



# ACE

## Engineering College

**An Autonomous Institution**

(NBA ACCREDITED B.TECH COURSES, ACCORDED NAAC 'A' GRADE)  
Ghatkesar, Hyderabad- 501 301

### R20 -B.TECH. FOUR YEAR DEGREE COURSE

### DEPARTMENT OF CSE (IoT) COURSE STRUCTURE

#### III Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	CO501PC	Finite Automata and Compiler Design	3	0	0	3
2	EC501PC	Microprocessors & Microcontrollers	3	0	0	3
3	CS503PC	Computer Networks	3	0	0	3
4	CO504PC	Database Management Systems	3	0	0	3
5		Professional Elective - I	3	0	0	3
6		Professional Elective - II	3	0	0	3
7	CO505PC	Database Management Systems Lab	0	0	3	1.5
8	EC505ES	Microprocessors & Microcontrollers Lab	0	0	3	1.5
9	EN508HS	Advanced Communication Skills Lab	0	0	2	1
10	MC509	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	CO601PC	IoT Communication Protocols	3	1	0	4
2	CO602PC	Computer Vision and Robotics	3	1	0	4
3	CO603PC	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	CO606PC	IoT lab	0	0	3	1.5
7		Professional Elective - III Lab	0	0	3	1.5
8	CO608PC	Computer Vision Lab	0	0	2	1
9	MC609	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	CO701PC	IoT Cloud Processing and Analytics	3	0	0	3
2	CO702PC	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	CO706PC	IoT Security & Cloud Computing Lab	0	0	2	1
7	CO707PC	Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*
8	CO708PC	Seminar	0	0	2	1
9	CO709PC	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	SM801MS	Organizational Behaviour	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	CO804PC	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

CO511PE	Architecting Smart IoT Devices
CO512PE	Data Analytics for IoT
CO513PE	IoT System Architectures
CO514PE	Operating Systems for IoT
CO515PE	Design and Analysis of Algorithms

### Professional Elective – II

CO521PE	Machine Learning
CO522PE	Real Time Systems
CO523PE	Embedded Hardware Design
CO524PE	Energy Sources and Power Management
CO525PE	Software Engineering

### Professional Elective – III

CO611PE	Mobile Application Development for IoT
CO612PE	Software Testing Methodologies
CO613PE	Cloud Computing and Virtualization
CO614PE	Artificial Intelligence
CO615PE	Lightweight Cryptography

**Professional Elective – III Lab**

CO621PE	Mobile Application Development for IoT Lab
CO622PE	Software Testing Methodologies Lab
CO623PE	Cloud Computing and Virtualization Lab
CO624PE	Artificial Intelligence Lab
CO625PE	Lightweight Cryptography Lab

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

**Professional Elective – IV**

CO711PE	Quantum Computing
CO712PE	Wireless Networks
CO713PE	Augmented Reality & Virtual Reality
CO714PE	IoT Automation
CO715PE	Ad-hoc & Sensor Networks

**Professional Elective - V**

CO721PE	Embedded Software Design
CO722PE	5G & IoT Technologies
CO723PE	Cognitive Computing
CO724PE	Distributed Systems
CO725PE	Edge Computing

**Professional Elective – VI**

CO811PE	Industrial IoT
CO812PE	Fog Computing
CO813PE	Smart Sensor Technologies
CO814PE	Digital Forensics
CO815PE	Blockchain Technology

# Syllabus

## III Year I Semester

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1	CO501PC	Finite Automata and Compiler Design	3	0	0	3
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3	CS503PC	Computer Networks	3	0	0	3
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9	EN508HS	Advanced Communication Skills Lab	0	0	2	1
10	MC509	Intellectual Property Rights	3	0	0	0
		<b>Total Credits</b>	<b>21</b>	<b>0</b>	<b>8</b>	<b>22</b>

### Professional Elective – I

CO511PE	Architecting Smart IoT Devices
CO512PE	Data Analytics for IoT
CO513PE	IoT System Architectures
CO514PE	Operating Systems for IoT
CO515PE	Design and Analysis of Algorithms

### Professional Elective – II

CO521PE	Machine Learning
CO522PE	Real Time Systems
CO523PE	Embedded Hardware Design
CO524PE	Energy Sources and Power Management
CO525PE	Software Engineering

## FINITE AUTOMATA AND COMPILER DESIGN

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Automata and compiler Design mainly deals with the languages which are formal and regular and also deals with grammar present in the machine.

**Course Outcomes:**

1. Graduates should be able to understand the concept of abstract machines and their power to recognize the languages.
2. Attain the knowledge of language classes & grammar relationship among them with the help of Chomsky hierarchy.
3. Ability to understand the design of a compiler given features of the languages.
4. Ability to implement practical aspects of automata theory.
5. Gain Knowledge of powerful compiler generation tools.

### UNIT - I

**Formal Language and Regular Expressions:** Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.

**Context Free grammars and parsing:** Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing.

### UNIT - II

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.

**Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

### UNIT - III

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

### UNIT - IV

**Run time storage:** Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

**Code optimization:** Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

### UNIT - V

**Code generation:** Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.

### TEXT BOOKS:

1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

### REFERENCE BOOKS:

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Cengage Learning.
3. Elements of Compiler Design, A.Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V.Raghavan, TMH.
5. Engineering a Compiler, K.D.Cooper, L.Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation – Kamala Krithivasan and Rama R, Pearson.
7. Modern Compiler Design, D.Grune and others,Wiley-India.
8. A Text book on Automata Theory, S.F.B.Nasir, P.K.Srimani, Cambridge Univ. Press.
9. Automata and Languages, A.Meduna, Springer.

## MICROPROCESSORS & MICROCONTROLLERS

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

### Course Objectives:

1. To familiarize the architecture of microprocessors and micro controllers.
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture.
4. To study the basic concepts of Advanced ARM processors.

**Course Outcomes:** Upon completing this course, the student will be able to

1. Understands the internal architecture, organization and assembly language programming of 8086 processors.
2. Understands the internal architecture, organization and assembly language programming of 8051/controllers.
3. Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

### UNIT - I:

**8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

**Instruction Set and Assembly Language Programming of 8086:** Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

### UNIT - II:

**Introduction to Microcontrollers:** Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

**8051 Real Time Control:** Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.

### UNIT - III:

**I/O And Memory Interface:** LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051. **Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

### UNIT - IV:

**ARM Architecture:** ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

### UNIT – V:

**Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

### TEXTBOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2<sup>nd</sup> Edition 2006.
2. ARM System Developer's guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

### REFERENCE BOOKS:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3<sup>rd</sup> Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2<sup>nd</sup> Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

# COMPUTER NETWORKS

**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	3

## Prerequisites:

- A course on “Programming for problem solving”.
- A course on “Data Structures”.

## Course Objectives:

1. The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

## Course Outcomes:

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

## UNIT - I

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet. Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

## UNIT - II

Data link layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols. Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

## UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

## UNIT - IV

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

## UNIT - V

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

## TEXT BOOK:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

## REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education.
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

# DATABASE MANAGEMENT SYSTEMS

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Prerequisites:** A course on “Data Structures”.

## Course Objectives:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

## Course Outcomes:

- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques

## UNIT - I

**Database System Applications:** A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS

**Introduction to Database Design:** Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

## UNIT - II

**Introduction to the Relational Model:** Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views.

Relational Algebra, Tuple relational Calculus, Domain relational calculus.

## UNIT - III

**SQL: QUERIES, CONSTRAINTS, TRIGGERS:** form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases.

**Schema Refinement:** Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

## UNIT - IV

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions.

## UNIT - V

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.



**TEXT BOOKS:**

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, *Tata Mc Graw Hill* 3rd Edition
2. Database System Concepts, Silberschatz, Korth, *Mc Graw hill*, V edition.

