Scheme & Syllabus of UG

Engineering Program

Bachelor of Technology

(B.Tech.)

Electronics & Communication Engineering

2022-23

IPS ACADEMY

INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(A UGC Autonomous Institute affiliated to RGPV)

IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curriculum

Department of Electronics & Communication Engineering

Bachelor of Technology (B.Tech.) VI Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted – Theory – End Sem.	Theory – Mid Sem. Exam.	Theory – Quiz/Assignment	Practical – End Sem	Practical – Term work Lab Work & Sessional	Total Marks	Contact Hours per week – L	T	P	Total Credits
1.	PCC- EC15	PCC	Embedded System and Robotics	60	25	15	-	-	100	2	-	-	2
2.	PCC- EC16	PCC	Antenna and Wave Propagation	60	25	15	-	-	100	2	1	-	3
3.	PCC- EC17	PCC	Internet of Things and it's Applications	60	25	15	-	-	100	3	-	-	3
4.	HSMC- HS06	HSMC	Humanities and Social Sciences Open Courses - II	60	25	15	-	-	100	2	-	-	2
5.	PEC- EC02	PEC	Professional Elective Course-II	60	25	15	-	-	100	3	-	-	3
6.	IOC- EC01	IOC	Interdisciplinary Open Course-I	60	25	15	-	-	100	3	-	-	3
7.	PCC- EC15(P)	PCC	Embedded System and Robotics	-	-	-	60	40	100	-	-	2	1
8.	PCC- EC16(P)	PCC	Antenna and Wave Propagation	-	-	-	60	40	100	-	-	2	1
9.	PCC- EC18(P)	PCC	Android App. Development	-	-	-	60	40	100	-	-	2	1
10.	SBC- EC05(P)	SBC	Electronics Workshop – IV (Prototype Development)	-	-	-	60	40	100	-	-	4	2
11.	LLC03	LLC	Liberal Learning Course -III	-	-	-	60	40	100	-	-	2	1
12.	MLC04	MLC	Intellectual Property Rights	-	-	-	60	40	-	1	-	-	Audit
13.	PROJ-EC01	PROJ	Minor Project	-	-	-	60	40	100	-	-	4	2
14.	PROJ-EC02	PROJ	To be completed anytime during sixth semester with minimum 90 hrs. Its evaluation/credit to be added in seventh semester.										
			Total	360	150	90	420	280	1200	16	1	16	24

Humanities and Social Sciences Open Courses (HSMC) – I, HS06 (Any One Course)	Professional Elective Course (PEC) -II, EC02 (Any One Course)	Interdisciplinary Open Course (IOC) -I, EC01 (Any One Course)
(a) Industrial Psychology	(a) Machine Learning and Artificial Intelligence	(a) Data Structure (CS03)
(b) Engineering Psychology	(b) Information Theory and Coding	(b) 3D Printing and Application (ME02)
(c) Engineering Economics	(c) Wireless Sensor Network	(c) Industrial Electronics (EX04)
(d) Finance for Engineers		(d) Non-Conventional Energy Sources (EX03)
(e) Stress Management		(e) Data Base Management System (CS08)
(f) Business Communication		

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

PCC- EC15	**Embedded Systems & Robotics**	**2L: 0T: 0P (02 hrs.)**	**Credits: 02**

Prerequisite: Fundamentals of microprocessors, microcontrollers, programming and interfacing.

Course Objective: The objective of this course is that students can learn fundamental concepts of Robotics and advanced microcontrollers like PIC, AVR and ARM.

MODULE I **(7 hrs.)**
Introduction & Fundamentals of Robotics: Introduction and classification of robots. Robotics Sensors: Position Sensors, robot calibration by optical encoder, proximity sensors, Ultrasonic & IR sensors, Force and Torque sensors, Touch and Slip sensors, Temperature and Humidity sensors, Light and Sound sensors, Pressure and Gas sensors, Acceleration sensors. Sensor Communication Protocols: I2C, SPI, CAN, USART.

