UG PROGRAM (4 Years Honors)
CBCS - 2020-21

SUBJECT
Internet of Things

Syllabus and Model Question Papers

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Note: BOS is to provide final soft copy in PDF and word formats and four copies of hard copies in bounded form to the office of Dean Academic affairs.

1. Resolutions of the Board of Studies

Meeting held on: - -2021Time:10.00 am
At: Convention Center,Adikavi Nannaya University

Agenda:

1. Syllabus
2. Preparation of model question paper
3. Paper setters list (Out of University)

Resolutions:

1. It is unanimously resolved to follow the pattern of 75% of marks for external assessment and 25% of marks for internal(for theory papers only) also resolved to continue the pattern of 50 marks for practical examinations for all the semester end practical examinations in electronics.
2. It is resolved that all the semester end examinations in electronics with section B has a weightage of 50 marks having internal choice questions and section A has a weightage of 25 marks in which the student has to answer 5 questions out of 10 questions given.
3. It is resolved to implement the enclosed syllabus in theory and practicals to I, II, III and IV semester students with effect from 2020-21 academic year.
4. It is resolved and submitted model question paper for I to IV semesters based on the weightage specified above.
5. It is resolved and submitted the list of question paper setters from outside university

UG Program (4 years Honors) Structure (CBCS)

2020-21 A. Y., onwards

BACHLOR OF SCIENCE

(3rd and 4th year detailed design will be followed as per APSCHE GUIDELINES)

Subjects/ Semesters		I		II		III		IV		V		VI			
		H/W	C	H/W	C	H/W	C	H/W	C	H/W	C	H/W	C		
Languages												THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester		FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations).	
English		4	3	4	3	4	3								
Language (H/T/S)		4	3	4	3	4	3								
Life Skill Courses		2	2	2	2	2+2	2+2								
Skill Development Courses		2	2	2+2	2+2	2	2								
Core Papers															
M-1	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1						
M-2	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1						
M-3	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1						
M-1	SEC (C6,C7)									4+2 4+2	4+1 4+1				
M-2	SEC (C6,C7)									4+2 4+2	4+1 4+1				
M-3	SEC (C6,C7)									4+2 4+2	4+1 4+1				
Hrs/ W (Academic Credits)		30	25	32	27	32	27	36	30	36	30	0	12	4	4
Project Work															
Extension Activities (Non Academic Credits)															
NCC/NSS/Sports/Extra Curricular									2						
Yoga							1		1						
Extra Credits															
Hrs/W (Total Credits)		30	25	32	27	32	28	36	33	36	30	0	12	4	4

M= Major; C= Core; SEC: Skill Enhancement Courses

Marks & Credits distribution: UG-Sciences

Sl. No	Course type	No. of courses	Each course teaching Hrs/wk	Credit for each course	Total credits	Each course evaluation			Total marks
						Conti-Assess	Univ-exam	Total	
1	English	3	4	3	9	25	75	100	300
2	S.Lang	3	4	3	9	25	75	100	300
3	LS	4	2	2	8	0	50	50	200
4	SD	4	2	2	8	0	50	50	200
5	Core/SE -I	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -II	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -III	5+2	4+2	4+1	35	25	75+50	150	1050
6	Summer-Intern	2		4	8		100	200	200
7	Internship/ Apprentice/ on the job training	1		12	12		200	200	200
		38			**159**				**4550**
8	**Extension Activities (Non Academic Credits)**								
	NCC/NSS/Sports/ Extra Curricular			2	2				
	Yoga	2		1	2				
	Extra Credits								
	Total	**40**			**142**				

DETAILS OF PAPER TITLES & CREDITS

Sem	Course no	Course name	Course type (T/L/P)	Hrs./ week	Credits	IA	EA	Total
FIRST YEAR								
I	1	Fundamentals of Computer andC -Programming	T	4	4	25	75	100
		Hardware and C Programming Lab	L	2	1	-	50	50
II	2	Fundamentals of IoT and Applications	T	4	4	25	75	100
		Arduino Lab	L	2	1	-	50	50
SECOND YEAR								
III	3	Data Communications & Computer Networks	T	4	4	25	75	100
		Wire and Wireless Network Lab	L	2	1	-	50	50
IV	4	RFID and Wireless Sensor Networks	T	4	4	25	75	100
		Network Simulator –3 Lab	L	2	1	-	50	50
	5	Implementing IoT with Raspberry Pi	T	4	4	25	75	100
		Raspberry Pi Lab	L	2	1	-	50	50
THIRD YEAR								
V	6A	Distributed IoT Systems	T	4	4	25	75	100
		Distributed IoT Lab	L	2	1	-	50	50
	7A	Object Oriented Programming Using Java	T	4	4	25	75	100
		Object Oriented Programming using Java Lab	L	2	1	-	50	50
	OR							
	6B	Embedded & IoT	T	4	4	25	75	100
		Embedded & IoT Lab	L	2	1	-	50	50
	7B	Machine Learning For Internet of Things	T	4	4	25	75	100
		Machine Learning For Internet of Things Lab	L	2	1	-	50	50
	OR							
	6C	Applications of IoT & Multimedia Technology	T	4	4	25	75	100
		Applications of IoT & Multimedia Technology Lab	L	2	1	-	50	50
	7C	Industrial IoT and Automation	T	4	4	25	75	100
		Industrial IoT and Automation Lab	L	2	1	-	50	50

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

Note 1: For Semester–V, for the domain subject **Internet of Things**, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note 2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

Note 3: To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSCHE Guidelines.

