SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)
(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
UG Programmes CE, CSE, ECE, EEE, IT & ME are Accredited by NBA, Accredited by NAAC with A+
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204
Estd:1980

| Regulation: R20 | IV / IV - B.Tech. I - Semester |
|---|---|

**COMPUTER SCIENCE AND DESIGN**

**SCHEME OF INSTRUCTION & EXAMINATION**
**(With effect from 2021-22 admitted Batch onwards)**

| Course Code | Course Name | Category | Cr | L | T | P | Int. Marks | Ext. Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| B20HS4101 | Universal Human Values-2: Understanding Harmony | HS | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| #PE-III | Professional Elective -III | PE | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| #PE-IV | Professional Elective -IV | PE | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| #PE-V | Professional Elective -V | PE | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| #OE-III | Open Elective-III | OE | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| #OE-IV | Open Elective-IV | OE | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| B20CD4105 | MERN Stack Technologies-Module II. | SOC | 2 | 1 | 0 | 2 | -- | 50 | 50 |
| B20CD4106 | Industrial/Research Internship 2 Months | PR | 3 | -- | -- | -- | -- | 50 | 50 |
| | | **TOTAL** | **23** | **19** | **0** | **2** | **180** | **520** | **700** |

| | Course Code | Course |
|---|---|---|
| #PE-III | B20AM4101 | Robotic Process Automation |
| | B20CS4101 | Cloud Computing |
| | B20CD4101 | Nature Inspired Computing Techniques |
| | B20AM4103 | NoSQL Databases |
| #PE-IV | B20AM4105 | Reinforcement Learning |
| | B20CD4102 | Software Project Management |
| | B20AM4108 | Block Chain Technologies |
| | B20CD4103 | Computer Vision |
| #PE-V | B20AM4110 | Social Network Analysis |
| | B20AM4111 | Recommender Systems |
| | B20AM4112 | AI Chatbots |
| | B20CD4104 | Data Visualization |
| #OE-III & #OE-IV | Student has to study one Open Elective each from OE-III & IV offered by CE or ECE or EEE or ME or S&H from the list enclosed. | |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20HS4101** | **HS** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**UNIVERSAL HUMAN VALUES-2: UNDERSTANDING HARMONY**

**(Common to AIDS, AIML, CSBS, CSG, CSE, IT & ME)**

**Course Objectives:**

| | |
|---|---|
| 1. | To enable students appreciate the essential complementarity between 'Values' and 'Skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. |
| 2. | To understand the harmony in the human being, family, society and nature/existence |
| 3. | To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Value based living in a natural way. |

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

| S.No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Identify** the importance of human values and skills for sustained happiness | K2 |
| 2. | **Understand** how to balance profession and personal happiness/ goals. | K2 |
| 3. | **Express** their commitment towards what they have understood (human values, human relationship and human society) | K2 |
| 4. | **Explain** the significance of trust, mutually satisfying human behavior and enriching interaction with nature. | K2 |
| 5. | **Develop**/ propose appropriate technologies and management patterns to create harmony in professional and personal life. | K3 |

**SYLLABUS**

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|---|---|
| **UNIT-I (10 Hrs)** | **Course Introduction** - Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfil the above human aspirations: understanding and living in harmony at various levels. |
| **UNIT-II (08 Hrs)** | **Understanding Harmony in the Human Being** - 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' - happiness and physical facility Page 29 of 43 Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the |

| | |
|---|---|
| | harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health. |
| | |
| **UNIT-III (08 Hrs)** | **Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship Understanding the meaning of Trust; Difference between intention and competence Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. |
| | |
| **UNIT-IV (08 Hrs)** | **Understanding Harmony in the Nature and Existence** - Whole existence as Coexistence Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature Understanding Existence as Co-existence of mutually interacting units in all pervasive space Holistic perception of harmony at all levels of existence. |
| | |
| **UNIT-V (08 Hrs)** | **Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations |
| | |
| **Textbooks:** | |
| 1. | Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 |
| **Reference Books:** | |
| 1. | Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. |
| 2. | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 3. | The Story of Stuff (Book). |
| 4. | The Story of My Experiments with Truth |
| 5. | Small is Beautiful E. F Schumacher by Mohandas Karamchand Gandhi |
| 6. | Slow is Beautiful Cecile Andrews |
| 7. | Economy of Permanence J C Kumarappa |

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| 8. | Bharat Mein Angreji Raj Pandit Sunderlal |
| 9. | Rediscovering India by Dharampal Hind Swaraj or Indian Home |
| 10. | Rule by Mohandas K. Gandhi |
| 11. | India Wins Freedom Vivekananda Maulana Abdul Kalam Azad 12Romain Rolland (English) |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4101** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