MODULE II **(7 hrs.)**
Robotics Actuators: Relays and their types, Specifications and characteristics of Stepper motors, AC motors, DC motors and servo motors. Power driving circuit and Power management for actuators, Torque and speed relationship of motors, Motor speed controlling techniques.

MODULE III **(8 hrs.)**
Classification of Robots, Basics of matrices, Rotations & transformations, Introduction to D-H parameters and its physical significance, Orientation of gripper, Trajectory planning.

MODULE IV **(9 hrs.)**
8-bit PIC (1PICF877) Microcontroller Architecture, memory technologies, timing circuit, power- up& reset, parallel ports, ADC, interrupts, PWM, counters & timers, Instruction set, Memory mapping, Peripherals, Software development environment, programming tools.AVR (ATMEGA328) Features, Architecture, Instruction Set, Peripherals, Programming Interfaces, Programming in embedded C.

MODULE V **(9 hrs.)**
Interfacing of PIC and AVR: LED, LCD, 7 segment display, motor driver, ADC, DAC, memory, timers, delays, keyboard, GSM. Introduction to ARM microcontroller.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcome:

Students should be able to:
1. Understand the fundamentals of Robotics and explain working of sensors and their types.
2. Define different types of Actuators used in Robotics and illustrate concepts about their working.
3. Classify types of Robots in different applications and define various concepts related to their movements.
4. Understand PIC & AVR microcontroller architectures and programming in Robotics and embedded systems.
5. Design automated embedded systems by interfacing different Modules with advance controllers. Illustrate overview of ARM microcontroller architectures.

Text/ Reference Books:

1. Muhammad Ali Mazidi, "The avr microcontroller and embedded system using assembly and c", 3rd edition, Pearson, 2010.
2. Rajesh Singh, "Embedded System Based on Atmega Microcontroller: Simulation, Interfacing & Projects", Alpha Science, 2016.
3. Morton John, "PIC Microcontroller: Your Personal Introductory Course", 3rd edition, English, Paperback, 2005.
4. Phillip John McKerrow, "Introduction to Robotics", 1st edition, Paperback.
5. Dr. Kevin Klein, "Robotics: Discover the Robotic Innovations of the Future - An Introductory Guide to Robotics", 1st edition, Paperback, 2016.
6. Muhammad Ali Mazidi, "PIC Microcontroller and Embedded Systems: Using assembly and C for PIC 18", 1st edition, Pearson, 2008.

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Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Electronics & Communication Engineering Department

PCC- EC15(P)	**Embedded Systems & Robotics**	**0L: 0T: 2P (02 hrs.)**	**Credits: 01**

List of Experiments:

1. Write a program in embedded C to read temperature from LM35 and display on LCD.
2. Write a program in embedded C to read data from keypad & display on LCD.
3. Write a program in embedded C to control speed of motor.
4. Write a program in embedded C to control servo motor.
5. Write a program in embedded C to control IR sensor.
6. Code a sequence in Robotic software to pick and place an object by Robotic hand.
7. Code a sequence in Robotic software to control hands of a humanoid Robot.
8. Code a sequence in Robotic software to control legs of a humanoid Robot.
9. Code a sequence in Robotic software to make a Robot walk.
10. Code a sequence in Robotic software to make a Robot dance.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcome:

Students should be able to:
1. Understand the fundamentals of Robotics and explain working of sensors and their types.
2. Define different types of Actuators used in Robotics and illustrate concepts about their working.
3. Classify types of Robots in different applications and define various concepts related to their movements.
4. Understand PIC & AVR microcontroller architectures and programming in Robotics and embedded systems.
5. Design automated embedded systems by interfacing different Modules with advance controllers. Illustrate overview of ARM microcontroller architectures.

