

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**  
**B.Tech. in CSE (INTERNET OF THINGS)**  
**III & IV YEAR COURSE STRUCTURE & TENTATIVE SYLLABUS (R18)**

**Applicable From 2020-21 Admitted Batch**

**III YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		Finite Automata and Compiler Design	3	0	0	3
2		Microprocessors & Microcontrollers	3	0	0	3
3		Computer Networks	3	0	0	3
4		Database Management Systems	3	0	0	3
5		Professional Elective - I	3	0	0	3
6		Professional Elective - II	3	0	0	3
7		Database Management Systems Lab	0	0	3	1.5
8		Microprocessors & Microcontrollers Lab	0	0	3	1.5
9		Advanced Communication Skills Lab	0	0	2	1
10		Intellectual Property Rights	3	0	0	0
		<b>Total Credits</b>	<b>21</b>	<b>0</b>	<b>8</b>	<b>22</b>

**III YEAR II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		IoT Communication Protocols	3	1	0	4
2		Computer Vision and Robotics	3	1	0	4
3		Programming Languages for IoT	3	1	0	4
4		Professional Elective – III	3	0	0	3
5		Open Elective - I	3	0	0	3
6		IoT lab	0	0	3	1.5
7		Professional Elective - III Lab	0	0	3	1.5
8		Computer Vision Lab	0	0	2	1
9		Environmental Science	3	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>3</b>	<b>8</b>	<b>22</b>

**IV YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		IoT Cloud Processing and Analytics	3	0	0	3
2		IoT Security	2	0	0	2
3		Professional Elective - IV	3	0	0	3
4		Professional Elective - V	3	0	0	3
5		Open Elective - II	3	0	0	3
6		IoT Security & Cloud Computing Lab	0	0	2	1
7		Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*
8		Seminar	0	0	2	1
9		Project Stage – I	0	0	6	3
		<b>Total Credits</b>	<b>14</b>	<b>0</b>	<b>10</b>	<b>21</b>

**IV YEAR II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1		Organizational Behaviour	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4		Project Stage – II	0	0	14	7
		<b>Total Credits</b>	<b>9</b>	<b>0</b>	<b>14</b>	<b>16</b>

**\*Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6<sup>th</sup> and 7<sup>th</sup> semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

MC – Environmental Science – Should be Registered by Lateral Entry Students Only.

MC – Satisfactory/Unsatisfactory.

**Professional Elective – I**

	Architecting Smart IoT Devices
	Data Analytics for IoT
	IoT System Architectures
	Operating Systems for IoT
	Design and Analysis of Algorithms

**Professional Elective – II**

	Machine Learning
	Real Time Systems
	Embedded Hardware Design
	Energy Sources and Power Management
	Software Engineering

**Professional Elective – III**

	Mobile Application Development for IoT
	Software Testing Methodologies
	Cloud Computing and Virtualization
	Artificial Intelligence
	Lightweight Cryptography

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

**Professional Elective – IV**

	Quantum Computing
	Wireless Networks
	Augmented Reality & Virtual Reality
	IoT Automation
	Ad-hoc & Sensor Networks

**Professional Elective - V**

	Embedded Software Design
	5G & IoT Technologies
	Cognitive Computing
	Distributed Systems
	Edge Computing

**Professional Elective – VI**

	Industrial IoT
	Fog Computing
	Smart Sensor Technologies
	Digital Forensics
	Blockchain Technology

**IOT COMMUNICATION PROTOCOLS****B.Tech. III Year II Sem.**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Objectives:** In this course, learners will be going to learn about various protocols designed for the implementation of the Internet of Things (IoT) applications.

**Course Outcomes:**

1. Understand fundamentals of IoT architecture outline and standards.
2. Understand and analyze different architectural views.
3. Understand the importance of IoT Data Link Layer & Network Layer Protocols.
4. Understand the importance of IoT Transport & Session Layer Protocols.

**UNIT - I**

**Introduction:** IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.

**Unit - II**

**IoT Reference Architecture:** Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant Architectural views. Real-World Design Constraints- Introduction, Technical Design constraints.

**UNIT - III**

**IoT Data Link Layer:** PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7

**UNIT - IV**

**Network Layer Protocols:** Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.

**UNIT - V**

**IOT Transport & Session Layer Protocols:** Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT.

**TEXT BOOKS:**

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications ,2016
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2015.