- **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).
- **Credit For Course: 04**

- **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).
- **Credit For Course: 04**

- **Third internship/Project work (6th Semester Period):**
  During the entire 6th Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work (the detailed guidelines are enclosed).
  Credit For Course:12

a. Proposed combination subjects: **Mathematics, Electronics, Internet of Things (MEIoT)**
b. Student eligibility for joining in thecourse:Intermediate MPC
   Intermediate Vocational (EET)(for those who have passed the bridgecourse)Intermediate Vocational (ET)(for those who have passed the bridge course) Diploma in ECE
   Diploma in EEE
c. Faculty eligibility for teaching the course:
   M.Sc. Electronics or M.Sc. Physics or M.Sc Computer Science with Specialization Electronics.
d. List of Proposed Skill enhancement courses with syllabus, if any
   i. Embedded Systems
   ii. Internet of Things
   iii. Electric Vehicles
   iv. Consumer Electronics
e. Any newly proposed Skill development/Life skill courses with draft syllabus andrequiredresources :
   i. Artificial Intelligence
   ii. Programming Python
f. Required instruments/software/ computers for the course (Lab/Practical course-wise

requiredi.e., for a batch of 15 students)

Sem. No.	Lab/Practical Name	Names of Instruments/Software/ computers required with specifications	Brand Name	Qty Required
I	Hardware and C Programming Lab	Intel Desktop PC	As per requirement	15 perbatch
II	Arduino Lab	Arduino UNO Board and Components	As per requirement	15 perbatch
III	Wire and Wireless Networks Lab	NS2/QUALNET/BWSIM/ MATLAB, Simulation Software	As per requirement	15 perbatch
IV	Network Simulator Lab-3	NETSIM Software and LAN Trainer kit.	As per requirement	15 perbatch
	Raspberry Pi Lab	Raspberry Pi board (Broadcom BCM 2835) Model B	As per requirement	15 perbatch

g. List of Suitable levels of positions eligible in the Govt/Pvt organizations
Suitable levels of positions for these graduates either in industry/govt organization like., technical assistants/ scientists/ school teachers., clearly define them, with reliable justification

S.No	Position	Company/ Govt Organization	Remarks	Additional skills required, if any
01	IoT/Cloud Software Developer	IT Industry	---	Industrial Training
02	IoT Infrastructure Architect	IT Industry	---	Industrial Training
03	IoT Systems Administrator	IT Industry	----	Industrial Training
04	Vulnerability/Cyber Engineer	IT Industry	----	Industrial Training
05	Scientific Assistant	DRDO , ISRO & Other Research Agencies	---	---
06	SSC	Central Govt.	--	Skills in functional English, and aptitude with GK.

h. List of Govt. organizations / PVT companies for employment opportunities or internships orprojects

i. Any specific instructions to the teacher /paper setters/Exam-Chief Superintendent

Teachers should make use of all the approaches for an efficient teaching-learning process i.e.:

- ✓ Use of Smart class rooms for simulation and demonstration for conveying thedifficultconcepts of IoT in class room teaching and laboratories.
- ✓ Teaching should be complimented with students seminar to be organized very Frequently.
- ✓ Open-ended project work should be given to all students individually, or in group to2-3 students depending upon the nature of the course.
- ✓ It is recommended that the maximum size of group for all IoT Laboratory courses shouldbe 12-15 students.
- ✓ Sufficient infrastructure for ICT and other facilities needed for technology-enabledlearning like computer facilities, PCs or laptops, Wi-Fi and internet facilities with all thenecessary software.
- ✓ Virtual and remote laboratories are e-learning resources that enhance the accessibility of experimental setups providing a distance teaching framework which meets the student's hands-on learning needs. The use of virtual remote laboratory should be encouraged as it enhances student's life-long learning capabilities along with routine subject/experimental skills.

Program objectives, outcomes, co-curricular and assessment methods

B. Sc	Internet of Things

1. Aim and objectives of UG program in Subject:

The overall aim and objectives of the B.Sc. Programme with IoT are to:

- Understand the definition and significance of the Internet of Things
- Discuss the architecture, operation, and business benefits of an IoT solution
- Examine the potential business opportunities that IoT can uncover
- Explore the relationship between IoT, cloud computing, and big data
- Identify how IoT differs from traditional data collection systems

2. Learning outcomes of Subject:

The student graduating with the Degree B.Sc. Programme with IoT discipline should be able to.

- Understand the various concepts, terminologies and architecture of IoT systems
- Use sensors and actuators for design of IoT.
- Understand and apply various protocols for design of IoT systems
- Use various techniques of data storage and analytics in IoT
- Understand various applications of IoT

3. Recommended Skill enhancement courses: (Titles of the courses given below and details of the syllabus for 4 credits (i.e., 2 units for theory and Lab/Practical) for 5 hrs class-cum-lab work

4. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments
2. Student seminars (Individual presentation of papers)
3. Quiz Programmes
4. Individual Field Studies/projects
5. Group discussion
6. Group/Team Projects

B General

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus

2. Group Discussions
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
4. Any similar activities with imaginative thinking.

5. Recommended Continuous Assessment methods:

Electronics is a professional academic program, so there is need to focus more on activity based evaluation rather than purely written examination. A variety of assessment methods that are appropriate within the disciplinary area of electronics must be used. Progress of learners towards achieving learning outcomes may be assessed making creative use of the following, either independently or in combination:

- Time-constrained examinations (say 1-hour or 2-hour tests);
- Closed-book and open-book tests (if applicable);
- Problem based assignments;
- Quizzes
- Real life projects;
- Lab reports
- Individual/Team project reports;
- Oral presentations, including seminar presentation;
- Viva voce,
- Interviews;
- Computerized adaptive testing for MCQ;
- Peer and self-assessment etc.
- Any other pedagogic approaches as may be relevant keeping in view the learners' level, credit load and class size

Details of course-wise Syllabus

B. Sc	Semester: I	Credits: 4
Course: 1	Fundamentals of Computer and C-Programming	Hrs/Wk: 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

B.Sc	Semester: I	Credits: 1
Course: 1(L)	Hardware and C Programming Lab	Hrs/Wk: 2

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

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – I
Course 1: Fundamentals of Computer and C-Programming

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. What is a computer? Explain the characteristics of computers
2. Explain the types of computers
3. Explain different types of operators in C
4. Explain storage classes in C
5. Write short notes on enumerated data types
6. Explain switch () statement with an example
7. Explain about nested structures in C
8. What is union & structure?

