn Web intelligence
- Understanding about XML, RDF, RDFS, OWL
- Querying Ontology and Ontology Reasoning
- To learn Semantic Web Applications, Services and Technology
- To learn Knowledge Representation for the Semantic Web

**Course Outcomes:**

- Understand the characteristics of the semantic web technology
- Understand the concepts of Web Science, semantics of knowledge resource and ontology
- Describe logic semantics and inference with OWL.
- Use ontology engineering approaches in semantic applications
- Learn about web graph processing for various applications such as search engine, community detection

**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 Index Search, TAP, Swoogle

**TEXT 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. Peter Mika, Social Networks and the Semantic Web, Springer

**REFERENCE BOOKS:**

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley Interscience
2. 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.
3. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
4. Semantic Web and Semantic Web Services - Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group)
5. Information Sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
6. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

## S24AM744PE: GAME THEORY (Professional Elective – IV)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**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**

- 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.

**REFERENCE BOOKS:**

1. Game Theory, Roger Myerson, Harvard University Press.
2. Game Theory, D. Fudenberg and J. Tirole, MIT Press.
3. Theory of Games and Economic Behavior, J. von Neumann and O. Morgenstern, New York: John Wiley and Sons.
4. Games and Decisions, R.D. Luce and H. Raiffa, New York: John Wiley and Sons.
5. Game Theory, G. Owen, 2nd Edition, New York: Academic Press.

**S24AM745PE: MOBILE COMPUTING (Professional Elective – IV)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:**

- Computer Networks
- Distributed Systems / Distributed Operating Systems

**Course Objectives:**

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

**Course Outcomes:**

- Understand the concept of mobile computing paradigm, its novel applications and limitations.
- Analyze and develop new mobile applications
- Understand the issues of various layers of mobile networks and their solutions.
- 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.

**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.

**S24AM746PE: PRINCIPLES OF GAMIFICATION IN ENGINEERING**
**(Professional Elective – IV)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Understand the genesis of Bharatiya civilization
- Examine the traditional knowledge system of India
- Analyze ancient engineering, technology, and architecture
- Learn the fundamentals of game design and gamification
- Explore the concepts of augmented, virtual reality and multi media

**Course Outcomes:** Student will able to

- Comprehend the significance of Bharatiya civilization
- Demonstrate knowledge of India's ancient education system
- Identify technological advancements in ancient India.
- Design and evaluate basic games and game mechanics
- Apply augmented, virtual reality and multimedia principles

**Unit-1**: Bharatiya Civilization and Development of Knowledge System:

Genesis of the Land, Antiquity of civilization, on the trail of the lost river, Discovery of Saraswati river and Saraswati-Sindhu civilization, Traditional Knowledge System, Vedas and main school of Philosophy, Ancient Education system, The Takshasila and Nalanda universities, Knowledge export from Bharata.

**Unit-2**: Engineering, Technology and Architecture:

Pre-Harappan and Sindhu valley civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic age and post-Vedic records.

**Unit-3**: Introduction to Game Design: Motivation, Types of games, Different aspects of game design; Different components in a game, Game engines, Design Schemas, Game Design Fundamentals.

Foundations of Gamification: Definition of Gamification, Why Gamify, Examples and Categories, Gamification in Context, Resetting Behavior, Replaying History, Gaming foundations: Fun Quotient, Evolution by loyalty, status at the wheel, the House always wins.

**Unit-4**: Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, applications of augmented reality Augmented Reality Ingredients of an Augmented Reality Experience.

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Applications of Virtual Reality

**Unit-5**: Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

**Text Books:**

1. The Knowledge System of Bharata by Bhag Chand Chauhan
2. Ernest Adams, "Fundamentals of Game Design", 3rd Edition, New Riders; ISBN-10: 0321929675, 2013
3. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 9781484236178 2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
4. Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHI/Pearson Education.

**References:**

1. Pride of India-A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati(2006)
2. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381.
3. Multimedia and communications Technology, Steve Heath, Elsevier(Focal Press).

