Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B^{++}'Grade (CGPA 2.96)

Name of the Faculty: Science &Technology

(As per New Education Policy 2020)

Syllabus: Electronics (Internet of Things)

Name of the Course: M. Sc. II (Sem. III &IV)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University,Solapur

M.Sc. Electronics (Internet of Things)

Based on NEP-2020

(w.e.f. June 2023 - 24)

1. Title of the Course : M.Sc.-Electronics (Internet of Things)

2. Introduction:

Master of Science (M.Sc.) in Electronics (Internet of Things) is running program at Post Graduate Department of Electronics, Shri Shivaji Mahavidyalaya, Barshi, Dist Solapur from June 2023 and disseminating knowledge of the subject from fundamental concepts to State-of- technologies. With the view to provide exposure to the recent technologies of various sectors of the Electronics and to empower the students to make them competent for industrial needs, R & D sectors and self employment as well the curriculum is framed. Indeed, the curriculum compasses knowledge of Embedded System, Communication Electronics and IoT Programming Languages. Therefore, the student can realize the state - of art of the technological designing and development. The Choice Based Credit System (CBCS) is implemented for this course. Objectives of the course:

Following are objectives of the course.

- To utilize various Embedded Technologies related to IoT, Sensor Networks, Communication Protocols, Cloud Computing, Accessing Resources and Services needed to perform functions with dynamically changing needs.
- To understand the IoT privacy and Security Concepts for secured IoT environment.
- To utilize the various IoT Platforms to explore Real Time IoT Applications Areas.
- To explore Modern IoT Trends
- To undertake industrial research projects for the development of future solutions in the domain of Data Analytics to make an impact in the technological advancement.
- To use advanced IoT Tools/ Decision-Making Tools/ Operation Research Techniques to analyze the complex problems and get ready to develop such new techniques for the future.
- To provide exposure to the students to there cent technologies.
- To provide the knowledge of design and implementation of instrumentation of significant preciseness.
- To inculcate awareness among the student to perform the project so find us trial standards, which could also, ensures the interdisciplinary approach.
- To empower the students to cater the needs of industrial sectors. It is also attempted to expose the students to there search activities and to inculcate there search awareness.
- To expose the students to the industrial environment a on job training and internship may be provided
- To empower the students to achieve the success in the NET/GATE/SET etc examinations.
- To expose the students to on-lineshooter certificate courses such as MOOC / SWAYAM/ NPTEL, etc.

3. Advantages of the Course:

Electronics is the subject, which ensures wide application potential in diverse sectors. Along with the basic sciences, it bears the knowledge of technology as well. Therefore, it depicts the tremendous opportunities in the electronic industrial sectors. It ensures well confluence of Science and Technology. Therefore, the course helps to achieve all round development. Moreover, the students can also opt for education field for their career.

4. Eligibility of the Course:
   - **1** B.Sc. with Electronics subject at Principal / Interdisciplinary /Allied / Applied / Subsidiary Level.
   - **2** B.Sc. Physics ,Computer Science or Any Relevant Subject with Electronics subject at subsidiary Level.
   - **3** B.C.S.(ECS)
5. Duration: 2 Years– 4 Semesters
6. The Choice Based Credit System(CBCS):

A Choice based credit system (CBCS) is implemented for this course. According to this system, choice is given to the students..The M.Sc. I Course has compulsory three Disciplinary Subject Course (DSC) Theory papers and three Disciplinary Subject Elective (DSE) . Theory papers for Semester-I and Semester-II respectively. Thus Paper DSC- I, II, III, IV are compulsory. Moreover, choice is given to the students to select One paper from DSE at each Semester

The M.Sc. II Course has compulsory three Disciplinary Subject Course (DSC) theory papers for Semester-III and Semester-IV respectively. Thus Paper DSC - V, VI, VII, VIII are compulsory. Moreover, choice is given to the students to select One paper from DSE at each Semester

7. The Credit and Grading System (CGPA):

Credit is a numerical value that indicates student's work load (lectures , lab work , seminars, tutorial, field work, etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. As per the present norms there are 4 contact hours per paper per subject per week, which works out to be 60 contact hours per paper per subject per semester or 120 contact hours in annual pattern. By converting these contact hours into credit at the rate of 15 contact hours for one credit, there will be 04 credits per paper per subject per semester and 08 credits in annual pattern. There are five papers at M.Sc. I level. The M.Sc. I student must complete minimum of 22 credits (maximum 44 credit points) in each semester.