## ROBOTIC PROCESS AUTOMATION

(Common to AIML and CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | Understand the Fundamentals of Robotic Process Automation (RPA) |
| 2. | Expertise in utilizing UI Path and managing control flows |
| 3. | Get proficiency in Advanced Automation Techniques and Exception Handling. |

**Course Outcomes:** Upon completion of the course, the students will be able to

| S. No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Interpret** concepts and applications of RPA | K2 |
| 2. | **Use** RPA tool to manipulate text data. | K3 |
| 3. | **Apply** Image, Text and Data Tables Automation techniques. | K3 |
| 4. | **Illustrate** handling of User Events & Assistant Bots and Exceptions | K2 |
| 5. | **Demonstarte** the deployment and maintenance of a bot | K3 |

## SYLLABUS

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|---|---|
| **UNIT-I (10Hrs)** | **Introduction to Robotic Process Automation:** Scope and techniques of automation, Robotic process automation, what is RPA, what can RPA do, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.<br>**RPA Basics:** RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem. |
| **UNIT-II (12 Hrs)** | **RPA Tool Introduction and Basics:**<br>**Introduction to RPA Tool:**<br>The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity. |

| | |
|---|---|
| | **Data Manipulation:** Introduction to Data Manipulation, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data. |
| | |
| **UNIT-III (12 Hrs)** | **Advanced Automation Concepts & Techniques:** Recording Introduction, Basic and Desktop Recording, Web Recording, Input/ Output Methods, Screen Scraping, Data Scraping, scraping advanced techniques, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image. **Introduction to Image & Text Automation**: Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, using tab for Images, Starting Apps, Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF. |
| | |
| **UNIT-IV (8 Hrs)** | **Handling User Events & Assistant Bots**, **Exception Handling:** What are assistant bots, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, an example of monitoring email. **Exception Handling:** Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors. |
| | |
| **UNIT-V (8 Hrs)** | **Deploying and Maintaining the Bot:** Publishing using publish utility, Creation of Server, Using Server to control the bots, Creating a provision Robot from the Server, Connecting a Robot to Server, Deploy the Robot to Server, Publishing and managing updates, Managing packages, Uploading packages, Deleting packages. |
| | |



| **Textbooks:** | |
|---|---|
| 1. | Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018. |
| **Reference Books:** | |
| 1. | RPA Design and Development V 4.0 Student Manual. |
| 2. | Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, “Introduction to Robotic Process Automation: a Primer”, Institute of Robotic Process Automation,1st Edition 2015. |
| 3. | Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant”, Independently Published, 1st Edition 2018. |
| 4. | Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes”, Packt Publishing, 1st Edition 2018. |
| | |
| **e-Resources** | |
| 1. | What is Robotic Process Automation - RPA Software \| UiPath |

| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| B20CS4101 | PE | 3 | -- | -- | 3 | 30 | 70 | 3 Hrs. |

**CLOUD COMPUTING**

(Common to CSE, AIML and CSD)

**Course Objectives**:

| | |
|---|---|
| 1 | Fundamentals of Cloud Computing, Concepts of Virtualization and the Cloud delivery and Deployment Models. |
| 2 | To introduce the various levels of services that can be achieved by cloud. |
| 3 | To motivate students to do programming and experiment with the various cloud computing environments. |
| 4 | Common types of persistent storage devices, Cloud computing software security objectives, design principles and development practices. |
| 5 | To motivate students to do programming and experiment with the various cloud computing environments. |

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

| S. No | OUTCOME | Knowledge Level |
|---|---|---|
| 1 | **Summarize** concepts for state-of-the-art cloud computing. | K2 |
| 2 | **Explain** how virtualization technology enabling cloud computing**.** | K2 |
| 3 | **Use** algorithms for cloud resource management and scheduling. | K3 |
| 4 | **Describe** storage system architectures and security fundamentals for cloud applications. | K2 |
| 5 | **Determine** suitable host provider for cloud applications development. | K3 |

**SYLLABUS**

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|---|---|
| **UNIT-I (10 Hrs)** | **Introduction to Cloud Computing**, Meaning of Cloud and History, Evolution of Cloud Computing, Cloud essential Characteristics, Cloud Computing Architecture: Cloud Service Models/Types (i.e., Public, Private, Hybrid, and Community), Cloud deployment models (i.e., IaaS, PaaS, SaaS, and PaaS), System models for Distributed and Cloud Computing, Service Oriented Architecture, Performance, Security and Energy Efficiency |
| **UNIT-II (10 Hrs)** | **Cloud Enabling Technologies**: Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation. |
| **UNIT-III** | **Cloud Resource Management and Scheduling:** Policies and Mechanisms for Resource |