**REFERENCE BOOKS:**

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, *Pearson Education*.
3. Introduction to Database Systems, C. J. Date, *Pearson Education*.
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, *SPD*.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, *PHI*.
6. Fundamentals of Database Management Systems, M. L. Gillenson, *Wiley Student* Edition.

## ARCHITECTING SMART IOT DEVICES (Professional Elective – I)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Prerequisite:** Embedded hardware design.

### Course Objectives:

1. To understand the architectural overview of the Internet of Things (IoT).
2. To acquire skills on data acquisition and communication in IoT.
3. To understand the threats of IoT.

### Course Outcome:

1. Understand how the IoT is different from traditional systems.
2. Demonstrate the revolution of internet in mobile and cloud.
3. Examine the architecture and operation of IoT.
4. Explore various tools and programming paradigms for IoT applications.
5. Develop an IoT prototype for real time scenario.
6. Understand the building blocks of IoT and security aspects.

### UNIT - I

**Design Principles of IoT:** Design principles of connected devices, data acquiring organizing and analytics in IoT, system architecture of IoT.

### UNIT - II

**Prototyping the Embedded Devices for IoT:** System hardware and prototyping, sensors and actuators for IoT, Radio module and wireless sensor network, gateways internet and web, software components.

### UNIT - III

**Embedded Programming for IoT:** Programming connected devices, C and python for IoT, Case study: Temperature controller, Smart irrigation system.

### UNIT - IV

**Embedded RTOS:** Program structure and real time, multitasking and scheduling, RTOS services, signals, semaphores, Nucleus SE, application timers, interrupts in nucleus ES, Nucleus SE initialization and start1p.

### UNIT - V

**Tools for IoT:** Introduction, chef puppet, NETCONF - YANG case studies.

**IoT physical Devices:** Basic building blocks of an IoT device and endpoints, family of IoT devices, pcDuino, Beagle bone black, cubie board, domain specific IoTs.

### TEXT BOOKS:

1. Raj Kamal, Internet of Things, Architecture and Design Principles, 1st edition, McGraw Hill Education, May 2017.
2. Arsheep Baga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1<sup>st</sup> Edition, Universities press, 2015.

### REFERENCE BOOKS:

1. David Etter, IoT (Internet of Things Programming: A simple and fast way of Learning IoT, Kindle edition 2016.
2. Fei HU, Security and Privacy in Internet of Things (IoT): Models, Algorithms, and Implementations, 1<sup>st</sup> Edition, CRC Press, 2016.
3. Colin Walls, Embedded RTOS Design Insights and Implementation. 1st edition. Elsevier. December 2020.

## DATA ANALYTICS FOR IOT (Professional Elective – I)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

### Course Objectives:

1. To understand IoT Analytics and Challenges
2. To Analyze the IoT data to infer the protocol and device characteristics
3. To Explore and visualize data, and techniques to understand data quality

### Course Outcomes:

1. Understand the fundamentals of IoT Analytics and Challenges
2. Understand and analyze IoT Devices and Networking Protocols
3. Apply IoT Analytics for the Cloud
4. Understand exploring and visualizing data

### UNIT - I:

**Defining IoT Analytics and Challenges:** Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges.

### UNIT - II:

**IoT Devices and Networking Protocols:** IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.

### UNIT - III:

**IoT Analytics for the Cloud:** Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.

### UNIT - IV:

**Exploring IoT Data:** Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.

### UNIT - V:

**Data Science for IoT Analytics:** Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.

### TEXT BOOK:

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730.

### REFERENCE BOOKS:

1. Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley.
2. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.
3. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Gerardus Blokdyk.
4. IoT Analytics A Complete Guide, 5starcooks.

## IOT SYSTEM ARCHITECTURES (Professional Elective – I)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Knowledge on concepts of IoT applications and IoT architectures, Event driven analysis and security testing IoT systems

### Course Outcomes:

1. Understand IoT applications and IoT Architectures.
2. Learn about IoT devices and event driven analysis
3. Understand and analyze IIoT.
4. Understand safety and security testing of IoT systems

### UNIT - I:

**The IoT Landscape:** What Is IoT? Applications, Architectures, Wireless Networks, Devices, Security and Privacy, Event-Driven Systems. **IoT System Architectures:** Introduction, Protocols Concepts, IoT-Oriented Protocols, Databases, Time Bases, Security.

### UNIT - II:

**IoT Devices & Event-Driven System Analysis:** The IoT Device Design Space, Cost of Ownership and Power Consumption, Cost per Transistor and Chip Size, Duty Cycle and Power Consumption, Platform Design. **Event-Driven System Analysis:** Introduction, Motivating Example, IoT Network Model, Events, Networks, Devices and Hubs, Single-Hub Networks, Multi-hub Networks, Network Models and Physical Networks, IoT Event Analysis, Event Populations, Stochastic Event Populations, Environmental Interaction Modeling, Event Transport and Migration.

### UNIT - III

**Industrial Internet of Things:** Introduction, Industry 4.0, Industrial Internet of Things (IIoT), IIoT Architecture, Basic Technologies, Applications and Challenges.

### UNIT - IV:

**Security and Safety:** Introduction, Systems Security, Network Security, Generic Application Security, Application Process Security and Safety, Reliable-and-Secure-by-Design IoT Applications, Run-Time Monitoring, The ARMET Approach, Privacy and Dependability.

### UNIT - V:

**Security Testing IoT Systems:** Introduction, Fuzz Testing for Security, White-Box Fuzzing, Black-Box Fuzzing, Fuzzing Industrial Control Network Systems, Fuzzing Modbus, The Modbus Protocol, Modbus/TCP Fuzzer.

### TEXT BOOKS:

1. Dimitrios Serpanos, Marilyn Wol, Internet-of-Things (IoT) Systems Architectures, Algorithms, Methodologies, ISBN 978-3-319-69714-7.

### REFERENCE BOOKS:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatias, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

## OPERATING SYSTEMS FOR IOT (Professional Elective – I)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Knowledge on Various Operating Systems of IoT.

**Course Outcomes:**

1. Understanding Free RTOS Techniques of Cube Software Tool.
2. Knowledge on Micro Python Features.
3. Understand and Acquire Knowledge on Micropython Hardware.
4. Apply Basic Data Structures and Functions of Micro Python.
5. Knowledge on Windows 10 For IoT Operating System.

**UNIT - I:**

**Processes, Tools, Toolchains and Hardware:** Design to Code -A Practical Approach, The Stm32cube Software Tool, The Practical Tool Set, The Stm32 Graphical Tool- Stm32cube Mx Details, The Stm32cubehal, Free RTOS Configuration in A Cube Project, The Stm32cube Cubeide Development Platform.

**UNIT - II:**

**Introducing Micropython:** Micropython Features, Micropython Limitations, What Does Micropython Run On?, Experimenting With Python On Your Pc, How Micropython Works, Off And Running With Micropython.

**UNIT - III:**

**Micropython Hardware:** Getting Started with Micropython Boards, Micropython-Ready Boards, Networking with The Pyboard, Getting Started with Wipy, Connecting to Your Wifi Network, Micropython-Compatible Boards, Other Boards, Breakout Boards and Add-Ons.

**UNIT - IV:**

**How To Program In Micropython:** Basic Concepts, Basic Data Structures, Statements, Modularization; Modules, Functions, And Classes, Learning Python By Example.

**UNIT - V:**

**Introducing the Windows 10 IoT Core:** Windows 10 IoT Core Features, Things You'll Need, Getting Started with Windows 10 IoT Core.