**S24AM721OE: INTRODUCTION TO NATURAL LANGUAGE PROCESSING**
**(Open Elective – II)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:**

- Data structures and compiler design

**Course Objectives:**

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

**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; and 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, Features

**UNIT - II**

**Syntax I:** Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms

**UNIT – III**

**Syntax II:** Models for Ambiguity Resolution in Parsing, Multilingual Issues

**Semantic Parsing I:** Introduction, Semantic Interpretation, System Paradigms, Word Sense

**UNIT - IV**

**Semantic Parsing II:** Predicate-Argument Structure, Meaning Representation Systems

**UNIT - V**

**Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, Bayesian parameter estimation, Language Model Adaptation, Language Models- class based, variable length, Bayesian topic based, 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

**REFERENCE BOOK:**

1. Speech and Natural Language Processing - Daniel Jurafsky& James H Martin, Pearson Publications.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

## S24AM722OE: AI APPLICATIONS (Open Elective – II)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:** Fundamentals of AI

**Course Objectives:**

- To give deep knowledge of AI and how AI can be applied in various fields to make life easy.

**Course Outcomes:**

- Correlate AI and solutions to modern problems.
- Use of AI in business applications
- Application of AI in manufacturing automation
- Use of AI in streaming of data and Network applications

**UNIT - I**

Alibaba: Using Artificial Intelligence To Power The Retail And Business-To-Business Services Of The Future

Amazon: Using Deep Learning To Drive Business Performance

**UNIT - II**

McDonald's: Using Robots And Artificial Intelligence To Automate Processes

Walmart: Using Artificial Intelligence To Keep Shelves Stacked And Customers Happy

**UNIT - III**

LinkedIn: Using Artificial Intelligence To Solve The Skills Crisis

Netflix: Using Artificial Intelligence To Give Us A Better TV Experience

**UNIT - IV**

Salesforce: How Artificial Intelligence Helps Businesses Understand Their Customers

Uber: Using Artificial Intelligence To Do Everything

**UNIT - V**

Siemens: Using Artificial Intelligence And Analytics To Build The Internet Of Trains

Tesla: Using Artificial Intelligence To Build Intelligent Cars

**TEXT BOOK:**

1. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

## S24AM703PC: PROFESSIONAL PRACTICE, LAW & ETHICS

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:**

- Understand the types of roles they are expected to play in the society as practitioners of the engineering profession.
- To develop some ideas of the legal and practical aspects of their profession.

**Course Outcome:**

- Practice ethics and rule of the land in their profession
- Follow the principles and elements of legal contracts
- Able to resolve disputes pertaining to arbitration, reconciliation
- Aware of intellectual property loss

**UNIT - I**

**Professional Practice and Ethics:** Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

**UNIT - II**

**Law of Contract:** Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

**UNIT - III**

**Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system:** Arbitration - meaning, scope and types - distinction between laws of 1940 and 1996; UNCITRAL model law - Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration;

**UNIT - IV**

**Arbitration agreements** – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

**UNIT - V**

**Law relating to Intellectual property:** Introduction - meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright - computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet - Remedies and procedures in India; Law relating to Patents under Patents Act, 1970

**TEXT BOOKS:**

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

**REFERENCE BOOKS:**

1. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
2. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
3. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.

**S24AM711PE: INTERNET OF THINGS LAB (Professional Elective – III)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives**

- To introduce the raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices

**Course Outcomes**

1. Ability to introduce the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
2. Get the skill to program using python scripting language which is used in many IoT devices

**List of Experiments**

1. Using Raspberry pi
   a. Calculate the distance using a distance sensor.
   b. Interface an LED and switch with Raspberry pi.
   c. Interface an LDR with Raspberrry Pi.

2. Using Arduino
   a. Calculate the distance using a distance sensor.
   b. Interface an LED and switch with Aurdino.
   c. Interface an LDR with Aurdino
   d. Calculate temperature using a temperature sensor.

3. Using Node MCU
   a. Calculate the distance using a distance sensor.
   b. Interface an LED and switch with Raspberry pi.
   c. Interface an LDR with Node MCU
   d. Calculate temperature using a temperature sensor.