**REFERENCE BOOKS:**

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

**COMPUTER VISION AND ROBOTICS****B.Tech. III Year II Sem.**

L	T	P	C
3	1	0	4

**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 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 Stereopsis, Binocular Fusion, Using More Cameras. **Segmentation by Clustering:** What Is Segmentation? Human Vision: Grouping and Gestalt, 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. 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.

**PROGRAMMING LANGUAGES FOR IOT****B.Tech. III Year II Sem.**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Objectives:**

1. This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi.
2. The course focuses on higher-level operating systems, advanced networking, user interfaces, multimedia and uses more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice.

**Course Outcomes:**

1. Appreciate the development technology for IoT.
2. Familiar with Basic Concepts of Linux.
3. Design real time IoT Devices and Familiar with basic foundations of Python Programming and libraries.
4. Comprehend the basic concepts of Mobile Cloud Computing.

**UNIT - I**

Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operates the Raspberry Pi in “headless mode”, Bash Command line, operating Raspberry Pi without needing a GUI interface.

Basics of Python programming language: Programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.

**UNIT - II**

**Introducing Micro Python:** MicroPython Features, MicroPython Limitations, Experimenting with Python on PC, Installing Python 3 on Windows 10, Running the Python Console, Running Python Programs with the Interpreter, The Run, Evaluate, Print Loop (REPL Console), Off and Running with MicroPython, Additional Hardware, Basic Electronics Kit, Breadboard and Jumper Wires and 3 Examples.

**UNIT - III**

**IoT Physical Servers and Cloud Offerings:** Introduction to Cloud Storage models and communication APIs. Web Server – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs.

**UNIT - IV**

**Baking Pi:** Powering Raspberry Pi, Formatting SD cards, Installing and connecting Raspberry pi, How to tell Raspberry pi is working, Installing Raspbian with NOOBS, Networking Raspberry Pi, Connecting with Ethernet, Connecting Via Local Computer Network, Connecting Via Wireless Network, Updating and Upgrading, Setting up a Host Name, Connecting Raspberry pi with SSH, Creating Simple Raspberry pi application.

**UNIT - V**

**FIRST Project on Java:** Bill of Materials, Getting Started with NetBeans, Downloading and Configuring NetBeans, Revisiting HelloRaspberryPi, Brewing Java, Communicating with a USB Scale, Coffee Calculator, Asynchronous Communication, Coffee Brewing Recipe, Commercial Licensing.

**TEXT BOOKS:**

1. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional.
2. MicroPython for the Internet of Things, A Beginner's Guide to Programming with Python on Microcontrollers, Charles Bell, Apress.
3. Raspberry Pi with Java: Programming the Internet of Things (IoT) (Oracle Press) 1st Edition.

**REFERENCE BOOKS:**

1. Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
2. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, JohnWiley & Sons
3. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc
4. The official raspberry Pi Projects Book,  
[https://www.raspberrypi.org/magpiissues/Projects\\_Book\\_v1.pdf](https://www.raspberrypi.org/magpiissues/Projects_Book_v1.pdf)

**MOBILE APPLICATION DEVELOPMENT FOR IOT (Professional Elective – III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:** Students will learn mobile application development for Internet of Things (IoT) devices.

**Course Outcomes:**

1. Understand significance of IoT programming fundamentals.
2. Understand and analyze IoT programming applications.
3. Develops IoT applications using standardized hardware.
4. Discuss concepts of IoT Advance Wireless Interfaces and IoT Production System.

**UNIT – I**

**IoT Product Conceptualization:** IoT Product Development Lifecycle, IoT Product Conceptualizations  
**IoT Programming Fundamentals:** Getting Started, IoT Programming setup for LED flashing, Program to display message on screen, Program to read LDR level and display on screen, Android APK to perform read write operation, Particle android APK to control LED intensity, LED switching with HTML interface, Cloud based motion detection, Displaying temperature sensor data on terminal, Publishing sensor values on the cloud, Performing computation on sensor values.

**UNIT - II**

**IoT Programming Applications:** Gas level detection using MQ2 sensor, Blink Android Application for controlling LED from mobile, Integration of Temperature and Gas Sensor with Blynk Mobile Application, Printing real-time Date and Time values on serial terminal, Display temperature value on serial terminal, Display temperature values on 16\*2 LCD display  
**Interfacing:** Interfacing of Nokia 5110 display, display image on Nokia 5110, Particle Electron displaying battery charging level status, GPS tracking device interface to get coordinates.

