B. Tech Computer Science and Engineering (Artificial Intelligence and Data Science)
Modified Scheme of Studies/Examination (w.e.f. Session 2023-24)
Semester VIII

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-402A	Reinforcement Learning	3:0:0	3	3	75	25	0	100	3 Hrs
2	HSS-404A	Entrepreneurship and Start-ups	3:0:0	3	3	75	25	0	100	3 Hrs
3	OEC	OEC Elective*-III	3:0:0	3	3	75	25	0	100	3 Hrs
4	PE	Elective* - III	2:0:0	2	2	75	25	0	100	3 Hrs
5	PE	Elective* - IV	2:0:0	2	2	75	25	0	100	3 Hrs
6	PC-CS AIDS-404LA	Reinforcement Learning Lab	0:0:2	2	1	0	40	60	100	3 Hrs
7	PE-LA	Elective-III Lab	0:0:2	2	1	0	40	60	100	3 Hrs
8	PC-CS-AIDS-408LA	Project-II	0:0:12	12	6	0	100	100	200	3 Hrs
9	PC-CS-AIDS-410LA	General Fitness	0:0:0	0	0	0	0	100	100	3 Hrs
		Total		**28**	**21**	**300**	**280**	**320**	**900**	

Code	**PE- Elective* - III**	Code	**PE- Elective* – IV**
PE-CS-AIDS- 414A	Social Networks	PE-CS-AIDS- 422A	Internet of Things
PE-CS-AIDS- 416A	Application of Data Science in Industry	PE-CS-AIDS- -424A	Block Chain
PE-CS-AIDS- 420A	Neural Network and Fuzzy Logic	PE-CS-AIDS- 426A	Next Generation Databases

Code	**OEC Elective*-III**	**Code**	**PE-LA- Elective* III Lab**
OE-CS- AIDS-402	Cyber Security	PE-CS-AIDS- 414 LA	Social Networks Lab
OE-CS- AIDS-404	Information Retrieval	PE-CS-AIDS- 416 LA	Application of Data Science in Industry Lab
OE-CS- AIDS-406	Robotics and Intelligent Systems	PE-CS-AIDS- 420 LA	Neural Network and Fuzzy Logic Lab
OE-CS- AIDS-408	Agile Software Engineering	**Note: *The students will choose any two departmental electives courses and One Open Elective course out of the given elective list in VIII**	
OE-CS- AIDS-410	Image Processing and Recognition		

PC-CS-AIDS-402A	Reinforcement Learning						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs**
Purpose	Purpose To provide knowledge of various Reinforcement Learning Algorithms						
Course Outcomes (CO)							
CO 1	To learn the basics of Reinforcement Learning concepts, various Reinforcement Learning architecture						
CO 2	To explore knowledge of various process of Reinforcement Learning						
CO 3	To understand the basics of Reinforcement Learning models						
CO 4	To implies about the different Reinforcement Learning algorithms and their applications to solve real world problems.						

UNIT-1

Introduction to Reinforcement Learning: Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. The Reinforcement Learning Process Elements of Reinforcement Learning RL Agent Taxonomy Reinforcement Learning Problem.

Unit-II

Markov Decision Process: Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

Unit-III

Monte Carlo Methods for Model Free Prediction and Control: Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

TD Methods Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD (1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

Unit-IV

Function Approximation Methods: Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD (0) algorithms, Eligibility trace for function approximation, Afterstates, Control with function approximation, least squares, Experience replay in deep Q-Networks

Suggested Books:

Richard S. Sutton and Andrew G. Barto “An Introduction to Reinforcement Learning Enes Bilgin “ Mastering Reinforcement Learning with Python: Build next-generation, self-learning models using reinforcement learning techniques and best practices” 1st Edition Kindle

HSS-404A	Entrepreneurship and Start-ups						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hour**
Purpose	To expose students to the joys and skills of being an entrepreneur.						
Course Outcomes (CO)							
CO1	To understand the basics of Entrepreneurship.						
CO2	To learn the basics of Creative and Design Thinking.						
CO3	To apply the Business Enterprises.						
CO4	To know about business models .						