A) Conversion of marks in to Grades :A table for the conversion of the marks obtained by a student in each paper (out of 100) to grade and grade points is given below.

Sr.No	Range of Marks	Grade	Grade Point
1.	80-100	O	10
2.	70-79	A+	9
3.	60-69	A	8
4.	55-59	B+	7
5.	50-54	B	6
6.	45-49	C+	5
7.	40-44	C	4
8.	<39	FC	0(Failed in Term Exam)
9.	<39	FR	0(Failed in Internal Assesment)

1. Grade Point Average at the end of the Semester (SGPA)

$$SGPA=\frac{(G1xC1)+(G2xC2)+\ldots\ldots}{\Sigma Ci}$$

(ΣCi-The total number of credits offered by the student during a semester

Cumulative Grade Point Average (CGPA)

$$\ldots CGPA=\frac{(G1xC1)+(G2xC2)+\ldots\ldots}{\Sigma Ci}$$

(ΣCi -the total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

2. Final Grade Point Average (FGPA) will be calculated in the similar manner for the total number of credits offered for completion of the said course.

Where: Ci: Credits allocated for the course Gi:
Grade point scored paper

B) Scheme of Evaluation: The candidate has to appear for Internal Evaluation of 20/10 marks and External Evaluation (University Exam) for80/40 marks for each paper/practical. The nature of internal evaluation will be decided by the Post Graduate Department of Electronics. The internal evaluation comprises unit tests , tutorials ,seminars ,Group discussion, oral, etc., which ensures a process of continuous assessment.

C) Nature of Question Papers: The nature of question paper shall be as per time to time prescribed by the university authorities. The complete question paper has objective type questions, short answer type questionsand long answer type questions.

D) Passing Standard: The student has to secure a minimum of 4.0 grade points (Grade C) in each paper A student who secures less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper (subject) and shall be required to reappear for respective paper. A student who failed in Term End Examination (Theory) & passed in Internal assessment of a paper (subject) shall begiven FC Grade. Such student will have to appear for Term End Examination only. A student who fails in Internal assessment and passed in Term End examination (Theory) shall be given FR Grade. Such student will have to appear for Term End examination as well as internal assessment. In case of year down candidates from the mark scheme the candidates shall appear for the same 80 marks paper of the external examination and his performances Shall be scaled to 100 marks.

E) ATKT: A student who fails in one fourth (25%) or less papers of the total papers offered in the 1^{st}and2^{nd}semester will be allowed for admission to second year (Sem.III -IV)

8. Structure of the Course:

The Course Structure of M.Sc. Electronics (Internet of Things) is as depicted in the table. It is integrated course of 2 years i.e. 4 semesters. For, M. Sc. I, semester I has Two compulsory theory papers 4 credits each , One Elective paper of 4 credits & Three Practical of DSC 2 Credits each & 4 Credits for RM Paper . For, M. Sc. I, semester II has Two compulsory theory papers , One Elective papers of 4 credits each & Three Practical of DSC 2 Credits each & 4 Credits for OJT Paper .

Specializations : Internet of Things

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Sc. Electronics (Internet of Things)

Choice Based Credit System (CBCS)

Course Structure (NEP-2020)

M.Sc. Part- I Electronics (IOT) w.e.f. 2023-24

Level/ Difficulty	Sem.	Major		RM	FP/RP/OJT/ Internship/ Apprenticeship	Credits	Cumulative Credits
		Mandatory	Elective				
6.0/400	I	DSC1-1 (4+2) Hardware , Programming and IDE tools- AVR & PIC Series DSC 1-2 (4+2) Sensors and Actuators	DSE 1-1 (4+2) 1. Programming with C and C++ 2. .Modern Communication System 3. Electronics System Design	Research Methodology (4)	---	22	44 PG Diploma in Discipline
	II	DSC 1-3(4+2) Interfacing & Embedded System Design using – AVR & PIC Microcontrollers DSC 1-4 (4+2) Fundamentals of Internet of Things	DSE 1-2 (4+2) 1. Application Development using Arduino, NodeMCU & LORA 2. Cellular Data Communication 3. Antenna and Wave Propogation	---	OJT/In-house Project/ Internship/ Apprenticeship(4)	22	
	Total 1 Yrs	24	12	04	04	44	
Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major							

Abbreviations: DSC: Discipline Specific Core, DSE: Discipline Specific Elective, RM: Research Methodology, OJT: On job training internship/Apprenticeship, FP: Field project

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Sc. Electronics (Internet of Things)

Course Structure (NEP-2020)