**UNIT – III**

**IoT Product Hardware Development:** Product realization, Connection diagram of IoT product, Engineering board development, Product board customization and optimization, Flowchart of IoT warehouse monitoring system, Wireless communication between the multiple kits, Particle cloud IDE.

**UNIT – IV**

**IoT Advance Wireless Interfaces:** Bluetooth communication between master and slave module, Data visualization on ThingSpeak cloud using webhook services, Storing data into google excel sheet and sending the sheets to emails.

**UNIT – V**

**IoT Production System:** IoT Warehouse Monitoring System, IoT Product Packaging, Future of IoT Product Development.

**TEXT BOOK:**

1. IoT Product Development with Programming: Stepwise programming approach with Particle Development board Kindle Edition by Mahesh Jadhav and Tejas Sarang Patil.

**REFERENCE BOOKS:**

1. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing 1st edition, CRC Press, 2019.
2. IoT Product Development with Programming: Stepwise programming approach with Particle Development board Kindle Edition by Mahesh Jadhav and Tejas Sarang Patil.

**SOFTWARE TESTING METHODOLOGIES (Professional Elective – III)****B.Tech. III Year II Sem.****L T P C**  
**3 0 0 3****Prerequisites:** A course on “Software Engineering”.**Course Objectives**

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test automation and management using latest tools.

**Course Outcomes:** Design and develop the best test strategies in accordance to the development model.**UNIT - I**

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

**UNIT - II**

Transaction Flow Testing: transaction flows, transaction flow testing techniques. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

**UNIT - III**

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

**UNIT - IV**

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

**UNIT - V**

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

**TEXT BOOKS:**

1. Software Testing techniques - Baris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

**REFERENCE BOOKS:**

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.



**CLOUD COMPUTING AND VIRTUALIZATION (Professional Elective - III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Course Objectives:**

1. Guiding design principles for Cloud Computing
2. Understand the concepts of virtualization for cloud computing.

**Course Outcomes:**

1. Knowledge on distributed system models.
2. Understand the concepts of cloud computing.
3. Explore several services provided by cloud.
4. Understand different types of virtualizations.

**UNIT - I**

Systems Modeling, Clustering and Virtualization: Distributed System Models and Enabling Technologies, Computer Clusters for Scalable Parallel Computing, Virtual Machines and Virtualization of Clusters and Data centers.

**UNIT - II**

Foundations: Introduction to Cloud Computing, Migrating into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, The Enterprise Cloud Computing Paradigm.

**UNIT - III**

Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS): Virtual machines provisioning and Migration services, On the Management of Virtual machines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a cluster as a Service, Secure Distributed Data Storage in Cloud Computing. Aneka, Comet Cloud, T-Systems', Workflow Engine for Clouds.

**UNIT - IV**

Virtualization - Hardware virtualization, Full virtualization, Para virtualization, Hypervisor, hardware assisted virtualization, emulator.

**UNIT - V**

Migration, operating system virtualization, application virtualization, memory virtualization, storage virtualization, network virtualization, network function virtualization.

**TEXT BOOKS:**

1. Cloud Computing and Virtualization, Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, Wiley.
2. T. Erl, R. Puttini, Z. Mahmood, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013.

**REFERENCE BOOKS:**

1. Balwinder Singh Sodh, IIT Ropar, Topics in virtualization and cloud computing.
2. T. Mather, S. Kumaraswamy, S. Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly Series, 2009.
3. Controlling data in the cloud: outsourcing computation without outsourcing control. In Proceedings of the 2009 ACM workshop on Cloud computing security (CCSW '09). ACM, New York, NY, USA, 85-90, 2009.

**ARTIFICIAL INTELLIGENCE (Professional Elective – III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:**

1. A course on “Computer Programming and Data Structures”
2. A course on “Advanced Data Structures”
3. A course on “Design and Analysis of Algorithms”
4. A course on “Mathematical Foundations of Computer Science”
5. Some background in linear algebra, data structures and algorithms, and probability will all be helpful

**Course Objectives:**

- To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

**Course Outcomes:**

- Ability to formulate an efficient problem space for a problem expressed in natural language.
- Select a search algorithm for a problem and estimate its time and space complexities.
- Possess the skill for representing knowledge using the appropriate technique for a given problem.
- Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.

