ANDHRA UNIVERSITY

Telegrams: UNIVERSITY
Telephone: 284 4000
Fax: 0891 - 2755324

All Official letters, packages etc, should be addressed to the Registrar by designation and not by name

No. L I (2)/UG Courses/B.A./Syllabus & MQP/ Data Science & Internet of Things /2021.

Visakhapatnam,
Dt: 05-08-2021.

From: THE REGISTRAR

To

The Principal,
Visakha Govt. Degree & P.G. College,
College for Women,
Visakhapatnam.

Sir/Madam,

Sub: Approval of Syllabus and Model Question Paper of Data Science & Internet of Things, w.e.f. 2020-21-Requesting – Reg.

Ref: 1. Letter dt. 31-07-2021, received from the Principal, Visakha Govt. Degree & P.G. College for Women, Visakhapatnam, enclosing the Syllabus and Model Question Paper of Data Science & Internet of Things, w.e.f. 2020-21.
2. No.C-II(4)Govt/New Market Oriented Courses/Affin/2020-21, College Development Council, Date 02-08-2021.

* * *

With reference to the above, I am by direction to inform that the Revised Choice Based Credit System, U.G. Courses (w.e.f. 2020-2021) Syllabus and Model Question Paper of Data Science & Internet of Things has been approved.

Hence, I request to arrange to circulate the same among the Teaching Staff and Students concerned and placed in A.U. website.

Thanking you,

Yours faithfully,

(B. RAMACHANDER)
ASSISTNAT REGISTRAR (ACADEMIC)

Copies to:

1. The Dean of Academic Affairs, A.U., VSP.
2. The Dean, U.G. & P.G, Professional Courses, A.U., Vsp.
3. The Dean, CDC, A.U., Vsp.
4. The Dean, Confidential, A.U., Vsp.
5. The Controller of Examinations, A.U., Vsp.
6. The Secretary to V.C., Rector Table, P.A. to Registrar, A.U., Vsp.
7. The Director, Computer Centre, A.U., Vsp.
8. O.C. & O.O.F.

REVISED SYLLABUS OF B.Sc. (Internet of Things) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR B.Sc. (Maths – Electronics – Internet of Things)

Market oriented course in Computer Science

Internet of Things (IoT)

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities)

For 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

Internet of Things

Year	Semester	Paper Code	Subject	Hrs. per Week	Credits	IA	ES	Total
First Year	I	C1	Fundamentals of Computer and C -Programming	4	3	25	75	100
	I	C1-P	Hardware and C Programming Lab	2	2	0	50	50
	II	C2	Fundamentals of IoT and Applications	4	3	25	75	100
	II	C2-P	Arduino Lab	2	2	0	50	50
Second Year	III	C3	Data Communications & Computer Networks	4	3	25	75	100
	III	C3-P	Wire and Wireless Network Lab	2	2	0	50	50
	IV	C4	RFID and Sensor Networks	4	3	25	75	100
	IV	C4-P	Network Simulator –3 Lab	2	2	0	50	50
	IV	C5	Implementing IoT with Raspberry Pi	4	3	25	75	100
	IV	C5-P	Raspberry Pi Lab	2	2	0	50	50

SEMESTER-I

Semester	Course Code	Course Title	Hours	Credits
I	C1	**Fundamentals of Computer and C-Programming**	60	4

Course Objectives

1. To explore basic knowledge on computers
2. Learn how to solve common types of computing problems.
3. Learn basic constructs of computer programming languages
4. Learn data types and control structures of C
5. Learn to map problems to programming features of C.
6. Learn to write good portable C programs.

Course Outcomes

Upon successful completion of the course, a student will be able to:

1. Appreciate and understand the working of a digital computer
2. Analyze a given problem and develop an algorithm to solve the problem
3. Improve upon a solution to a problem
4. Use the 'C' language constructs in the right way
5. Design, develop and test programs written in 'C'

UNIT-I

Introduction to computers - Characteristics and limitations of computer, Block diagram of computer, types of computers, computer generations. Number systems: binary, hexadecimal and octal numbering system. Input and output devices: Keyboard and mouse, inputting data in other ways

Types of Software: system software, Application software, commercial, open source, domain and free ware software, Memories: primary, secondary and cache memory.

UNIT-II

Problem Analysis and its Tools: Problem solving technique and Program Development Life Cycle, Problem Definition, Algorithm, Flow Charts, Types of Errors, Testing and Debugging.
Basics of C: Historical development of C Language, Basic Structure of C Program, C Character Set, Identifiers and Keywords, constants, variables, Data types.