M.Sc. Part- I Electronics (IoT) w.e.f. 2023-24

M.Sc. Electronics (IoT) Semester -I											
Paper Code	Title of the Paper	Credits	Contact hours/week			Distribution of Marks for Examination					
			Th (L)	Pr	Total	Internal		External		Total	
						Th	Pr	Th	Pr	Th	Pr
DSC-1-1	Hardware , Programming and IDE tools- AVR & PIC Series	4	4	---	4	40	---	60	---	100	---
DSC-1-2	Sensors and Actuators	4	4	---	4	40	---	60	---	100	---
DSE-1-1	1. Programming with C and C++ 2.Modern Communication System 3.Electronics System Design	4	4	---	4	40	---	60	---	100	---
RM	Research Methodology	4	4	---	4	40		60	---	100	---
Lab-1	Practical-1: (Based on DSC-1-1)	2	---	4	4	---	20	---	30	---	50
Lab-2	Practical-1: (Based on DSC-1-2)	2	---	4	4	---	20	---	30	---	50
Lab-3	Practical-1: (Based on DSE-1-1)	2	---	4	4		20		30		50
Total for Semester-I		22	16	12	28	160	60	240	90	400	150
M.Sc. Electronics (IoT) , Semester –II											
Code	Title of the Paper	Credits	Contact hours / week			Distribution of Marks for Examination					
			Th (L)	Pr	Total	Internal		External		Total	
						Th	Pr	Th	Pr	Th	Pr
DSC-1-3	Interfacing & Embedded System Design using - AVR & PIC Microcontrollers	4	4	---	4	40	---	60	---	100	---
DSC-1-4	Fundamentas of Internet of Things	4	4	---	4	40	---	60	---	100	---
DSE-1-2	1. Application Development using Arduino, NodeMCU & LORA 2.Cellular Data Communication 3. Antenna and Wave Propogation	4	4	---	4	40	---	60	---	100	---
OJT/FP	OJT/FP	4	---	8	8	---	40	---	60	---	100
Lab-1	Practical-1: (Based on DSC-1-3)	2	---	4	4	---	20	---	30	---	50
Lab-2	Practical-1: (Based on DSC-1-4	2	---	4	4	---	20	---	30		50
Lab-3	Practical-1: (Based on DSE-1-2)	2	---	4	4	---	20		30		50
Total for Semester- II		22	12	20	32	120	100	180	150	300	250

DSC: Discipline Specific Course, DSE: Discipline Specific Elective, FP: Field projects **OJT:** On Job Training: Internship/ Apprenticeship, **RM**: Research Methodology, **RP**: Research Project

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Sc. Electronics (Internet of Things)
Choice Based Credit System (CBCS)
Course Structure (NEP-2020)
M.Sc. Part- II Electronics(IoT) w.e.f. 2024 -25

Level/ Difficulty	Sem.	Major		RM	FP/RP/OJT/ Internship/ Apprenticeship	Credits	Cumulative Credits
		Mandatory	Elective				
6.0/400	III	DSC-1-5 (4+2) Introduction to Rasberry Pi DSC-1-6 (4+2) Fundamentals of Sensor Networks	DSE-1-3 (4+2) 1. Programming in Python and Application Devlopment 2. Introduction to Cloud Computing 3. IoT Platform and System Design	--	RP (4)	22	88 PG Degree in Discipline
	IV	DSC-1-7 (4+2) Data Analytics & Industrial IoT DSC-1-8 (4+2) Advanced Wireless Sensor Networks	DSE 1- 4 (4+2) 1. Java Programming For Mobile Application Devlopment 2. Advanced Java 3. Mobile Computing	--	RP (4)	22	
	Total 2 Yrs	48	24	04	12	88	
Exit option: Award of UG degree in Major with 132 Credits OR Continue with Major							

Abbreviations: DSC: Discipline Specific Core, DSE: Discipline Specific Elective, RM: Research Methodology, OJT: On job training internship/Apprenticeship, FP: Field project

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Sc. Electronics (Internet of Things)

Choice Based Credit System (CBCS)

Course Structure (NEP-2020)