4. Installing OS on Raspberry Pi
   a) Installation using PiImager
   b) Installation using image file
      - Downloading an Image
      - Writing the image to an SD card
        - using Linux
        - using Windows
      - Booting up Follow the instructions given in the URL https://www.raspberrypi.com/documentation/computers/getting-started.html

5. Accessing GPIO pins using Python
   a) Installing GPIO Zero library.
      update your repositories list:
      install the package for Python 3:
   b) Blinking an LED connected to one of the GPIO pin
   c) Adjusting the brightness of an LED Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

6. Create a DJANGO project and an app.
7. Create a DJANGO view for weather station REST API
8. Create DJANGO template
9. Configure MYSQL with DJANGO framework

**TEXT BOOKS:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

**REFERENCE BOOKS:**

1. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

## S24AM712PE: DATA MINING LAB (Professional Elective – III)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Prerequisites**

- A course on "Database Management System

**Course Objectives:**

- 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:**

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

**LIST OF EXPERIMENTS**: Experiments using Weka/ Pentaho/Python

1. Data Processing Techniques:
   (i) Data cleaning (ii) Data transformation – Normalization (iii) Data integration
2. Partitioning - Horizontal, Vertical, Round Robin, Hash based
3. Data Warehouse schemas – star, snowflake, fact constellation
4. Data cube construction – OLAP operations
5. Data Extraction, Transformations & Loading operations
6. Implementation of Attribute oriented induction algorithm
7. Implementation of apriori algorithm
8. Implementation of FP – Growth algorithm
9. Implementation of Decision Tree Induction
10. Calculating Information gain measures
11. Classification of data using Bayesian approach
12. Classification of data using K – nearest neighbour approach
13. Implementation of K – means algorithm
14. Implementation of BIRCH algorithm
15. Implementation of PAM algorithm
16. 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

## S24AM713PE: SCRIPTING LANGUAGES LAB (Professional Elective – III)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Prerequisites:** Any High level programming language (C, C++)

**Course Objectives**

- To Understand the concepts of scripting languages for developing web based projects
- To understand the applications the of Ruby, TCL, Perl scripting languages

**Course Outcomes**

- Ability to understand the differences between Scripting languages and programming languages
- Gain some fluency programming in Ruby, Perl, TCL

**LIST OF EXPERIMENTS**

1. Write a Ruby script to create a new string which is n copies of a given string where n is a non-negative integer
2. Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area.
3. Write a Ruby script which accept the users first and last name and print them in reverse order with a space between them
4. Write a Ruby script to accept a filename from the user print the extension of that
5. Write a Ruby script to find the greatest of three numbers
6. Write a Ruby script to print odd numbers from 10 to 1
7. Write a Ruby script to check two integers and return true if one of them is 20 otherwise return their sum
8. Write a Ruby script to check two temperatures and return true if one is less than 0 and the other is greater than 100
9. Write a Ruby script to print the elements of a given array
10. Write a Ruby program to retrieve the total marks where subject name and marks of a student stored in a hash
11. Write a TCL script to find the factorial of a number
12. Write a TCL script that multiplies the numbers from 1 to 10
13. Write a TCL script for sorting a list using a comparison function
14. Write a TCL script to (i) create a list (ii) append elements to the list (iii) Traverse the list (iv) Concatenate the list
15. Write a TCL script to comparing the file modified times.
16. Write a TCL script to Copy a file and translate to native format.
17. a) Write a Perl script to find the largest number among three numbers.
    b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.
18. Write a Perl program to implement the following list of manipulating functions
    a) Shift
    b) Unshift
    c) Push
19. a) Write a Perl script to substitute a word, with another word in a string.
    b) Write a Perl script to validate IP address and email address.
20. Write a Perl script to print the file in reverse order using command line arguments

**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 Pramatic Progammers 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.

## S24AM714PE: MOBILE APPLICATION DEVELOPMENT LAB (Professional Elective – III)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives:**

- To learn how to develop Applications in an android environment.
- To learn how to develop user interface applications.
- To learn how to develop URL related applications.

**Course Outcomes:**

- Understand the working of Android OS Practically.
- Develop user interfaces.
- 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 the 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 (Datepicker), 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 the right fragment instead of the second screen with the back button. Use Fragment transactions and Rotation event listeners.
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 usernames 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 a 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.

**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, 2013.

**REFERENCE BOOK:**

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

**S24AM715PE: CLOUD COMPUTING LAB (Professional Elective – III)**

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives:**

1. This course provides an insight into cloud computing
2. Topics covered include- distributed system models, different cloud service models, service-oriented architectures, cloud programming and software environments, resource management.