Operators and expressions: Arithmetic, Relational, Logical, Assignment, Unary, Conditional and Bitwise operators.Type conversions. Input and output statements: getchar( ), getch( ), getche( ), putchar( ), printf( ), scanf( ), gets( ), puts( )

UNIT-III

Control statements: Decision making statements: if, if else, else if ladder, switch statements. Loop control statements: while loop, for loop and do-while loop. Jump Control statements: break, continue and goto.
Arrays: one dimensional Array, two dimensional arrays.

UNIT-IV

Strings: Input/ Output of strings, string handling functions, table of strings
Functions: Function Prototype, definition and calling. Return statement. Nesting of functions. Categories of functions. Recursion, Parameter Passing by address & by value. Local and Global variables. Storage classes: automatic, external, static and register.

UNIT-V

Pointers: Pointer data type, Pointer declaration, initialization, accessing values using pointers. Pointer arithmetic. Pointers and arrays, pointers and functions.
Structures and Unions : Using structures and unions, use of structures in arrays and arrays in structures. Comparison of structure and Union.

Text Books:

1. E. Balagurusway, “Programming in C”, Tata McGrwal Hill.
2. Computer fundamentals and c programming in c by Reemathareja, oxford university press

Reference Books

1. Introduction to C programming by REEMA THAREJA from OXFORD UNIVERSITY PRESS
2. E Balagurusamy: ―COMPUTING FUNDAMENTALS & C PROGRAMMING – Tata McGraw-Hill, Second Reprint 2008, ISBN 978-0-07-066909-3.
3. Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson Edition Publ, 2002.
4. Henry Mullish&HuubertL.Cooper: The Spirit of C An Introduction to modern Programming, Jaico Pub. House,1996.
5. Y kanithkar, let us C BPB, 13 th edition-2013, ISBN:978-8183331630,656 pages.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Creating Text Editor in C".
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
I	**C1-P**	**Hardware and C Programming Lab**	**30**	**1**

SEMESTER-I

Hardware Lab:

1. Identify various Memory components of the Computer.
2. Identify Various Cables and their uses
3. Identify various Network Devices.
4. Assembling and Disassembling of Computers.

C Programming Lab

1. Find the biggest of three numbers using C.
2. Write a c program to find the sum of individual digits of a positive integer.
3. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
4. Write a c program to check whether a number is Armstrong or not.
5. Write a program to perform various string operations.
6. Write a c program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
7. Write a c program that uses functions to perform the following: Addition of two matrices. Multiplication of two matrices.
8. Write a c program that implements searching of given item in given list.
9. Write a c program to sort a given list of integers in ascending order.
10. Write a c program to perform various operations using pointers.
11. Write a c program to read data of 10 employees with a structure of 1.employee id 2.aadar no, 3.title, 4.joined date, 5.salary, 6.date of birth, 7.gender, 8.department.
12. Write a program for concatenation of two strings.
13. Write a program for length of a string

SEMESTER-II

Semester	Course Code	Course Title	Hours	Credits
II	**C2**	**Fundamentals of IoT and Applications**	**60**	**4**

Course Objectives

1. To study fundamental concepts of IoT
2. To understand roles of sensors in IoT
3. To Learn different protocols used for IoT design
4. To be familiar with data handling and analytics tools in IoT
5. Appreciate the role of big data, cloud computing and data analytics in a typical IoT system.

6. Understand the role of IoT in various domains of Industry.

Course Outcomes:

On completion of the course, student will be able to

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Use sensors and actuators for design of IoT.
3. Understand and apply various protocols for design of IoT systems
4. Use various techniques of data storage and analytics in IoT
5. Understand various applications of IoT
6. Understand APIs to connect IoT related technologies

UNIT-I

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

UNIT-II

Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

UNIT-III

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.
IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.
Edge connectivity and protocols

UNIT-IV

Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications

UNIT-V

Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Text Books:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
5. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

References

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
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. https://onlinecourses.nptel.ac.in/noc17_cs22/course
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual

participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Developing IoT real time application using Arduino".
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
II	**C2-P**	**Arduino Lab**	**30**	**1**

List of Experiments

1. Understanding Arduino UNO Board and Components
2. Installing and work with Arduino IDE
3. Blinking LED sketch with Arduino
4. Simulation of 4-Way Traffic Light with Arduino
5. Using Pulse Width Modulation
6. LED Fade Sketch and Button Sketch
7. Analog Input Sketch (Bar Graph with LEDs and Potentio metre)

8. Digital Read Serial Sketch (Working with DHT/IR/Gas or Any other Sensor)
9. Working with Adafruit Libraries in Arduino
10. Spinning a DC Motor and Motor Speed Control Sketch
11. Working with Shields
12. Interfacing Arduino with Cloud (Thingspeak API)

SEMESTER-III

Semester	Course Code	Course Title	Hours	Credits
III	**C3**	**Data Communications & Computer Networks**	**60**	**4**

UNIT - I

Introduction to Data communications, Network Criteria, point-to-point and multi point connection, physical topology, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, protocols and standards.