Text/ Reference Books:

1. Muhammad Ali Mazidi, "The avr microcontroller and embedded system using assembly and c", 3rd edition, Pearson, 2010.
2. Rajesh Singh, "Embedded System Based on Atmega Microcontroller: Simulation, Interfacing & Projects", Alpha Science, 2016.
3. Morton John, "PIC Microcontroller: Your Personal Introductory Course", 3rd edition, English, Paperback, 2005.
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5. Dr. Kevin Klein, "Robotics: Discover the Robotic Innovations of the Future - An Introductory Guide to Robotics", 1st edition, Paperback, 2016.
6. Muhammad Ali Mazidi, "PIC Microcontroller and Embedded Systems: Using assembly and C for PIC 18", 1st edition, Pearson, 2008.

PCC- EC16	**Antenna and wave propagation**	**2L: 1T: 0P (03 hrs.)**	**Credits: 03**

Prerequisite: Engineering Mathematics, Electromagnetic theory.

Course Objective: The objective of this subject is that the student must be familiar with the basic concept behind the radiation of energy by elementary antenna and designing of different kinds of antenna and antenna array to get desired radiation pattern.

THEORY:

MODULE I **(10 hrs.)**
Antenna terminologies and fundamentals: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity, Friis Transmission equation, Antenna Temperature. Solution of Maxwell's equations: Radiation Integrals: Vector potentials **A, J, F, M**, Electric and magnetic fields electric and magnetic current sources, solution of inhomogeneous vector potential wave equation, far field radiation.

MODULE II **(6 hrs.)**
Linear wire antenna: Current distribution on linear antennas, Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects. Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.

MODULE III **(8 hrs.)**
Linear antenna array: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, non uniform amplitude, array factor, binomial and dolph chebyshev array.

MODULE IV **(6 hrs.)**
Aperture and slot antenna: Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna, Reflector antenna, Aperture blockage, Feeding structures, Slot antennas.

MODULE V **(10 hrs.)**
Special antennas: lens antenna, turnstile antenna, V-antenna, rhombic antenna, beverage antenna Structural details, dimensions, radiation pattern, specifications, features and applications of following antennas: log periodic antenna, helical antenna, biconical antenna, folded dipole antenna, Yagi-Uda antenna. Resonant and travelling wave antennas for different wave lengths. Designing microstrip antenna.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Understand the basic terminologies and parameters related to antenna and also analyze Maxwell's equations in context of waves radiated by antenna.

2. Analyze the radiation pattern of an infinitesimal current element, half wave dipole etc. and derived the equation of E and H component of EM wave radiated by such antennas.
3. Analyze uniform antenna array and learn to design non uniform antenna array.
4. Understand analytical methods for analysis of aperture antenna and their application to various specific antennas.
5. Analyze some special antennas, their specifications along with their applications and design Micro strip patch antenna.

Text/Reference Books:

1. A. Balanis, "Antenna theory- analysis and design", 2nd Edition, Wileys, 2005.
2. J. D. Krauss, "Antennas", 4th Edition, McGraw Hill, 2010.
3. A. R. Harish, M. Sachhidanand, "Antennas and wave propagation" Oxford university press, 2010.
4. Chatterji, Rajeshwari, "Antenna theory and practice", New edge publication, 2006.
5. K. D. Prasad, "Antenna and wave propagation", Satyaprakashan, 2003.
6. G. S. N. Raju, "Antennas and wave propagation", Pearson education, 2008.
7. B. L. Smith, "Modern antennas", Springer India Pvt. Ltd., 2nd edition, 2008.

PEC- EC02 (A)	**Machine Learning and Artificial Intelligence**	**3L: 0T: 0P (03 hrs.)**	**Credits: 03**

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To learn understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc. and strong foundation of fundamental concepts in Artificial Intelligence.

MODULE I **(8 hrs.)**
Introduction to machine learning, scope and limitations, regression, probability, statistics and linear algebra for machine learning, convex optimization, data visualization, hypothesis function and testing, data distributions, data preprocessing, data augmentation, normalizing data sets, machine learning models, supervised and unsupervised learning.