Unit I

Introduction to Entrepreneurship, Meaning and concept of entrepreneurship, the history of entrepreneurship development, role of entrepreneurship in economic development, Myths about entrepreneurs, types of entrepreneurs.

Unit II

The skills/ traits required to be an entrepreneur, Creative and Design Thinking, the entrepreneurial decision process, entrepreneurial success stories.

Unit III

Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas, Introduction to lean start-ups, Business Pitching.

Unit IV

Institutions Supporting Small Business Enterprises: Central level institutions. State level institutions. Other agencies. Industry Associations. Class exercise- discussions on current government schemes supporting entrepreneurship and finding out which scheme will most suit the business plan devised by the student.

Text Books:

- Kuratko, D , Hornsby J.S. (2017) New Venture Management: Entrepreneur's roadmap
- Hisrich, R.D., Manimala, M.J., Peters, M.P., Shepherd, D.A.: Entrepreneurship, Tata McGraw Hill
- Ries, Eric(2011)The lean Start-up: How constant innovation creates radically

• S. Carter and D. Jones-Evans (2012), Enterprise and small business- Principal Practice and Policy, Pearson Education (2006)

OE-CS-AIDS-402	Cyber Security						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hours**
Purpose	1. Learn the foundations of Cyber security and threat landscape. 2. To equip students with the technical knowledge and skills needed to protect and defend against cyber threats. 3. To develop skills in students that can help them plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.						
Course Outcomes							
CO1	Understand the cyber security threat landscape.						
CO2	Develop a deeper understanding and familiarity with various types of cyber-attacks, cyber crimes, vulnerabilities and remedies thereto.						
CO3	Increase awareness about cyber-attack vectors and safety against cyber-frauds						
CO4	Analyze and evaluate existing legal framework and laws on cyber security.						

Unit-I

Overview of cyber security: Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker, non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies.

Unit-II

Cyber Crimes: Cybercrimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach, Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cyber-squatting, Pharming, Cyber espionage, Crypto jacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news cybercrime against persons -cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.

Unit-III

Cyber Laws and Data Privacy: passive Cybercrime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cybercrime and punishments,

Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Block chain, Darknet and social media, Cyber Laws of other countries, Case Studies.

Data Privacy and Data Security: Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles.

Unit-IV

Data Privacy and Data Security: Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations (GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., social media- data privacy and security issues.

Cyber security Management, Compliance and Governance: Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.

Suggested Books:

Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.

Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.

OE-CS-AIDS-404	Information Retrieval						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	The Major objective of an Information Retrieval system is minimization of human resources required in the finding of needed information to accomplish a task.						
Course Outcomes							
CO 1	Ability to apply information retrieval principles and retrieval models to locate relevant information from large collections of data						
CO 2	Apply various indexing technique and understanding of different data structures.						
CO 3	Implementation of various clustering and searching techniques.						
CO 4	Understanding of information visualization and various advance topics.						

Unit-I

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities, Retrieval Models: Boolean, vector space, TFIDF, Okapi, probabilistic, language modeling, latent semantic indexing. Vector space scoring. The cosine measure. Efficiency considerations. Document length normalization.

Unit-II

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages, Information Extraction.

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

Unit-III

Document and Term Clustering: Introduction to Clustering, clustering versus classification, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.Text Clustering: Partitioning methods, k-means clustering, Mixture of Gaussians model, Hierarchical agglomerative clustering, clustering terms using documents.

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.
Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.

Unit-IV

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

Advanced Topics: Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval.

Suggested Books:

Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007.

Search Engines: Information Retrieval in Practice. Bruce Croft, Donald Metzler, and Trevor Strohman, Pearson Education, 2009.

Modern Information Retrieval. Baeza-Yates Ricardo and Berthier Ribeiro-Neto. 2nd edition, Addison-Wesley, 2011.

Information Retrieval: Implementing and Evaluating Search Engines. Stefan Buttcher, Charlie Clarke, Gordon Cormack, MIT Press, 2010.