M.Sc. Part- II Electronics(IoT) w.e.f. 2024-25

M.Sc. Electronics (IoT) Semester -III

Paper Code	Title of the Paper	Credits	Contact hours/week			Distribution of Marks for Examination					
			Th (L)	Pr	Total	Internal		External		Total	
						Th	Pr	Th	Pr	Th	Pr
DSC-1-5	Introduction to Rasberry Pi	4	4	---	4	40	---	60	---	100	---
DSC-1-6	Fundamentals of Sensor Networks	4	4	---	4	40	---	60	---	100	---
DSE-1-3	1. Programming in Python and Application Devlopment 2. Introduction to Cloud Computing 3. IoT Platform and System Design	4	4	---	4	40	---	60	---	100	---
OJT/FP/RP	RP	4	4	---	4	---	40	---	60	---	100
Lab-1	Practical-1: (Based on DSC-1-5)	2	---	4	4	---	20	---	30	---	50
Lab-2	Practical-1: (Based on DSC-1-6)	2	---	4	4	---	20	---	30		50
Lab-3	Practical-1: (Based on DSE-1-3)	2	---	4	4	---	20		30		50
Total for Semester-I		22	16	12	28	120	100	180	150	300	250

M.Sc. Electronics (IoT) , Semester -IV

Code	Title of the Paper	Credits	Contact hours / week			Distribution of Marks for Examination					
			Th (L)	Pr	Total	Internal		External		Total	
						Th	Pr	Th	Pr	Th	Pr
DSC-1-7	Data Analytics & Industrial IoT	4	4	---	4	40	---	60	---	100	---
DSC-1-8	Advanced Wireless Sensor Networks	4	4	---	4	40	---	60	---	100	---
DSE -1-4	1. Java Programming For Mobile Application Devlopment 2. Advanced Java Programming 3. Mobile Computing	4	4	---	4	40	---	60	---	100	---
OJT/FP/RP	RP	4	---	8	8	---	40	---	60	---	100
Lab-1	Practical-1: (Based on DSC-1-7)	2	---	4	4	---	20	---	30	---	50
Lab-2	Practical-1: (Based on DSC-1-8)	2	---	4	4	---	20	---	30		50
Lab-3	Practical-1: (Based on DSE-1-4)	2	---	4	4	---	20		30		50
Total for Semester- II		22	12	20	32	120	100	180	150	300	250

DSC: Discipline Specific Course, DSE: Discipline Specific Elective, FP: Field projects **OJT:** On Job Training: Internship/ Apprenticeship, **RM**: Research Methodology, **RP**: Research Project

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester :III
Subject : Electronics (Internet of Things) **Credit : 04**
Paper Code : DSC 1-5 **(60 Periods)**

DSC 1-5 : INTRODUCTION TO RASPBERRY PI

Course Contents:

Unit 1: Getting Started with Raspberry Pi **12**

Introduction to Raspberry Pi , Comparison of various Rpi Models , Understanding SoC architecture and SoCs used in Raspberry Pi ,Pin Description of Raspberry Pi , On-board components of Rpi, Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use

Unit 2 Operating system **12**

Implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 4, Downloading an Operating System, format an SD card and booting the OS, 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, Connecting with Display , Audio , Keyboards & Mouse ,SD Card ,External Storage , Networks & Power supply.

Unit 3. Communication with devices **12**

Communication with devices through the GPIO 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 4. Programming & Interfacing with Rasberry Pi **12**

Programming & Interfacing Rasberry Pi using Python ,Using GPIO Port of Rasberry Pi , Installing GPIO Python libaray , GPIO output –flashing led ,controlling relay ,PWM DC motor ,steeper motor control & Servo Motor Interfacing , ADC / DAC Interfacing , GPIO input – reading push button ,reading matrix keyboard, Reading sensor input(Temperature/Humidity / PIR), Interfacing Display (Seven Segment & LCD)

Unit 5. Rasberry Pi Alternatives **12**

Introduction to Nvidia-Jetson Nano, Rock pi -4, Beagle Bone BLACK , Odroid XU-4, Asus Tinker Board , Banana Pi –M4 ,Pink 64 – Rock Pro 64

Text & References:

Text:

- Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional
- Massimo Banzi, "Getting Started with Arduino", First Edition, February 2009, O'Reilly Media, Inc

References:

- Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
- Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, John Wiley & Sons

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Class : M. Sc.-II, Semester :III
Subject : Electronics (Internet of Things) **Credit : 04**
Paper Code : DSC 1-6 **(60 Periods)**

DSC 1-6 – Fundamentals of Sensor Networks

Unit 1. Introduction to Wired Sensor Networks **15**

Overview of wired sensor networks , Characteristics and requirements , Applications and challenges Components and functionalities of wired sensor nodes ,Sensor interfacing and signal conditioning , Wired communication protocols (e.g., SPI ,I2C ,USB ,J Tag, UART ,USART , RS-485, Ethernet, LIN, CAN ,4-20 mA Standard) ,Protocol stacks (e.g., TCP/IP, Modbus) ,Synchronization and timing issues in wired networks , Wired network topologies (e.g., star, bus, ring)