MODULEII **(8 hrs.)**
Linearity vs non linearity, activation functions like sigmoid, ReLU, etc., weights and bias, loss function, gradient descent, multilayer network, back propagation, weight initialization, training, testing, unstable gradient problem, auto encoders, batch normalization, dropout, L1 and L2 regularization, momentum, tuning hyper parameters.

MODULE III **(8 hrs.)**
Convolutional neural network, flattening, sub sampling, padding, stride, convolution layer, Pooling layer, loss layer, dance layer 1x1 convolution, inception network, input channels, Transfer learning, one shot learning, dimension reductions, implementation of CNN like tensor flow, keras etc

MODULE IV **(8 hrs.)**
General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches depth first breadth first search. Hill climbing, branch and bound technique, best first search & A* algorithm, AND / OR graphs, problem eduction & AO* algorithm, constraint satisfaction problems.

MODULE V **(8 hrs.)**
First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency. Parsing techniques, context free grammar, recursive transitions nets (RNT), augmented transition nets (ATN), case and logic grammars, semantic analysis.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. Apply knowledge of computing and mathematics to machine learning problems, model and algorithms.
2. Analyze a problem and identify the computing requirements appropriate for its solution.
3. Design, implement, and evaluate an algorithm to meet desired needs.

4. Learning of general issues and overview of AI.
5. Design of different problem solving, search and control strategies in AI.

Text/ Reference Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag New York Inc., 2nd Edition, 2011.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, First edition, 2017.
3. Elaine Rich and Kevin Knight, "Artifical Intelligence" - Tata McGraw Hill.
4. Dan W. Patterson "Introduction to Artifical Intelligence and Expert Systems", Prentice India
5. Aurelien Geon, "Hands-On Machine Learning with Scikit-Learn and Tensor flow: Concepts, Tools, and Techniques to Build Intelligent Systems", hroff/O'Reilly; First edition (2017).
6. Francois Chollet, "Deep Learning with Python", Manning Publications, 1 edition (10 January 2018).
7. Russell, S. and Norvig, N. "Artificial Intelligence: A Modern Approach", Prentice HallSeries in Artificial Intelligence. 2003.
8. Clocksin&C.S.Melish "Programming in PROLOG", Narosa Publishing House.
9. M. Sasikumar, S. Ramani, "Rule based Expert System", Narosa Publishing House

PEC- EC02(B)	**Information Theory and Coding**	**3L: 0T: 0P (3hrs.)**	**Credits: 03**

Prerequisite: Mathematics, Digital communication and its applications, Probability Theory

Course objective: To make the students understand the fundamental concepts of information theory and coding, that provides quantitative measures of information and allows us to analyze and characterize the fundamental limits of communication systems.

THEORY:

MODULE 1 **(6 hrs.)**

Information Theory: Introduction to uncertainty, entropy and its properties, entropy of binary memoryless source and its extension to discrete memory-less source, Measure of information, Information content of message, Average Information content of symbols. Self-information, Mutual information and its properties.

MODULE 2 **(8 hrs.)**

Coding theorem: Source coding theorem, prefix coding, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm, Huffman coding, Extended Huffman coding, Arithmetic Coding, Lempel-Ziv Coding, Run Length Encoding.

MODULE 3 **(8 hrs.)**

Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, Discrete memory less channels, Binary symmetric channel and its channel capacity, channel coding theorem, and its application to Binary Erasure Channel, Shannon's theorem on channel capacity, capacity of channel of infinite bandwidth, Continuous Channels.

MODULE 4 **(12 hrs.)**

Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Probability of undetected error for linear block code in BSC, hamming Codes and their applications, Cyclic Codes: Cyclic codes and its basic properties, Encoding using an (n-k) Bit Shift register, Generator & parity check matrix of cyclic codes, encoding & decoding circuits, syndrome computation, error detection and correction.

MODULE 5 **(6 hrs.)**

Introduction to BCH codes, its encoding & decoding, error location & correction. Convolution Codes: Introduction to convolution codes, its construction, Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, Viterbi algorithm: Introduction of theorem for maximum likelihood decoding.

