

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara
Department of Electronics
Syllabus for Certificate Course (PG)

1. **TITLE: Post Graduate Diploma in Internet of Things**

2. **YEAR OF IMPLEMENTATION: 2018**

3. **PREAMBLE:**

Post Graduate Diploma in Internet of Things is an integrated course in faculty of Electronics. This is a humble endeavor to initiate the process towards an era of knowledge. The students from Electronics field should also be competent for this change in the technology.

In this year, a student will be able to understand handling of laboratory equipments, design embedded systems with confidence. In the subject, the student will also get a circuit designing and proper knowledge in the field of Internet of Things design

4. **GENERAL OBJECTIVES OF THE COURSE:**

1. Explore the world of IoT and its applications
2. Educate the students about computation mathematics
3. Develop designing and analyzing attitude about C programming
4. Familiar sensors and actuators for IoT system design
5. Make familiar with Linux operating system
6. Make familiar interfacing of different peripherals with Arduino
7. Develop designing and analyzing attitude about networks and wireless communication
8. Educate the advance IoT boards and interfacing of different peripherals
9. Familiar Modern trends i/n IoT

5. **DURATION: Two Year**

6. **PATTERN: Annual**

7. **MEDIUM OF INSTRUCTION: English**

8. **STRUCTURE OF COURSE:**

Year	Paper No and Name	Contact hours	Credits	Marks
1	CET 101: Introduction to Programming Technologies and Operating Systems	48	4	100
	CEL 102: Introduction to Programming Technologies and Operating Systems Lab	96	4	100
	CEP 103: Project Work	24	2	50
	Total	168	10	250
2	DET 201: IoT Systems	48	4	100

	DEL 202: IoT Systems Lab	96	4	100
	DEP 203: Project Work	24	2	50
	Total	168	10	250
	Total	336	20	500

C: Certificate Course, D: Diploma, T: Theory, L: Lab work, P: Project work

9. OTHER FEATURES:

A. LIBRARY:

• REFERENCE BOOKS

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Published Jun 13, 2017 by Cisco Press.
6. W. David Stephenson, SmartStuff: an introduction to the Internet of Things
7. Mathew Neil and Richard Stones, Beginning Linux Programming, 4th Edition. Published by. Wiley Publishing
8. The design of UNIX operating system – Maurice J. Bach.
9. Linux commands – Instant reference by Bryan PF affenberge
10. Unix concept and application – Sumitabha Das
11. Unix shell programming – Yashwant kanetkar
12. T. Budd, Exploring Python, TMH, 1st Ed, 2011
13. Python Tutorial/Documentation www.python.or 2010
14. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: learning with Python, Freely available online.2012
15. Simon Monk, Programming the Raspberry Pi: Getting Started with Python
16. Derek Molloy, Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Wiley, 1st Edition
17. Alex Bradbury, Ben Everard, Learning Python with Raspberry Pi, Wiley
18. Dan Nixon, Getting Started with Python and Raspberry Pi

• **JOURNALS AND PERIODICALS**

1. Journal of Instrument Society of India
2. Express Computer
3. Embedded For You
4. Electronics Maker
5. Electronics For You
6. PCQUEST
7. Digit

B. SPECIFIC EQUIPMENTS:

Computers, Laptops, Printers, Scanners, LCD Projectors, E- Podium, Smart Board, Document Camera, Visualizer

C. LABORATORY EQUIPMENTS:

1. Digital storage Oscilloscope: 60 MHz
2. Signal generator
3. Microwave Test bench (Gunn Source)
4. Antenna Trainer
5. Arduino Development Board
6. CPLD development boards
7. Microcontroller Boards – 8051, MSP430, PIC18F, AVR MEGA32, ARDUINO NANO, UNO, MEGA
8. KEIL - IDE
9. Mikro C Compilers for 8051, PIC and ARM
10. Soft Computing Tools – SCILAB, MATLAB
11. PCB Designing Tool: DipTrace

Diploma in Internet of Things

DET201: Development of IoT

• **Learning Objectives:**

1. To learn Arduino development board.
2. To study sensors, actuators and interfacing techniques
3. To study python programming concepts
4. To study of advanced IoT boards

Unit I: Introduction to Arduino **10**

Integrated Development Environment (IDE) for ARDUINO microcontrollers, free IDEs like ARDUINO Studio, Installing and configuring for Robot programming, In System Programmer (ISP) Developing first sketch in Arduino, simulating sketch, Debugging of sketch, loading programmers on Arduino board, Testing to toggle LED on Arduino board.

Unit II: Sensors, Actuators and Interfacing Techniques **12**

Sensors: IR range sensor of different range, Analog IR proximity sensors, Position encoders, Ultrasound scanner, Gyroscope and Accelerometer, Magnetometer, GPS receiver

Actuators: DC Motors, Servo Motors, Stepper motors, Motor Control and its implementations, LCD interfacing with the robot (2 x 16 Characters LCD)

Timer/Counter operations: PWM generation, Motor velocity control, Servo control, velocity calculation and motor position Control, event scheduling

Communication: Wired RS232 (serial) Communication, Wireless ZigBee Communication, USB Communication, Introduction to Node Red, Visual Prototyping with Arduino and connectivity to IOT platforms

Unit III: Introduction to Python Programming **16**

Structure of a Python Program, Elements of Python, Python Interpreter, Using Python as calculator, Python shell, Indentation, Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

Creating Python Programs: Input and Output Statements, Control statements (Looping-while Loop, for Loop, Loop Control, Conditional Statement- if...else, Difference between break, continue and pass)

Structures: Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments

HTML Programming: What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags. Creating Web Page

Cloud Computing: General Benefits and Architecture, Business Drivers, Main players in the Field, Overview of Security Issues, XaaS Cloud Based Service Offerings

Unit IV: Study of Advanced IoT Boards

10

Raspberry Pi, NodeMCU etc., Native vs. Cross Building Applications, Supporting Libraries, Peripheral Management on Linux (UART, GPIO, ADC, SPI, I2C, etc) Wearable, industrial standards, Open Data Management & API.

