R18 B.TECH. MINOR IN AIML (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Foundations of AI (3 credits)	AI Lab (1.5 credits)	4.5
2.	III - II Semester	AI Applications (4 credits)	----	4.0
3.	IV - I Semester	Machine Learning/ Deep Learning/ MOOCS (3 credits)	Machine Learning/ Deep Learning Lab (1.5 credits)	4.5
4.	IV - II Semester	**Elective any ONE of the following subjects** (3 credits)**:** 1. Robotics Process Automation 2. Natural Language Processing 3. Game Theory 4. Computer Vision & Robotics 5. Speech & Video Processing 6. Soft Computing	----	3.0
5.	IV - II semester	Mini Project	---	2.0
			Total credits	**18.0**

***Mini Project:** For Mini Project, Students must enroll at the beginning of the IV Year II Semester and will complete the Mini Project by the end of semester.

Evaluation for Mini Project is similar to Industrial Oriented Mini Project in R18 B.Tech. IV Year I Semester. For more information, please refer **Item 8.5** of **R18 B.Tech. Academic Regulations**.

ROBOTICS PROCESS AUTOMATION

L	T	P	C
3	0	0	3

Course Objectives: To make learners familiar with the concepts of Robotic Process Automation.

Course Outcomes:

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

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOK:

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

REFERENCE BOOK:

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

NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisites:

1. Data Structures, Finite Automata and Probability Theory.

Course Objectives: Introduction to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Course Outcomes:

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

UNIT - I

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

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

UNIT - II

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

UNIT - III

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

UNIT - IV

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT - V

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross Lingual Language Modeling

TEXT BOOKS:

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

REFERENCE BOOK:

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

GAME THEORY

L	T	P	C
3	0	0	3

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

Course Outcomes:

1. Understand the basic concepts of game theory and solutions.
2. Understand different types of equilibrium interpretations.
3. Understand and analyze knowledge and solution concepts.
4. Analyze extensive games with perfect information.

UNIT - I

Introduction- Game Theory, Games and Solutions Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation.

Nash Equilibrium- Strategic Games, Nash Equilibrium Examples, Existence of a Nash Equilibrium, Strictly Competitive Games, Bayesian Games: Strategic Games with Imperfect Information.

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

Repeated Games - The Basic Idea, Infinitely Repeated Games vs. Finitely Repeated Games.

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

COMPUTER VISION AND ROBOTICS

L	T	P	C
3	0	0	3

Pre-Requisites: UG level Course in Linear Algebra and Probability.

Course Objectives:

1. To understand the Fundamental Concepts Related To sources, shadows and shading.
2. To understand the Geometry of Multiple Views.

Course Outcomes:

1. Implement fundamental image processing techniques required for computer vision
2. Implement boundary tracking techniques
3. Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
4. Apply 3D vision techniques and Implement motion related techniques.
5. Develop applications using computer vision techniques.

UNIT - I

CAMERAS: Pinhole Cameras

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

Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models.

Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT - II

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates.

Edge Detection: Noise, Estimating Derivatives, Detecting Edges.

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

UNIT - III

The Geometry of Multiple Views: Two Views

Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras.

Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT - IV

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

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

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

UNIT - V

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations

Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization

Model-Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining

Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

SPEECH AND VIDEO PROCESSING

L	T	P	C
3	0	0	3

Course Objectives: Knowledge on speech and video processing techniques

Course Outcomes:

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

UNIT - I:

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

UNIT - II:

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

UNIT - III:

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

UNIT - IV:

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

UNIT - V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

SOFT COMPUTING

L	T	P	C
3	0	0	3

Course Objectives:

1. Familiarize with soft computing concepts.
2. Introduce and use the idea of fuzzy logic and use of heuristics based on human experience.
3. Familiarize the Neuro-Fuzzy modeling using Classification and Clustering techniques.
4. Learn the concepts of Genetic algorithm and its applications.
5. Acquire the knowledge of Rough Sets.

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

1. Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
2. Understand fuzzy logic and reasoning to handle and solve engineering problems.
3. Apply the Classification and clustering techniques on various applications.
4. Understand the advanced neural networks and its applications.
5. Perform various operations of genetic algorithms, Rough Sets.
6. Comprehend various techniques to build model for various applications.

UNIT - I

Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

UNIT - II

Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems

UNIT - III

Fuzzy Decision Making, Particle Swarm Optimization

UNIT - IV

Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

UNIT - V

Rough Sets, Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.

TEXT BOOK:

1. Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning.