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Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Draw a block diagram of computer ? Explain each part of the computer
(Or)
(b) Discuss about primary memory and secondary memory

10. (a)Explain the structure of c program with example
(Or)
(b) Explain various Data types available in C ? Explain each with example

11. (a)What is Decision control statement ? Explain each with example
(Or)
(b) What is an Array? What are the different types of Arrays in C

12. (a)Discuss the different categories of functions ? Illustrate with example
(Or)
(b) Write a C program to find the Multiplication of Two Matrices

13. (a) What is a pointer and structure ? Explain with example program?
(Or)
(b) Write about the following:
(i) Pointer function
(ii) Nested structures

B. Sc	Semester: II	Credits: 4
Course: 2	Fundamentals of IoT and Applications	Hrs/Wk: 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 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
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)

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 "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

B.Sc	Semester: II	Credits: 1
Course: 2(L)	Arduino Lab	Hrs/Wk: 2

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)

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – II
Course 2: Fundamentals of IoT and Applications

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. What is the Internet of Things (IoT)**?** Explain the characteristics of IoT
2. What are the advantages of IoT?
3. Write short notes on Arduino function libraries.
4. Write a shot note on RFID.
5. What are the wireless sensor networks?
6. What are Wireless technologies for the IoT?
7. What is Big Data? Explain about Types of Data analytics.
8. Explain about IP Based Protocols?

Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Explain about design objectives of IoT architecture?

(Or)

(b) Explain various Identifiers in IoT? Explain about Frameworks in IoT?

10. (a) Explain various types of Sensors.

(Or)

(b) Explain the Sensor Modules in Arduino.

11. (a) Explain about Wireless Technologies for the IoT

(Or)

(b) Explain about Edge Connectivity in IP Based Protocol for IoT.

12. (a) What are the difference between Real Time and Local Analytics?

(Or)

(b) Explain about Data Handling and Analytics.

13. (a) Explain various IoT Applications.

(Or)

(b)Explain the Legal challenges in IoT.

B.Sc	Semester: III	Credits: 4
Course: 3	Data Communications & Computer Networks	Hrs/Wk: 4

Course Objectives:

1. Build an understanding of the fundamental concepts of data communication and computer networking.
2. Understand how errors detected and corrected that occur in transmission
3. How collisions to be handled when many stations share a single channel
4. Know about routing mechanisms and different routing protocols
5. Understand transport layer functions
6. Know about different application layer protocols

Learning Outcomes:

After completing this course the student must demonstrate the knowledge and ability to:

1. Describe the basis and structure of an abstract layered protocol model
2. Independently understand basic computer network technology.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP.
5. Identify the different types of network devices and their functions within a network
6. Understand and building the skills of routing mechanisms.
7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation
8. Understand how the Internet works today.
9. Conversant with primitives of network application programming.

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.

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 "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

B Sc	Semester: III	Credits: 1
Course: 3(L)	Wire and Wireless Networks Lab	Hrs/Wk: 2

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

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – III
Course 3: Data Communications & Computer Networks

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Explain about WAN
2. Write about guided transmission media
3. Explain about ALOHA
4. Discuss about logical address
5. Write about domain name space
6. What is the difference between TDMA and CDMA
7. Explain different types of errors
8. Write about UDP

Section – B

Answer ALL the following questions: **5x10=50M**

9. (A) Explain the different topologies of the network
   (OR)
   (B) Explain the TCP/IP model?
10. (A) discuss the error control mechanism
    (OR)
    (B) With a neat diagram explain Go-Back-N ARQ
11. (A) write about collision detection and avoidance
    (OR)
    (B) Explain about wireless LAN(802.11)
12. (A) write about virtual LANs
    (OR)
    (B) With a neat diagram explain IPV4
13. (A) Explain about different types of routing protocols
    (OR)
    (B) Explain the TCP protocol

B Sc	Semester: IV	Credits: 4
Course: 4	RFID and Wireless Sensor Networks	Hrs/Wk: 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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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 "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

B Sc	Semester: IV	Credits: 1
Course: 4	Network Simulator Lab-3	Hrs/Wk: 2

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

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 4: RFID and Wireless Sensor Networks

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Write about RFID.
2. Explain active and passive transponders
3. What is data integrity?
4. Explain about physical layer
5. Describe about the characteristics of MAC
6. Write about security in WSN
7. Discuss about various types of attacks on RFID
8. Write about contention based MAC protocol

Section - B

Answer ALL the following questions: **5x10=50M**

9. (A) Explain the different features of RFID systems

(or)

(B) Explain fundamental operating principles

10. (A) write about anticollision

(or)

(B) Write about security of RFID systems

11. (A) explain the challenges and constraints of wireless sensor networks

(or)

(B) Write about operating systems

12. (A) describe about various routing protocols

(or)

(B)Write an ALP to arrange given 8-bit numbers in ascending order.

13 .(A) Explain IEEE 802.15.4

(or)

(B) Explain about Zigbee security

B Sc	Semester: IV	Credits: 4
Course: 5	Implementing IoT with Raspberry Pi	Hrs/Wk: 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

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
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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

B Sc	Semester: IV	Credits: 1
Course: 5	Raspberry Pi Lab	Hrs/Wk: 2

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

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 5: Implementing IoT with Raspberry Pi

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Write about Raspberry Pi.
2. Explain functionalities of Raspberry Pi B+ board.
3. Write about raspberry Pi Remote access.
4. Describe the general purpose IO pins.
5. Write about cloud for IoT.
6. How to design a RESTful web API
7. What is LAMP web server?
8. How to create webpage for LAMP?

Section - B

Answer ALL the following questions: **5x10=50M**

9. (A) Explain about features of Linux operating system.

(or)

(B) Write about booting process of Raspberry Pi3

10. (A) Explain in detail about Bash command line.

(or)

(B) Explain functions in python.

11. (A) Explain about GPIO access

(or)

(B) Write about Tkinter python library

12. (A) describe about Cloud storage models

(or)

(B) write about python web application frame work.

13. (A) Explain LAMP server

(or)

(B) Explain about MQTT protocol

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 6A	**Distributed IoT Systems**	**Hrs/Wk: 4**

Course Objectives:

1. Knowledge of the most relevant protocols used in industry
2. General knowledge of protocols, communication methods and technologies for distributedsystems
3. Enlighten in the different methods to improve performance in distributed systems.
4. The ability to implement communication protocols in industrial equipment
5. The ability to implement an industry standard protocol in an embedded controller
6. The ability to implement a communication system with IoT devices.
7. The ability to specify, design and implement an industrial communication system includingIoT devices.