**Course Outcomes:**

1. Understand various service types, delivery models and technologies of a cloud computing environment.
2. Understand the ways in which the cloud can be programmed and deployed.
3. Understand cloud service providers like Cloudsim, Globus Toolkit etc.
4. Examine various programming paradigms suitable to solve real world and scientific problems using cloud services.

**List of Experiments:**

1. Install Virtualbox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance.
4. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.
9. Create a database instance in the cloud using Amazon RDS.
10. Create a database instance in the cloud using Google Cloud SQL

**TEXT BOOK:**

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014

**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 Computing Bible, Barrie Sosinsky, Wiley-India, 2010

## S24AM716PE: PREDICTIVE ANALYTICS LAB (Professional Elective – III)

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives:**

Exposure to various predictive analytic techniques.

**Course Outcomes:**

1. Implement Linear Regression models.
2. Apply the knowledge of Addictive models.
3. Implement n model assessment and validation
4. Apply the knowledge of Model Assessment

**List of Experiments:**

1. Write a Python program to implement Simple Linear Regression
2. Implement logistic Regression
3. Implement SVM / Decision tree classification techniques.
4. Implement clustering techniques
5. Basic CRUD operations in MongoDB.
6. Implement Naive Bayes algorithm.
7. Write a Program on Time-series analysis
8. Execute clustering and association rule mining algorithms on different datasets.
9. To perform market basket analysis using Association Rules (Apriori).
10. Implement AdaBoost algorithm.
11. Execute gradient boosting algorithm, Examples (Spam data, California housing, New Zealand fish, Demographic data).

**TEXT BOOK:**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data
2. Mining, 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 to Statistical Learning with Applications inR.

## S24*MC706: Universal Human Values

**B.Tech. IV Year I Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

**Course Objectives**

1. To instill among the Engineering professionals, the need to follow ethical principles in life.
2. To help students, initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being
4. To inculcate a sense of moral responsibility and professional ethics is Engineers
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

**UNIT I: Understanding Value Education:**

Basic Concepts: Moral and Morality, Ethics, Values, Principles - Thoughts of Ethics: Indian Thought versus Global Thought - Objectives of Value Education - Importance of Value Education - Personal Ethics- Professional Ethics

**UNIT II: Understanding Harmony in the Human Being & Family**

Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of "I"

Harmony and Values in Relationships in the Family - the basic unit of human interaction, Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas & Samman; Difference between intention and competence,

**UNIT III: Understanding Harmony in the Society & Nature**

Understanding the harmony in the society: Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha).

Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature

**UNIT IV: Professional Ethics:**

Profession and Professionalism-Ethics in Engineering-Role of Engineers - Responsibilities of Engineers- Engineering Code of Ethics – Ethical Dilemmas – CASE STUDIES.

**UNIT V: Exploring Attitudes towards gender**

Understanding gender and Basic Gender Concepts/terminology – exploring attitude towards gender-construction of gender-socialization: Making Women, making Men.

**Text Books**:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Towards a World of Equals: a bilingual Textbook on Gender. A Suneetha, and others…Telugu Academy, Telangana Gov. 2015

**References:**

1. Fundamentals of Ethics for Scientists and Engineers by Edmund G,SeeBauer, Robert L, Barry Oxford University Press, 2015.
2. Professional Ethics by R.Subramanian, Oxford University Press, 2013

**S24AM851PE: SOCIAL NETWORK ANALYSIS (Professional Elective – V)**

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites**

- Web Technologies
- Computer Networks
- Data Warehousing and Data Mining

**Course Objectives**

- Understand the concepts of social media
- Learn the mechanisms for social network analysis
- Analysis of widely used services such as email, Wikis, Twitter, flickr, YouTube, etc.

**Course Outcomes**

- Ability to construct social network maps easily
- Gain skills in tracking the content flow through the social media
- Understand NodeXL use 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 Modelling collections of Connections.

**UNIT - II**

NodeXL, Layout, Visual Design, and Labelling, Calculating and Visualising Network Metrics, Preparing Data and Filtering, Clustering and Grouping.