REFERENCE BOOKS:

1. S. N. Sivanandam & S. N. Deepa, “Principles of Soft Computing”, 2nd edition, Wiley India, 2008.
2. David E. Goldberg, “Genetic Algorithms-In Search, optimization and Machine learning”, Pearson Education.
3. J. S. R. Jang, C.T. Sun and E. Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education, 2004.
4. G.J. Klir & B. Yuan, “Fuzzy Sets & Fuzzy Logic”, PHI, 1995.
5. Melanie Mitchell, “An Introduction to Genetic Algorithm”, PHI, 1998.
6. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw- Hill International Editions, 1995.

R18 B.TECH. MINOR IN CYBER SECURITY (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Principles of Information Security (3 credits)	Principles of Information Security Lab (1.5 credits)	4.5
2.	III - II Semester	Foundations of Cyber Security (4 credits)	----	4.0
3.	IV - I Semester	Ethical Hacking/ Digital Forensics/ MOOCS (3 credits)	Ethical Hacking Lab/ Digital Forensics Lab (1.5 credits)	4.5
4.	IV - II Semester	**Elective any ONE of the following subjects** (3 credits)**:** 1. Security Incident & Response Management 2. Mobile Security 3. IoT Security 4. Blockchain Technologies 5. Authentication Techniques 6. Cloud Security	----	3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

***Mini Project:** For Mini Project, Students must enroll at the beginning of the IV Year II Semester and will complete the Mini Project by the end of semester.

Evaluation for Mini Project is similar to Industrial Oriented Mini Project in R18 B.Tech. IV Year I Semester. For more information, please refer **Item 8.5** of **R18 B.Tech. Academic Regulations**.

SECURITY INCIDENT AND RESPONSE MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisites

1. Knowledge in information security and applied cryptography.
2. Knowledge in Operating Systems.

Course Objectives:

1. Give an introduction to preparation of inevitable incident and incident detection and characterization.
2. To get an exposure to live data collection, Forensic duplication.
3. To gain knowledge on data analysis including Windows and Mac OS Systems.

Course Outcomes:

1. Learn how to handle the incident response management.
2. Perform live data collection and forensic duplication
3. Identify network evidence
4. Analyze data to carry out investigation

UNIT - I

Introduction: Preparing for the Inevitable incident: Real world incident, IR management incident handbook, Pre-incident preparation, Preparing the Organization for Incident Response, Preparing the IR team, Preparing the Infrastructure for Incident Response. Incident Detection and Characterization: Getting the investigation started on the right foot, collecting initial facts, Maintenance of Case Notes, Understanding Investigative Priorities. Discovering the scope of incident: Examining initial data, Gathering and reviewing preliminary evidence, determining a course of action, Customer data loss scenario, Automated clearing fraud scenario.

UNIT - II

Data Collection: Live Data Collection: When to perform live response, Selecting a live response tool, what to collect, collection best practices, Live data collection on Microsoft Windows Systems, Live Data Collection on Unix-Based Systems. Forensic Duplication: Forensic Image Formats, Traditional duplication, Live system duplication, Duplication of Enterprise Assets.

UNIT - III

Network Evidence: The case for network monitoring, Types for network monitoring, Setting Up a Network Monitoring System, Network Data, Analysis, Collect Logs Generated from Network Events. Enterprise Services: Network Infrastructure Services, Enterprise Management Applications, Web servers, Database Servers

UNIT - IV

Data Analysis: Analysis Methodology: Define Objectives, Know your data, Access your data, Analyse your data, Evaluate Results. Investigating Windows Systems: NTFS and File System analysis, Prefetch, Event logs, Scheduled Tasks, The Windows Registry, Other Artifacts of Interactive Sessions, Memory Forensics, Alternative Persistence Mechanisms.

UNIT - V

Investigating Mac OS X Systems: HFS+ and File System Analysis, Core Operating systems data. Investigating Applications: What is Application Data? Where is application data stored?, General Investigation methods, Web Browser, Email Clients, Instant Message Clients.

TEXT BOOKS:

1. “Incident Response and Computer Forensics”, Jason T. Luttgens, Mathew Pepe and Kevin Mandia, 3rd Edition, Tata McGraw-Hill Education.
2. “Cyber Security Incident Response-How to Contain, Eradicate, and Recover from Incidents”, Eric. C. Thompson, Apress.

REFERENCE BOOK:

1. “The Computer Incident Response Planning Handbook: Executable Plans for Protecting Information at Risk”, N.K. McCarthy, Tata McGraw-Hill.

MOBILE SECURITY

L	T	P	C
3	0	0	3

Course Objectives: This course provides a thorough understanding of mobile platforms, including attack surfaces, risk landscape & more.