Course Outcomes:

1. Discover key IoT 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 industriallandscape 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: Smart Objects

The "Things" in IoT, Sensors, Actuators, and Smart Objects, Hardware Communications Criteria (Ethernet, Wi-Fi, Bluetooth, Zigbee) M2M To IOT -M2M Vs IOT

UNIT II: Communication & Networking Technologies in IoT

Introduction Sensor Networks, Network Layer Model (OSI or TCP/IP), Network Topologies, Communication Models; Wired: RS232, RS485, CAN, Ethernet. Wireless: Bluetooth, WLAN, GPS, LoRa, Cellular.

UNIT III: IoT Gateway

Introduction Gateway, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M, Data Exchange Formats (JSON, XML), MQTT Protocol, HTTP REST, CoAP, XMPP and AMQP, Protocol Interoperability & Bridging, Data Aggregation using Gateway.

UNIT IV: Real-Time Operating System

Introduction, Real-Time Systems Concepts, Kernel Structure, Task Management, Semaphores, Mutual Exclusion (MUTEX), Message Mailbox, Message Queue, Memory Management, PortingRTOS.

UNIT V: Case Studies

Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture. IoTWearables, Health care systems, Agri and Allied sectors.

TEXT BOOKS:

1. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure usingIndustry 4.0 - by Giacomo Veneri and Antonio Capasso.
2. Mastering the FreeRTOS Real Time Kernel – a Hands On Tutorial Guide

REFERENCE BOOKS:

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by FrancisdaCosta, ISBN: 978-1-4302-5740-0, 2013
2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011 Arduino Yun", Packt Publishing, 2014.
3. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors toclouds with communication systems, analytics, and security, 2nd Edition by Perry Lea.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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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)
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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. Tryto 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.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 1**
Course: 6A	**Distributed IoT Lab**	**Hrs/Wk: 2**

List of Experiments

1. Understanding the Distributed System
2. IoT System - Thing, Gateway, Server/Cloud.
3. Working with Various Types of Sensors.
4. Wired protocols: RS232, RS485
5. Wireless protocols: Bluetooth, WLAN, GPS, LoRa, Celluar
6. IoT Gateway: Data Exchange Formats (JSON, XML).
7. MQTT Protocol
8. HTTP REST, CoAP
9. XMPP and AMQP
10. RTOS (Real-Time Operating System)

MODEL QUESTION PAPER (Sem-End Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 6A: Distributed IoT Systems

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. What is a sensor, actuators and smart objects.
2. Explain about GPS and LoRa.
3. Explain about RS232,RS485 and CAN
4. Explain about Fog computing and Gateway.
5. What is real time operating system
6. Explain message Queue.
7. Explain about smart and connected cities.
8. Explain IoT wearables.

Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Expalin different types of sensors and actuators.

(Or)

(b) Discuss about Ethernet ,Wi-Fi ,Bluetooth,and ZigBee.

10. (a)Explain about wired and wireless communication models.

(Or)

(b) What is a sensor network and explain OSI model with a neat digram

11. (a)What are Fog and M2M,data exchange formats JSON,XML

(Or)

(b) Expalin about Data Agrigation using Gateway

12. (a)Discuss Kernal structure and task management .

(Or)

(b) What are memory managemnet and porting RTOS

13. (a) Discuss about sanrt city IoT Architecture

(Or)

(b) Write about the following:

(i) IoT at Health care system
(ii) IoT at agri and allied sectors

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 7A	**Object Oriented Programming Using Java**	**Hrs/Wk: 4**

Aim and objectives of Course:

- To introduce the fundamental concepts of Object-Oriented programming and todesign &implement object oriented programming concepts in Java.

Learning outcomes of Course:

- Understand the benefits of a well-structured program
- Understand different computer programming paradigms
- Understand underlying principles of Object-Oriented Programming in Java
- Develop problem-solving and programming skills using OOP concepts
- Develop the ability to solve real-world problems through software developmentin high-levelprogramming language like Java

Detailed Syllabus: (Five units with each unit having 12 hours of class work)

UNIT I:

Introduction to Java: Features of Java, The Java virtual Machine, Parts of Java **Naming Conventions and Data Types:** Naming Conventions in Java, Data Types in Java, Literals **Operators in Java**: Operators, Priority of Operators. **Control Statements in Java**: if... else Statement, do... while Statement, while Loop, for Loop, switch Statement, break Statement, continue Statement, return Statement. **Input and Output:** Accepting Input from the Keyboard, Reading Input with Java.util.Scanner Class, Displaying Output with System.out.printf(), Displaying Formatted Output with String.format(). **Arrays:** Types of Arrays, Three Dimensional Arrays (3D array), array name. length, Command Line Arguments

UNIT II:

Strings: Creating Strings, String Class Methods, String Comparison, Immutability of Strings. **Introduction to OOPs**: Problems in Procedure Oriented Approach, Features of Object- Oriented Programming System (OOPS). **Classes and Objects**: Object Creation, Initializing the InstanceVariables, Access Specifiers,Constructors.

Methods in Java: Method Header or Method Prototype, Method Body, Understanding Methods, Static Methods, Static Block, The keyword „this", Instance Methods, Passing Primitive Data Typesto Methods, Passing Objects to Methods, Passing Arrays to Methods, Recursion, Factory Methods. **Inheritance:** Inheritance, The keyword „super", The Protected Specifier, Types ofInheritance.

UNIT III:

Polymorphism: Polymorphism with Variables, Polymorphism using Methods, Polymorphism with Static Methods, Polymorphism with Private Methods, Polymorphism with Final Methods, final Class. **Type Casting**: Types of Data Types, Casting Primitive Data Types, Casting Referenced Data Types, The Object Class. **Abstract Classes**: Abstract Method and Abstract Class.

Interfaces: Interface, Multiple Inheritance using Interfaces. **Packages:** Package, Different Types of Packages, The JAR Files, Interfaces in a Package, Creating Sub Package in a Package, Access Specifiers in Java, Creating API Document. **Exception Handling:** Errors in Java Program, Exceptions, throws Clause, throw Clause, Types of Exceptions, Re – throwing an Exception.