Unit 2. Introduction to Wireless Sensor Networks **06**

Introduction to Wireless Sensor Networks, Architecture of WSN, Types of WSN, Characteristics of WSN, Architecture of Wireless sensor Node, End Device, Co-ordinator, FFD, PFD, Standard WS nodes,. Applications of WSNs

Unit 3. Introduction to Wireless Sensor Network Protocols **14**

Overview of Communication Protocols for Wireless Networking, ISM band, data rate, Network layers for WSN, Physical layer (Source Encoding, Channel Encoding ,Modulation, Signal Propogation), MAC layers (Overview Wireless Mac Protocol , IEEE 802.11, IEEE 802.15.4 standards & Zigbee, Characteristics of Mac Protocol in Sensor Network) , Network Layer (overview, routing Matix - Data centic , Proactive ,On-demand , Hierachical ,Location Base routing , QoS Routing Protocol , Application layers, Frame Format.

Unit 4. Wireless Sensor Technology **15**

Architecture of the Bluetooth, Bluetooth Low Energy ,Wi-Fi, Zigbee, RFID,NFC, LTE, LoRa, HAN technology , Device addressing, Designing of WS Node with WS technology.

Unit 5. Application of Wireless Sensor Network **10**

Traffic Monitoring system , Health Monitoring system ,Precision Aggriculture system , Pipeline Monitoring system

Text & References:

1 Fundamentals of Wireless Sensor Networks Theory and Practice by 1.Waltenegus dargie andChristianpoullabauer wiley Publication

2. Wireless Sensor Networks technology, protocols and applications, Kazem Sohraby , Daniel Minoli, Taieb Znati, Wiley, 2013

3. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC PRESS Publication, Edited by Mohammad Ilyas and Imad Maugoub.

4. Datasheet of Bluetooth, Wi-Fi, Zigbee, RFID,NFC, LTE, LoRa, HAN technology

5. Wireless communication and Networking V K Garg Elsevier, 200927

6. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)

Reference Books:

- KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
- B. Krishnamachari, "Networking Wireless Sensors", Cambridge University Press.
- N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag

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Class : M. Sc.-II, Semester :III
Subject : Electronics (Internet of Things) **Credit : 04**
Paper Code : DSE 1-3.1 **(60 Periods)**

DSE 1-3.1 Programming in Python and Application Development

Unit 1: Introduction , Data types and Operators in Python **12**

Python, Features of Python, Execution of a Python Program, Flavors of Python Structure of Python program, Comparisons between C and Python, , writing Simple program in python.

Data types in Python: Built-in data types, bool Data type, Sequences in Python, Sets, Literals in Python, Determining the Data type of a Variable, User-defined Data types Constants in Python, Identifiers and Reserved words, **Operators in Python :** Arithmetic, logical, Boolean, Bitwise Operators, membership, Operator precedence and Associativity.

Unit 2 : Control Statements and **Arrays in Python** **12**

The control statements : if , if … else, Case, The Loops- While, for, nested loops.

Arrays in Python : Advantages of Arrays, Creating an Array, Importing the Array Module, Indexing and Slicing on Arrays, Processing the Arrays, Types of Arrays, Working with Arrays using numpy , Creating Arrays using array(), linspace, logspace, arange() Function, Creating Arrays using zeros() and ones() Functions, Dimensions of Arrays, Attributes of an Array, The reshape() Method, The flatten() Method,Working with Multi-dimensional Arrays, introduction to Lists, tuples and dictionaries

Unit 3 Functions and Files in Python **12**

Difference between a Function and a Method, Defining a Function, Calling a Function, Returning Results from a Function, Returning Multiple Values from a Function, Functions are First Class Objects, Pass by Object Reference, Formal and Actual Arguments, Positional Arguments, Keyword Arguments, Recursive Functions, Anonymous Functions or Lambdas, python modules **Files :** Types of Files in Python, Opening a File, Closing a File, Working with Text Files, Containing Strings, The with Statement Pickle in Python, The seek() and tell() Methods ,

Unit 4 Data Structures in Python **06**

Structures, Linked Lists, types of link lists, insertion and deletion of nodes, Stacks, Queues

Unit 5 IoT Applications of Python Using Raspberry Pi **18**

Building an MQTT Server on Raspberry Pi, Healthcare Monitoring , Remote Rasberry Pi Camera Viewing , Weather Station (Temperature and Humidity)Monitoring system , Iot based Home Automation , Water Level Controller, Green House Automation System , Smart Parking System Using RFID , Vehicle tracking system based on GPS & GSM