Course Outcomes:

1. Understand common mobile application security vulnerabilities
2. Define the security controls of multiple mobile operating systems
3. Understand and analyze Bluetooth technology
4. understand and analyze overview of SMS security and Enterprise security

UNIT – I:

Top Mobile Issues and Development Strategies: Top Issues Facing Mobile Devices, Physical Security , Secure Data Storage (on Disk), Strong Authentication with Poor Keyboards , Multiple-User Support with Security, Safe Browsing Environment , Secure Operating Systems, Application Isolation, Information Disclosure, Virus, Worms, Trojans, Spyware, and Malware , Difficult Patching/Update Process, Strict Use and Enforcement of SSL, Phishing , Cross-Site Request Forgery (CSRF), Location Privacy/Security, Insecure Device Drivers, Multi Factor Authentication, Tips for Secure Mobile Application Development .

UNIT – II:

WAP and Mobile HTML Security WAP and Mobile HTML Basics, Authentication on WAP/Mobile HTML Sites, Encryption, Application Attacks on Mobile HTML Sites, Cross-Site Scripting, SQL Injection, Cross-Site Request Forgery, HTTP Redirects, Phishing, Session Fixation, Non-SSL Login, WAP and Mobile Browser Weaknesses, Lack of HTTP Only Flag Support, Lack of SECURE Flag Support, Handling Browser Cache, WAP Limitations.

UNIT – III:

Bluetooth Security Overview of the Technology , History and Standards , Common Uses , Alternatives, Future, Bluetooth Technical Architecture , Radio Operation and Frequency, Bluetooth Network Topology , Device Identification , Modes of Operation , Bluetooth Stack ,Bluetooth Profiles, Bluetooth Security Features , Pairing , Traditional Security Services in Bluetooth, Security “Non-Features” , Threats to Bluetooth Devices and Networks, Bluetooth Vulnerabilities, Bluetooth Versions Prior to v1.2, Bluetooth Versions Prior to v2.1. Security for 1g Wi-Fi Applications, Security for 2g Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications

UNIT – IV:

SMS Security Overview of Short Message Service, Overview of Multimedia Messaging Service, Wireless Application Protocol (WAP), Protocol Attacks, Abusing Legitimate Functionality, Attacking Protocol Implementations, Application Attacks, iPhone Safari, Windows Mobile MMS, Motorola RAZR JPG Overflow, Walkthroughs, Sending PDUs, Converting XML to WBXML.

UNIT – V:

Enterprise Security on the Mobile OS Device Security Options, PIN, Remote, Secure Local Storage, Apple iPhone and Keychain, Security Policy Enforcement, Encryption, Full Disk Encryption, E-mail Encryption, File Encryption, Application Sandboxing, Signing, and Permissions, Application Sandboxing, Application Signing, Permissions, Buffer Overflow Protection, Windows Mobile, iPhone, Android, BlackBerry, Security Feature Summary.

TEXT BOOK:

1. Mobile Application Security, Himanshu Dwivedi, Chris Clark, David Thiel, TATA McGraw-Hill.

REFERENCE BOOKS:

1. Mobile and Wireless Network Security and Privacy, Kami S. Makki, et al, Springer.
2. Android Security Attacks Defenses, Abhishek Dubey, CRC Press.

IOT SECURITY

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the fundamentals, various attacks and importance of Security aspects in IoT.
2. Understand the techniques, protocols and some idea on security towards Gaming models.
3. Understand the operations of Bitcoin blockchain, crypto-currency as application of blockchain technology.
4. Understand the essential components of IoT.
5. Understand security and privacy challenges of IoT.

Course Outcomes:

1. Incorporate the best practices learnt to identify the attacks and mitigate the same.
2. Adopt the right security techniques and protocols during the design of IoT products.
3. Assimilate and apply the skills learnt on ciphers and block chains when appropriate.
4. Describe the essential components of IoT.
5. Find appropriate security/privacy solutions for IoT.

UNIT - I

Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data Block ciphers Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity Modeling faults and adversaries Difference among IoT devices, computers, and embedded devices.

UNIT - II

IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT.

IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions Consensus algorithms and their scalability problems Accelerometer, photoresistor, buttons

UNIT - III

Security Engineering for IoT Development Hardware Security, Merkle trees and Elliptic curves digital signatures, Verifiable Random Functions, Zero-Knowledge Systems Motor, LED, Vibrator.

IoT Security Lifecycle Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), Blockchain, the Challenges, and Solutions, Analog Signal vs. Digital Signal.