**UNIT - III**

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

**UNIT - IV**

**CASE STUDIES:**
Visualizing and Interpreting Facebook Networks, WWW Hyperlink Networks

**UNIT - V**

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

**TEXT BOOK**:

1. Hansen, Derek, Ben Sheiderman, Marc Smith, Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.

**REFERENCE BOOKS:**

1. Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability, Sybex, 2009.
2. Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1st Edition, MGH, 2011.

**S24AM852PE: FEDERATED MACHINE LEARNING (Professional Elective – V)**

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites**

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

**Course Objectives**

- Understand the key concepts and issues behind Federated Learning
- Get familiar with key theoretical results of Federated Learning

**Course Outcomes**

- Understand the basics on privacy-preserving ML
- Analyze the key concepts of Distributed ML and FL
- Understand the key concepts and applications of Horizontal FL and Vertical FL
- Motivates the intensive mechanism design for FL
- Analyze the concepts of federated 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
**Background:** 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, Homomorphic 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 FedAvg 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 Payoff Weightage

**UNIT - V**

**Federated Learning for Vision, Language, and Recommendation:** Federated Learning for Computer Vision, Federated CV, Federated Learning for 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

**TEXT BOOK:**

1. Federated Learning, Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and Han Yu Synthesis Lectures on Artificial Intelligence and Machine Learning 2019.

## S24AM853PE: AUGMENTED REALITY & VIRTUAL REALITY (Professional Elective –V)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Provide a foundation to the fast-growing field of AR and make the students aware of the various AR concepts**.**
- 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:**

- Describe how AR systems work and list the applications of AR.
- Understand the software architectures of AR.
- Understand the Visual perception and rendering in VR
- Understand the interaction, auditory perception and rendering in VR

**UNIT - I**

**Introduction to Augmented Reality:** Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields

**Displays:** Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays

**Tracking:** Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

**UNIT - II**

**Computer Vision for Augmented Reality:** Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

**Interaction**: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

**Software Architectures**: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

**UNIT - III**

**Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception

**The Geometry of Virtual Worlds:** Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations

**Light and Optics:** Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

**UNIT - IV**

**The Physiology of Human Vision:** From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

**Visual Perception:** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color

**Visual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

**UNIT - V**

**Motion in Real and Virtual Worlds:** Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

**Interaction:** Motor Programs and Remapping, Locomotion, Social Interaction

**Audio:** The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

**TEXT BOOKS:**

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

**REFERENCE BOOKS:**

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
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.

## S24AM854PE: WEB SECURITY (Professional Elective –V)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Give an Overview of information security
- Give an overview of Access control of relational databases

**Course Outcomes:** Students should be able to

- Understand the Web architecture and applications
- Understand client side and service side programming
- Understand how common mistakes can be bypassed and exploit the application
- Identify common application vulnerabilities

**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

**UNIT - V**

Future Trends 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

## S24AM855PE: AD-HOC & SENSOR NETWORKS (Professional Elective – V)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites**

- Computer Networks
- Distributed Systems
- Mobile Computing

**Course Objectives**

- To understand the challenges of routing in ad-hoc and sensor networks
- To understand various broadcast, mutlicast and geocasting protocols in ad hoc and sensor networks
- To understand basics of Wireless sensors, and Lower Layer Issues and Upper Layer Issues of WSN

**Course Outcomes**

1. Understand the concepts of sensor networks and applications
2. Understand and compare the MAC and routing protocols for adhoc networks
3. Understand the transport protocols of sensor networks

**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, WRP; Reactive: DSR, AODV, TORA; Hybrid: ZRP; *Position- based* routing algorithms-Location Services-DREAM, Quorum-based, GLS; Forwarding Strategies, Greedy Packet, Restricted Directional Flooding-DREAM, LAR; Other routing algorithms-QoS Routing, CEDAR.

**UNIT - II**

**Data Transmission**

Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour 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.

**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)

**REFERENCE BOOKS:**

1. C. Siva Ram Murthy, B.S. Manoj Ad Hoc Wireless Networks: Architectures and Protocols.
2. Taieb Znati Kazem Sohraby, Daniel Minoli, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley.

## S24AM861PE: SPEECH AND VIDEO PROCESSING (Professional Elective – VI)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To make students understand 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.