Assessment: Mid-term test, Assignment, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Acquire the knowledge in measurement of information and errors.
2. Know the application of coding theorem for efficient utilization of communication resources.
3. Understand the utilization of various communication channels for communication system.
4. Design the block and cyclic codes for error correction and detection in communication systems
5. Know the significance of source and channel codes in various applications.

Text/Reference Books:

1. Simon Haykin, "Communication Systems", 4th edition, John Wiley and Sons, 2001.
2. Peterson W., "Error Correcting Codes", 2th edition, MIT Press, 1991.
3. John G. Proakis, "Digital Communication", 5th edition, TMH, 2016.
4. Ranjan Bose, "Information Theory, Coding and Cryptography", 2th edition, TMH, 2008.
5. Singh and Sapre, "Communication Systems", 2nd edition, TMH, 2007
6. A. Thomas, Thomas M. Cover, "Elements of information theory", 2nd edition Wiley-Interscience, 2006.
7. S. Gravano, "Introduction to Error Control Codes" OUP Oxford, 2001.

PEC- EC02(C)	**Wireless Sensor Network**	**3L: 0T: 0P (3 hrs.)**	**Credits: 03**

Prerequisite: Digital Signal Processing, Mobile Communication

Course Objective: Though this course student will learn in deep about Architecture and different MAC/ routing protocol and OS used in the field of WSN.

THEORY:

MODULE 1 **(8 hrs.)**
Introduction to wireless sensor Networks –Characteristic requirements for WSN Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes– Imote, IRIS, Mica Mote, EYES nodes, BT nodes, Telos B, Sunspot - Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

MODULE 2 **(8 hrs.)**
Medium Access Control Protocols: Fundamentals of MAC protocols **-** Low duty cycle protocols and wakeup concepts - Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

MODULE 3 **(9 hrs.)**
Routing And Data Gathering Protocols- Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping –Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS –Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN,APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

MODULE 4 **(8 hrs.)**
Embedded Operating Systems: Introduction-Operating System Design Issues - Examples of Operating Systems Tiny OS, Magnet OS, MANTIS. Introduction to Tiny OS – Nes C – Interfaces and Modules- Configurations and

MODULE 5 **(7 hrs.)**
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

Assessment: Mid-term tests, Tutorials, Quizzes,

Course outcome:

Students earning credits will develop ability to:

1. Understand the basis of Sensors node and their characteristic.
2. Understand the design issues of various MAC protocols
3. Develop the concepts of design issues of different routing protocols of WSN
4. Understand different embedded operating system used in WSN
5. To explore and implement solutions to real world problems using sensor devices, enumerating its principles of working.

Text/ Reference Book:

1. Holger Karl and Andreas Willey, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.
2. Zhao and L. Guibas, "Wireless Sensor Networks", Morgan Kaufmann, San Francisco, 2004
3. C. S. Raghavendra, K.M.Shivalingam and T.Znati, "Wireless Sensor Networks", Springer, New York, 2004
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley & Sons, 2004.
5. Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley Inter Science, 2007.

PCC- EC16 (P)	Antenna and wave propagation	0L: 0T: 2P (02 hrs.)	Credits: 01

List of Experiments:

1. To perform & plot the radiation pattern of omni-directional antenna using AMS.
2. To study the radiation pattern of directional antenna.
3. To perform & plot the radiation pattern of dipole antenna using AMS.
4. To perform & plot the radiation pattern of folded dipole antenna using AMS.
5. To perform & plot the radiation pattern of monopole antenna using AMS.
6. To perform & plot the radiation pattern of rectangular loop antenna using AMS.
7. To perform & plot the radiation pattern of helical antenna using AMS.
8. To perform & plot the radiation pattern of collinear array antenna using AMS.
9. To perform & plot the radiation pattern of E- horn antenna using AMS.
10. To perform & plot the radiation pattern of patch antenna using AMS.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Understand the basic terminologies and parameters related to antenna and also analyze Maxwell's equations in context of waves radiated by antenna.
2. Analyze the radiation pattern of an infinitesimal current element, half wave dipole etc. and derived the equation of E and H component of EM wave radiated by such antennas.
3. Analyze uniform antenna array and learn to design non uniform antenna array.
4. Understand analytical methods for analysis of aperture antenna and their application to various specific antennas.
5. Analyze some special antennas, their specifications along with their applications and design Micro strip patch antenna.