**TEXT BOOKS:**

1. Jim Cooling, Real-Time Operating Systems Book 2 - The Practice: Using Stm Cube, Freertos And the Stm32 Discovery Board (Engineering of Real-Time Embedded Systems) Jim Cooling, Isbn-10: 1973409933, Isbn-13: 978-1973409939.
2. Charles Bell, Micropython For the Internet of Things, A Beginner's Guide to Programming with Python on Microcontrollers, Apress, Isbn-13 (Pbk): 978-1-4842-3122-7, Isbn-13 (Electronic): 978-1-4842-3123-4.
3. Charles Bell Windows 10 For the Internet of Things 1st Edition, Apress, Isbn-13 (Pbk): 978-1-4842-2107-5 Isbn-13, (Electronic): 978-1-4842-2108-2.

**REFERENCE BOOKS:**

1. Gerardus Blokdyk, IOT Operating Systems A Complete Guide, Isbn-10: 0655416471, ISBN-13: 978-0655416470.
2. Klaus Elk, Embedded Software for The IoT, De Gruyter, Isbn: 9781547401048.

## DESIGN AND ANALYSIS OF ALGORITHMS (Professional Elective – I)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

### Prerequisites:

1. A course on “Computer Programming and Data Structures”.
2. A course on “Advanced Data Structures”.

### Course Objectives:

- Introduces the notations for analysis of the performance of algorithms.
- Introduces the data structure disjoint sets.
- Describes major algorithmic techniques (divide-and-conquer, backtracking, dynamic programming, greedy, branch and bound methods) and mention problems for which each technique is appropriate;
- Describes how to evaluate and compare different algorithms using worst-, average-, and best-case analysis.
- Explains the difference between tractable and intractable problems, and introduces the problems that are P, NP and NP complete.

### Course Outcomes:

- Ability to analyze the performance of algorithms
- Ability to choose appropriate data structures and algorithm design methods for a specified application
- Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

### UNIT - I

**Introduction:** Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation and Little oh notation.

**Divide and conquer:** General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

### UNIT - II

**Disjoint Sets:** Disjoint set operations, union and find algorithms

**Backtracking:** General method, applications, n-queen's problem, sum of subsets problem, graph coloring

### UNIT - III

**Dynamic Programming:** General method, applications- Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

### UNIT - IV

**Greedy method:** General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

### UNIT - V

**Branch and Bound:** General method, applications - Travelling sales person problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

**NP-Hard and NP-Complete problems:** Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

### TEXT BOOK:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University Press.

### REFERENCE BOOKS:

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and sons.

## MACHINE LEARNING (Professional Elective – II)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

### Prerequisites

1. Data Structures
2. Knowledge on statistical methods

### Course Objectives

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

### Course Outcomes

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

### UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

**Decision Tree Learning** – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

### UNIT - II

**Artificial Neural Networks-1**– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

**Artificial Neural Networks-2**- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

**Evaluation Hypotheses** – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

### UNIT - III

**Bayesian learning** – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

**Computational learning theory** – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

**Instance-Based Learning**- Introduction,  $k$ -nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

### UNIT- IV

**Genetic Algorithms** – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

**Learning Sets of Rules** – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

**Reinforcement Learning** – Introduction, the learning task, Q-learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

#### **UNIT - V**

**Analytical Learning-1-** Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

**Analytical Learning-2-** Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

**Combining Inductive and Analytical Learning** – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

#### **TEXT BOOK:**

1. Machine Learning – Tom M. Mitchell, - MGH.

#### **REFERENCE BOOK:**

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.



## REAL TIME SYSTEMS (Professional Elective – II)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Prerequisite:** Computer Organization and Operating System

### Course Objectives:

- To provide broad understanding of the requirements of Real Time Operating Systems.
- To make the student understand, applications of these Real Time features using case studies.

### Course Outcomes:

- Be able to explain real-time concepts such as pre-emptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time, and semaphores.
- Able describe how a real-time operating system kernel is implemented.
- Able explain how tasks are managed.
- Explain how the real-time operating system implements time management.
- Discuss how tasks can communicate using semaphores, mailboxes, and queues.
- Be able to implement a real-time system on an embedded processor.
- Be able to work with real time operating systems like RT Linux, Vx Works, MicroC /OSII, Tiny Os

### UNIT – I

**Introduction:** Introduction to UNIX/LINUX, Overview of Commands, File I/O,( open, create, close, lseek, read, write), Process Control ( fork, vfork, exit, wait, waitpid, exec).

### UNIT - II

**Real Time Operating Systems:** Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

### UNIT - III

**Objects, Services and I/O:** Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

### UNIT - IV

**Exceptions, Interrupts and Timers:** Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

### UNIT - V

**Case Studies of RTOS:** RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, and Tiny OS.

### TEXT BOOK:

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011.

### REFERENCE BOOKS:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.
2. Advanced UNIX Programming, Richard Stevens.
3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh.

## EMBEDDED HARDWARE DESIGN (Professional Elective – II)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Knowledge on fundamental concepts on building hardware, Serial ports, AVR Microcontrollers and CAN.

### Course Outcomes:

1. Understand and analyze Forth/Open Firmware, interaction with hardware and memory.
2. Discussion on how to add Peripherals Using SPI and I<sup>2</sup>C.
3. Understand the significance of serial ports, IrDA and USB.
4. Understand various microcontrollers.

### UNIT – I

**An Introduction to Computer Architecture** - Processors, Basic System Architecture, Interrupts, CISC and RISC, Digital Signal Processors, Memory and its types, Input/Output, DMA, Parallel and Distributed Computers, Embedded Computer Architecture.

**Forth/Open Firmware** - Introducing Forth, String Word, Stack Manipulation, Creating New Words, Comments, if...else, Loops, Data Structures, Interacting with Hardware and Memory, Forth Programming Guidelines.

### UNIT - II

**Building Hardware** - Tools, Soldering, Quick Construction, Printed-Circuit Boards, Building it, JTAG  
**Adding Peripherals Using SPI** - Serial Peripheral Interface, SPI-Based Clock/Calendar, SPI-Based Digital Potentiometer.

**Adding Peripherals Using I<sup>2</sup>C** – Overview of I<sup>2</sup>C, Adding a Real-Time Clock with I<sup>2</sup>C, Adding a Small Display with I<sup>2</sup>C.

### UNIT - III

**Serial Ports** – UARTs, Error Detection, Old Faithful: RS-232C, RS-422, RS-485.

**IrDA** - Introduction to IrDA, An IrDA Interface, Other Infrared Devices.

**USB** – Introduction to USB, USB Packets, Physical Interface, Implementing USB Interface.

### UNIT - IV

**Networks** – Controller Area Network (CAN), Ethernet.

**Analog** – Amplifiers, A to D conversion, Interfacing an External ADC, Temperature Sensor, Light sensor, Accelerometer, Pressure Sensor, Magnetic-Field Sensor, D to A conversion, PWM, Motor Control.

**The PIC Microcontrollers** - A Tale of Two Processors, Starting simple, A Bigger PIC, Motor control with a PIC.

### UNIT –V

**The AVR Microcontrollers** - The AVR Architecture, The ATtiny15 Processor, Downloading Code, A Bigger AVR, Bus interfacing.

**68000-Series Computers** – Architecture, A Simple 68000-Based Computer.

**DSP-Based Controllers** - The DSP56800, A DSP56805-Based Computer, JTAG.

### TEXT BOOK:

1. Designing Embedded Hardware, 2nd Edition by John Catsoulis, O'Reilly Media, Inc.

### REFERENCE BOOK:

1. K. Shibu, Introduction to Embedded Systems, McGraw Hill Education.

## ENERGY SOURCES AND POWER MANAGEMENT (Professional Elective – II)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

**Course objectives:** To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Conventional energy Sources, Power distribution management system.