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

OE-CS-AIDS-406	Robotics and Intelligent Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Purpose	To impart understanding of the main abstractions and reasoning for Robotics and Intelligent Systems						
Course Outcomes (CO)							
CO1	Understand the basic terminologies in Robotics to develop intelligent systems						
CO2	Apply the random search and heuristic search for intelligent systems.						
CO3	Understand the abstractions and reasoning for intelligent systems						
CO4	Apply the rule based methods in intelligent systems						

Unit-I

Introduction to robotics- History, growth; Robot applications- Manufacturing industry, defense, rehabilitation, medical, Robot mechanisms, type of robots and use of robots in different area.

Unit-II

Degree of freedom, classification and specifications of Robots, controller, actuator and drives. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force Sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.

U**nit-III**

Intelligent Systems: Knowledge acquisition, Computational intelligence, Rule-based systems, Forward-chaining (a data-driven strategy), Conflict resolution, Backward chaining (a goal-driven strategy), Sources of uncertainty, Bayesian updating, Certainty theory.

Unit-IV

Possibility theory: fuzzy sets and fuzzy logic, Object-oriented systems, Data abstraction, Inheritance, Encapsulation, Unified Modeling Language (UML), Dynamic (or late) binding. **Key Application Areas:** Expert System, Decision Support Systems, **Deep Learning:** Speech and vision, natural Language processing, Information Retrieval, Semantic Web.

SUGGESTED BOOKS:

Artificial Intelligence' RB Mishra, PHI
Introduction to Artificial Intelligence, Charnaik, Pearson.
Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
Introduction to Artificial Intelligence and Expert Systems by Dan W Patterson, Pearson Education.

OE-CS-AIDS-408	Agile Software Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**MajorTest**	**MinorTest**	**Total**	**Time**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	This course makes student learn the fundamental principles and practices associated with each of the agile development methods. To apply the principles and practices of agile software development on a project of interest and relevance to the student.						
Course Outcomes							
CO1	Analyze existing problems with the team, development process and wider organization						
CO2	Apply a thorough understanding of Agile principles and specific practices						
CO3	Select the most appropriate way to improve results for a specific circumstance or need						
CO4	Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems and risk analysis.						

Unit-I

Agile Software Development: Basics and Fundamentals, of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project/ How Agile helps to build quality

Unit-II

Agile and Scrum Principles: Agile Manifesto, Twelve Practices of XP, Scrum Practices, Applying Scrum. Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values Agile Product Management: Communication, Planning, Estimation Managing the Agile Approach Monitoring progress, Targeting and motivating the team, managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile Approach Monitoring progress, Targeting and motivating the team, managing business involvement and Escalating issue

Unit-III

Agile Requirements: User Stories, Backlog Management. Agile Architecture: FeatureDriven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test

Unit-IV

Agile Review: Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy,The rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools

Suggested Books:

Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices Alan Apt Series (2018)

Succeeding with Agile : Software Development Using Scrum, Pearson (2017)

OE-CS-AIDS-410	**Image Processing and Recognition**

Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To imparts knowledge in the area of image and image processing, fundamentals of digital image processing and also to learn the fundamentals of pattern recognition and to choose an appropriate feature.						
Course Outcomes							
CO 1	To Understand Basics of Image formation and transformation using sampling and quantization						
CO 2	To Understand different types signal processing techniques used for image sharpening and smoothing						
CO 3	To understand the nature and inherent difficulties of the pattern recognition problems.						
CO 4	Understand concepts, trade-offs, and appropriateness of the different feature types and classification techniques such as Bayesian, maximum likelihood, etc						

Unit-I INTRODUCTION TO IMAGE PROCESSING AND RESTORATION

Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception. Digital Image-sampling and quantization serial & parallel Image processing**.** Image Restoration-Constrained and unconstrained restoration Wiener filter, Motion blur remover.

Unit-II SEGMENTATION TECHNIQUES

Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection.

Unit-III PATTERN RECOGNITION

Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation

Unit-IV STATISTICAL PATTERN RECOGNITION: Dimension reduction methods – Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

Suggested Books

Digital Image Processing – Ganzalez and Wood, Addison Wesley, 1993.