**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 non linear filter banks, spectral estimation of speech using DFT.
Linear Prediction analysis of speech.

**UNIT - II**

**Speech recognition**

Feature extraction for speech, static and dynamic feature for speech recognition, MFCC, LPCC, Distance measures, vector quantization models, Gaussian Mixture model, HMM.

**UNIT - III**

**Multi-Dimensional Signals and Systems**

Multi-Dimensional Signals, Multi-Dimensional Transforms, Multi-Dimensional Systems, Multi-Dimensional Sampling Theory, Sampling Structure Conversion
**Digital Images and Video:** Human Visual System and Color, Digital Video

**UNIT - IV**

**Motion Estimation**

Image Formation, Motion Models, 2D Apparent-Motion Estimation, Differential Methods, Matching Methods, Nonlinear Optimization Methods, Transform-Domain Methods, 3D Motion and Structure Estimation

**UNIT - V**

**Video Segmentation and Tracking**

Image Segmentation, Change Detection, Motion Segmentation, Motion Tracking, Image and Video Matting, Performance Evaluation

**TEXT BOOKS:**

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series
2. Digital Video processing, A Murat Tekalp, 2nd edition,Prentice Hall.

**REFERENCE BOOKS:**

1. Discrete-time speech signal processing: principles and practice, Thomas F. Quatieri, Coth.
2. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education
3. “Speech and Audio Signal Processing”, B.Gold and N. Morgan, Wiley.
4. “Digital image sequence processing, Compression, and analysis”, Todd R. Reed, CRC Press
5. “Handbook of Image and Video processing”, Al Bovik, Academic press, second Edition.

## S24AM862PE: ROBOTIC PROCESS AUTOMATION (Professional Elective – VI)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Introduce robotic process automation, techniques of automation using UIPath RPA tool.

**Course Outcomes:**

- Understand the concepts of Robotic Process Automation.
- Apply the flow chart mechanism in various calculations.
- Applying UIPath tool for debugging process
- Design system managing techniques.
- Create application for process automation using UIPath tool.

**UNIT - I**

**Robotic Process Automation:** Introduction**,** Scope and techniques of automation, Robotic process automation, Components of RPA, RPA platforms, About UiPath

**UIPath Stack** Uipath Studio, Uipath Robot, Types of Robots, UiPath Orchestrator

**UIPath Studio** Projects, User interface

**The User Interface:** Task recorder, Advanced UI interactions: Input methods, Output methods

**UNIT - II**

**Sequence, Flowchart, and Control Flow:** Sequencing the workflow, Activities, Control Flow, various types of loops and decision making

**Data Manipulation:** Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, File operation with step-by-step example, CSV/Excel to data table and vice versa

**UNIT - III**

**Taking Control of the Controls:** Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Handling events, revisit recorder, When to use OCR, Types of OCR available, How to use OCR

**Plugins and Extensions:** Terminal Plugin, SAP Automation, Citrix automation and Credential management

**UNIT - IV**

**Handling User Events and Assistant Bots:** Assistant bots, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event

**Exception Handling, Debugging, and Logging:** Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting

**UNIT - V**

**Managing and Maintaining the Code:** Project organization, nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines, or Sequences, Using config files

**Deploying and Maintaining the Bot:** Publishing using publish utility, using Orchestration Server to control bots, deploy bots, License Management, Publishing and Managing updates

**TEXT BOOK:**

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

**REFERENCE BOOK:**

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

## S24AM863PE: RANDOMIZED ALGORITHMS (Professional Elective – VI)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objective:**

- To introduce the power of randomization in the design of algorithms.

**Course Outcomes:**

- Appreciate the fundamentals of randomized algorithm design.
- Understand the fundamentals of Markov chains and the Monte Carlo method.
- Apply high probability analysis to selected randomized algorithms.
- Understand the Fingerprint and Pattern Matching techniques

**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, Two Point sampling, The Coupon Collector's problem.

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, Pattern Matching

**UNIT- IV**

Data Structures: The Fundamental of Data-structures, Random Treaps, Skip Lists, Hash Tables

Graph Algorithms: All Pairs Shortest Path, 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, Cambridge University Press
2. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and
3. Data Analysis by Eli Upfal and Michael Mitzenmacher.