### Course Outcomes:

1. Understand conventional energy sources and energy management systems.
2. Understand the significance of intelligent electronic devices.
3. Knowledge on distribution management system.
4. Understand the importance of smart meters.

### UNIT - I

**Introduction to Energy Sources:** Conventional energy sources---Thermal, Hydel, Nuclear, Gas power stations (Single line diagrams –qualitative approach only).

### UNIT - II

Renewable energy sources--Solar, wind, Tidal, wave, OTEC, Fuel cells, Geothermal, Energy Storage.

### UNIT - III

**Energy Management System:** Energy Management System (EMS) – SMART GRID -Smart Grid Concept - Definitions and Need for Smart Grid – Functions – Opportunities – Benefits and challenges, Difference between conventional & Smart Grid, Smart substations - Substation Automation - Feeder Automation, SCADA – Remote Terminal Unit – Intelligent Electronic Devices – Protocols, Phasor Measurement Unit – Wide area monitoring protection and control, Smart integration of energy resources

### UNIT - IV

**Distribution Management System:** Distribution Management System (DMS) – Volt / VAR control – Fault Detection, Isolation and Service Restoration, Network Reconfiguration, Outage management System, Customer Information System, Geographical Information System, Effect of Plug in Hybrid Electric Vehicles

### UNIT - V

**Smart Meters:** Introduction to Smart Meters – Advanced Metering infrastructure (AMI), AMI protocols – Standards and initiatives, Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

### TEXT BOOKS:

1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012.
3. Generation, distribution and utilization of Electric power, C.L. Wadhwa, New Age Publications.
4. Renewable sources and emerging technologies, D. P. kothari, K.C. iSingal, Rakesh Ranjan, PHI 2/e.

### REFERENCE BOOKS:

1. Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015
2. Kenneth C. Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014.

### E BOOKS:

1. <https://books.google.co.in/books?isbn=1119969093>
2. <https://books.google.co.in/books?isbn=135123093X>

## SOFTWARE ENGINEERING (Professional Elective – II)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

### Course Objectives:

- To provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

### Course Outcomes:

- Ability to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
- Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

### UNIT - I

**Introduction to Software Engineering:** The evolving role of software, changing nature of software, software myths. **A Generic view of process:** Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. **Process models:** The waterfall model, incremental process models, evolutionary process models, the unified process.

### UNIT - II

**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. **Requirements engineering process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. **System models:** Context models, behavioral models, data models, object models, structured methods.

### UNIT - III

**Design Engineering:** Design process and design quality, design concepts, the design model. **Creating an architectural design:** software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

### UNIT - IV

**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. **Product metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

### UNIT - V

**Metrics for Process and Products:** Software measurement, metrics for software quality. **Risk management:** Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. **Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

### TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6<sup>th</sup> edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7<sup>th</sup> edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

### REFERENCE BOOKS:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, McGraw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

## DATABASE MANAGEMENT SYSTEMS LAB

B.Tech. III Year I Sem.

L	T	P	C
0	0	3	1.5

### Co-requisites:

- Co-requisite of course "Database Management Systems"

### Course Objectives:

- Introduce ER data model, database design and normalization
- Learn SQL basics for data definition and data manipulation

### Course Outcomes:

- Design database schema for a given application and apply normalization
- Acquire skills in using SQL commands for data definition and data manipulation.
- Develop solutions for database applications using procedures, cursors and triggers

### List of Experiments:

1. Concept design with E-R Model
2. Relational Model
3. Normalization
4. Practicing DDL commands
5. Practicing DML commands
6. Querying (using ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT, Constraints etc.)
7. Queries using Aggregate functions, GROUP BY, HAVING and Creation and dropping of Views.
8. Triggers (Creation of insert trigger, delete trigger, update trigger)
9. Procedures
10. Usage of Cursors

### TEXT BOOKS:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill, 3rd Edition
2. Database System Concepts, Silberschatz, Korth, McGraw Hill, V edition.

### REFERENCES BOOKS:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, *Pearson Education*
3. Introduction to Database Systems, C.J. Date, *Pearson Education*
4. Oracle for Professionals, The X Team, S. Shah and V. Shah, *SPD*.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, *PHI*.
6. Fundamentals of Database Management Systems, M. L. Gillenson, *Wiley Student Edition*.

## MICROPROCESSORS & MICROCONTROLLERS LAB

B.Tech. III Year I Sem.

L	T	P	C
0	0	3	1.5

**Course Objectives:** To familiarize the architecture of microprocessors and micro controllers.

**Course Outcomes:**

1. Understands the internal architecture, organization and assembly language programming of 8086 processors.
2. Understands the internal architecture, organization and assembly language programming of 8051/controllers
3. Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

**List of Experiments:**

**Using 8086 Processor Kits and/or Assembler**

- Write Assembly Language Programs to 8086 to Perform
  1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
  2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

**Using 8051 Microcontroller Kit**

- Introduction to IDE
  1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions.
  2. Time delay Generation Using Timers of 8051.
  3. Serial Communication from / to 8051 to / from I/O devices.
  4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ.

**Interfacing I/O Devices to 8051**

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8 bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

**TEXT BOOKS:**

1. Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education, 2006.
2. The 8051 *Microcontrollers*: Architecture, Programming & Applications by Dr. K. Uma Rao, Andhe Pallavi, Pearson, 2009.

**REFERENCE BOOKS:**

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3<sup>rd</sup> Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2<sup>nd</sup> Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

## ADVANCED COMMUNICATION SKILLS LAB

B.Tech. III Year I Sem.

L	T	P	C
0	0	2	1

### 1. INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3<sup>rd</sup> year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

### 2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

### 3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

#### **4. MINIMUM REQUIREMENT:**

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

#### **5. SUGGESTED SOFTWARE:**

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7<sup>th</sup> Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

#### **TEXT BOOKS:**

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2<sup>nd</sup> Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5<sup>th</sup> Edition.

#### **REFERENCE BOOKS:**

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.



## INTELLECTUAL PROPERTY RIGHTS

**B.Tech. III Year I Sem.**

L	T	P	C
3	0	0	0

### **UNIT – I**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

### **UNIT – II**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

### **UNIT – III**

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

### **UNIT – IV**

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

### **UNIT – V**

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

### **TEXT & REFERENCE BOOKS:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

# Syllabus

## III Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	CO601PC	IoT Communication Protocols	3	1	0	4
2	CO602PC	Computer Vision and Robotics	3	1	0	4
3	CO603PC	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	CO606PC	IoT lab	0	0	3	1.5
7		Professional Elective - III Lab	0	0	3	1.5
8	CO608PC	Computer Vision Lab	0	0	2	1
9	MC609	Environmental Science	3	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>3</b>	<b>8</b>	<b>22</b>

### Professional Elective – III

CO611PE	Mobile Application Development for IoT
CO612PE	Software Testing Methodologies
CO613PE	Cloud Computing and Virtualization
CO614PE	Artificial Intelligence
CO615PE	Lightweight Cryptography

### Professional Elective – III Lab

CO621PE	Mobile Application Development for IoT Lab
CO622PE	Software Testing Methodologies Lab
CO623PE	Cloud Computing and Virtualization Lab
CO624PE	Artificial Intelligence Lab
CO625PE	Lightweight Cryptography Lab

## 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.**

L	T	P	C
3	1	0	4

### 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 Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

### REFERENCE BOOKS:

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

## MOBILE APPLICATION DEVELOPMENT FOR IOT 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. 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.**

<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>

**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.

L	T	P	C
0	0	3	1.5

### 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.

# Syllabus

## IV Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	CO701PC	IoT Cloud Processing and Analytics	3	0	0	3
2	CO702PC	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	CO706PC	IoT Security & Cloud Computing Lab	0	0	2	1
7	CO707PC	Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*
8	CO708PC	Seminar	0	0	2	1
9	CO709PC	Project Stage – I	0	0	6	3
		<b>Total Credits</b>	<b>14</b>	<b>0</b>	<b>10</b>	<b>21</b>

### Professional Elective – IV

CO711PE	Quantum Computing
CO712PE	Wireless Networks
CO713PE	Augmented Reality & Virtual Reality
CO714PE	IoT Automation
CO715PE	Ad-hoc & Sensor Networks

### Professional Elective – V

CO721PE	Embedded Software Design
CO722PE	5G & IoT Technologies
CO723PE	Cognitive Computing
CO724PE	Distributed Systems
CO725PE	Edge Computing

## IOT CLOUD PROCESSING AND ANALYTICS

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

L	T	P	C
3	0	0	3

**Course Objectives:** Knowledge on IoT networking connectivity protocols and IoT Analytics for the cloud processing.

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

1. Implement the architectural components and protocols for application development.
2. Identify data analytics and data visualization tools as per the problem characteristics.
3. Collect, store and analyze IoT data.