Fundamental of Image Processing – Anil K.Jain, Prentice Hall of India.
Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006
An Introduction to Digital Image Processing – Wayne Niblack, Prentice Hall, 1986
Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.
Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009

PE-CS-AIDS- 414A	Social Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs**
Purpose	Students will be able to use Social networks for business and personal use, conducting social network analysis, social network developer tools and social network concepts for solving real-world issues.						
Course Outcomes (CO)							
CO1	Demonstrate proficiency in the use of social networks for business and personal use						
CO2	Demonstrate proficiency in the use of social network analysis concepts and techniques.						
CO3	Demonstrate proficiency in the use of social network developer tools.						
CO4	Examine the various types of processors and demonstrate proficiency in the use of social network concepts for solving real world issues.						

Unit I INTRODUCTION TO SEMANTIC WEB: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

Unit II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modeling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

Unit III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks.

Unit IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES

Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis.

TEXT BOOKS:

Peter Mika, Social Networks and the Semantic Web‖, First Edition, Springer 2007.
Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

PE-CS-AIDS-416A	Application of Data Science in Industry						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs.**
Purpose	Introduce the mathematical foundations required for data science and R Programming. Students will learn the data analytics problem solving framework**.**						
Course Outcomes							
CO1	Describe a flow process for data science problems						
CO2	Classify data science problems into standard typology						
CO3	Develop R codes for data science solutions						
CO4	Correlate results to the solution approach followed and Construct use cases to validate approach and identify modifications required						

Unit-I

Linear algebra for Data science: Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse, Geometric view - vectors, distance, projections, eigenvalue decomposition.

Unit-II

Statistics for Data Science: descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates.

Unit-III

Optimization for Data Science: Typology of data science problems and a solution framework, Simple linear regression and verifying assumptions used in linear regression, Multivariate linear regression, model assessment, assessing importance of different variables, subset selection Classification using logistic regression, Classification using kNN and k-means clustering.

Unit-IV

Data Science in Industry: Case Study of Walmart supply Chain Management, Solving Data Analysis Problems using case study of Google Company, Case study ofOLAP tool for the Fast-Food Industry, Real-Time Data Streaming with Apache Kafka with Company data set, Real-Time Data Processing using Spark Streaming, Building Automated Data Pipelines with Airflow, Analytics using PySpark.

Suggested Books:

Guandong Xu ,Yanchun Zhang and Lin Li, Web Mining and Social Networking Techniques and applications‖, First Edition, Springer, 2011.
Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.

PE-CS-AIDS-420A	Neural Network and Fuzzy Logic						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3Hrs**
Course Outcomes							
CO1	Understand the concept of Artificial Intelligence, search techniques and acknowledge representation issues						
CO2	Understanding reasoning and fuzzy logic for artificial intelligence						
CO3	Students will be able to learn defuzzied fiction and fuzzy measures						
CO4	Students will be able to learn the applications of fuzzy logic and hybrids of computing techniques						

Unit I–INTRODUCTION

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks-basic models-important technologies-applications. Fuzzy logic: Introduction-crisp sets-fuzzy sets
- crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditionaloptimizationandsearchtechniques-Geneticbasicconcepts.

Unit II-NEURAL NETWORKS

McCulloch-Pitts neuron-linear separability-Hebb network-supervised learning network: perceptron networks' adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto- associative memory network, hetero-associative memory network, BAM, hop field networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self-organizing feature maps, LVQ–CP networks, ART network.

Unit III- FUZZY LOGIC

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning: truth values , fuzzy propositions, formation of rules- ,aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

Unit IV-HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem

using genetic algorithm approach, soft computing-based hybrid fuzzy controllers.