**S24AM864PE: COGNITIVE COMPUTING (Professional Elective – VI)**

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**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 cognitive computing
- 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, 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 BOOK:**

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), 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 Hollan.

**S24VAM865PE: CONVERSATIONAL AI (Professional Elective – VI)**

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To be familiar with the basic knowledge about conversational systems.
- To understand the different techniques of natural language processing
- Study the fundamental role of machine learning in building conversational systems.
- To know the various applications of conversational systems and its future development

**Course Outcomes:**

- Understand the basic technologies required for building a conversational system.
- Learn the rule-based dialogue system
- Involve AI in building conversational system and build advanced systems that are cognitively inclined towards human behaviour.
- Develop a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.

**UNIT- I Introducing Dialogue Systems**

Introduction of Dialogue System, History of Dialogue Systems, Present-Day Dialogue Systems, Modeling Conversation Dialogue Systems, Designing and Developing Dialogue Systems

**UNIT- II Rule-Based Dialogue Systems: Architecture, Methods, and Tools**

Dialogue Systems Architecture, designing a Dialogue System, Tools for Developing Dialogue Systems, Rule-Based Techniques in Dialogue Systems Participating in the Alexa Prize

**UNIT- III Statistical Data-Driven Dialogue Systems**

Motivating the Statistical Data-Driven Approach, Dialogue Components in the Statistical Data-Driven Approach, Reinforcement Learning (RL), Representing Dialogue as a Markov Decision Process, From MDPs to POMDPs, Dialogue State Tracking, Dialogue Policy, Problems and Issues with Reinforcement Learning in POMDPs

**UNIT- IV Evaluating Dialogue Systems**

Process of Evaluation, Evaluating Task-Oriented Dialogue Systems, Evaluating Open-Domain Dialogue Systems, Evaluation Frameworks- PARADISE, Quality of Experience (QoE), Interaction Quality, Best Way to Evaluate Dialogue Systems.

**UNIT- V End-to-End Neural Dialogue Systems**

Neural Network Approaches to Dialogue Modeling, A Neural Conversational Model, Introduction to the Technology of Neural Dialogue, Retrieval-Based Response Generation, Task-Oriented Neural Dialogue Systems, Open-Domain Neural Dialogue Systems, Some Issues and Current Solutions, Dialogue Systems: Datasets, Competitions, Tasks, and Challenges.

**TEXT BOOKS:**

1. Michael McTear, “Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots”, Second Edition, Moran and Claypool Publishers, 2020.

**REFERENCE BOOK:**

1. Cathy Pearl, “Designing Voice User Interfaces: Principles of Conversational Experiences”, O’REILLY, 2016.

**S24AM831OE: CHATBOTS (Open Elective – III)**

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Knowledge on concepts of chatbots and understanding the developer environment bot framework.

**Course Outcomes:**

- Understand basic concepts of chatbots
- Analyze different entities in building bots
- Understand the concepts of advanced bot building
- Discuss different types of chatbot use cases

**UNIT - I**

**Introduction to Chatbots:** Definition of chatbots, Journey of Chatbots, Rise of Chatbots, Messaging Platforms

**UNIT - II**

**Setting Up the Developer Environment Botframework**

Local Installation, Installing NodeJS, Following the Development Pipeline, Storing Messages in Database.

**UNIT - III**

Basics of Bot Building- Intents, Entities

**UNIT - IV**

**Advanced Bot Building**

Design Principles, Showing Product Results, Saving Messages, Building Your Own Intent Classifier

**UNIT - V**

**Business and Monetization**

Analytics, Chatbot Use Cases- Modes of Communication- Business-to-Business (B2B), ChapBusiness-to-Consumer (B2C) Consumer-to-Consumer (C2C) Business-to-Employee (B2E), Employee-to-Employee (E2E), Chatbots by Industry Vertical