| | |
|---|---|
| **(10 Hrs)** | Management, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing. |
| | |
| **UNIT-IV (10 Hrs)** | **Storage Systems:** Evolution of storage technology, storage models, File systems and database, distributed file systems, general parallel file systems. Google file system. **Cloud Computing Software Security Fundamentals**: Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Secure Cloud Software Requirements. |
| | |
| **UNIT-V (10 Hrs)** | **Cloud Technologies and Advancements: Hadoop: MapReduce**, Programming on Amazon AWS and Microsoft Azure, Google App Engine and Programming Environment for Google App Engine, **Federation in the Cloud**: Four Levels of Federation Federated Services and Applications, Future of Federation. |
| | |

| **TEXT BOOK:** | |
|---|---|
| 1. | Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier. |
| 2. | Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier. |
| **REFERENCE BOOKS:** | |
| 1. | Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press |
| 2. | Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH |
| 3. | Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH |



| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20CD4101** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**NATURE INSPIRED COMPUTING TECHNIQUES**

(For CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the fundamentals of nature inspired techniques which influence computing |
| 2. | To study the Swarm Intelligence and Immune computing techniques. |
| 3. | To familiarize the DNA Computing and Quantum Computing techniques. |

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

| S.No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Explain** The basics concepts of Natural systems | K2 |
| 2. | **Describe** concepts of Natural systems and its applications | K2 |
| 3. | **Use** Swarm Intelligence in various algorithms | K3 |

| | | |
|---|---|---|
| 4. | **Use** immune computing in various algorithms. | K3 |
| 5. | **Analyze** computing techniques for DNA validation. | K4 |

**SYLLABUS**

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|---|---|
| **UNIT-I (10 Hrs)** | **Introduction**: From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributive Interactivity, Adaptation Feedback-Self-Organization-complexity, Emergence and ,Bottom-up Vs Top-Down- Determination, Chaos and Fractals. |
| **UNIT-II (10 Hrs)** | **Computing Inspired by Nature:** Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming |
| **UNIT-III (10 Hrs)** | **SWARM INTELLIGENCE:** Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge , Particle Swarm Optimization (PSO) |
| **UNIT-IV (10 Hrs)** | **IMMUNO COMPUTING**: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm, Artificial Immune Networks |
| **UNIT-V (10 Hrs)** | **COMPUTING WITH NEW NATURAL MATERIALS:** DNA Computing: Motivation, DNA Molecule, Adleman's experiment, test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing. |



**Textbooks:**


| | |
|---|---|
| 1. | Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007 |
| | |


**Reference Books:**


| | |
|---|---|
| 1. | Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies",MIT Press, Cambridge, MA, 2008. |
| 2. | Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006. |
| 3. | Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005 |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4103** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**NoSQL DATABASES**

(Common to AIML and CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph). |
| 2. | Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases. |
| 3. | Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases. |

**Course Outcomes:** Upon completion of the course, the students will be able to

| S.No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Explain** Aggregate Data Models | **K2** |
| 2. | **Use** distribution models for handling data replication and consistency | **K3** |
| 3. | **Apply** key-value features for databases by considering suitable use cases | **K3** |
| 4. | **Use** document and column-family features for databases | **K3** |
| 5. | **Model** graph and schemaless databases | **K3** |

**SYLLABUS**

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|---|---|
| **UNIT-I (10Hrs)** | Why NoSQL, The Value of Relational Databases, Impedance Mismatch, Application and Integration Databases, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. |
| **UNIT-II (10 Hrs)** | Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. |
| **UNIT-III (10 Hrs)** | What Is a Key-Value Store, Key-Value Store Features, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets |
| **UNIT-IV** | Document Databases, What Is a Document Database, Features, Suitable Use Cases, When |

| | |
|---|---|
| **(10 Hrs)** | Not to Use, what is Column-Family Data Store, Features, Suitable use cases, when not to use |
| | |
| **UNIT-V (10 Hrs)** | Graph Databases, What Is a Graph Database, Features, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use**,** Schema changes in RDBMS, Schema changes in a NOSQL Data Store |
| | |
| **Textbooks:** | |
| 1. | Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012 |
| | |
| **Reference Books:** | |
| 1. | Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338) |
| 2. | Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022) |
| 3. | Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694) |
| | |
| **e-Resources** | |
| 1. | https://www.coursera.org/learn/introduction-to-nosql-databases |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4105** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**REINFORCEMENT LEARNING**