**UNIT - I****Problem Solving by Search-I:** Introduction to AI, Intelligent Agents

**Problem Solving by Search –II:** Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A\* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environment .

**UNIT - II****Problem Solving by Search-II and Propositional Logic**

**Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions.

**Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

**Propositional Logic:** Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

**UNIT - III****Logic and Knowledge Representation**

**First-Order Logic:** Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic.

**Inference in First-Order Logic:** Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

**Knowledge Representation:** Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

#### **UNIT - IV**

##### **Planning**

**Classical Planning:** Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

**Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

#### **UNIT - V**

##### **Uncertain knowledge and Learning**

**Uncertainty:** Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use,

**Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

**Learning:** Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

#### **TEXT BOOK:**

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

#### **REFERENCE BOOKS:**

1. Artificial Intelligence, 3<sup>rd</sup> Edn, E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3<sup>rd</sup> Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

**LIGHTWEIGHT CRYPTOGRAPHY (Professional Elective – III)****B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	3

**Prerequisites:** Undergraduate level knowledge of Network Security.**Course Objectives:**

1. Gain in-depth knowledge on Lightweight Cryptography and its relation to the new security in RFID tags.
2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

**Course Outcomes:**

1. Ability to learn Cryptographic based solutions, attacks and intrusions.
2. Understand security and privacy issues in radio frequency identification (RFID) systems.
3. Understanding multiple ways to attack and defend in industrial systems.

**UNIT - I****Anti-counterfeiting and RFID** - Anti-Counterfeiting and Supply Chain Security, Networked RFID Systems, PC Network Architecture, A Security Primer.**UNIT - II****Security and Privacy Current Status** - Addressing Insecurities and Violations of Privacy, RFID Tag Vulnerabilities in RFID Systems, From Identification to Authentication – A Review of RFID Product Authentication Techniques.**UNIT - III****Network Based Solutions** - EPC System for a Safe & Secure Supply Chain and How it is Applied, The Potential of RFID and NFC in Anti-Counterfeiting, Improving the Safety and Security of the Pharmaceutical Supply Chain.**UNIT - IV****Cryptographic Solutions** - Product Specific Security Based on RFID Technology, Strengthening the Security of Machine-Readable Documents, Enhancing Security of Class I Generation 2 RFID against Traceability and Cloning.**UNIT - V****Low-cost Cryptographic Solutions:** A Random Number Generator for Application in RFID Tags, A Low-Cost Solution to Cloning and Authentication Based on a Lightweight Primitive, Lightweight Cryptography for Low Cost RFID.**TEXT BOOK:**

1. Networked RFID Systems and Lightweight Cryptography by Peter H. Cole · Damith C. Ranasinghe First edition, Springer publication 2008.

**REFERENCE BOOKS:**

1. RFID Security and Privacy by Yingjiu Li, Robert H. Deng.
2. RFID HANDBOOK by Klaus Finkenzeller, Third edition Wiley Publications.

**IOT LAB****B.Tech. III Year II Sem.****L T P C**  
**0 0 3 1.5****Course Objectives:**

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

**Course Outcomes:**

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

**List of Experiments:**

1. Using raspberry pi
  - a. Calculate the distance using a distance sensor.
  - b. Basic LED functionality.
2. Using Arduino
  - a. Calculate the distance using a distance sensor.
  - b. Basic LED functionality.
  - c. Calculate temperature using a temperature sensor.
3. Using Node MCU
  - a. Calculate the distance using a distance sensor.
  - b. Basic LED functionality.
  - c. Calculate temperature using a temperature sensor.

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**MOBILE APPLICATION DEVELOPMENT FOR IOT LAB (PE – III Lab)****B.Tech. III Year II Sem.****L T P C**  
**0 0 3 1.5****Course Objectives:**

1. To develop android applications using raspberry PI platform for IoT devices.
2. To develop android applications using arduino platform for IoT devices.

**Course Objectives**

1. Students understand the working of Raspberry PI and Arduino.
2. Students will be able to develop, deploy and maintain the Android Applications for IoT devices.
3. Implement android application to measure temperature using a temperature sensor.
4. Develop an android application to measure the distance using a distance sensor.

**List of Experiments****Using raspberry pi**

1. Develop an android application to demonstrate LED Blinking.
2. Develop an android application to Control an LED by a button.
3. Develop an android application to RGB LED.
4. Develop an android application to measure the distance using a distance sensor.
5. Develop an android application to measure temperature using a temperature sensor.