Reference Books

1. Core Python Programming- Dr. R. Nageswara Rao- Dreamtech Press, 2017
2. LEARNING TO PROGRAM WITH PYTHON- Richard L. Halterman,
3. http://www.davekuhlman.org/python_book_01.pdf , 2011
4. Core Python Programming, Wesley J. Chun, PHI, 2006
5. A Python Book: Beginning Python, Advanced Python, and Python Exercises- Dave Kuhlman www.opensource.org/licenses/mitlicense.php, 2013

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Class : M. Sc.-II, Semester :III
Subject : Electronics (Internet of Things) **Credit : 04**
Paper Code : DSE 1-3.2 **(60 Periods)**

DSE 1-3.2 : INTRODUCTION TO CLOUD COMPUTING

Unit 1.Introduction to Cloud Computing **15**

What is a cloud, Definition of Cloud Computing, Characteristics of Cloud Computing, Driving factors towards cloud,Architecture, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models: IaaS, PaaS, SaaS, NaaS, Cloud Clients, Deployment Models: Public Clouds, Community Clouds, Hybrid Cloud, Private Cloud, Issues in Cloud Computing, Applications.

Unit 2.Infrastructure as a Service(IaaS) **15**

IaaS definition, Introduction to virtualization, Different approaches to virtualization, Resource Virtualization-Server, Storage, Network, Hypervisors, Machine Image, Virtual Machine(VM), Data storage in cloud computing (storage as a service), Examples like Amazon EC2-Renting, EC2 Computer Unit, Platform and Storage, pricing, customers.

Unit 3.Platform as a Service(PaaS) **10**

What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Examples like Google App Engine.

Unit 4.Software as a Service(SaaS) **10**

Introduction to SaaS, Web services, Web 2.0

Unit 5.Overview of Security Issues **10**

Overview of Security Issues, Infrastructure Security: Network level security, Host level security,Application level security, Data security and Storage, Challenges and Risks of Cloud Computing Platforms and Cloud Services

Text & References:

Text:

- Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, Cloud Computing: Principles and paradigms, 2011
- Michael Miller, Cloud Computing, 2008

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Class : M. Sc.-II, Semester :III
Subject : Electronics (Internet of Things) **Credit : 04**
Paper Code : DSE 1-3.3 **(60 Periods)**

DSE 1.3.3 : IOT PLATFORMS AND SYSTEM DESIGN

Unit 1. IoT Networking Core **12**

Technologies involved in IoT development, Internet web and Networking technologies, Infrastructure, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wireless networking equipment and configurations, accessing hardware and device file interactions.

Unit 2. M2M to IoT **12**

Role of M2M in IoT, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3. IoT Architecture -State of the Art **12**

IoT reference Model and Architecture- Functional View, Information View, Deployment and Operational View, Other Relevant architectural views, Middleware Introduction-FiWare etc., Remote monitoring and sensing, remote controlling and performance analysis, layering concepts, communication pattern, 6LoWPAN, Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Unit 4. IoT Application Development **12**

Application protocols: MQTT, REST/HTTP, CoAP, MySQL, Back-end Application Designing Apache for handling HTTP Requests, MongoDB Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development

Unit 5. IoT Security and case studies **12**

Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities.

Texts & References:

Texts:

- Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014
- Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, November 2013, John Wiley and Sons.71

References:

- Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications, 2013
- CunoPfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
- Zach Shelby, Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, John Wiley and Sons.
- Dr. OvidiuVermesan, Dr. Peter Friess “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Class : M. Sc.-II, Semester :IV
Subject : Electronics Electronics (Internet of Things) **Credit : 04**
Paper Code : DSC 1-7 **(60 Periods)**

DSC 1-7 : Data Analytics & Industrial IoT

Unit 1.Database Design & Modeling

Database Design : Database system Applications ,Purpose of Database, Database Architecture , Database Properties , Database Languages , View of Data , Instances and Schema .

Data Modeling :Relational Model ,Data Modeling :ER Model , Attributes and their types Relationships, Cardinalities , Extended ER Diagram , Specialization and Generalization ,Aggregation and Attribute Inheritance.