UNIT IV:

Streams: Stream, Creating a File using FileOutputStream, Reading Data from a File uingFileInputStream, Creating a File using FileWriter, Reading a File using FileReader, Zippingand Unzipping Files, Serialization of Objects, Counting Number of Characters in a File, File Copy, File Class.

Threads: Single Tasking, Multi Tasking, Uses of Threads, Creating a Thread and Running it, Terminating the Thread, Single Tasking Using a Thread, Multi Tasking Using Threads, Multiple Threads Acting on Single Object, Thread Class Methods, Deadlock of Threads, Thread Communication, Thread Priorities, thread Group, Daemon Threads, Applications of Threads, Thread Life Cycle.

UNIT V:

Applets: Creating an Applet, Uses of Applets, <APPLET> tag, A Simple Applet, An Applet with Swing Components, Animation in Applets, A Simple Game with an Applet, Applet Parameters.

Java Database Connectivity: Database Servers, Database Clients, JDBC (Java Database Connectivity), Working with Oracle Database, Working with MySQL Database, Stages in a JDBC Program, Registering the Driver, Connecting to a Database, Preparing SQL Statements, Using jdbc– odbc Bridge Driver to Connect to Oracle Database, Retrieving Data from MySQL Database, Retrieving Data from MS Access Database, Stored Procedures and CallableStatements, Types of Result Sets.

TEXT BOOKS:

1. Core Java: An Integrated Approach, Authored by Dr. R. Nageswara Rao &Kogent LearningSolutions Inc.
2. E.Balaguruswamy, Programming with JAVA, A primer, 3e, TATA McGraw-HillCompany.

REFERENCES:

1. John R. Hubbard, Programming with Java, Second Edition, Schaum‟s outlineSeries, TMH.
2. Deitel&Deitel. Java TM: How to Program, PHI (2007)

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 1**
Course: 7A	**Object Oriented Programming Using Java Lab**	**Hrs/Wk: 2**

Details of Lab Syllabus: Object Oriented Programming using Java Lab

1. Write a program to read ***Student Name, Reg.No, Marks[5]*** and calculate ***Total***,***Percentage, Result***. Display all the details of students
2. Write a program to perform the following String Operations
   - **a.** Read a string
   - **b.** Find out whether there is a given substring or not
   - **c.** Compare existing string by another string and display status
   - **d.** Replace existing string character with another character
   - **e.** Count number of works in a string
3. Java program to implements Addition and Multiplication of two N X N matrices.
4. Java program to demonstrate the use of Constructor.
5. Calculate area of the following shapes using method overloading.
   - **a.** Triangle
   - **b.** Rectangle
   - **c.** Circle
   - **d.** Square
6. Implement inheritance between ***Person (Aadhar, Surname, Name, DOB, and Age)*** and ***Student (Admission Number, College, Course, Year)***classes where ReadData(),DisplayData() are overriding methods.
7. Java program for implementing Interfaces
8. Java program on Multiple Inheritance.
9. Java program for to display ***Serial Number from 1 to N*** by creating two Threads
10. Java program to demonstrate the following exception handlings
    - **e.** Divided by Zero
    - **f.** Array Index Out of Bound
    - **g.** File Not Found
    - **h.** Arithmetic Exception
    - **i.** User Defined Exception
11. Create an Applet to display different shapes such as Circle, Oval, Rectangle, Square and Triangle.
12. Write a program to create ***Book (ISBN,Title, Author, Price, Pages, Publisher)***structure and store book details in a file and perform the following operations
    - **j.** Add book details
    - **k.** Search a book details for a given ISBN and display book details, if available
    - **l.** Update a book details using ISBN
    - **m.** Delete book details for a given ISBN and display list of remaining Books

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabuscontent and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individualactivity))
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.

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 7A: Object Oriented Programming Using Java

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Explain about JVM.
2. Explain about factory methods.
3. Explain about „this" keyword with example.
4. Explain about Type casting.
5. Define Abstract class and Abstract method.
6. Explain Zipping and Unzipping files.
7. How to terminate a thread.
8. Explain JDBC.

Section - B

Answer ALL the following questions: **5x10=50M**

9. a) Explain Looping statements in JAVA.

(or)

b) Explain operators and types of operators.

10. a) Explain Inheritance and types of Inheritance.

(or)

b) Explain constructors and types of constructors with an example.

11. a) Describe Interface? Critically explain and define Accessing Interface variable.

(or)

b) Explain concept of Exception handling.

12. a) Explain the concept of Creating a file using File Writer using an example program.

(or)

b) Discuss Thread Life Cycle.

13. a) Define Applet. Explain how to create an Applet.

(or)

b) Explain the procedure to connect Oracle Database using jdbc-odbc driver.

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 6B	**Embedded & IoT**	**Hrs/Wk: 4**

Course Objectives

To understand fundamentals of IoT and embedded system including essence, basic design strategy andprocess modeling.

1. To develop comprehensive approach towards building small low cost embedded IoT system.
2. To learn real world application scenarios of IoT along with its societal and economic impactusing case studies

Course Outcomes

1. On completion of the course, student will be able to
2. Understand the basic concepts of embedded systems and IoT.
3. Apply the design methodology for embedded IoT Platform.
4. Develop programs using Python for Raspberry Pi.
5. Comprehend web of things and cloud of things.
6. Implement IoT Cloud Offerings for
7. Solve the given societal challenge using IoT

UNIT I: INTRODUCTION TO EMBEDDED SYSTEM AND IoT

Introduction to embedded systems, Application Areas ,Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Introduction to ARM processor and its architecture. Internet Of Things Promises–Definition– Scope–Sensors, IoT Applications–Structure of IoT– IoT Map Device ; IoT Sensors-Characteristics-types. IoT Issues and Challenges, Applications.

UNIT II: EMBEDDED IoT PLATFORM DESIGN METHODOLOGY

Purpose and requirement specification, Process specification, Domain model specification, information model specification, Service specifications, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Application development.

UNIT III: PILLARS OF EMBEDDED IoT AND PHYSICAL DEVICES

The internet of devices, The internet of objects, The internet of transducer, o The internet of controllers, Device to Connect and Manage, talk, Connect. Network, Basic building blocks of and IoT device, Exemplary device: Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, ▪ Beagle board and other IoT Devices.