UNIT - IV

Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT Device/User Authentication in IoT IoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication

UNIT - V

Introduction to Authentication Techniques Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency.

Data Trustworthiness in IoT Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges data analytics in IoT - simple data analyzing methods.

TEXT BOOKS:

1. B. Russell and D. Van Duren, “Practical Internet of Things Security,” Packt Publishing, 2016.
2. FeiHU, “Security and Privacy Internet of Things (IoTs): Models, Algorithms and Implementations”, CRC Press, 2016.
3. Narayanan et al., “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,” Princeton University Press, 2016.

REFERENCE BOOKS:

1. A. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Crypto currencies,” O’Reilly, 2014.
2. T. Alpcan and T. Basar, “Network Security: A Decision and Game-theoretic Approach,” Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues” European Research Cluster.
5. Ollie Whitehouse, “Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond”, NCC Group, 2014.
6. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisites

1. Knowledge in security and applied cryptography.
2. Knowledge in distributed databases.

Course Objectives:

1. To Introduce block chain technology and Cryptocurrency.

Course Outcomes:

1. Learn about research advances related to one of the most popular technological areas today.
2. Understand Extensibility of Blockchain concepts.
3. Understand and Analyze Blockchain Science.
4. Understand Technical challenges, Business model challenges.

UNIT - I

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding.

UNIT - II

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

UNIT - III

Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

UNIT - IV

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency.

UNIT - V

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

TEXT BOOK:

1. Melanie Swan, Blockchain Blueprint for Economy, O'reilly.

REFERENCE BOOKS:

1. Building Blockchain Apps, Michael Juntao Yuan, Pearson Education.
2. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition.
3. Bradley Lakeman, Blockchain Revolution: Understanding the Crypto Economy of the Future. A Non-Technical Guide to the Basics of Cryptocurrency Trading and Investing.

AUTHENTICATION TECHNIQUES

L	T	P	C
3	0	0	3

Course Objectives: Knowledge on concept of authentication types, protocols, physical identification and various authentication algorithms.

Course Outcomes:

1. Understand different types of authentication techniques.
2. Understand text based and voice-based authentication techniques.
3. Understand significance of authentication algorithms and its standards.
4. Apply various authentication protocols in multi-server environment and their representation.

UNIT - I:

Definition of Authentication, Identification/verification, Stages and steps of authentication, Authentication Entity : User, Device and Application; Authentication attributes: Source, Location, Path, Time duration etc.; Authentication Types : Direct / Indirect, One Way / Mutual, On demand/ Periodic/ Dynamic/Continuous authentication, Assisted/Automatic; 3 Factors of authentication; Passwords, Generation of passwords of varied length and of mixed type, OTP, passwords generation using entity identity credentials; Secure capture, processing, storage, verification and retrieval of passwords.

UNIT - II:

Physical identification using smart cards, remote control device, proximity sensors, surveillance camera, authentication in Card present / Card Not Present transactions as ATM/ PoS Device, mobile phone, wearable device and IoT device-based authentication; single sign- on; Symmetric Key Generation, Key Establishment, Key Agreement Protocols.

UNIT - III:

Biometrics – photo, face, iris, retinal, handwriting, signature, fingerprint, palm print, hand geometry, voice – Text based and text independent voice authentication, style of talking, walking, writing, keystrokes, gait etc. multi-modal biometrics.

UNIT - IV:

Matching algorithms, Patterns analysis, errors, performance measures, ROC Curve; Authentication Standards – International, UIDAI Standard. Kerberos, X.509 Authentication Service, Public Key Infrastructure, Scanners and Software; Web Authentication Methods: Http based, Token Based, OAuth and API.

UNIT - V:

User authentication protocols in multi-server environment, BAN Logic, Representation of authentication protocols using BAN Logic, Random Oracle Model, Scyther Tools, Proverif tool, Chebyshev Chaotic Map, Fuzzy Extractor, Fuzzy Extractor Map, Bloom Filter, LU Decomposition based User Authentication, Blockchain based authentication.

TEXT BOOKS:

1. Protocols for Authentication and Key Establishment, Colin Boyd and Anish Mathuria, springer, 2021
2. Guide to Biometrics, Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonathan H. Connell, Springer 2009.

REFERENCES:

1. Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education 2010.
2. Biometric System and Data Analysis: Design, Evaluation, and data Mining, Ted Dunstone and Neil Yager, Springer.
3. Biometrics Technologies and verification Systems, John Vacca, Elsevier Inc, 2007.
4. Pattern Classification, Richard O. Duda, David G. Stork, Peter E. Hart, Wiley 2007.