Network Models: Layered tasks, Connection-Oriented and Connectionless Services, Service Primitives, The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI and TCP/IP Reference Models, addressing.

UNIT – II

Physical Layer: Basis for Data Communication: Transmission of digital signals: Bit rate, bit length, baseband and broadband transmission, transmission impairment, data rate limits, performance, Guided Transmission Media Twisted Pair Coaxial Cable and Fiber Optics

Data Link Layer: Framing, Error Control, Flow Control, Error-Detection and correction: Introduction, Error detection using CRC. Data Link Protocols: Simplest Protocol, Stop-and-Wait Protocol, Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, HDLC.

UNIT – III

Multiple Accesses. Random Access: ALOHA, Carrier Sense Multiple Access (CSMA) Protocols, CSMA with Collision Detection, CSMA with Collision Avoidance..Controlled Access: Reservation, Polling and Token Passing. Channelization: FDMA, TDMA, CDMA.

Wired LAN: Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN (802.11).

UNIT - IV

Connecting LANs, Backbone and Virtual LANs: Connecting devices, Back bone Networks, Virtual LANs. Network Layer: Need for network layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 datagram's, Transition from Ipv4 to Ipv6.

UNIT - V

Network Layer: Delivery, Forwarding, Types of Routing protocols, Unicast Routing Protocols, The Transport Layer: Process to process Delivery, User Datagram Protocol (UDP) and TCP. Application layer: Domain name space, Distribution of name space, Resolution.

Text Books:

1. Data communications and Networking-4th edition BeharouzA.Forouzan, TMH
2. Alberto Leon-Garcia, Communication Networks, 2012, Ninth Reprint, Tata McGraw-Hill, India.

Reference Books:

1. Data Communications and Computer Networks By Prakash C. Gupta, PHI Publishers.
2. Computer Networks By Andrew S.Tanenbaum, Pearson Education.
3. Wireless Technologies Circuits, Systems and Devices by Krzysztof Iniewski CRC Press.
4. Wireless Networking Technology: From Principles to Successful Implementationby Stephen A. Rackley.
5. Robert Gallager, Data Networks, 2010, 2nd edition, Prentice Hall, India.
6. W. Stallings, Data and Computer Communications, 2004, Prentice Hall, India.

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4. Study projects (by very small groups of students on selected local real-time

problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Establishing a hybrid network protocol as per your college needs".
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
III	**C3-P**	**Wire and Wireless Networks Lab**	**30**	**1**

List of Experiments

List of Experiments (NS2/QUALNET/BWSIM/MATLAB)

1. Study of Network Devices in detail
2. Study of Network IP and basic network command and network configuration commands
3. Wired and Wireless network scenario creation.

4. Simulation of Four Node Point To Point Network
5. Transmission Of Ping Message
6. Implement various Topologies
7. Study of Routing Protocols.
8. Study of performance of MAC Protocols
9. UDP and TCP Simulation
10. Call establishment in cellular network.
11. Handover in cellular network.
12. Study of Performance Comparison of TCP and UDP using NS – 2

SEMESTER-IV

Semester	Course Code	Course Title	Hours	Credits
IV	**C4**	**RFID and Wireless Sensor Networks**	**60**	**4**

Course Objectives:

1. Understand and designing Radio frequency identification (RFID) systems, middleware architectures for real-world applications.
2. Understanding RFID and related Architectures, RFID Principles and security issues
3. Determine road map for transformation of flexible electronics from foils to textiles
4. Understanding the implementation, challenges and design constraints of WSN
5. Knowing about the MAC layer and routing protocols in WSN
6. Modeling of WSN for interfacing with IoT platform.
7. Knowing Security threats and resolution methods in WSN

.

Course Outcomes

1. Students will be familiar with RFID technology, various components involved.
2. Getting familiar with various RFID standards, Students learn various Security issues involved in RFID.
3. Students learn about Wireless Sensor Networks
4. Familiar with WSN protocols routing algorithms.
5. Various Security issues involved in Wireless Sensor Networks.