Suggested Books:

Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition,Tata Mcgraw-Hill, 2005.
Stuart Russel and Peter Norvig,"Artificial Intelligence:AModernApproach",3rd
T1.Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
Lawrence Fussett-fundamental of Neural network Prentice Hall,FirstEdition.
Bart Kosko, ―Neural network and Fuzzy System‖-PrenticeHall-1994.
Vallusu Rao and Hayagvna Rao,―C++Neural network and fuzzy logic‖-BPB Publication, NewDelhi,1996

Code	PE-Elective-IV
PE-CS-AIDS- 422A	Internet of Things
PE-CS-AIDS- -424A	Block Chain
PE-CS-AIDS- 426A	Natural Language Processing

PE-CS-AIDS-422A	Internet of Things						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs.**
Purpose	This course will illuminate the students in the concepts of calculus. To enlighten the learners in the concept of differential equations and multivariable calculus. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.						
Course Outcomes							
CO 1	Understanding of basic concepts of Internet of things.						
CO 2	Implementation of programming fundamentals on Arduino.						
CO 3	Understanding of various sensors and IoT protocols.						
CO 4	Importance of cryptographic fundamentals in Internet of things.						

Unit-1

IOT − OVERVIEW - Introduction to IoT, Key Features, Advantages, Disadvantages, IoT Standards, Components of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models.

Unit-II

The Arduino Platform -The Arduino Open-Microcontroller Platform, Arduino Basics, Arduino Board Layout & Architecture, Introduction to various Functions, reading from Sensors, Programming fundamentals (C language), Arduino Programming & Interface of Sensors, Interfacing sensors with Arduino, Programming Arduino.

Unit-III

IoT Sensor and Actuator – Sensor, Type of Sensor, Use of Sensor, Actuator, Type of Actuator, Basic of IoT Networking, Gateway Technology for IoT, IoT challenge, connectivity technology.

IoT Protocol: Architecture and Design Principles for IoT: Internet connectivity, Internet-based communication, IPv4, IPv6, 6LoWPAN protocol, IP Addressing in the IoT,

Unit-IV

Cryptographic fundamentals for IOT -Cryptographic primitives and its role in IoT – Encryption, and Decryption – Hashes – Digital Signatures – Random number generation – Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication

IoT & M2M -Machine to Machine, Difference between IoT and M2M, Software define Network Challenges in IoT Design challenges, Development challenges, Security challenges, and other challenges.

Suggested Books:

Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

Programming Arduino: Getting Started with Sketches, Second Edition, Mc Graw Hill, Simon Monk.

PE-CS-AIDS-424A	Block Chain						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3 Hrs.**
Purpose	To give students the understanding of emerging abstract models for Blockchain Technology and to familiarise with the functional/operational aspects of cryptocurrency eco-system.						
Course Outcomes							
CO 1	Understanding of distributed systems and importance of security in networks.						
CO 2	Basic Concept of blockchain and application of blockchain in various domains.						
CO 3	Knowledge of various hash functions and consensus algorithms.						
CO 4	Understanding the concepts of Ethereum blockchain and tools used for implementation.						

Unit-I

Distributed Systems: Introduction, benefits and limitations, types, applications. Consistency and replication in distributed environment. CAP theorem, Distributed computing: concept, pros and cons of using distributed computing. Client-Server architecture, peer-to-peer architecture. Byzantine Generals problem.

Security in Networks: Concept, Types of Security breaches, attacks, control measures, Classifying cryptosystems, classical cryptosystems, block cipher modes of operation, DES encryption and decryption, triple DES, AES encryption and decryption.

Unit-II

Block chain: Introduction to block chain, Bitcoin and Block ChainHistory, problem of double spending. Architecture of Block chain, structure of block, genesis block, transaction

life cycle, centralized and decentralized network, characteristics, Types of Block chain: Public, Private, hybrid. benefits and limitations of Block chain.

Use cases: Block chain in Financial applications, supply chains, healthcare, real estate and media.

Unit-III

Hash Function, secure hash algorithm (SHA) and types, Digital signature, RSA digital signature algorithm, elliptic curve digital signature algorithm, zero-knowledge proofs.

Mining Mechanism: mining, mining reward, mining pool, hash rate, difficulty. Distributed ledger, distributed consensus: proof of work, proof of stake, Delegated Proof of Stake, Practical Byzantine Fault Tolerance, Proof of Elapsed Time. Merkle tree, soft and hard fork, sybil attack.

Unit-IV

Ethereum ecosystem: Ethereum virtual machine, types of accounts, keys and addresses, bytecode, smart contracts, oracle, Ethereum network: mainnet, testnet, private net. Tools: Remix, Nodejs, ganache, digital wallet.