(Common to AIML, CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning. |

**Course Outcomes:** Upon completion of the course, the students will be able to

| S. No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Apply** Reinforcement learning principles to solve the sequential decision-making problems and multi-armed bandit problems | K3 |
| 2. | **Apply** concepts of finite Markov decision processes and dynamic programming to evaluate and optimize decision-making policies | K3 |
| 3. | **Use** Monte Carlo and Temporal Difference learning methods for optimal decision-making in reinforcement learning tasks. | K3 |
| 4. | **Apply** n-step bootstrapping and eligibility traces techniques within the framework of temporal difference learning for reinforcement learning problems. | K3 |
| 5. | **Explain** policy approximation techniques and applications of reinforcement learning. | K2 |

**SYLLABUS**

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|---|---|
| **UNIT-I (10Hrs)** | **Introduction:** Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe<br>**Multi-armed Bandits:** A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper Confidence-Bound Action Selection |
| **UNIT-II (12 Hrs)** | **Finite Markov Decision Process:** The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notation for Episodic and Continuing Tasks, Policies and Value Functions, Optimal Policies and Optimal Value Functions<br>**Dynamic Programming:** Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming |
| **UNIT-III (12 Hrs)** | **Monte Carlo Methods:** Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Incremental |

| | |
|---|---|
| | Implementation, Off-policy Monte Carlo Control<br>**Temporal Difference Learning:** TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-policy TD Control, Q-Learning: Off-policy TD Control, Expected Sarsa, Maximization Bias and Double Learning |
| | |
| **UNIT-IV (8 Hrs)** | **n-step Bootstrapping:** n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, The n-step Tree Backup Algorithm<br>**Eligibility Traces:** The λ-return, TD(λ), n-step Truncated λ-return methods |
| | |
| **UNIT-V (8 Hrs)** | **Policy Gradient Methods:** Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods<br>**Applications and Case Studies:** TD-Gammon, Samuel's Checkers Player, Optimizing Memory Control, Personalized Web Services |
| | |
| **Textbooks:** | |
| 1. | R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," Second Edition, MIT Press, 2020. |
| **Reference Books:** | |
| 1. | Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010. |
| 2. | Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014. |
| | |
| **e-Resources** | |
| 1. | https://onlinecourses.nptel.ac.in/noc20_cs74/preview |
| 2. | https://www.coursera.org/learn/fundamentals-of-reinforcement-learning |

| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| B20CD4102 | PE | 3 | 0 | 0 | 3 | 30 | 70 | 100 |

**SOFTWARE PROJECT MANAGEMENT**

(For CSD)

**Course Objectives:** Students are expected to

| | |
|---|---|
| 1 | Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project |
| 2 | Compare and differentiate organization structures and project structures |
| 3 | Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools |

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

| S. No | Outcome | Knowledge Level |
|---|---|---|
| 1 | **Apply** the process to be followed in the software development life-cycle models. | K3 |
| 2 | **Apply** the concepts of project management & planning. | K3 |
| 3 | **Demonstrate** architectures, processes of software project. | K3 |
| 4 | **Determine** Process Planning and Responsibilities of Organizations in building software project. | K3 |
| 5 | **Use** various automata tools for project control and estimations. | K3 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10 Hrs)** | **Conventional Software Management:** The Waterfall Model, Conventional Software Management Performance.<br>**Evolution Of Software Economics:** Software Economics, Pragmatic Software Cost Estimation.<br>**Life Cycle Phases:** Engineering and production stages, inception, Elaboration, construction, transition phases. |
| **UNIT-II (10 Hrs)** | **Improving Software Economics:** Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.<br>**The Old Way and The New:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.<br>**Artifacts of The Process**: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. |

| | |
|---|---|
| **UNIT-III (10 Hrs)** | **Model Based Software Architectures:** A Management perspective and technical perspective.<br>**Work Flows of the Process:** Software process workflows, Iteration workflows.<br>**Checkpoints of the Process:** Major milestones, Minor Milestones, Periodic status assessments. |
| | |
| **UNIT-IV (10 Hrs)** | **Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.<br>**Project Organizations and Responsibilities**: Line-of-Business Organizations, Project Organizations, evolution of Organizations. |
| | |
| **UNIT-V (10 Hrs)** | **Process Automation:** Automation Building blocks, The Project Environment.<br>**Project Control and Process Instrumentation**: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.<br>**Project Estimation and Management:** COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach |
| | |

| **Textbook:** | |
|---|---|
| 1 | Software Project Management, Walker Royce, Pearson Education, 2005. |
| 2 | Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH. |
| **Reference Books:** | |
| 1 | Software Project Management, Joel Henry, Pearson Education. |
| 2 | Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005. |
| 3 | Effective Software Project Management, Robert K. Wysocki, Wiley, 2006. |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4108** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**BLOCK CHAIN TECHNOLOGIES**