CLOUD SECURITY

L	T	P	C
3	0	0	3

Pre-requisites: Computer Networks, Cryptography and Network Security, Cloud Computing.

Course Objectives:

1. To understand the fundamentals concepts of cloud computing.
2. To understand the cloud security and privacy issues.
3. To understand the Threat Model and Cloud Attacks
4. To understand the Data Security and Storage
5. To analyze Security Management in the Cloud.

Course Outcome:

1. Ability to acquire the knowledge on fundamentals concepts of cloud computing.
2. Able to distinguish the various cloud security and privacy issues.
3. Able to analyze the various threats and Attack tools
4. Able to understand the Data Security and Storage
5. Able to analyze the Security Management in the Cloud.

UNIT - I

Overview of Cloud Computing: Introduction, Definitions and Characteristics, Cloud Service Models, Cloud Deployment Models, Cloud Service Platforms, Challenges Ahead.
Introduction to Cloud Security: Introduction, Cloud Security Concepts, CSA Cloud Reference Model, NIST Cloud Reference Model, NIST Cloud Reference Model.
Note: Laboratory practice will be imparted with the help of relevant case studies as and when required.

UNIT - II

Cloud Security and Privacy Issues: Introduction, Cloud Security Goals/Concepts, Cloud Security Issues, Security Requirements for Privacy, Privacy Issues in Cloud.
Infrastructure Security: The Network Level, the Host Level, the Application Level, SaaS Application Security, PaaS Application Security, IaaS Application Security.
Note: Laboratory practice will be imparted with the help of relevant case studies as and when required.

UNIT - III

Threat Model and Cloud Attacks: Introduction, Threat Model- Type of attack entities, Attack surfaces with attack scenarios, A Taxonomy of Attacks, Attack Tools-Network-level attack tools, VM-level attack tools, VMM attack tools, Security Tools, VMM security tools.
Note: Laboratory practice will be imparted with the help of relevant case studies as and when required.

UNIT - IV

Information Security Basic Concepts, an Example of a Security Attack, Cloud Software Security Requirements, Rising Security Threats. **Data Security and Storage:** Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.
Note: Laboratory practice will be imparted with the help of relevant case studies as and when required.

UNIT - V

Evolution of Security Considerations, Security Concerns of Cloud Operating Models, Identity Authentication, Secure Transmissions, Secure Storage and Computation, Security Using Encryption Keys, Challenges of Using Standard Security Algorithms, Variations and Special Cases for Security Issues with Cloud Computing, Side Channel Security Attacks in the Cloud
Security Management in the Cloud- Security Management Standards, Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.
Note: Laboratory practice will be imparted with the help of relevant case studies as and when required.

TEXT BOOKS:

1. Cloud Security Attacks, Techniques, Tools, and Challenges by Preeti Mishra, Emmanuel S Pilli, Jaipur R C Joshi Graphic Era, 1st Edition published 2022 by CRC press.
2. Cloud Computing with Security Concepts and Practices Second Edition by Naresh Kumar Sehgal Pramod Chandra, P. Bhatt John M. Acken, 2nd Edition Springer nature Switzerland AG 2020.
3. Cloud Security and Privacy by Tim Mather, Subra Kumaraswamy, and Shahed Lati First Edition, September 2019.

REFERENCE BOOKS:

1. Essentials of Cloud Computing by K. Chandrasekaran Special Indian Edition CRC press.
2. Cloud Computing Principles and Paradigms by Rajkumar Buyya, John Wiley.

R18 B.TECH. MINOR IN DATA SCIENCE (2021-22)

S. No.	Year/Semester	# Theory (Credits - 3)	# Labs (Credits - 1.5)	Total Credits
1.	III - I Semester	Introduction to Data Science (3 credits)	R Programming Lab (1.5 credits)	4.5
2.	III - II Semester	Data Science Applications (4 credits)	-----	4.0
3.	IV - I Semester	Data Wrangling and Visualization/ Big Data Analytics/ MOOCS (3 credits)	Data Wrangling and Visualization Lab/ Big Data Analytics Lab (1.5 credits)	4.5
4.	IV - II Semester	**Elective any ONE of the following subjects** (3 credits)**:** 1. Exploratory Data Analysis 2. Mining Massive Datasets 3. Social Network Analysis 4. Predictive Analytics 5. Web & Social Media Analytics 6. Video Analytics	-----	3.0
5.	IV-II semester	Mini Project	---	2.0
			Total credits	**18.0**

***Mini Project:** For Mini Project, Students must enroll at the beginning of the IV Year II Semester and will complete the Mini Project by the end of semester.