Case studies: Connected use cases in Real-life/Thematic areas – Smart Homes/Buildings, Smart Cities, Smart Industry, Smart Medical care, Smart Automation etc.

- **Learning Outcomes:**

Students should demonstrate their ability to:

- 1) Develop systems using Arduino boards
- 2) Interface Sensors, Actuators and Interfacing Techniques
- 3) Develop python programs and structures
- 4) Use advanced IoT boards for applications

- **Recommended Books:**

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011
2. Python Tutorial/Documentation www.python.org 2010
3. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: learning with Python, Freely available online.2012
4. <http://docs.python.org/3/tutorial/index.html>
5. <http://interactivepython.org/courselib/static/pythonds>
6. <http://www.ibiblio.org/g2swap/byteofpython/read/>
7. <http://mobileeducationkit.net/labmanuals/LAB-Manual-RaspberryPi.pdf>
8. Simon Monk, Programming the Raspberry Pi: Getting Started with Python
9. Derek Molloy, Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Wiley, 1st Edition
10. Alex Bradbury, Ben Everard, Learning Python with Raspberry Pi, Wiley
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- **Learning Objectives:**
 1. To learn Arduino development board.
 2. To study sensors, actuators and interfacing techniques
 3. To study python programming concepts
 4. To study of advanced IoT boards

GROUP A

1. Interfacing of LCD
2. Interfacing of DC Motors White line sensors ,
3. Interfacing of:
 - a. Ultrasound transceiver, IR range sensor of different range, Analog IR proximity sensors
 - b. Analog directional light intensity sensors, Position encoders
 - c. Interfacing of Gyroscope, Accelerometer, Magnetometer, GPS receiver
4. Interfacing with Bluetooth module with arduino
5. Battery voltage sensing and Current Sensing using Arduino
6. Interfacing of Servo Motors and Stepper motors, Motor Control and its implementations.
7. Program to:
 - a. Read n integers and display them as a histogram.
 - b. Display sine, cosine, polynomial and exponential curves.
 - c. Plot a graph of people with pulse rate p vs. height h. The values of P and H are to be entered by the user.
8. WAP to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula $m=60/(t+2)$, where t is the time in hours. Sketch a graph for t vs. m, where $t \geq 0$.
9. A population of 1000 bacteria is introduced into a nutrient medium. The population p grows as follows: $P(t) = (15000(1+t))/(15+ e)$
10. Where, the time t is measured in hours. WAP to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.
11. Input initial velocity and acceleration, and plot the following graphs depicting equations of motion:
 - a. Velocity wrt time ($v=u+at$)
 - b. Distance wrt time ($s=u*t+0.5*a*t*t$)
 - c. Distance wrt velocity ($s=(v*v-u*u)/2*a$)
12. Write a menu-driven program to create mathematical 3D objects:
 - 1) Curve 2) Sphere 3) Cone 4) Arrow 5) Ring 6) Cylinder.

GROUP B

1. To study the architecture of application board of Raspberry Pi.
 2. To demonstration the OS (Debian) for RPi in a SD card preparation
 3. Configuration of Raspberry Pi during first booting and use of remote SSH like putty
 4. To demonstrate the basic linux commands on Raspberry pi. 18-20
 5. To create a database & Store the value in Raspberry Pi.
 6. To install Android on Raspberry Pi
 7. To Setup RPi first time without using screen, mouse, keyboard.
 8. To interface ADC at GPIOs of Raspberry Pi for measuring analog voltage.
 9. Read a Push Button, Control a Buzzer – in this project you can learn step-by-step how to build a simple buzzer alarm circuit;
 10. To design web page for controlling devices
 11. Interface wifi module with IoT board to toggle LEDs and control relays
 12. To develop IoT system for Smart Homes
- **Learning outcomes:**

Students should demonstrate their ability to:

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 - **Recommended Books:**
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 2. Python Tutorial/Documentation www.python.org 2010
 3. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: learning with Python, Freely available online.2012
 4. <http://docs.python.org/3/tutorial/index.html>
 5. <http://interactivepython.org/courselib/static/pythonds>
 6. <http://www.ibiblio.org/g2swap/byteofpython/read/>
 7. <http://mobileeducationkit.net/labmanuals/LAB-Manual-RaspberryPi.pdf>
 8. Simon Monk, Programming the Raspberry Pi: Getting Started with Python
 9. Derek Molloy, Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Wiley, 1st Edition
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 11. Dan Nixon, Getting Started with Python and Raspberry Pi

DEP203: Project Work

(24)

Every student should take up a project & submit in the report the work he/she has carried out. The project work will be assessed independently at the time of practical examination.

Mr. J. A. Wagh
Chairman
B.O.S. (Electronics)