UNIT IV: WEB OF THINGS AND CLOUD OF THINGS

Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things Architecture.

UNIT V: IoT CLOUD OFFERINGS AND IoT CASE STUDIES

Introduction to Cloud Storage Models, Communication API, Amazon Web Services for IoT, Skynet IoT Messaging Platform. Case Studies: Home Intrusion Detection, Weather Monitoring System, Air Pollution Monitoring, Smart Irrigation, Energy Harvesting

TEXT BOOKS:

1. Adrian McEwen and Hakim Cassimally, ―Designing the Internet of Things‖, John Wiley andSons Ltd, UK, 2014.
2. Vijay Madisetti, Arshdeep Bahga, ―Internet of Things (A Hands-on Approach), UniversitiesPress, 2015.

REFERENCE BOOKS:

1. Dieter Uckelmann, Mark Harrison, Florian Michahelles, ―Architecting the Internet ofThings‖, Springer, New York, 2011.
2. John H. Davies, ―MSP430 Microcontroller Basics‖, First Edition, Newnes Publication. 2010

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.

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 .
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

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 6B	**Embedded & IoT Lab**	**Hrs/Wk: 4**

List of Experiments

1. Introduction to MSP430 launch pad and Programming Environment.
2. Read input from switch and Automatic control/flash LED (soft-ware delay).
3. Interrupts programming example using GPIO.
4. Configure watchdog timer in watchdog & interval mode.
5. Configure timer block for signal generation (with given frequency).
6. Read Temperature of MSP430 with the help of ADC.
7. Test various Power Down modes in MSP430.
8. PWM Generator.
9. Use Comparator to compare the signal threshold level.
10. Speed Control of DC Motor
11. Master slave communication between MSPs using SPI.
12. Networking MSPs using Wi-Fi.

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 6B: Embedded & IoT

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. What are the applications of IoT
2. Explain about Embeded system specifications.
3. Explain Domain model specification
4. Explain Application Develoopment
5. Write a short note on intenet of objects
6. Explain about web of things.
7. Explain about mobile cloud computing
8. Write a short note on Cloud storage models

Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Draw Embedded syatem architecture and explain categories of embedded system,

(Or)

(b) Draw the architecture of ARM processor and Explain it

10. (a)Explain the Process specification and Service specification

(Or)

(b) Explain about Device and component integration .

11. (a)What is internet of controllers,internet of transducer.

(Or)

(b) Explai about Raspberry Pi and its interfaces

12. (a)Discuss Architecture Standardization of WoT.

(Or)

(b) Write about cloud of things architecture

13. (a) Write about skynet IoT Messaging Platform

(Or)

(b) Write about the weather monitoringsystem.

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 7B	**Machine Learning For Internet of Things**	**Hrs/Wk: 4**

Course Objectives

1. The main objective of this course is to introduce the students to the basics of Machine Learning Concepts applicable with Internet of Things.
2. To learn and understand the basics of Machine Learning and IoT
3. To get acquainted with machine learning for IOT Data Analysis.
4. To learn and understand Machine learning and deep learning methods for IoTapplications.
5. To design IoT applications using ML , DL methods
6. To understand the Internet of Things and its benefits for society..

Course Outcomes

On completion of this course, student will be able to–

1. Identify and understand the machine learning elements andtechniques
2. Implement data preprocessing methods for IoT using python
3. Compare Machine Learning and Deep Learning
4. Identify and understand Machine Learning accelerators for IoTDevices
5. Design & implement deep learning model for sensor data
6. Compare advanced machine learning techniques
7. Design various IoT applications using ML and DL techniques

UNIT I: Overview of Machine Learning

Introduction to ML, Introduction to Statistical Learning Methods, Classic and adaptive machines, Machine-Learning Problem, Machine-Learning Techniques and Paradigms, Machine Intelligence, Elements of Machine Learning, Introduction to Advanced ML - Deep Learning, Reinforcement Learning

UNIT II: Predictive Analysis for IoTIOT Data Pre-processing:

Data Preparation for Predictive Maintenance Modeling, Cleaning and Standardizing IoTData,Applying Advanced Data Exploration Techniques.

Feature Engineering:

Exploring Feature Engineering, Applying Feature Selection Techniques, Feature set selection using ML, Machine learning for Internet of Things data analysis

UNIT III: ML & DL Methods for IoT

Machine learning (ML) methods for IoT Applications :

Decision Trees (DTs), Support Vector Machines (SVMs), Bayesian theorem-based algorithms, k-Nearest neighbour (KNN), Random forest (RF), Association Rule (AR) algorithms, Ensemble learning (EL), k-Means clustering, Principal componentanalysis (PCA)

Deep learning (DL) methods for IoT Applications :

Convolutional neural networks (CNNs), Recurrent neural networks (RNNs), Deep autoencoders (AEs), Restricted Boltzmann machines (RBMs), Deep belief networks (DBNs), Generative adversarial networks (GANs), Ensemble of DL networks (EDLNs)

UNIT IV: Machine Learning Accelerators for IoT Devices

Compact fast Machine Learning Accelerators for IOT devices:

Edge Computing on IOT Devices, IOT Based Smart Buildings, Distributed Machine Learning, Machine Learning Accelerator, Machine Learning Model Optimization,

Least-Squares-Solver for Shallow Neural Network:

Introduction, Algorithm Optimization, Hardware Implementation

UNIT V:

Deep Learning for IOT:

Deep Learning Models For Sensor Data, Embedded Deep Learning, Real Time IOT Imaging with Deep Neural Network

Applications of ML and IOT :

Case Studies: IOT for Agriculture, Remote Patient Monitoring, Smart City, Smart Transportation, IOT Security using ML

TEXT BOOKS:

1. Ethem ALPAYDIN, "Introduction to Machine Learning" ,The MIT Press, October 2004,ISBN 0-262-01211-1
2. Hantao Huang, Hao Yu, "Compact and Fast Machine Learning Accelerator for IoT Devices,"Edition: 1st ed. Publisher: Springer Singapore Year: 2019ISBN: 978-981-13-3323- 1

REFERENCE BOOKS:

1. Trevor Hastie Robert Tibshirani Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition, Springer Series in Statistics, Feb 2009
2. Tom M. Mitchell , " Machine Learning", McGraw-Hill Science/Engineering/Math; (March 1, 1997)ISBN: 0070428077
3. Neeraj Kumar, Aaisha Makkar, " MACHINE LEARNING IN COGNITIVE IOT", https://www.routledge.com/Machine-Learning-in-Cognitive-IoT/Kumar-Makkar/p/book/9780367359164 ISBN 9780367359164 Published June 1, 2020 by CRCPress.
4. Puneet Mathur, " IoT Machine Learning Applications in Telecom, Energy, and Agriculture,
5. With Raspberry Pi and Arduino Using Python", ISBN 978-1-4842-5549-0
6. Nicolas Modrzyk, " Real-Time IoT Imaging with Deep Neural Networks - Using Java on the Raspberry Pi 4" , Apress Publication , Year: 2020, ISBN: 9781484257210, 978148425722

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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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;

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5. Observation of practical skills,
6. Individual and group project reports .
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

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 1**
Course: 7B	**Machine Learning For Internet of Things Lab**	**Hrs/Wk: 2**

1. **Programming for IOT : R- programming, Python Libraries, Azure Cloud platform Examining Machine Learning for IoT**
   Develop an Application on Arduino/Raspberry-Pi to capture the values of temperature sensorafter every 15 sec of time interval, store this values in .csv format and predict the temperature at particular time t using linear regression analysis.
   Hint: Create the dataset of at least 20-25 instances, use any data analysis tool (WEKA/R)
2. **Getting Started with Azure Machine Learning**
   Deploy your first Azure/Think Speak IoT Edge module to a virtual Linux or Windowsdevice

   Reference
   1. Deploy your first IoT Edge module to a Linux device
   2. Deploy your first IoT Edge module to a Windows device
   3. Things Speak for IoT
   4. Collect the sensor data on private cloud using Things Speak

3 Exploring Code-First Machine Learning with Python

1. Download the Dataset of your choice
2. Divide the dataset into Training data and Testing data.
3. Perform the classification of the instances using any machine learning algorithm like KNNAlgorithm, Naïve Bayes, Decision Tree or any.
4. Evaluate the machine learning model by considering the parameter (TPR, TNR, FPR, FNR,accuracy, precision, recall, error rate etc.)

MODEL QUESTION PAPER (Sem-end. Exam)
B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 7B: Machine Learning For Internet of Things

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Explain about ML for IoT
2. Explain about Deep Learning
3. What is Productive analysis for IoT
4. What is Association rule algorithms
5. Write short notes on k-Means clustering
6. Explain Distributed ML
7. Explain about Neural Netorks
8. What is IoT Security Using ML

Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Explain about Machine –Learning Techniques and Paradigms
(Or)
(b) Discuss about Machine Intelligence and Elements of ML.

10. (a)Explain cleaning and standardizing IoT data.
(Or)
(b) Explain Feature selection Techniques .

11. (a) Expalin about DTs and SVMs.
(Or)
(b) Write about CNNs and RNNs

12. (a)Discuss Edge computing on IoT Devices .
(Or)
(b) Write about ML Model Optimization and Algorithm Optimization

13. (a) What is a Embedded Deep Learning
(Or)
(b) Write about real time IoT imaging with deep neural netorks.

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 6C	**Applications of IoT & Multimedia Technology**	**Hrs/Wk: 4**

Course Objectives

1. Knowledge of the IoT standards & IoT components .
2. Knowledge of IoT Design Methodology.
3. To know about Specification Integration and Application Development.
4. The ability to Building IoT With Microcontroller.
5. The ability to work with Software & Management Tools of IoT.
6. The ability to implement a communication system with IoT devices.
7. The ability to specify Multimedia Technology and Industrial IoT Implementations.

Course Outcomes

1. Outlines a fundamental full stack architecture for IoT
2. Describes various development technologies in each IoT layer
3. Develops IoT applications using standardized hardware and software platforms.
4. Creates prototype using low power communication technologies.
5. Explains IoT solution development from Productmanagement perspective
6. Understand how to develop and implement own IoT technologies,solutions,and applications
7. At the end of the program, students will be able to understand how to develop andimplement their own IoT technologies, solutions, andapplications

UNIT I: Fundamentals of IoT

Introduction to Internet of Things- The Internet of Things Today, Towards the IoT Universe, Internet of Things Vision, IoT Concepts, IoT Standards, Components of IoT System, Domain Specific IoTs - IoT Applications - Home, Cities, Environment, Energy Systems, Retail, Logistics, Industry, Agriculture, Health and Life style.

UNIT II: IoT Design Methodology

IoT systems management – IoT Design Methodology - Internet of Things Use cases and Examples – Specification Integration and Application Development.

UNIT III: Building IoT With Microcontroller

Various Real time applications of IoT – Connecting IoT to cloud – CLOUD STORAGE FOR IOT – Data Analytics for IoT – Software & Management Tools for IoT, Multimedia Technology and Industrial IoT Implementations..

UNIT IV:

Introduction to IoT Security – Vulnerabilities, Attacks and Counter measures. Information Assurance. Attack types. New security threats and vulnerabilities. Fault Trees and CPS. Counter measures to thwartattack. Threat Modelling.

UNIT V: Case Studies and Advanced Topics

Case Study on: Home, Cities, Environment, Energy Systems, Retail, Logistics, Industry, Agriculture, Health and Life style.

TEXT BOOKS:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, by David Hanes, Gonzalo Salgueiro, Rob Barton, 2017,ISBN: 9780134307091.
2. Internet of Things, by Mayur Ramgir, Publisher: Pearson Education India, 2019.