(Common to AIML and CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | Understand how blockchain systems (mainly Bitcoin and Ethereum) work and to securely interact with them. |
| 2. | Design, build, and deploy smart contracts and distributed applications, |
| 3. | Integrate ideas from blockchain technology into their own projects. |

**Course Outcomes** Upon completion of the course, the students will be able to

| S. No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Explain** the fundamental concepts of the block chain technology | K2 |
| 2. | **Summarize** Blockchain concepts and the risks involved in building its application | K2 |
| 3. | **Determine** various blockchain solutions for designing applications | K3 |
| 4. | **Apply** concepts of Etherium for implementing Blockchain | K3 |
| 5. | **Describe** the concept of Hyperledger used for different usecases | K2 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10Hrs)** | **Introduction**, Scenarios, Challenges Articulated Block chain, Block chain Characteristics, Opportunities Using Block chain, History of Block chain, Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market. |
| **UNIT-II (10 Hrs)** | **Block chain Concepts**: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with block chain solutions, life cycle of block chain transaction. |
| **UNIT-III (10 Hrs)** | **Architecting Block chain solutions:** Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications, Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for |

| | |
|---|---|
| | Designing Block chain Applications. |
| | |
| **UNIT-IV (10 Hrs)** | **Ethereum Block chain Implementation:** Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Meta mask.<br>Tuna Fish Use Case Implementation, Open Zeppelin Contracts |
| | |
| **UNIT-V (10 Hrs)** | **Hyper ledger Block chain Implementation**, Introduction, Use Case – Car Ownership Tracking, Hyper ledger Fabric, Hyper ledger Fabric Transaction Flow, Fab Car Use Case Implementation, Invoking Chain, code Functions Using Client Application. |
| | |
| **Textbooks:** | |
| 1. | Ambadas, Arshad Sarfarz Ariff, Sham "Block chain for Enterprise Application Developers", Wiley, 2020 |
| 2. | Andreas M. Antonpoulos, "Mastering Bitcoin: Programming the Open Block chain" , O'Reilly, 2017 |
| **Reference Books:** | |
| 1. | Block chain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill. |
| 2. | Block chain: Blueprint for a New Economy, Melanie Swan, O'Reilly |
| | |
| **e-Resources** | |
| 1. | https://www.coursera.org/specializations/blockchain |
| 2. | https://www.coursera.org/learn/blockchain-basics |
| 3. | https://onlinecourses.nptel.ac.in/noc22_cs44/preview |

| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20CD4103** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**COMPUTER VISION**

(For CSD)

**Course Objectives**:

| | |
|---|---|
| 1. | To introduce students the fundamentals of image formation |
| 2. | To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; |
| 3. | To develop an appreciation for various issues in the design of computer vision and object recognition systems; |
| 4. | To provide the student with programming experience from implementing computer vision and object recognition applications. |

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

| S. No | OUTCOME | Knowledge Level |
|---|---|---|
| 1. | **Explain** the concepts of Image Formation and Processing | K2 |
| 2. | **Describe** the principles of feature detection and matching, | K2 |
| 3. | **Use** the structure and motion estimations techniques related to vision. | K2 |
| 4. | **Demonstrate** Image stitching models and computational photography concepts | K3 |
| 5. | **Determine** a computer vision system for a 3D Reconstruction, Albedos, image based rendering views and depths. | K3 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10 Hrs)** | Introduction: Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, More Neighbourhood Operators, Fourier Transforms, Pyramids and Wavelets, Geometric Transformations, Global Optimization. |
| **UNIT-II (08 Hrs)** | Feature Detection and Matching: Points and Patches, Edges, Lines, Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature-Based Alignment: 2D and 3D Feature-based Alignment, Pose Estimation, Geometric Intrinsic Calibration. |
| **UNIT-III (10 Hrs)** | Structure and Motion: Triangular, Two-frame Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion, Dense Motion Estimation: Translation Alignment, Parametric Motion, Spline-based Motion, Optical Flow, Layered motion |

| | |
|---|---|
| **UNIT-IV (08 Hrs)** | Image Stitching: Motion Models, Global Alignment, Composing, Computational Photography: Photometric Calibration, High Dynamic Range Imaging, Super-Resolution and Blur Removal,image Matting and Compositing, Texture Analysis and Synthesis. |
| | |
| **UNIT-V (08 Hrs)** | 3D Reconstruction: Shape From X, Active Range Finding, Surface Representation, Point based Representation, Volumetric Representation, Model-based Reconstruction, Recovering Texture Maps and Albedos, Image- based Rendering: View Interpolation, Layered Depth Images, LightFields and Lumigraphs, Environment Mattes, Video-based Rendering. |
| | |
| **TEXTBOOK:** | |
| 1. | Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited,2011 |
| 2. | Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited,2011 Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2012 |
| **REFERENCE BOOKS:** | |
| 1. | Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill. |
| 2. | Haralick & Shapiro, “Computer and Robot Vision”, Vol II |
| 3. | GerardMedioni and Sing Bing Kang “Emerging topics in computer vision”166 |
| E- **Reference:** | |
| 1. | NPTEL LINK: https://onlinecourses.nptel.ac.in/noc22_ee48/preview |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4110** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**SOCIAL NETWORK ANALYSIS**