Evaluation for Mini Project is similar to Industrial Oriented Mini Project in R18 B.Tech. IV Year I Semester. For more information, please refer **Item 8.5** of **R18 B.Tech. Academic Regulations**.

EXPLORATORY DATA ANALYSIS

L	T	P	C
3	0	0	3

Course Objectives:

1. This course introduces the methods for data preparation and data understanding.
2. It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.
3. Supports to Summarize the insurers use of predictive analytics, data science and Data Visualization.

Course Outcomes:

1. Handle missing data in the real-world data sets by choosing appropriate methods.
2. Summarize the data using basic statistics. Visualize the data using basic graphs and plots.
3. Identify the outliers if any in the data set.
4. Choose appropriate feature selection and dimensionality reduction
5. Techniques for handling multi-dimensional data

UNIT - I:

Introduction To Exploratory Data Analysis: Data Analytics lifecycle, Exploratory Data Analysis (EDA) – Definition, Motivation, Steps in data exploration, The basic data types Data Type Portability.

UNIT - II:

Preprocessing - Traditional Methods and Maximum Likelihood Estimation: Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, Improving the accuracy of analysis.

Preprocessing Bayesian Estimation: Introduction to Bayesian Estimation, Multiple Imputation-Imputation Phase, Analysis and Pooling Phase, Practical Issues in Multiple Imputation, Models for Missing Notation Random Data.

UNIT - III:

Data Summarization & Visualization: Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, N-D Statistical data analysis.

UNIT - IV:

Outlier Analysis: Introduction, Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data.

Feature Subset Selection: Feature selection algorithms: filter methods, wrapper methods and embedded

methods, Forward selection backward elimination, Relief, greedy selection, genetic algorithms for features selection.

UNIT - V

Dimensionality Reduction: Introduction, Principal Component Analysis (PCA), Kernel PCA, Canonical Correlation Analysis, Factor Analysis, Multidimensional scaling, Correspondence Analysis.

TEXT BOOK:

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

REFERENCE BOOKS:

1. Charu C. Aggarwal, “Data Mining the Text book”, Springer, 2015.
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Inge Koch, “Analysis of Multivariate and High dimensional data”, Cambridge University Press, 2014.
4. Michael Jambu, “Exploratory and multivariate data analysis”, Academic Press Inc., 1990.
5. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC press, 2015.

MINING MASSIVE DATASETS

L	T	P	C
3	0	0	3

Prerequisites: Students should be familiar with Data mining, algorithms, basic probability theory and Discrete math.

Course Objectives:

1. This course will cover practical algorithms for solving key problems in mining of massive datasets.
2. This course focuses on parallel algorithmic techniques that are used for large datasets.
3. This course will cover stream processing algorithms for data streams that arrive constantly, page ranking algorithms for web search, and online advertisement systems that are studied in detail.

Course Outcomes:

1. Handle massive data using MapReduce.
2. Develop and implement algorithms for massive data sets and methodologies in the context of data mining.
3. Understand the algorithms for extracting models and information from large datasets.
4. Develop recommendation systems.
5. Gain experience in matching various algorithms for particular classes of problems.

UNIT - I:

Data Mining-Introduction-Definition of Data Mining-Statistical Limits on Data Mining.
MapReduce and the New Software Stack-Distributed File Systems, MapReduce, Algorithms Using MapReduce.

UNIT - II:

Similarity Search: Finding Similar Items**-**Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Distance Measures.
Streaming Data: Mining Data Streams-The Stream Data Model, Sampling Data in a Stream, Filtering Streams.

UNIT - III:

Link Analysis-PageRank, Efficient Computation of PageRank, Link Spam.
Frequent Itemsets-Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.
Clustering-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism.

UNIT IV:

Advertising on the Web-Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem, The Adwords Problem, Adwords Implementation.
Recommendation Systems-A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The Netflix Challenge.

UNIT - V:

Mining Social-Network Graphs-Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles

TEXT BOOKS:

1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd Edition.

REFERENCE BOOKS:

1. Jiawei Han & Micheline Kamber, Data Mining – Concepts and Techniques, 3rd Edition Elsevier.
2. Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA.
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann.

SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisites:

1. A course on “Web Technologies”;
2. A course on “Computer Networks”;
3. A course on “Data Warehousing and Data Mining”.

Course Objectives:

1. It introduces the concepts of social media
2. It provides the mechanisms for social network analysis
3. Includes the concepts that allow for better visualization and analysis of widely used services such as email, Wikis, Twitter, flickr, YouTube, etc.