UNIT-I

Introduction of RFID, Automatic Identification Systems, A Comparison of Different ID Systems, Components of an RFID System, Differentiation Features of RFID Systems, Transponder Construction Formats, Frequency, Range and Coupling , Active and Passive Transponders, Information Processing in the Transponder , Selection Criteria for RFID Systems, Fundamental Operating Principles.

UNIT-II

Frequency Ranges and Radio Licensing Regulations, Coding and Modulation, Data Integrity, Multi-Access Procedures – Anticollision, Security of RFID Systems, Attacks on RFID Systems

UNIT-III

Wireless Sensor Networks- Introduction, Challenges and Constraints, Applications, Node Architecture, Operating Systems, Physical Layer.

UNIT-IV

Medium Access Control: Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Network Layer: Various Routing Protocols.

UNIT-V

Security in WSN: Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security

Text Books

1. RFID Handbook, Klaus Finkenzeller,WILEY & SONS
2. Fundamentals of Wireless Sensor Networks: theory and practice by Waltenegus Dargie, Christian Poellabauer

Reference Books

1. RFID and Sensor Networks Architecture, Protocols, Security and integration by Yan Zhang, Laurence T. Yang, Jining.
2. Ian F. Akyildiz, and Mehmet Can Vuran, Wireless Sensor Networks, 2010, Wiley, USA.
3. IBM Bluemix: The Cloud Platform for Creating and Delivering Applications, http://www.redbooks.ibm.com/redpapers/pdfs/redp5242.pdf
4. Wireless Sensor Networks Technology, protocols and applications by KAZEM SOHRABY, DANIEL MINOLI TAIEB ZNATI, JOHN WILEY & SONS, INC Publication.

5. REILLY, RFID Essentials By Bill Glover, Himanshu Bhatt.
6. W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks, 2010, Wiley, USA.
7. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, 2011, Wiley, USA.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,

5. Observation of practical skills,
6. Individual and group project reports like “Design of RFID Smart Attendance cum Doorlock System for College Laboratory”.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
IV	**C4-P**	**Network Simulator Lab-3**	**30**	**1**

List of Experiments

1. Introduction to network simulators used for wireless Ad Hoc and Sensor Networks.
2. Introduction to TCL scripting: demonstration of one small network simulation script.
3. To study various trace file formats of network simulators.
4. To implement and compare various MAC layer protocols.
5. To implement and compare AODV and DSR routing algorithms in MANET
6. To implement DSDV routing algorithms in MANET
7. To implement signal strength based link management routing protocols.
8. To calculate and compare average throughput for various TCP variants
9. To implement and compare various routing protocols for wireless sensor networks

Semester	Course Code	Course Title	Hours	Credits
IV	**C5**	**Implementing IoT with Raspberry Pi**	**60**	**4**

Course Objectives:

The course is aimed at

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
3. After doing this course, students should be able to design and deploy multiple IoT devices that could connect to the gateway.
4. Acquainting students with the basic web app creation
5. Connecting and Using various IoT Cloud Based Platforms such as Blynk, Thingspeak, AWS IoT, Google Cloud IoT Core etc..
6. Working with Big Data Processing Techniques
7. Developing Mobile App for IoT application

Course Outcomes:

At the end of the course the student should be able to

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

UNIT-I

Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution.

UNIT-II

Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operate the Raspberry Pi in “headless mode”, Bash Command line, operating Raspberry Pi without needing a GUI interface.

Basics of the 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-III

Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface

UNIT-IV

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

UNIT-V

IoT Design using Raspberry Pi IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, Communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi

Text books:

1. Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, January 2012, McGraw Hill Professional
2. The official raspberry Pi Projects Book https://www.raspberrypi.org/magpi-issues/Projects_Book_v1.pdf

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

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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A. Measurable

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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user,,s approval.".
7. Efficient delivery using seminar presentations,

8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
IV	**C5-P**	**Raspberry Pi Lab**	**30**	**1**

List of Experiments

1. Getting started with Raspberry Pi, Install Raspian on your SD card
2. Linux basic commands.
3. Coding simple programs in Python.
4. How to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device
5. How to have your Raspberry Pi interact with online services through the use of public APIs and SDKs
6. Understanding the connectivity of Raspberry-Pi with IR sensor. Write an application to detect obstacle and notify user using LEDs.
7. Design APP Using MIT App Inventor and Connect to Temperature Sensor