**TEXT BOOK:**

1. Rashid Khan, Anik Das, Build Better Chatbots: A Complete Guide to Getting Started with Chatbots, Apress

**REFERENCE BOOKS:**

1. Drexen Braxley, Chat GPT #1 Bible - 10 Books in 1: A Comprehensive Guide to AI: Elevate Your Daily Life, Increase Work Output, Secure Financial Gains, Foster Career Growth, and Cultivate Modern Talents Paperback
2. D. Nardo Publications, ChatGPT Made Simple How Anyone Can Harness AI To Streamline Their Work, Study & Everyday Tasks To Boost Productivity & Maintain Competitive Edge By Mastering Prompt Engineering
3. Robert E. Miller,Prompt Engineering Bible Join and Master the AI Revolutions Profit Online with GPT-4 & Plugins for Effortless Money Making!
4. Lucas Foster, Chat GPT Bible Developer and Coder Special Edition: Enhancing Coding Productivity with AI-Assisted Conversations.

## S24AM832OE: EVOLUTIONARY COMPUTING (Open Elective – III)

**B.Tech. IV Year II Sem.**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Prerequisites:** Knowledge on algorithms

**Course Objectives:**

- Introduce the concepts of evolutionary computing and various evolution algorithms

**Course Outcomes:**

1. Appraise the significance of evolutionary computing
2. Apply genetic operators and genetic programming for classification problems
3. Hybridization of genetic algorithms with other techniques
4. Understand multi objective, interactive evolutionary algorithms

**UNIT - I**

**Optimization, Modelling, and Simulation Problems**

Search Problems, Optimization Versus Constraint Satisfaction, The Famous NP Problems

**Evolutionary Computing:** The Origins: The Main Evolutionary Computing Metaphor, Brief History, The Inspiration from Biology, Evolutionary Computing

**Evolutionary Algorithm:** Definition, Components of Evolutionary Algorithms, An Evolutionary Cycle by Hand, Example Applications, The Operation of an Evolutionary Algorithm, Natural Versus Artificial Evolution, Evolutionary Computing, Global Optimization, and Other Search Algorithms

**UNIT - II**

**Representation, Mutation, and Recombination**

Representation and the Roles of Variation Operators, Binary Representation, Integer Representation, Real-Valued or Floating-Point Representation, Permutation Representation, Tree Representation

**Fitness, Selection, and Population Management:** Population Management Models, Parent Selection, Survivor Selection, Selection Pressure, Multimodal Problems, Selection, and the Need for Diversity

**Popular Evolutionary Algorithm Variants:** Genetic Algorithms, Evolution Strategies, Evolutionary Programming, Genetic Programming, Learning Classifier Systems, Differential Evolution, Particle Swarm Optimization, Estimation of Distribution Algorithms

**UNIT - III**

**Parameters and Parameter Tuning:** Evolutionary Algorithm Parameters, EAs and EA Instances, Designing Evolutionary Algorithms, The Tuning Problem, Algorithm Quality: Performance and Robustness, Tuning Methods.

**Parameter Control:** Introduction, Examples of Changing Parameters, Classification of Control Techniques, Examples of Varying EA Parameters

**UNIT - IV**

**Working with Evolutionary Algorithms:** Working of EA, Performance Measures, Test Problems for Experimental Comparisons, Example Applications

**Hybridization with Other Techniques: Memetic Algorithms:** Motivation for Hybridizing EAs, A Brief Introduction to Local Search, Structure of a Memetic Algorithm, Adaptive Memetic Algorithms, Design Issues for Memetic Algorithms, Example Application: Multistage Memetic Timetabling

**UNIT - V**

**Multiobjective Evolutionary Algorithms**

Multiobjective Optimization Problems, Dominance and Pareto Optimality, EA Approaches to Multiobjective Optimization, Example Application: Distributed Coevolution of Job Shop Schedules

**Constraint Handling:** Two Main Types of Constraint Handling, Approaches to Handling Constraints, Example Application: Graph Three-Colouring

**Interactive Evolutionary Algorithms:** Characteristics of Interactive Evolution, Algorithmic Approaches to the Challenges of IEAs, Interactive Evolution as Design vs. Optimization, Example Application: Automatic Elicitation of User Preferences

**TEXT BOOK:**

1. A. E. Eiben, J. E. Smith, Introduction to Evolutionary Computing, Second Edition, Springer.

**REFERENCE BOOKS:**

1. David E. Goldberg, "Genetic Algorithms in search, Optimization & Machine Learning".
2. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.