Course Outcomes:

1. Ability to construct social network maps easily.
2. Gain skills in tracking the content flow through the social media.
3. Use NodeXL to perform social network analysis.

UNIT - I:

Introduction: Social Media and Social Networks.
Social Media: New Technologies of Collaboration.
Social Network Analysis: Measuring, Mapping, and Modelling collections of Connections.

UNIT - II:

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

UNIT - III:

CASE STUDIES - I:

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

UNIT - IV:

CASE STUDIES - II:

Visualizing and Interpreting Facebook Networks, WWW Hyperlink Networks.

UNIT-V:

CASE STUDIES - III:

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

TEXT BOOKS:

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

REFERENCE BOOK:

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

PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

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

Course Outcomes

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

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

WEB AND SOCIAL MEDIA ANALYTICS

L	T	P	C
3	0	0	3

Course Objectives: Exposure to various web and social media analytic techniques.

Course Outcomes:

1. Knowledge on decision support systems.
2. Apply natural language processing concepts on text analytics.
3. Understand sentiment analysis.
4. Knowledge on search engine optimization and web analytics.

UNIT – I:

An Overview of Business Intelligence, Analytics, and Decision Support: Analytics to Manage a Vaccine Supply Chain Effectively and Safely, Changing Business Environments and Computerized Decision Support, Information Systems Support for Decision Making, The Concept of Decision Support Systems (DSS), Business Analytics Overview, Brief Introduction to Big Data Analytics.

UNIT – II:

Text Analytics and Text Mining: Machine Versus Men on Jeopardy! The Story of Watson, Text Analytics and Text Mining Concepts and Definitions, Natural Language Processing, Text Mining Applications, Text Mining Process, Text Mining Tools,

UNIT – III:

Sentiment Analysis: Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis and Speech Analytics.

UNIT – IV:

Web Analytics, Web Mining: Security First Insurance Deepens Connection with Policyholders, Web Mining Overview, Web Content and Web Structure Mining, Search Engines, Search Engine Optimization, Web Usage Mining (Web Analytics), Web Analytics Maturity Model and Web Analytics Tools.

UNIT – V:

Social Analytics and Social Network Analysis: Social Analytics and Social Network Analysis, Social Media Definitions and Concepts, Social Media Analytics.

Prescriptive Analytics - Optimization and Multi-Criteria Systems: Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

TEXT BOOK:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics: Systems for Decision Support, Pearson Education.

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra - Fernandez," Business Intelligence – Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, Shaku Atre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. Yuli Vasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting", SPD Shroff, 2012.

VIDEO ANALYTICS

L	T	P	C
3	0	0	3

Course Objectives: To acquire the knowledge of extracting information from surveillance videos, understand the models used for recognition of objects, humans in videos and perform gait analysis.

Course Outcomes:

1. Understand the basics of video- signals and systems.
2. Able to estimate motion in a video
3. Able to detect the objects and track them
4. Recognize activity and analyze behaviour
5. Evaluate face recognition technologies

UNIT – I:

Introduction: Multidimensional signals and systems: signals, transforms, systems, sampling theorem. Digital Images and Video: human visual system and color, digital video, 3D video, digital-video applications, image and video quality.

UNIT – II:

Motion Estimation: Image formation, motion models, 2D apparent motion estimation, differential methods, matching methods, non-linear optimization methods, transform domain methods, 3D motion and structure estimation.

UNIT – III:

Video Analytics: Introduction - Video Basics - Fundamentals for Video Surveillance - Scene Artifacts - Object Detection and Tracking: Adaptive Background Modelling and Subtraction- Pedestrian Detection and Tracking Vehicle Detection and Tracking- Articulated Human Motion Tracking in Low-Dimensional Latent Spaces.

UNIT – IV:

Behavioural Analysis & Activity Recognition: Event Modelling- Behavioural Analysis- Human Activity Recognition-Complex Activity Recognition Activity modelling using 3D shape, Video summarization, shape-based activity models- Suspicious Activity Detection.

UNIT – V:

Human Face Recognition & Gait Analysis: Introduction: Overview of Recognition algorithms – Human Recognition using Face: Face Recognition from still images, Face Recognition from video, Evaluation of Face Recognition Technologies- Human Recognition using gait: HMM Framework for Gait Recognition, View Invariant Gait Recognition, Role of Shape and Dynamics in Gait Recognition

TEXT BOOKS:

1. A. Murat Tekalp, “Digital Video Processing”, second edition, Pearson, 2015.
2. Rama Chellappa, Amit K.Roy-Chowdhury, Kevin Zhou.S, “Recognition of Humans and their Activities using Video”, Morgan & Claypool Publishers, 2005.
3. Yunqian Ma, Gang Qian, “Intelligent Video Surveillance: Systems and Technology”, CRC Press (Taylor and Francis Group), 2009.