Text/Reference Books:

1. A. Balanis, "Antenna theory- analysis and design", 2nd Edition, Wileys, 2005.
2. J. D. Krauss, "Antennas", 4th Edition, McGraw Hill, 2010.
3. A. R. Harish, M. Sachhidanand, "Antennas and wave propagation" Oxford university press, 2010.
4. Chatterji, Rajeshwari, "Antenna theory and practice", New edge publication, 2006.
5. K. D. Prasad, "Antenna and wave propagation", Satyaprakashan, 2003.
6. G. S. N. Raju, "Antennas and wave propagation", Pearson education, 2008.
7. B. L. Smith, "Modern antennas", Springer India Pvt. Ltd., 2nd edition, 2008.

PCC- EC17	**Internet of Things and its Applications**	**3L: 0T: 0P (03 hrs.)**	**Credits: 03**

Prerequisite:-Embedded C, Microcontroller Programming.

Course Objective: The purpose of this subject is to understand principles and foundations of IOT in electronics and communication.

MODULE I **(8 hrs.)**

Introduction: Definition, Characteristics of IOT, IOT Conceptual framework, IOT Architectural view, Physical design of IOT, Logical design of IOT, Application of IOT.

MODULE II **(8 hrs.)**

Machine-to-machine (M2M), SDN (software defined networking) and NFV (network function virtualization) for IOT, data storage in IOT, IOT Cloud Based Services.

MODULE III **(8 hrs.)**

Design Principles for Web Connectivity: Web Communication Protocols for connected devices, Message Communication Protocols for connected devices, MQTT, CoAP, SOAP, REST, HTTP Restful and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet based communication, IP addressing in IOT, Media Access control.

MODULE IV **(8 hrs.)**

Sensor Technology, Industrial IOT and Automotive IOT, Actuator, Sensor data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Network Technology.IOT Design methodology: Specification -Requirement, process, model, service, functional & operational view.IOT Privacy and security solutions, Raspberry Pi &arduinodevices.IOT Case studies: smart city streetlights control & monitoring.

MODULE V **(8 hrs.)**

Introduction to R, python, LORAWAN and IOT WIFI Modules like ESP8266 series, AT Commands, Interfacing with microcontroller, server, data transfer in IOT, Design of IOT systems like temperature logger, actuator etc.

Assessment: Internal viva, Continuous evolution of experiments, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Understand in depth about Internet of things.
2. Establish secure communication for his network for his devices connected in IOT.
3. Store his data securely on cloud and access it when required
4. Design web based application using various internet protocols and services

5. Use sensor technology and RFID and wireless networking for maintaining privacy and security concern in smart city and housing environmental considerations.

Text/Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of things(A-Hand-on Approach)"1st Edition , Universal Press 2014.
2. Francis dacosta "Rethinking the Internet of things: A scalable Approach to connecting everything", 1st edition, Apress publications 2013.
3. Hakima Chaouchi "The Internet of Things: Connecting Objects", 1st edition, Wiley publication 2010.
4. Donald Norris "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", 1st edition, McGraw Hill publication 2015.

PCC- EC18(P)	**Android App. Development**	**0L: 0T: 2P (hrs.)**	**Credits: 01**

Prerequisite: Java, C, C++.

Course Objective: By the end of the course, student will be able to write simple GUI applications, use built-in widgets and components, work with the database to store data locally, and much more.

List of Experiments:

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.

Assessment: Internal viva, Continuous evolution of experiments, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. Analyze the different formats and GUI available in android OS.
2. Critically evaluate alternate assumptions, approaches, procedures, tradeoffs, and results during electronic circuit designing.
3. Design variety of electronic circuits using simulation software.
4. Demonstrate their design and able to present views.
5. Get skilled and deliver technical presentation.