### UNIT - I

IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.

### UNIT - II

IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage.

### UNIT - III

Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.

### UNIT - IV

Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.

### UNIT - V

Strategies to Organize Data for Analytics: Linked Analytical Datasets, Managing data lakes, data retention strategy.

### TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands on Approach", Universities Press, 2015.
2. Kevin, Townsend, Carles, Cufí, Akiba and Robert Davidson, "Getting Started with Bluetooth Low Energy" O'Reilly.

### REFERENCE BOOKS:

1. Madhur Bhargava "IoT Projects with Bluetooth Low Energy, Packt Publishing, August 2017.
2. Robin Heydon," Bluetooth Low Energy: The Developer's Handbook", Pearson, October 2012
3. Kumar Saurabh," Cloud Computing", Wiley India, 1st Edition, 2016.

# IOT SECURITY

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

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

## **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 in 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 Cryptocurrencies," 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" by 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.

## QUANTUM COMPUTING (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

### Course Objectives:

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

### Course Outcomes:

1. Understand basics of quantum computing
2. Understand physical implementation of Qubit
3. Understand Quantum algorithms and their implementation
4. Understand the Impact of Quantum Computing on Cryptography

### UNIT - I

**Introduction to Essential Linear Algebra:** Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrices, Transcendental Numbers.

### UNIT - II

**Basic Physics for Quantum Computing:** The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

**Basic Quantum Theory:** Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

### UNIT - III

**Quantum Architecture:** Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. **Quantum Hardware:** Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

### UNIT - IV

**Quantum Algorithms:** What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

### UNIT - V

**Current Asymmetric Algorithms:** RSA, Diffie-Hellman, Elliptic Curve. **The Impact of Quantum Computing on Cryptography:** Asymmetric Cryptography, Specific Algorithms, Specific Applications.

### TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

### REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

## WIRELESS NETWORKS (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

**Prerequisite:** Wireless Sensor Networks.

### Course Objectives:

1. To study the fundamentals of wireless Ad-Hoc Networks.
2. To study the operation and performance of various Ad Hoc wireless network protocols.
3. To study the architecture and protocols of Wireless sensor networks.

### Course Outcomes:

1. Students will be able to understand the basis of Ad-hoc wireless networks.
2. Students will be able to understand design, operation and the performance of MAC layer protocols of Ad Hoc wireless networks.
3. Students will be able to understand design, operation and the performance of routing protocol of Ad Hoc wireless network.
4. Students will be able to understand design, operation and the performance of transport layer protocol of Ad Hoc wireless networks.
5. Students will be able to understand sensor network Architecture and will be able to distinguish between protocols used in Adhoc wireless networks and wireless sensor networks.

### UNIT - I:

**Wireless LANs and PANs:** Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

**Ad-Hoc Wireless Networks:** Introduction, Issues in Ad Hoc Wireless Networks.

### UNIT - II:

**MAC Protocols:** Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

### UNIT - III:

**Routing Protocols:** Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

### UNIT - IV:

**Transport Layer Protocols:** Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

### UNIT - V:

**Wireless Sensor Networks:** Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

### TEXT BOOKS:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press.

### REFERENCE BOOKS:

1. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh, 1<sup>st</sup> Ed. Pearson Education.
2. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.

## AUGMENTED REALITY AND VIRTUAL REALITY (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

### Course objectives:

1. The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices.
2. To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

### Course Outcomes:

1. Describe how AR systems work and list the applications of AR.
2. Understand and analyze the hardware requirement of AR.
3. Describe how VR systems work and list the applications of VR.
4. Understand the design and implementation of the hardware that enables VR systems to be built.

### UNIT - I:

**Introduction to Augmented Reality:** What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

### UNIT - II:

**AR Devices & Components:** AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene. AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems.

### UNIT - III:

**Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality

### UNIT - IV:

**Representing the Virtual World:** Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Case Study: GHOST (General Haptics Open Software Toolkit) software development toolkit.

### UNIT - V:

**Visual Perception & Rendering:** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information, Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.

### TEXT BOOKS:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494

### REFERENCE BOOKS:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381.
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0.
6. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

## IOT AUTOMATION (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

### Course Objectives:

1. While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.
2. Students acquire the upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space.

### Course Outcomes:

1. Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security
2. Explore IoT technologies, architectures, standards, and regulation
3. Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices
4. Examine technological developments that will likely shape the industrial landscape in the future
5. Understand how to develop and implement own IoT technologies, solutions, and applications
6. At the end of the program, students will be able to understand how to develop and implement their own IoT technologies, solutions, and applications.

### UNIT - I:

**Introduction & Architecture:** What is IIoT and the connected world? the difference between IoT and IIoT, Architecture of IIoT, IIoT node, Challenges of IIoT. Fundamentals of Control System, introductions, components, closed loop & open loop system.

### UNIT - II:

**IIoT Components:** Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11). Digital switch, Electro Mechanical switches.

### UNIT - III:

**Communication Technologies of IIoT:** Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication.

### UNIT - IV:

**Visualization and Data Types of IIoT:** Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud database, Cloud computing, Fog or Edge computing. Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

### UNIT - V:

**Retrieving Data:** Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M). **Control & Supervisory Level of Automation:** Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA). HMI in an automation process, ERP & MES.

### TEXT BOOKS:

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cyber manufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

### REFERENCE BOOK:

1. Jerker Delsing, IoT Automation: Arrowhead Framework, CRC Press.

## AD-HOC & SENSOR NETWORKS (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

### Prerequisites

1. A course on “Computer Networks”.
2. A course on “Mobile Computing”.

### Course Objectives:

- To understand the concepts of sensor networks.
- To understand the MAC and transport protocols for ad hoc networks.
- To understand the security of sensor networks.
- To understand the applications of adhoc and sensor networks.

### Course Outcomes:

- Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc and Wireless Sensor Networks
- Ability to solve the issues in real-time application development based on ASN.
- Ability to conduct further research in the domain of ASN

### UNIT - I

**Introduction to Ad Hoc Networks** - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

**Routing in MANETs** - Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms-**Proactive**: DSDV; **Reactive**: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-**Location Services**-DREAM, Quorum-based; **Forwarding Strategies**: Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

### UNIT - II

**Data Transmission** - Broadcast Storm Problem, **Rebroadcasting Schemes**-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting**: **Tree-based**: AMRIS, MAODV; **Mesh-based**: ODMRP, CAMP; **Hybrid**: AMRoute, MCEDAR.

### UNIT - III

**Geocasting**: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR. TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

### UNIT - IV

**Basics of Wireless, Sensors and Lower Layer Issues**: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

### UNIT - V

**Upper Layer Issues of WSN**: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

### TEXT BOOKS:

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications, March 2006, ISBN – 981–256–681–3.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman).