(Common to AIML and CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | To understand the levels of SNA and network growth and rank models |
| 2. | To understand cascade behaviour in networks |

**Course Outcomes** Upon completion of the course, the students will be able to

| S.No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Describe** the levels of SNA and Network measures | K2 |
| 2. | **Illustrate** various network growth models and rank models | K2 |
| 3. | **Apply** different community structures and link prediction models. | K3 |
| 4. | **Illustarte** cascade prediction and anomaly detection in social networks | K2 |
| 5. | **Apply** graph representation learning methods to address real-world problems | K3 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10Hrs)** | **Introduction:** Introduction, Applications, Preliminaries, Three Levels of Social Network Analysis, Historical Development, Graph Visualization Tools<br>**Network Measures:** Network Basics, Node Centrality, Assortativity, Transitivity and Reciprocity, Similarity, Degeneracy |
| **UNIT-II (10 Hrs)** | **Network Growth Models**: Properties of real world networks, Random network model, Ring lattice network model, Watts-Strogatz Model, Preferential Attachment Model, Price's Model, Local-world Network Growth Model<br>**Link Analysis:** Applications, Signed Networks, Strong and Weak Ties, Link Analysis and Algorithms, Page Rank, Personalized Page Rank, DivRank, SimRank, PathSim |
| **UNIT-III (10 Hrs)** | **Community Structure in Networks:** Applications, Types of Communities, Community Detection Methods, Disjoint Community Detection, Overlapping Community Detection, Local Community Detection, Community Detection vs Community Search, Evaluation of Community Detection Methods<br>**Link Prediction:** Applications, Temporal Changes in a Network, Problem Definition Evaluating Link Prediction Methods, Heuristic Models, Probabilistic Models, Supervised Random Walk, Information-theoretic Model |

| | |
|---|---|
| **UNIT-IV (10 Hrs)** | **Cascade Behaviours and Network Effects:** Preliminaries, Cascade Model, Case Study, Probabilistic Cascades, Epidemic Models, Independent Cascade Models, Cascade Prediction<br>**Anomaly Detection in Static Networks**: Outliers vs. Network-based Anomalies, Challenges, Anomaly Detection in Static Networks |
| | |
| **UNIT-V (10 Hrs)** | **Graph Representation Learning**: Machine Learning Pipelines, Intuition behind Representation Learning, Benefits, Criterion of GRL, GRL Pipelines, Representation Learning Methods<br>**Applications and Case Studies:** Malicious Activities on OSNs, Sockpuppets in OSNs, Modeling the Spread of COVID-19, Recommender System |
| | |
| **Textbooks:** | |
| 1. | Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021 |
| **Reference Books:** | |
| 1. | Network Science, Albert-Lazzlo Barabasi |
| 2. | Social Network Analysis: methods and Applications, Stanley Wasserman, Katherine Faus |
| | |
| **e-Resources** | |
| 1. | https://onlinecourses.nptel.ac.in/noc22_cs117/preview |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4111** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**RECOMMENDER SYSTEMS**

(Common to AIML, CSD)

**Course Objectives:**

To develop expertise in designing, implementing, and evaluating diverse recommender systems using collaborative filtering, supervised models, knowledge-based and content-based techniques.

**Course Outcomes:** On completion of the course the students will be able to:

| S. No. | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Interpret** the types of recommender systems and their applications. | K2 |
| 2. | **Use** Neighbourhood-based collaborative filtering methods for building recommender systems. | K3 |
| 3. | **Apply** supervised models and Latent Factor Models for implementing recommender systems. | K3 |
| 4. | **Illustrate** content-based and knowledge-based techniques for building recommender systems. | K2 |
| 5. | **Describe** paradigms, goals, design issues and metrics for recommender system evaluation. | K2 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10Hrs)** | **An Introduction to Recommender Systems:** Goals of Recommender Systems, Basic Models of Recommender Systems, Collaborative Filtering Models, Content-Based Recommender Systems, Knowledge-Based Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications. |
| **UNIT-II (10 Hrs)** | **Neighborhood-based Collaborative Filtering:** Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, Graph Models for Neighborhood-Based Methods. |
| **UNIT-III (10 Hrs)** | **Model-Based Collaborative Filtering:** Decision and Regression Trees, Rule-Based Collaborative Filtering, Naïve Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-box, Latent Factor Models: Singular Value Decomposition, Non-negative Matrix Factorization |