Suggested Books:

Tanenbaum A.S., Steen M.V., "Distributed Systems: Principles and Paradigms", Prentice Hall of India.
Behrouz A. Forouzan, Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, Mc Graw Hill Education, 2016.
Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition by Imran Bashir
Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations", by Henning Diedrich

PE-CS-AIDS-426A	Next Generation Databases						
Lecture	**Tutorial**	**Practical**	**Credit**	**MajorTest**	**MinorTest**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3Hrs.**
Purpose	To understand the basic concepts and terminology related to Unstructured Database. Familiarize students with databases like NOSQL, XML. Implement and evaluate complex, scalable database systems, with emphasis on providing experimental evidence for design decisions.						
Course Outcome							
CO1	Implement and evaluate complex, scalable database systems, with emphasis on providing experimental evidence for design decisions.						
CO2	Demonstrate the management of structured and unstructured data management with recent tools and technologies.						
CO3	Demonstrate competency in designing No SQL database management systems						
CO4	Demonstrate competency in designing XML Databases						

Unit-I

Introduction: Three Database Revolutions, The Third Database Revolution, Google, Big Data, and Hadoop

Unit-II

Sharding, Amazon, and the Birth of NoSQL, Document Databases, JSON Document Databases, Tables are Not Your Friends: Graph Databases, Column Databases, Column Database Architectures

Unit-III

XML, XML Databases – XML Tools and Standards, XML Databases, XML Support in relational systems, JSON Document Databases, MOngoDB, Column Databases, Graph Databases

Unit-IV

Distributed Database Patterns, Nonrelational Distributed Databases, MongoDB Sharding and Replication, HBase. Consistency Models, Consistency in MongoDB, Data Models and Storage, Languages and Programming Interfaces, NoSQL APIs

Suggested Books:

Next Generation Databases, Mr. Guy Harrison, Apress

Beginning JSON,by Mr. Ben Smith, Apress

NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot by Pramod Sadalage, Martin Fowler Persistence, 1st Edition.

PC-CS-AIDS-404LA	Reinforcement Learning Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	To implement the concepts of Reinforcement Learning Algorithms.						
Course Outcomes							
CO1	Implement Python programming advance and paradigm.						
CO2	Implement various process of Reinforcement Learning						
CO3	Implement various Reinforcement Learning models						
CO4	Implement various Reinforcement Learning algorithms.						

1.	The probability that it is Friday and that a student is absent is 3 %. Sincethereare5schooldaysinaweek, theprobability that it is Friday is 20%.Whatisthe probability that a student is absent given that today is Friday? Apply Bayes rule in python to get the result. (Ans:15%)
2.	Extract the data from database using python
3.	Implement k-nearest neighbors classification using python
4.	Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606,using there sultofk-meansclusteringwith3means(i.e.,3centroids) VAR1 VAR2 CLASS 1.713 1.586 0 0.180 1.786 1 0.353 1.240 1 0.940 1.566 0 1.486 0.759 1 1.266 1.106 0 1.540 0.419 1 0.459 1.799 1 0.773 0.186 1

5.	The following training examples map description so find visuals onto high, medium and low Credit-worthiness. medium skiing design single twenties no ->high Risk high golf trading married forties yes ->low Risk ow speedway transport married thirties yes ->med Risk medium football banking single thirties yes ->low Risk high flying mediamarried fifties yes ->high Risk ow football security single twenties no ->med Risk medium golf media single thirties yes ->med Risk medium golftransport married forties yes ->low Risk high skiing bankingsingle thirties yes ->high Risk ow golf unemployed married forties yes ->high Risk Input attributes are (from left to right) income, recreation, job, status, age- group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `med Risk' in the dataset?
6.	Implement linear regression using python.
7.	Implement Naïve Bayes theorem to classify the English text
8.	Implement an algorithm to demonstrate the significance of genetic algorithm

PE-CS-AIDS-414 LA	Social Networks Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**2 Hours**
Purpose	Students will be able to use Social networks for business and personal use, conducting social network analysis, social network developer tools and social network concepts for solving real-world issues.						
Course Outcomes (CO)							
CO1	Demonstrate proficiency in the use of social networks for business and personal use						
CO2	Demonstrate proficiency in the use of social network analysis concepts and techniques.						
CO3	Demonstrate proficiency in the use of social network developer tools.						
CO4	Examine the various types of processors and demonstrate proficiency in the use of social network concepts for solving real world issues.						