SBC- EC05(P)	**Electronics Workshop – IV (Prototype Development & Introduction to Python)**	**0L: 0T: 4P (02hrs.)**	**Credits: 02**

Prerequisite: Mathematics, microcontrollers, Fundamental of Electronics and Electrical devices and circuits.

Course Objective: The purpose of this lab is to learn and implementation of electronic project using different circuits, embedded system and programming.

COURSE CONTENTS:

The student should select a topic for electronic project. He should do the literature survey, analyze the problem and propose some solution for the same. He should prepare a detailed (typed) report regarding the topic and should present the same at the end of the semester. The analysis of the problem may be done with the help of hardware and software in the lab.

Assessment: Internal viva, Continuous evolution of experiments, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Analyze the mathematical and physical foundations of electronics engineering.
2. Critically evaluate alternate assumptions, approaches, procedures, tradeoffs, and results related to engineering problems.
3. Design a variety of electronic and computer-based components and systems for applications including signal processing, communications, computer networks, VLSI and Embedded systems etc.
4. Lead a small team of student engineers performing a laboratory exercise or design project; to participate in various roles in a team and understand how they contribute to accomplishing the task at hand.
5. Use written and oral communications to document work and present project results.

OEC-EC01(A)	**Data Structure**	**3L: 0T: 0P (3hrs.)**	**3 credits**

Prerequisite: Knowledge of Programming Languages

Course Objective: The objective of this course is to understand different types of data structures and algorithms usedin program.

Module 1 **(9hrs.)**
Review of C programming language. Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Implementation aspects: Memory representation. Data structures operations and its cost estimation. Introduction to linear data structures- Arrays, representation & Operations, Linked List: Representation of linked list in memory, different types of linked list. Circular linked list, doubly linked list, etc.

Module 2 **(8hrs.)**
Stacks: Stacks as ADT. Application of Stack: Conversion of infix to postfix notation , evaluation of postfix expression, Recursion. Queues: Queues as ADT, Circular queue, Concept of Dqueue and Priority Queue, Application of queues.

Module 3 **(7hrs.)**
Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree - Operations, Traversal, Search, AVL Tree, Applications and comparison of various types of tree.

Module 4 **(8hrs.)**
Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST) - Kruskal, Prim's algorithms. Application of graphs.

Module 5 **(08 hrs.)**
Sorting: Introduction, Classification of sorting method, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort, Merge sort; comparison of various sorting techniques. Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods.

Course Outcome:

1. Understand basic data structures such as arrays, linked lists, stacks and queues
2. Introduce the concept of data structures through ADT including List, Stack, Queues.
3. Understand the basic operations of trees and its types.
4. Understand the basic concept of graph and its operations.
5. Demonstrate searching sorting algorithms.

List of Text / Reference Books:

1. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures” ComputerScience Press.
2. Mark Allen Weiss “Algorithms, Data Structures, and Problem Solving with C++” , Pearson Education (US) 1996
3. R. G. Dromey “How to Solve it by Computer”, 2nd Impression by, PHI
4. AM Tanenbaum, Y Langsam& MJ Augustein, “Data structure using C and C++”,2nd Ed., 2006, Prentice Hall India.
5. Robert Kruse, Bruse Leung, “Data structures & Program Design in C”, 2nd Ed.,1997, Pearson Education.
6. Aho, Hopcroft, Ullman, “Data Structures and Algorithms”, Pearson Education.
7. Richard, GilbergBehrouz, Forouzan, “Data structure – A Pseudocode Approach with C”, 2nd Ed., Thomson press.

Perspectives:

1. Data Structure is helpful in adding structure to our data that can make the algorithms much simpler, easier to maintain, and often faster.
2 . Data Structure is necessary for designing efficient algorithms.

Recommendations:

Students pursuing a concentration in **Data Structure** must also take the following concentration requirements and electives:

1. Major Project I
2. Major Project II