## EMBEDDED SOFTWARE DESIGN (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Knowledge on fundamental concepts of real time embedded systems and applications.

**Course Outcomes:**

1. Understand requirements for real time software design method for embedded systems.
2. Understand and analyze overview of Real-Time Software Design Method for Embedded Systems.
3. Discussion on State Machines for Real-Time Embedded Systems with examples.
4. Understand the importance of software architectural Patterns for Real-Time Embedded Systems.

### UNIT - I

Introduction - The Challenge, Real-Time Embedded Systems and Applications, Characteristics of Real-Time Embedded Systems, Distributed Real-Time Embedded Systems, Cyber-Physical Systems, Requirements for Real-Time Software Design Method for Embedded Systems, COMET/RTE: A Real-Time Software Design Method for Embedded Systems, Visual Modeling Languages: UML, SysML, and MARTE.

Real-Time Software Design and Architecture Concepts - Object-Oriented Concepts, Information Hiding, Inheritance, Active and Passive Objects, Concurrent Processing, Cooperation between Concurrent Tasks, Information Hiding Applied to Access Synchronization, Runtime Support for Real-Time Concurrent Processing, Task Scheduling, Software Architecture and Components.

### UNIT - II

Overview of Real-Time Software Design Method for Embedded Systems - COMET/RTE System and Software Life Cycle model, Phases in COMET/RTE Life Cycle model.

Structural Modeling for Real-Time Embedded Systems with SysML and UML - Static Modeling Concepts, Categorization of Blocks and Classes using Stereotypes, Structural Modeling of the Problem Domain with SysML, Structural Modeling of the System Context, Hardware/Software Boundary Modeling, Structural Modeling of the Software System Context, Defining Hardware/Software Interfaces, System Deployment Modeling. Use Case Modeling for Real-Time Embedded Systems.

### UNIT - III

State Machines for Real-Time Embedded Systems- State Machines and examples, Events and Guard Conditions, Actions, Hierarchical State Machines, Cooperating State Machines, Inherited State Machines, Developing State Machines from Use Cases.

Object and Class Structuring for Real-Time Embedded Software- Object and Class Structuring Criteria, Object and Class Structuring Categories, Object Behavior and Patterns, Boundary Classes and Objects, Entity Classes and Objects, Control Classes and Objects, Application Logic Classes and Objects.

Dynamic Interaction Modeling for Real-Time Embedded Software - Object Interaction Modeling, Message Sequence Description, Approach for Dynamic Interaction Modeling, Stateless Dynamic Interaction Modeling, State Dependent Dynamic Interaction Modeling. Modeling: Microwave Oven System.

### UNIT - IV

Software Architectures for Real-Time Embedded Systems- Overview of Software Architectures, Multiple Views of a Software Architecture, Transition from Analysis to Design, Separation of Concerns

in Subsystem Design, Subsystem Structuring Criteria, Decisions about Message Communication between Subsystems.

Software Architectural Patterns for Real-Time Embedded Systems - Software Design Patterns, Layered Software Architectural Patterns, Control Patterns for Real-Time Software Architectures, Client/Service Software Architectural Patterns, Basic Software Architectural Communication Patterns, Software Architectural Broker Patterns, Group Message Communication Patterns.

#### **UNIT - V**

Component-Based Software Architectures for Real-Time Embedded Systems- Concepts for Component-Based Software Architectures, Designing Distributed Component-Based Software Architectures, Component Interface Design, Designing Composite Components, Component Structuring Criteria, Design of Service Components, Distribution of Data, Software Deployment, Design of Software Connectors.

Concurrent Real-Time Software Task Design - Concurrent Task Structuring Issues, Categorizing Concurrent Tasks, I/O Task Structuring Criteria, Internal Task Structuring Criteria, Task Priority Criteria, Task Clustering Criteria, Design Restructuring by Using Task Inversion, Developing the Task Architecture, Task Communication and Synchronization, Task Interface and Task Behavior Specifications.

#### **TEXT BOOK:**

1. Real-Time Software Design for Embedded Systems by Hassan Gomaa.

#### **REFERENCE BOOK:**

1. K. Shibu, Introduction to Embedded Systems, McGraw Hill Education.



## 5G & IOT TECHNOLOGIES (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IoT Devices.

**Course Outcomes:**

1. Able to understand the application areas of IoT.
2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. Able to understand building blocks of Internet of Things and characteristics.
4. Understand IoT and M2M.

### UNIT - I

Overview of 5G Broadband Wireless Communications: Evolution of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.

### UNIT - II

The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems, 3GPP standards for 5G, IEEE 802.15.4

### UNIT - III

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

### UNIT - IV

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER

### UNIT - V

IoT Physical Devices and Endpoints - Introduction to Raspberry PI - Interfaces (serial, SPI, I2C). Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

### TEXT BOOKS:

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

### REFERENCE BOOKS:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.
2. Amitabha Ghosh and Rapeepat Ratasuk "Essentials of LTE and LTE-A", Cambridge University Press.
3. Athanasios G. Kanatos, Konstantina S. Nikita, Panagiotis Mathiopoulos, "New Directions in Wireless Communication Systems from Mobile to 5G", CRC Press.
4. Theodore S. Rappaport, Robert W. Heath, Robert C. Danials, James N. Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications.

## COGNITIVE COMPUTING (Professional Elective – V)

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

L	T	P	C
3	0	0	3

**Prerequisites:** Probability theory

**Course Objectives:**

1. To provide an understanding of the central challenges in realizing aspects of human cognition.
2. To provide a basic exposition to the goals and methods of human cognition.
3. To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
4. To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

**Course Outcomes:**

1. Understand what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and develop the business implications of cognitive computing.

### UNIT - I

**Introduction to Cognitive Science:** Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach to cognition.

### UNIT - II

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics.

### UNIT - III

Cognitive Modeling: modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making.

### UNIT - IV

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.

### UNIT - V

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems.

**TEXT BOOKS:**

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), Cambridge University Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, Cambridge University Press.

**REFERENCE BOOKS:**

1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles Cognitive Computing and Big Data Analytics, Wiley
2. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, Cognitive Computing: Theory and Applications: Volume 35 (Handbook of Statistics), North Holland.

## DISTRIBUTED SYSTEMS (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

### Pre-requisites

- A course on “Operating Systems”.
- A course on “Computer Organization & Architecture”.

### Course Objectives:

1. This course provides an insight into Distributed systems.
2. Topics include- Peer to Peer Systems, Transactions and Concurrency control, Security and Distributed shared memory

### Course Outcomes:

1. Ability to understand Transactions and Concurrency control.
2. Ability to understand Security issues.
3. Understanding Distributed shared memory.
4. Ability to design distributed systems for basic level applications.

### UNIT - I

**Characterization of Distributed Systems**-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models -Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication, Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI

### UNIT - II

**Operating System Support**- Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture.

### UNIT - III

**Peer to Peer Systems**-Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore. Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement-Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

### UNIT - IV

**Transactions and Concurrency Control**-Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering. Distributed Transactions-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

### UNIT - V

**Replication**-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data. Distributed shared memory, Design and Implementation issues, Consistency models.

### TEXT BOOKS:

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2. Distributed Systems, S. Ghosh, Chapman & Hall/CRC, Taylor & Francis Group, 2010.

### REFERENCE BOOKS:

1. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
2. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and Mukesh Singhal, Cambridge, rp 2010.

## EDGE COMPUTING (Professional Elective – V)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Knowledge on how 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. Security and privacy issues related to the area of edge computing and IoT.
3. Understand the RaspberryPi architecture and its components.
4. Work with RaspberryPi components and evaluate its performance.