REFERENCE BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer, 2011.
2. Yao Wang, Jorn Ostermann and Ya-Qin Zhang, “Video Processing and Communications”, Prentice Hall, 2001.
3. Thierry Bouwmans, Fatih Porikli, Benjamin Höferlin and Antoine Vacavant, “Background Modeling and Foreground Detection for Video Surveillance: Traditional and Recent Approaches, Implementations, Benchmarking and Evaluation”, CRC Press, Taylor and Francis Group, 2014.
4. Md. Atiqur Rahman Ahad, “Computer Vision and Action Recognition-A Guide for Image Processing and Computer Vision Community for Action Understanding”, Atlantis Press, 2011.

R18 B.TECH. MINOR IN INTERNET OF THINGS (2021-22)

S. No.	Year/Semester	# Theory (Credits)	# Labs (Credits)	Total Credits
1.	III - I Semester	Python Programming (3 credits)	Python Programming Lab for 3 Hrs (1.5 credit)	4.5
2.	III - II Semester	Introduction to Internet of Things (3 credits) Smart Technologies (3 credits)	-----	6.0
3.	IV - I Semester	Programming Languages for IoT (3 credits)	IoT Automation with Raspberry PI Lab (1.5 credit)	4.5
4.	IV - II Semester	Fog & Edge Computing for IoT (3 credits)	----	3.0
			Total credits	**18.0**

FOG AND EDGE COMPUTING FOR IOT

L	T	P	C
3	0	0	3

Course Objectives: This course gives an overview of Fog, Edge computing and Internet of Things (IoT) can be used as a way to meet application demands in intelligent IoT systems.

Course Outcomes:

1. Understand use of the IoT architecture with its entities and protocols, from the IoT devices.
2. Understand IoT + Fog + Cloud Infrastructures and its components and working of components and its performance.
3. Understand Optimization Problems in Fog and Edge Computing.
4. Explore Data Management in Fog Computing.

UNIT - I

Internet of Things (IoT) and New Computing Paradigms: Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Advantages of FEC: SCALE, FEC Achieves These Advantages: SCANC, Hierarchy of Fog and Edge Computing, Business Models, Opportunities and Challenges.

Addressing the Challenges in Federating Edge Resources: Introduction, The Networking Challenge, The Management Challenge, Miscellaneous Challenges.

UNIT - II

Integrating IoT + Fog + Cloud Infrastructures: System Modeling and Research Challenges: Introduction, Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use-Case Scenarios, Integrated C2F2T Literature by Metrics, Future Research Directions.

Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing, Management in Edge and Fog, Future Research Directions.

UNIT - III

Optimization Problems in Fog and Edge Computing: Introduction, Background / Related Work, Preliminaries, The Case for Optimization in Fog Computing, Formal Modeling Framework for Fog Computing, Metrics, Further Quality, Attributes, Optimization, Opportunities along the Fog Architecture, Optimization Opportunities along the Service Life Cycle, Toward a Taxonomy of Optimization Problems in Fog Computing, Optimization Techniques, Future Research Directions.

Middlewares: Introduction, Need for Fog and Edge Computing Middleware, Design Goals, State-of-the-Art Middleware Infrastructures, System Model, Proposed Architecture, Case Study Example, Future Research Directions.

UNIT - IV

Lightweight Container Middleware for Edge Cloud Architectures: Introduction, Background/Related Work, Clusters for Lightweight Edge Clouds, Architecture Management – Storage and Orchestration, IoT Integration, Security Management for Edge Cloud Architectures, Future Research Directions.

Data Management in Fog Computing: Introduction, Background, Fog Data Management, Future Research and Direction.

UNIT - V

Fog Computing Realization for Big Data Analytics: Introduction, Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation, Architecture, Configurations, Case Studies, Related Work, Future Research Direction.

Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking: Introduction, Human Object Detection, Object Tracking, Lightweight Human Detection, Case Study, Future Research Directions.

TEXT BOOK:

1. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by Rajkumar Buyya and Satish Narayana Srirama.

REFERENCES:

1. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya
2. Amir Vahid Dastjerdi and Rajkumar Buyya, —Fog Computing: Helping the Internet of Things Realize its Potential, University of Melbourne.