| | |
|---|---|
| **UNIT-IV (10 Hrs)** | **Content-Based Recommender Systems:** Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations. Knowledge-Based Recommender Systems: Introduction, Constraint-Based Recommender Systems |
| | |
| **UNIT-V (10 Hrs)** | **Evaluating Recommender Systems:** Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures |
| | |
| **Textbooks:** | |
| 1. | Charu .C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016. |
| **Reference Books:** | |
| 1. | Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed. |
| 2. | Francesco Ricci, Lior Rokach, Bracha Shapira., Recommender Systems Handbook, Springer (2022), 3rd ed. |
| | Akshay K., Adarsha Shivananda, Anoosh K., V Adithya Krishnan, Applied Recommender Systems with Python: Build Recommender Systems with Deep Learning, NLP and Graph-Based Techniques, Apress, 2023. |
| 3. | Kim Faalk, Practical Recommender Systems, Manning publishers, 2019 |
| 3. | Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed. |
| | |
| **e-Resources** | |
| 1. | http://pzs.dstu.dp.ua/DataMining/recom/bibl/1aggarwal_c_c_recommender_systems_the_textbook.pdf |

| Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20AM4112** | **PE** | **3** | **--** | **--** | **3** | **30** | **70** | **3 Hrs.** |

**AI CHATBOTS**

(Common to AIML, CSD)

**Course Objectives:**

| | |
|---|---|
| 1. | Learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases. |
| 2. | Identify best practices for defining a chatbot use case and use a rapid prototyping framework to develop a use case for a personalized chatbot. |
| 3. | |

**Course Outcomes** Upon completion of the course, the students will be able to

| S.No | Outcome | Knowledge Level |
|---|---|---|
| 1. | **Explain** chatbot data sources, GDPR principles, and customer-centric chatbot solutions for financial services, integrating ethical considerations | K2 |
| 2. | **Apply** rules-based and AI-based chatbot development approaches, conversational flow components, and key chatbot terms to develop a customer service-centric chatbot for a 24x7 insurance agent use case. | K3 |
| 3. | **Illustarte** business considerations for chatbot solutions, chatbots, apps, success metrics including customer satisfaction index and completion rate, and generic solution architecture for private chatbots. | K2 |
| 4. | **Develop** chatbots using various natural language processing, understanding, and generation libraries | K3 |
| 5. | **Use** third-party APIs and modules to integrate chatbots, connect to an enterprise data store. | K3 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10Hrs)** | Introduction: Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape<br>Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR) |
| **UNIT-II (10 Hrs)** | Chatbot Development Essentials: Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent |

| | |
|---|---|
| **UNIT-III (10 Hrs)** | Building a Chatbot Solution: Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots |
| | |
| **UNIT-IV (10 Hrs)** | Natural Language Processing, Understanding, and Generation: Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications. |
| | |
| **UNIT-V (10 Hrs)** | Introduction to Microsoft Bot, RASA, and Google Dialog flow: Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow<br>Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module |
| | |
| **Textbooks:** | |
| 1. | Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks", ISBN 978-1-4842-5034-1, Apress,2019 |
| **Reference Books:** | |
| 1. | Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669. |
| 2. | Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298 |
| 3. | Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564. |
| 4. | Abhishek Singh, Karthik Ramasubramanian and Shrey Shivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334. |

| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20CD4104** | **PE** | **3** | **0** | **0** | **3** | **30** | **70** | **100** |

**DATA VISUALISATION**

(For CSD)

**Course Objectives:** Students are expected to

| | |
|---|---|
| 1 | To learn different statistical methods for Data visualization. |
| 2 | To know categories of visualization and application areas |
| 3 | To understand the role of user interaction within visualizations |
| 4 | To understand the visualization design process |

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

| S. No | Outcome | Knowledge Level |
|---|---|---|
| 1 | **Explain** the basics of Data Visualization for various representations | K2 |
| 2 | **Apply** visualizing distributions techniques in data representation. | K3 |
| 3 | **Find** visualization of time series, proportions & associations. | K3 |
| 4 | **Apply** visualization on Trends and uncertainty. | K3 |
| 5 | **Apply** principles of proportions | K3 |