REFERENCE BOOKS:

1. Arshdeep Bahga, Vijay Madishetti, "Internet of Things – A hands – on approach", UniversitiesPress, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O"Relly (SPD), 2014,ISBN:9789350239759.
3. Manoel Carlos Ramon, "Intel Galileo Gen 2: API Features and Arduino Projects for LinuxProgrammers", Apress, 2014.
4. Marco Schwartz, "Internet Of Things With The Arduino Yun", Packt Publising, 2014.
5. Hands-On Industrial Internet of Things, by Giacomo Veneri, Antonio Capasso, Publisher:Packt Publishing, 2018, ISBN: 9781789537222
6. Smarter Homes: How Technology Will Change Your Home Life, by Alexandra Deschamps-Sonsino, Publisher: Apress, 2018, ISBN: 9781484233634

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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;

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4. Practical assignments and laboratoryreports,
5. Observation of practical skills,
6. Individual and group project reports .
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

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 1**
Course: 6C	**Applications of IoT & Multimedia Technology Lab**	**Hrs/Wk: 2**

List of Experiments

1. List out the different IOT applications and importance of IOT in present scenario.
2. List the application of Arduino and Node MCU
3. Know the different sensors available to measure the current and voltage
4. Design the digital voltmeter and ammeter for both AC and DC circuits
5. Design a digital frequency meter to measure the frequency in an AC circuit.
6. Measure the power and energy consumption in a home using Arduino
7. Measure the power factor and phase angle in an AC circuit using Arduino/Node MCU.
8. Design a system to control the traffic signals through IOT
9. Develop a system to control the direction of three phase induction motor
10. Model a system to control the railway gate using stepper motors.
11. Know the functioning of relay module and a 3-phase contactor.
12. Design a system to protect the three phase induction motor from abnormal fault conditions
13. Design a system to control the direction and speed of DC motor
14. Design a relay to protect the home appliances from over currents, under voltages and overvoltages

MODEL QUESTION PAPER (Sem-end. Exam)B.Sc DEGREE EXAMINATIONS
SEMESTER – IV
Course 6C: Applications of IoT & Multimedia Technology

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Explain the vision and concept of IoT system .
2. What are the application of IoT ?
3. Explain IoT design Methodology
4. What are real time application of IoT
5. What is cloud storage for Iot
6. Explain IoT secutity Vulnerabilities .
7. What are the Types of Security attacks in IoT
8. What is union & structure?

Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Discuss about the components and IoT standards

(Or)

(b) Explain about IoT at environment ,retail ,Health care and life style.

10. (a)Explain the specification integraton of IoT

(Or)

(b) Explain applicaton development and syatem management of IoT

11. (a) Explain Software and Managemnet tools for IoT.

(Or)

(b) What is Multimedia Technology and Industrial IoT implications

12. (a) Discuss about IotT security attacks and counter measures.

(Or)

(b) Write about the following:
   (i) Fault trees and CPS
   (ii) Threat Modelling

13. (a) Explain about IoT applications at Energy system and Logistics

(Or)

(b) Write about the IoT at Industry and Medical Sectors

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 4**
Course: 7C	**Industrial IoT and Automation**	**Hrs/Wk: 4**

Course Objectives

By 2025, there will be 50 billion devices connected to the Internet. How will the students capitalize on this tremendous opportunity?

1. Students will learn the new evolution in hardware, software, and data.
2. 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.
3. Students acquire 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, wirelessprotocols, data storage and security
2. Explore IoT technologies, architectures, standards, and regulation
3. Realize the value created by collecting, communicating, coordinating, and leveragingthe data from connected devices
4. Examine technological developments that will likely shape the industrial landscape inthe 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 connected world? the difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT.

UNIT II: IIOT Components

Fundamentals of Control System, introductions, components, closed loop & open loop system.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 networkcommunication.

UNIT IV: Visualization and Data Types of IoT

Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud data base, Could computing, Fog or Edge computing**.**

Connecting an Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Raspberry pi board for the IoT.

UNIT V: Retrieving Data & Control & Supervisory Level of Automation

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: Cybermanufacturing 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 BOOKS:

1. "The Fourth Industrial Revolution" by Klaus Schwab
2. "The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies"by Erik Brynjolfsson and Andrew McAfee
3. Precision: Principles, Practices and Solutions for the Internet of Things" by Timothy Chou

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work andshall 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 andcontribution 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 .
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

B Sc	**Semester: V** (Skill Enhancement Course - Elective)	**Credits: 1**
Course: 7C	**Industrial IoT and Automation Lab**	**Hrs/Wk: 2**

1. Introduction to Arduino, ESp8266, Introduction to raspberry Pi.
2. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
3. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisturesensor) using Raspberry pi/node mcu.
4. Modules and Actuators Interfacing (Relay, Motor, Buzzer) usingRaspberry pi/node mcu.
5. Demonstration of MQTT communication.
6. Demonstration of LoRa communication.
7. Visualization of diverse sensor data using dashboard (part of IoT"s „control panel")
8. Sending alert message to the user. ways to control and interact with your environment)
9. Device control using mobile Apps or through Web pages.
10. Machine to Machine communication.
11. Digital logic gates programming using ladder diagram.
12. Implementation of Boolean expression using ladder diagram.
13. Simulation of PLC to understand the process control concept

MODEL QUESTION PAPER (Sem-end. Exam)B.Sc
DEGREE EXAMINATIONS
SEMESTER – IV
Course 7C: Industrial IoT and Automation

Time: 3Hrs. **Max.Marks:75**

Section - A

Answer any FIVE questions. Each question carries 5 marks. **5 X 5M = 25M**

1. Explain the challenges of IIoT.
2. Explain components of IIoT control system
3. Explain about cloosed loop control system .
4. Explain about wirless network communication.
5. What are EDGE devices explain them .
6. What is cloud computing explain it.
7. What are the types of IoT interaction.
8. Explain real time control system

Section - B

Answer ALL the following questions: **5x10=50M**

9. (a) Draw the architecture of IIoT & Explain it.
   (Or)
   (b) What are the difference between IoT and IoT

10. (a)Explain about any 3 or more sensors with their working principles.
    (Or)
    (b) Explain about electromechanical switches and their basic switching terms.

11. (a) Explain IEEE 802.15.4, ZigBee, Bluetooth, NFC ,RFID .
    (Or)
    (b) Explain LoRA WAN and MQTT in industry standards communication technology.

12. (a)Discuss about the cloud data base and Edge computing .
    (Or)
    (b) Detailed explanation about Aurduino development environment.

13. (a) Explain about grabbing and sending data to the web.
    (Or)
    (b) Write about the following
    (i) SCADA
    (ii) PLC