**Using Arduino**

1. Develop an android application to demonstrate LED Blinking.
2. Develop an android application to Control an LED by a button.
3. Develop an android application to RGB LED.
4. Develop an android application to measure the distance using a distance sensor.
5. Develop an android application to measure temperature using a temperature sensor.

**TEXT BOOKS:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

**REFERENCE BOOK:**

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

**SOFTWARE TESTING METHODOLOGIES LAB (PE – III Lab)****B.Tech. III Year II Sem.****L T P C**  
**0 0 3 1.5****Prerequisites:** A basic knowledge of programming.**Course Objectives:**

- To provide knowledge of Software Testing Methods.
- To develop skills in software test automation and management using latest tools.

**Course Outcome:**

- Design and develop the best test strategies in accordance to the development model.

**List of Experiments:**

1. Recording in context sensitive mode and analog mode
2. GUI checkpoint for single property
3. GUI checkpoint for single object/window
4. GUI checkpoint for multiple objects
5. a) Bitmap checkpoint for object/window  
a)Bitmap checkpoint for screen area
6. Database checkpoint for Default check
7. Database checkpoint for custom check
8. Database checkpoint for runtime record check
9. a) Data driven test for dynamic test data submission  
b) Data driven test through flat files  
c) Data driven test through front grids  
d) Data driven test through excel test
10. a) Batch testing without parameter passing  
b) Batch testing with parameter passing
11. Data driven batch
12. Silent mode test execution without any interruption
13. Test case for calculator in windows application

**TEXT BOOKS:**

1. Software Testing techniques - Baris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.

**REFERENCE BOOKS:**

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

**CLOUD COMPUTING AND VIRTUALIZATION LAB (PE – III Lab)****B.Tech. III Year II Sem.**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**Course Objectives:**

1. Guiding design principles for Cloud Computing.
2. Understand the concepts of virtualization for cloud computing.

**Course Outcomes:**

1. Knowledge on distributed system models.
2. Understand the concepts of cloud computing.
3. Explore several services provided by cloud.
4. Understand different types of virtualizations.

**List of Experiments:**

1. Install Oracle Virtual box and create two VMs on your laptop.
2. Install Turbo C in guest OS and execute C program.
3. Test ping command to test the communication between the guest OS and Host OS
4. Install Hadoop single node setup.
5. Hopkinson's test on DC shunt machines
6. Develop hadoop application to count no of characters, no of words and each character frequency.
7. Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.
8. Develop hadoop application to process given data and produce results such as how many female and male students in both schools the results should be in following format.  
GP-F #number  
GP-M #numbers  
MS-F #number  
MS-M #number
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase
11. Use the Zookeeper to implement the coordination model in Problem 10.
12. Develop a Hello World application using Google App Engine
13. Develop a Guestbook Application using Google App Engine
14. Develop a Windows Azure Hello World application using.
15. Create a Mashup using Yahoo! Pipes.

**TEXT BOOKS:**

1. Cloud Computing and Virtualization, Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, Wiley.
2. T. Erl, R. Puttini, Z. Mahmood, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013.

**REFERENCE BOOKS:**

1. Balwinder Singh Sodh, IIT Ropar, Topics in virtualization and cloud computing.
2. T. Mather, S. Kumaraswamy, S. Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O'Reilly Series, 2009.
3. Controlling data in the cloud: outsourcing computation without outsourcing control. In Proceedings of the 2009 ACM workshop on Cloud computing security (CCSW '09). ACM, New York, NY, USA, 85-90, 2009.



**ARTIFICIAL INTELLIGENCE LAB (PE – III Lab)****B.Tech. III Year II Sem.****L T P C**  
**0 0 3 1.5**

**Course Objectives:** Become familiar with basic principles of AI toward problem solving, knowledge representation, and learning.

**Course Outcomes:** Apply basic principles of AI in solutions that require problem solving, knowledge representation, and learning.

**List of Experiments (AI)**

1. Basic programs in Python to get familiarized with various programming structures.
2. Implementation of logical rules in Python.
3. Using any data apply the concept of:
  - a. Linear regression
  - b. Gradient decent
  - c. Logistic regression
4. Perform and plot overfitting in a data set.
5. Implementation of kNN classification algorithm.
6. Implementation of k-means clustering algorithm.
7. Explore statistical methods for machine learning.