### UNIT - I

IoT and Edge Computing Definition and Use Cases: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

### UNIT - II

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

### UNIT - III

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

### UNIT - IV

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

### UNIT - V

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

### TEXT BOOKS:

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

### REFERENCE BOOKS:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE.

## **IOT SECURITY & CLOUD COMPUTING LAB**

**B.Tech. IV Year I 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>

**Prerequisite of course:** Fundamentals of computer network, wireless sensor network, communication & internet technology, web technology, information security.

**Course Objective:**

1. To learn about how to integrate the security aspect into their IoT design taking into consideration all the threats that can possibly happen.
2. To develop web applications in cloud.
3. To learn the design and development process involved in creating a cloud-based application.

**Course Outcomes:**

1. Understand the vision of IoT from a global context for secure and smart city.
2. Use of Devices, Gateways and Data Management in IoT. Its security building state of the art architecture in IoT, with Security deployment.
3. Configure various virtualization tools such as Virtual Box, VMware workstation.
4. Design and deploy a web application in a PaaS environment.

**LIST OF EXPERIMENTS: (IOT SECURITY LAB)**

1. Introduction to Open Source Hardware & its Application.
  - a. Arduino
  - b. Raspberry Pi
2. Exploring various types of Sensors
3. Develop Applications using Arduino and Raspberry Pi
4. Exploring Open Source tools for Security and Privacy issues in IoT.
5. Implement Eclipse IoT Project with Emphasis on Security related issues.
6. Explore the working of AWS IoT Device Defender.

**REFERENCE BOOKS:**

1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

**SUPPLEMENTARY RESOURCES:**

1. <https://github.com/connectIoT/iottoolkit>
2. <https://www.arduino.cc/>
3. <http://www.zettajs.org/>
4. Contiki (Open source IoT operating system)
5. Arduino (open source IoT project)
6. IoT Toolkit (smart object API gateway service reference implementation)
7. Zetta (Based on Node.js, Zetta can create IoT servers that link to various devices and sensors)

**LIST OF EXPERIMENTS: (CLOUD COMPUTING LAB)**

1. Install Virtualbox/Vmware Workstation with different flavors of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6. Install Hadoop single node cluster and run simple applications like word count.

**E-RESOURCES:**

1. <https://www.iitk.ac.in/nt/faq/vbox.htm>
2. <https://www.google.com/urlsa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjqrNG0za73AhXZt1YBHZ21DWEQFnoECAMQAQ&url=http%3A%2F%2Fwww.cs.columbia.edu%2F~sedwards%2Fclasses%2F2015%2F1102-fall%2Flinuxvm.pdf&usg=AOvVaw3xZPuF5xVgk-AQnBRsTtHz>
3. <https://www.cloudsimtutorials.online/cloudsim/>
4. <https://edwardsamuel.wordpress.com/2014/10/25/tutorial-creating-openstack-instance-in-trystack/>
5. <https://www.edureka.co/blog/install-hadoop-single-node-hadoop-cluster>

# Syllabus

## IV Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	SM801MS	Organizational Behaviour	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	CO804PC	Project Stage – II	0	0	14	7
		<b>Total Credits</b>	<b>9</b>	<b>0</b>	<b>14</b>	<b>16</b>

### Professional Elective – VI

CO811PE	Industrial IoT
CO812PE	Fog Computing
CO813PE	Smart Sensor Technologies
CO814PE	Digital Forensics
CO815PE	Blockchain Technology

## ORGANIZATIONAL BEHAVIOUR

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

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

**Course Objectives:** The objective of the course is to provide the students with the conceptual framework and the theories underlying Organizational Behavior.

**Course Outcomes:**

1. Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
2. Analyze the complexities associated with management of the group behavior in the organization.
3. Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

**UNIT - I:**

Introduction to OB - Definition, Nature and Scope – Environmental and organizational context – Impact of IT, globalization, Diversity, Ethics, culture, reward systems and organizational design on Organizational Behaviour. Cognitive Processes-I: Perception and Attribution: Nature and importance of Perception – Perceptual selectivity and organization – Social perception – Attribution Theories – Locus of control –Attribution Errors –Impression Management.

**UNIT- II:**

Cognitive Processes-II: Personality and Attitudes – Personality as a continuum – Meaning of personality - Johari Window and Transactional Analysis - Nature and Dimension of Attitudes – Job satisfaction and organizational commitment-Motivational needs and processes- Work-Motivation Approaches Theories of Motivation- Motivation across cultures - Positive organizational behaviour: Optimism – Emotional intelligence – Self-Efficacy.

**UNIT - III:**

Dynamics of OB-I: Communication – types – interactive communication in organizations – barriers to communication and strategies to improve the follow of communication - Decision Making: Participative decision-making techniques – creativity and group decision making. Dynamics of OB –II Stress and Conflict: Meaning and types of stress –Meaning and types of conflict - Effect of stress and intra-individual conflict - strategies to cope with stress and conflict.

**UNIT - IV:**

Dynamics of OB –III Power and Politics: Meaning and types of power – empowerment - Groups Vs. Teams – Nature of groups – dynamics of informal groups – dysfunctions of groups and teams – teams in modern work place.

**UNIT - V:**

Leading High performance: Job design and Goal setting for High performance- Quality of Work Life- Socio technical Design and High-performance work practices - Behavioural performance management: reinforcement and punishment as principles of Learning –Process of Behavioural modification - Leadership theories - Styles, Activities and skills of Great leaders.

**REFERENCE BOOKS:**

1. Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2009
2. McShane: Organizational Behaviour, 3e, TMH, 2008
3. Nelson: Organizational Behaviour, 3/e, Thomson, 2008.



4. Newstrom W. John & Davis Keith, Organisational Behaviour-- Human Behaviour at Work, 12/e, TMH, New Delhi, 2009.
5. Pierce and Gardner: Management and Organisational Behaviour: An Integrated perspective, Thomson, 2009.
6. Robbins, P. Stephen, Timothy A. Judge: Organisational Behaviour, 12/e, PHI/Pearson, New Delhi, 2009.
7. Pareek Udai: Behavioural Process at Work: Oxford & IBH, New Delhi, 2009.
8. Schermerhorn: Organizational Behaviour 9/e, Wiley, 2008.
9. Hitt: Organizational Behaviour, Wiley, 2008
10. Aswathappa: Organisational Behaviour, 7/e, Himalaya, 2009
11. Mullins: Management and Organisational Behaviour, Pearson, 2008.
12. McShane, Glinow: Organisational Behaviour--Essentials, TMH, 2009.
13. Ivancevich: Organisational Behaviour and Management, 7/e, TMH, 2008.

## INDUSTRIAL IOT (Professional Elective – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** To provide students with a good depth of knowledge of Designing Industrial IOT Systems for various applications.

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

1. Identify the Key opportunities and benefits in Industrial IoT.
2. Apply virtual network to demonstrate the use of Cloud in Industrial IoT.
3. Analyze industrial IoT Three tier topology and data management system.
4. Summarize Legacy Industrial and Modern Communication Protocols.
5. Describe Middleware Architecture, LoRaWAN- and Augmented reality.

### UNIT - I:

**Introduction to Industrial Internet and Use-Cases:** Industrial Internet- Key IIoT Technologies- Innovation and the IIoT -Key Opportunities and Benefits -The Digital and Human Workforce - Logistics and the Industrial Internet- IOT Innovations in Retail.

### UNIT – II:

**The Technical and Business Innovators of The Industrial Internet:** Cyber Physical Systems (CPS) – IP Mobility – Network Virtualization - SDN (Software Defined Networks)- The Cloud and Fog – Role of Big Data in IIOT - Role of Machine learning and AI in IIOT.