Unit 2. Introduction to SQL

Relational Database : Relational Model , Keys Concepts Integity Constraints

Introduction to SQL : Data Types nd Literals , DDL, DML, Statements , Views : Creating Dropping , Updating using Views , Indexes , Handling Nulls . Basic Filtering and Advance Filtering with SQL , Wildcards in SQL ,Sorting and Maths Operations Buit –in Database

Unit 3. Data Analysis

Introduction , Data Analysis , Machine Learning – Supervise and Unsupervised Learning , Machine Learning Models- Classification Regression and Clustering , Model buiding process –Traniong the Model , Testing the Model , Validation OF Model , Modeling Algorithem ,Decision Tree , Linear Regression , Logistic Regression , k-Means , Model performance ,Big Data Platform , Big Data Pipeline –Kafka ,Flinks ,Real Life Projects

Unit 4 . Industry 4.0

Globalization & Emerging issues , 4 th Revolution , LEAN Production Systems , Smart and Connected Bussiness Perspective Smart Factories , cyber physical system and next generation sensors , Colaborating Platform and product life cycle management , augmented reality and virtual reality , Atrificial Intelligence , Big Data Analysis ,

Unit 5.Industrial IoT

Introduction to Industrial IoT (I IoT) ,Buissness Model and Reference Architecture , Industrial IoT Layers – I IoT Sensing , I IoT Processing ,I IoT communication , I IoT Networking

Big Dat Analytics and Software Define Networks – I IoT Analytics Introduction , Machine Learning Data Science ,Julya Programming , Data Management with Hadoop ,Dat Center Network , I IoT security ,Fog Computing and Cloud Computing I IoT Application in milk Processing and Packaging Industry

Text

1.Industrial Internet Of Things – by I.A.Dhotre Technical Publication

2 Industrial Internet Of Things – by Dr. Gajanan WalunjakarcDr. Archana Ratnparkhe Dr. Dipesh Pardeshi & Dr Anup Ingale –Nirali Prakashan

4. Industry 4.0 Gilchrist A Press

5. Introduction to Industrial Internet Of Things & Industry 4.0 by Dr.Sudip Mishra Chandana Roy & Anandrup Mukharji CRC Press

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Class : M. Sc.-II, Semester :IV
Subject : Electronics **Credit : 04**
Paper Code : DSC 1.8 **(60 Periods)**

DSC 1-8 : Advanced Wireless Sensor Networks

Unit 1. Energy efficient protocol of WSN **10**

Network topologies, Star, Mesh, and Ring, Peer- peer, Fundamental SPR Need of power saving, Hierarchical protocols, LEACH, PEGASIS, SPIN, TEEN, etc, Performance analysis of the WSN,

Unit 2. Energy management and WSN security issues **15**

Need for energy management, classification of energy management, battery management schemes, transmission power management schemes, system power management schemes, Location discovery, privacy, integrity, authentication, secure localization, secure aggregation, attacks and defence mechanisms.

Unit 3 Operating System for Sensor Network **10**

Introduction , Design Issue, Example of Operating System,. Node level simulator performance and Taffic management Issues ,WSN Design Issues , Perfomance Module of WSN Imerging application

Unit 4 Sensor Network Programming **15**

Challenges in sensor network programming ,Node centic programming –nesC Language , Tinygals,sensor network application construction kit ,Thread base models

Macro programming –Abstract region ,Envirotrack Database approaches, Dynamic Programming , Sensor Network simulator –Network simulator tools and Environments

Unit 5 Future Trends in Wireless Sensor networks **10**

Wireless Multimedia sensor network ,wireless sensor and actor network ,sensor network application in challenging Environment –Underwater acoustic sensor network , Wireless underground sensor network, Crosslayer, Design for wireless sensor network

Text & References:

1. Wireless sensor network works – Networking perspective by Junzheng and abbas jamalipour wiley Publication
2. Wireless Sensor network by Dr. S.Omkumar
3. Fundamentals of Wireless Sensor Networks
4. Wireless Sensor Networks technology, protocols and applications, Kazem Sohraby , Daniel Minoli, Taieb Znati, Wiley, 2013
6. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC PRESS Publication, Edited by Mohammad Ilyas and Imad Maugoub.
7. Wireless communication and Networking V K Garg Elsevier, 200927

Reference Books:

- KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.
- B. Krishnamachari, "Networking Wireless Sensors", Cambridge University Press.
- N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and

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Class : M. Sc.-II, Semester :IV
Subject : Electronics Credit : 04
Paper Code : DSE 1- 4.1 (60 Periods)

DSE 1-4.1: Java Programming For Mobile Application Devlopment

Unit 1:. Java Programming FOR Mobile Application Devlopment

Object-Oriented Programming Concepts , Fundamentals of Object-Oriented Programming , Java Evolution , Overview of Java Language , Constants, Variables and Data Types , Operators and Expressions , Decision making, Branching and Looping Classes, Objects and Methods, Arrays, String and Collections, Interfaces, Packages, Managing Errors and Exceptions, Java Multithreading, Java I/O Handling.