LIST OF PRACTICALS:

1. Understanding uses various social networking sites.
2. Use social networks for business as well as professional use.
3. Understand and learn what social network analysis is.
4. Use any social network analysis development tools.
5. Understand the basic concept of machine learning in social network.
6. Understand public sector media using big data analysis.
7. Use privacy while creating social networking Content.
8. Using social network concepts for solving any real-life world issues.
9. Use natural language processing and linguistics for information and relation extraction.
10. Write a note on Subgroups, Cliques, Block models, Ego networks, Social capital, structural holes, equivalence

PE-CS-AIDS-416LA	Application of Data Science in Industry Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	Introduce the mathematical foundations required for data science and R Programming. Students will learn the data analytics problem solving framework.						
Course Outcomes							
CO1	Describe a flow process for data science problems						
CO2	Classify data science problems into standard typology						
CO3	Develop R codes for data science solutions						
CO4	Correlate results to the solution approach followed and Construct use cases to validate approach and identify modifications required						

List of Experiments:

Practical 1:

Data Science in in Delivery Logistics using Data Visualization Tool

Practical 2:

Create Dashboard and Story on IPL Cricket Match data using Data Visualization Tool

Practical 3:

Create Dashboard and Story on Transport **data** using Data Visualization Tool

Practical 4:

Create Dashboard and Story on E-Commerce **data** using Data Visualization Tool

Practical 5:

Create Dashboard and Story on Health Care **data** using Data Visualization Tool

Practical 6:

Create Dashboard and Story on Airline Routing Planning **data** using Data Visualization Tool

Practical 7:

Create Dashboard and Story on Medicine and Drug Development **data** using Data Visualization Tool

PE- CS-AIDS-420 LA	Neural Network and Fuzzy Logic Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Purpose	This Lab introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer,FLCs,PI and Multilayer Feed Forward Networks.						
Course Outcomes							
CO1	To give students an understanding of foundational concepts of fuzzy control primarily based on fuzzy set theory. To know operations on fuzzy sets, fuzzy relations.						
CO2	To understand basic building blocks of Mamdani Fuzzy Logic Controllers (FLCs).						
CO3	To get an insight into Fuzzification, Fuzzy Inferencing, Defuzzification.						
CO4	To understand the nonlinearity of different blocks of FLC and to analyze adaptive issues in the stability issues of FLCs.						

List of Experiments:

1. To implement PI, PD & PID controllers for temperature control of an oven on pilot plant &/or on a simulation kit.

2. To implement PI, PD & PID controllers for water level control of a single & two tank coupled systems on pilot plant &/or on a simulation kit.

3. To implement Fuzzy controller for temperature control of an oven & for water level control of a single & two tank coupled systems

4. To implement Fuzzy controller for speed control of dc motor.

5. To observe the effects of nonlinearities (such as saturation, backlash etc.) on the performance of PI, PD & PID controllers used for a first order system.

6. To observe the effects of nonlinearities (such as saturation, backlash etc.) on the performance of PI, PD & PID controllers used for a second order system.

7. To observe the effects of parametric disturbances on the performance of PI, PD, PID & Fuzzy

controllers.

8. To observe the effects of load disturbances on the performance of PI, PD, PID & Fuzzy controllers.

9. To control speed of a dc motor using choppers.

10. Implementation of speed control of a stepper motor.

11. To implement fuzzy controller on a 2nd/3rd order system.

12. To control the pressure of Hydraulic System.

13. To control the pressure of Pneumatic System.

14. To study vector control of induction motor.

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-408LA	Project-II	0:0:12	12	6	0	100	100	200	3

S. No.	Course No.	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-AIDS-410LA	General Fitness	0:0:0	0	0	0	0	100	100	3