### UNIT - III:

**IIOT Reference Architecture:** Industrial Internet Architecture Framework (IIAF) -Industrial Internet Viewpoints -. Architectural Topology: The Three-Tier Topology- Key System Characteristics- Data Management- Advanced data analytics.

### UNIT - IV:

**Protocols for Industrial Internet Systems:** Legacy Industrial Protocols - Modern Communication Protocols-Proximity Network Communication Protocols- Wireless Communication Technologies- Gateways: industrial gateways - CoAP (Constrained Application Protocol) - NFC.

### UNIT - V:

**Middleware Software Patterns and IIOT Platforms:** Publish/Subscribe Pattern: MQTT, XMPP, AMQP, DDS- Middleware Architecture- SigFox- LoRaWAN Augmented reality- Real-World Smart Factories

**Application of IIOT:** Case study: Health monitoring, lot smart city, Smart irrigation, Robot surveillance.

### TEXT BOOKS:

1. Gilchrist, Alasdair, “Industry 4.0 The Industrial Internet of Things”, Apress, 2017.
2. Zaigham Mahmood, “The Internet of Things in the Industrial Sector: Security and Device connectivity, smart environments and Industry 4.0 (Springer), 2019.

### REFERENCE BOOKS

1. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat “Industrial Internet of Things: Cyber manufacturing Systems” (Springer), 2017.
2. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)
3. Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014
4. Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
5. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1<sup>st</sup> Edition, Apress Publications, 2013 Cuno Pfister, Getting Started with the Internet of Things, O’ Reilly Media, 2011, ISBN: 978-1-4493-9357-1

### BOOK:

1. <https://www.apress.com/gp/book/9781484220467>

## FOG COMPUTING (Professional Elective – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** This course gives an overview of Fog Computing and its architecture, challenges and applications in different contexts.

**Course Outcomes:**

1. Become familiar with the concepts of Fog.
2. Understand the architecture and its components and working of components and its performance.
3. Explore Fog on security, multimedia and smart data.
4. Model the fog computing scenario.

### UNIT - I

**Introduction to Fog Computing:** Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.

### UNIT - II

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, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds, IoT Integration, Security Management for Edge Cloud Architectures.

Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.

### UNIT - III

Fog computing requirements when applied to IoT: Scalability, Interoperability, Fog-IoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, Cloud Infrastructures: Methodology, Integrated C2F2T Literature by Modeling Technique by Use-Case Scenarios, Integrated C2F2T Literature by Metrics.

### UNIT - IV

Exploiting Fog Computing in Health Monitoring: An Architecture of a Health Monitoring IoT Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction, Data-Driven Intelligent Transportation Systems, Fog Computing for Smart Transportation Applications Case Study: Intelligent Traffic Lights Management (ITLM) System.

### UNIT - V

Software Defined Networking and application in Fog Computing: Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing, Machine Learning based security in Fog Computing, Cyber- Physical Energy Systems over Fog Computing.

**TEXT BOOKS:**

1. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.
2. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by Rajkumar Buyya and Satish Narayana Srirama.
3. Amir Vahid Dastjerdi and Rajkumar Buyya, —Fog Computing: Helping the Internet of Things Realize its Potential, University of Melbourne.

**REFERENCE BOOKS:**

1. Flavio Bonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, —Fog Computing and Its Role in the Internet of Things, MCC' 12, August 17, 2012, Helsinki, Finland. Copyright 2012 ACM 978-1-4503-1519-7/12/08... \$15.00.
2. Shanhe Yi, Cheng Li, Qun Li, —A Survey of Fog Computing: Concepts, Applications and Issues, Mobidata' 15, ACM 978-1-4503-3524-9/15/06, DOI: 10.1145/2757384.2757397, June 21, 2015, Hangzhou, China.
3. Amir M. Rahmani, Pasi Liljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet of Things - Intelligence at the Edgel, Springer International Publishing, 2018.
4. Ivan Stojmenovic, Sheng Wen, "The Fog Computing Paradigm: Scenarios and Security Issues", Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014.

## SMART SENSOR TECHNOLOGIES (Professional Elective – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

**Course Objectives:** Obtain knowledge on sensors, sensors with microcontrollers and their applications.

**Course Outcomes:**

1. Analyze the sensors available in IoT based on application requirements and the Sensing methods.
2. Create a Real-time application by choosing appropriate sensors for temperature monitoring.
3. Interfacing different types of Sensors with MCU.
4. Infer Wireless Sensing, RF Sensing and RF MEMS.
5. Design a real-time application for landslide monitoring and hazard mitigation.

**UNIT - I:**

**Basics of Sensors:** Introduction- Sensor Vs Transducer, Nature of Sensors, Sensor Output Characteristics, Sensing Technologies, Digital Output Sensors.

**UNIT - II:**

**Application Specific Sensors:** Occupancy and motion detectors: ultrasonic – microwave – capacitive detectors- optical presence sensor, Light Detectors: Photo diodes – phototransistor – photoresistor- CCD and CMOS image sensors, Temperature Sensors: thermos-resistive sensors – thermoelectric contact sensor.

**UNIT - III:**

**Sensor with Microcontroller:** Introduction, Amplification and Signal Conditioning, Integrated Signal Conditioning, Digital Conversion, MCU Control, MCUs for Sensor Interface, Techniques and Systems Considerations, Sensor Integration.

**UNIT - IV:**

**Wireless Sensing:** Wireless Data and Communications, Wireless Sensing Networks, Industrial Wireless Sensing Networks, RF Sensing, Telemetry, RF MEMS, Complete System Consideration.

**UNIT - V:**

**Smart Applications and System Requirements:** Automotive Applications, Industrial (Robotic) Applications, Consumer Applications, Future Sensor Plus Semiconductor Capabilities, Future System Requirements.

**TEXT BOOKS:**

1. Frank, Randy, "Understanding smart sensors", Artech House integrated microsystems series, 3rd Edition, 2013.
2. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", 5th Edition, Springer, 2016.

**REFERENCE BOOKS:**

1. Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, "Internet of Things: Technologies and Applications for a New Age of Intelligence", Academic Press, 16-Nov- 2018.
2. Henry Leung, Subhas Chandra Mukhopadhyay, "Intelligent Environmental Sensing", Springer, 22-Jan-2015.

**BOOKS**

1. <https://www.sciencedirect.com/topics/engineering/smart-sensors>
2. <https://www.azosensors.com/article.aspx?ArticleID=1289>

## DIGITAL FORENSICS (Professional Elective – VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

**Pre-Requisites:** Cybercrime and Information Warfare, Computer Networks.

### Course Objectives:

1. provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

**Course Outcomes:** On completion of the course the student should be able to

1. Understand relevant legislation and codes of ethics.
2. Computer forensics and digital detective and various processes, policies and procedures.
3. E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Email and web forensics and network forensics.

### UNIT - I

**Digital Forensics Science:** Forensics science, computer forensics, and digital forensics.

**Computer Crime:** Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

### UNIT - II

**Cyber Crime Scene Analysis:** Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

### UNIT - III

**Evidence Management & Presentation:** Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

### UNIT - IV

**Computer Forensics:** Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case.

**Network Forensics:** open-source security tools for network forensic analysis, requirements for preservation of network data.

### UNIT - V

**Mobile Forensics:** mobile forensics techniques, mobile forensics tools.

**Legal Aspects of Digital Forensics:** IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

### TEXT BOOK:

1. John Sammons, The Basics of Digital Forensics, Elsevier John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.

### REFERENCE BOOKS:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

## BLOCKCHAIN TECHNOLOGY (Professional Elective – VI)

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

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### **Prerequisites:**

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

**Course Objectives:** 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, ISBN: 1393889158.