Unit 2:. Java Fundamentals for Android Application

History of Java ,How java program works ? , Install java JDK and JIE , Why Google choose Java for Android Application, Android OS structure ,installing Andriod Studio , Creating AN Android Project (Java project) using android studio ,Writing Java program, Java methods , Running a Java program

Unit 3: Introduction to Android OS & its Application Components

Introduction to Android Operating System: Android OS and Features – Android development framework; Installing and running applications on Android Studio, Creating AVDs, Types of Android application; Creating Activities, Activity Life Cycle, Activity states, monitoring state changes; Android application components – Android Manifest file, Externalizing recourses like Simple Values, Drawables, Layouts, Menus, etc, Building User Interfaces: Fundamental Android UI design, Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components

Unit 4: Fragments

Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities

Unit 5: Intents and Broadcasts

Using intents to launch Activities, Types of Intents, Passing data to Intents, Getting results from Activities, Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters

Text

- Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition: I
- Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
- Worklight resources

References:

- Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
- Barry Burd, "Android Application Development All in one for Dummies", Edition: I
- Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
- Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, 2012

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Class : M. Sc.-II, Semester :IV

Subject : Electronics | Credit : 04
Paper Code : DSE 1-4.2 | (60 Periods)

DSE 1 -4.2: ADVANCED JAVA PROGRAMMING

Unit 1. Distributed Computing

Introduction to Java RMI, RMI services, RMI client, Running client and server, Introduction of Swing, Swing Components, Look and Feel for Swing Components, Introduction to Multimedia Programming.

Unit 2.Database Connectivity

ODBC and JDBC Drivers, Connecting to Database with the java.sql Package, Using JDBC Terminology, JDBC with mysql, postgresql.

Unit 3.Servlet Programming

Introduction to Servlets, Servlet Life Cycle, Servlet based Applications, Servlet and HTML.Filters, jdbc with servelets, session Management techniques in detail.

Unit 4.JSP Programming

JSP: Introduction to JSP, JSP implicit objects, JSP based Applications, Java. Net. Login & Logout Example, jdbc with jsp.

Unit 5.JEE Web Appliaction

The Model-View-Controller Architecture What is Struts, Struts Tags, Creating Beans, Other Bean Tags, Bean Output, Creating HTML Forms, The Action Form class The Action class, Simple Struts: a simple Struts application; Introduction to EJB.

Text & References:

Text:

- Java 2 Unleashed (Techmedia – SAMS), Jamie Jaworski
- Professional Java Server Programming (a Press), Allamaraju
- Developing Java Servlets (Techmedia – SAMS), James Goodwill sing Java 1.2 Special Edition (PHI), Webber

References:

- David Flanagan,Jim Parley, William Crawford & Kris Magnusson, Java Enterprise in a nutshell - A desktop Quick reference - O'REILLY, 2003
- Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley-2001
- JaisonHunder& William Crawford, Java Servlet Programming, O'REILLY, 2002
- Dietal and Deital, “JAVA 2” PEARSON publication

Class : M. Sc.-II, Semester :IV
Subject : Electronics Credit : 04
Paper Code : DSE 1- 4.3 (60 Periods)

DSE 1-4.3 : MOBILE COMPUTING

Unit 1.Introduction to Personal Communications Services (PCS)

PCS Architecture, Mobility management, Networks signaling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.

Unit 2.General Packet Radio Services (GPRS) &Wireless Application Protocol (WAP)

GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP. Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML).

Unit 3.Third Generation (3G) Mobile Services

Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G. Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

Unit4. Global Mobile Satellite Systems

Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems.

Unit 5. Enterprise Networks

Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. Advanced techniques in mobile computing.

Text & References:

Text:

- "Wireless and Mobile Networks Architectures", by Yi-Bing Lin &ImrichChlamtac, John Wiley & Sons, 2001.
- "Mobile and Personal Communication systems and services", by Raj Pandya, Prentice Hall of India, 2001.

References:

- "Guide to Designing and Implementing wireless LANs", by Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
- "Wireless Web Development", Ray Rischpater, Springer Publishing, 2000.
- "The Wireless Application Protocol", by Sandeep Singhal, Pearson Education Asia, 2000.
- "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers, 2001.