**SYLLABUS**

| | |
|---|---|
| **UNIT-I (10 Hrs)** | **Introduction To Visualization:** Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data. |
| **UNIT-II (10 Hrs)** | **Visualizing Distributions:** Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heat maps, Visualizing Distributions: Histograms and Density Plots-Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis |
| **UNIT-III (10 Hrs)** | **Visualizing Associations & Time Series:** Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Tree maps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatter plots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables |

| | |
|---|---|
| **UNIT-IV (10 Hrs)** | **Visualizing Uncertianity**: Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots. |
| | |
| **UNIT-V (10 Hrs)** | **Principle Of Proportiona Link**: The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2DHistograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Non-monotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency |
| | |
| **Textbook:** | |
| 1 | Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019. |
| 2 | Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018. |
| **Reference Books:** | |
| 1 | Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization,O'Reilly, 2016. |

| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| B20CD4105 | SOC | 1 | -- | 2 | 2 | -- | 50 | 3Hrs |

**MERN STACK TECHNOLOGIES-MODULE II- REACT JS, MONGODB**

(For CSG)

**Course Objectives:** Students are expected to

| | |
|---|---|
| 1 | The core concepts of frontend and dynamic, responsive development for web applications. |

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

| S. No | Outcome | Knowledge Level |
|---|---|---|
| 1 | **Develop** dynamic and responsive web pages using React JS. | K4 |
| 2 | **Develop** web applications with document database using MongoDB. | K4 |

**SYLLABUS**

| | |
|---|---|
| 1 | **React JS:** Setting up React environment, Create React App, Hello World, Components, JSX,Functional vs class components, Props, State, Lifecycle methods, Hooks – use State, use Effect, use Context, Event handling, Forms – controlled components, submission, validation, Conditional rendering – if, ternary, Lists and keys, Importance of keys, Styling – CSS, CSS Modules, CSS-in-JS, React Router – setup, routes, parameters, Redux – setup, actions, reducers, Async/await, Promises, Fetch API, Error handling, debugging, optimization |
| **2** | **MongoDB:** Introduction to MongoDB Structure and Architecture, MongoDB Remote Management, Installing MongoDB on the local computer (Mac or Windows), Introduction to MongoDB Cloud, Create MongoDB Atlas Cluster, GUI tools Overview, Install and Configure MongoDB Compass, Introduction to the MongoDB Shell, MongoDB Shell JavaScript Engine, MongoDB Shell JavaScript Syntax, Introduction to the MongoDB Data Types, Create and Delete Databases and Collections, Introduction to MongoDB Queries. |

**Textbook:**

| | |
|---|---|
| 1 | Beginner's Guide to MERN Technology: Building Modern Web Applications Kindle Edition, Vishal Kamal. |
| 2 | MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow,O'Reilly |

**Web Links:**

| | |
|---|---|
| 1 | https://reactresources.com/ |
| 2 | https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/o verview (MongoDB) |

| Regulation: R20 | IV / IV - B.Tech. II - Semester |
|---|---|

**COMPUTER SCIENCE AND DESIGN**

**SCHEME OF INSTRUCTION & EXAMINATION**
**(With effect from 2021-22 admitted Batch onwards)**

| Course Code | Course Name | Category | Cr | L | T | P | Int. Marks | Ext. Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| B20CD4201 | Project Work (Project work, seminar and internship in industry) | PR | 8 | 0 | 0 | 16 | 60 | 140 | 200 |
| | **TOTAL** | | **8** | **0** | **0** | **16** | **60** | **140** | **200** |

| Course Code | Category | L | T | P | C | I.M | E.M | Exam |
|---|---|---|---|---|---|---|---|---|
| **B20CD4201** | **PR** | **--** | **--** | **16** | **8** | **60** | **140** | **3 Hrs.** |

**PROJECT WORK**

(For CSD)

**Course Objectives:**

| | |
|---|---|
| 1 | To provide an opportunity to work in group on a topic / problem / experimentation |
| 2 | To encourage creative thinking process |
| 3 | To provide an opportunity to analyze and discuss the results to draw conclusions |
| 4 | To acquire and apply fundamental principles of planning and carrying out the work plan of the project through observations, discussions and decision-making process. |

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

| S.No. | Outcome | Knowledge Level |
|---|---|---|
| 1 | **Identify** a current problem through literature/field/case studies | K3 |
| 2 | **Identify** the objectives and methodology for solving the problem | K3 |
| 3 | **Design** and Develop technology/process for solving the problem | K4 |
| 4 | **Evaluate** the technology/process | K5 |

*The object of Project Work is to enable the student to take up investigative study in the broad field of Computer Sccience and Design, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or a group of students, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.

The assignment to normally include:

a) Survey and study of published literature on the assigned topic.

b) Working out a preliminary approach to the problem relating to the assigned topic.

c) Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/ Feasibility.

d) Preparing a written report on the study conducted for presentation to the department.

e) Final Seminar, as oral Presentation before a departmental committee.