**TEXT BOOK:**

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

**REFERENCE BOOKS:**

1. Artificial Intelligence, 3rd Edn, E. Rich and K.Knight (TMH).
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

**LIGHTWEIGHT CRYPTOGRAPHY LAB (PE - III Lab)****B.Tech. III Year II Sem.**

L	T	P	C
0	0	3	1.5

**Course Objectives:**

1. Gain in-depth knowledge on Lightweight Cryptography and its relation to the new security in RFID tags.
2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.

**Course Outcomes:**

1. Ability to learn Cryptographic based solutions, attacks and intrusions.
2. Understand security and privacy issues in radio frequency identification (RFID) systems.
3. Understanding multiple ways to attack and defend in industrial systems.

**List of Experiments:**

1. Write a program to implement the AES algorithm.
2. Write a program to implement the SHA-256 hash function algorithm
3. Write a program to implement the Tiny Encryption Algorithm (TEA).
4. Write a program to implement the scalable encryption algorithm.
5. Write a program to implement the Message Authentication Codes
6. Write a program to implement the Block ciphers
7. Write a program to implement the Stream Ciphers
8. Write a program to implement the Hash functions
9. Write a program to implement the Random Number Generation

**TEXT BOOK:**

1. Networked RFID Systems and Lightweight Cryptography by Peter H. Cole · Damith C. Ranasinghe First edition, Springer publication 2008.

**REFERENCE BOOKS:**

1. RFID Security and Privacy by Yingjiu Li, Robert H. Deng.
2. RFID HANDBOOK by Klaus Finkenzeller, Third edition Wiley Publications.

**COMPUTER VISION LAB****B.Tech. III Year II Sem.**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Objectives:**

1. To Make students acquainted with practical aspects of computing with images.
2. To Improve quality of image by applying enhancement techniques.
3. To understand Feature Extraction algorithms.

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

1. Understand the basic image processing techniques and enhance images by adjusting contrast.
2. Detects edges using various kernels using transformation.
3. Apply histogram processing, convert between various color spaces.
4. Partition dataset by classification and clustering.
5. Comprehend computer vision systems for real world problems.

**Description:**

Use any tool like OpenCV/ Scilab/ python/R Programming etc.,

List of Programs

1. Familiarization of the tool used for computer vision.
2. Implement basic image operations
  - a. Loading and displaying an image.
  - b. Color formats
  - c. Image enhancement.
3. Implement smoothing filters on an image using
  - a. Gaussian filter
  - b. Median filter
  - c. Mean Filter
4. Demonstrate fourier Transformations.
5. Implement histogram calculation and equalization for the given image.
6. Implement morphological operations like dilation, erosion, opening and closing on the given image
7. Implement edge detection on images using any two edge detection masks.
8. Detection of motion from structure.
9. Implement texture extraction of a given image.
10. Implement object detection like recognizing pedestrians.
11. Implement face recognition of an image using K-Means clustering.
12. Implement dimensionality reduction using PCA for the given images.
13. Demonstrate model based reconstruction using tensor flow.

**TEXT BOOKS:**

1. Gary Bradski and Adrian Kaehler, "Learning OpenCV", O'Reilly Media, Inc., 1st Edition, 2008.
2. Talita Perciano and Alejandro C Frery, "Introduction to Image Processing Using R:" Learning by Examples, Springer, 1st Edition, 2013.
3. "Computer Vision: Algorithms and Applications" by Richard Szeliski; Springer-Verlag London Limited 2011.

**REFERENCE BOOKS:**

1. R C Gonzalez and R E woods, "Digital Image Processing", Addison Pearson, 3rd Edition, 2013.
2. David A. Forsyth and Jean Ponce, Computer Vision-A Modern Approach, PHI, 1st Edition, 2003.

## ENVIRONMENTAL SCIENCE

**B.Tech. III Year II Sem.**

L	T	P	C
3	0	0	0

**Course Objectives:**

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures
- Understanding the environmental policies and regulations

**Course Outcomes:**

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

**UNIT - I**

**Ecosystems:** Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

**UNIT - II**

**Natural Resources: Classification of Resources:** Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

**UNIT - III**

**Biodiversity And Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

**UNIT - IV**

**Environmental Pollution and Control Technologies: Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

**UNIT - V**

**Environmental Policy, Legislation & EIA:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-

economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

**TEXT BOOKS:**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

**REFERENCE BOOKS:**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4<sup>th</sup> Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.