



Electronics - I
Embedded System Design
[CORE COURSE]

Semester: IV	Credits: 2	Subject Code: BS42105	Lectures: 36
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Course Outcomes
<p>At the end of this course, the learner will be able to:</p> <ul style="list-style-type: none"> ● Distinguish between general computing and the Embedded systems. ● Explain the fundamentals of embedded systems. ● Demonstrate the use of Single board Computer (Such as Raspberry Pi) for an embedded system application. ● Identify the programming environment to develop embedded systems and their interfaces with peripheral devices. ● Show familiarity with tools used to develop an embedded environment.

Unit 1: Introduction to Embedded systems using single board computers (SBC)	8
<ul style="list-style-type: none"> ● Single boards computer block diagram, types, ● Comparison of SBC models, Specifications, ● I/O devices (Storage, display, keyboard and mouse), ● Network access devices 	

Unit 2: Architecture of System on Chip (SOC)	8
<ul style="list-style-type: none"> ● Architecture of SoC, Basic version Broad Coprocessor, ● Pin Description of Raspberry Pi, ● Architectural features: CPU Overview, CPU Pipeline stages, CPU Cache Organization, Branch Prediction & Folding (Concept), GPU Overview 	

Unit 3: Programming using Python	10
<ul style="list-style-type: none"> ● Overview of Rasberian OS (Operating System), Installation, different types of Operating Systems ● Basic Python Programming (Script programming): Variable & data types, Flow Control structures, Conditional statements (If...Then...else) ● Functions: I/O function (GPIO, Digital), Time functions, Library functions ● Basic Arithmetic Programs: Addition, Subtraction, Multiplication, Division 	

Unit 4: Interfacing of devices using Python Programming	10
<ul style="list-style-type: none"> ● Basic interfacing: LED, Switch, LCD Internal ● Advanced: Bluetooth, Wifi, Ethernet, ● External advanced: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, FingerPrint reader. 	

12 hours for Library work, practical or field work or research purposes

Basic Reading:
<ul style="list-style-type: none"> ● Alex Bradbury, Ben Everard, "Learning Python with Raspberry Pi", John Wiley & Sons, Inc, March 2014

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- ARM1176JZ-S, Technical Reference Manual, 19th July 2004
- Eben Upton, Greath Halfacree, "Raspberry Pi User Guide", John Wiley & Sons, Inc, 22nd August 2016
- Simon Monk, "Raspberry Pi CookBook: Software & Hardware Problems and Solutions", O'Reilly Media Inc., third edition 2019
- Warren Gay, "Raspberry Pi Hardware Reference", Apress, 2014
- Wolfram Donat, "Learn Raspberry Pi programming with Python", Apress, July 2018

Reference Books:

- BDM's Raspberry Pi- Tricks, Hack's, & Fixes, BDM Publications, 2018
- Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi", Apress, 23rd January 2004
- Eben Upton, Jeffery Duntemann, Ralph Roberts, Tim Mamtora, Ben Everard, "Learning Computer Architecture with Raspberry Pi", First edition, Wiley, 2016
- Gareth Halfacree, "The Official Raspberry Pi Beginner's Guide- How to use your new computer", Raspberry Pi Press, 1 November 2019
- Matt Timmons-Brown, "Learn Robotics with Raspberry Pi", no starch press, San Francisco, 29 January 2019
- Simon Monk, "Electronics Cookbook- Practical electronic recipes with Arduino & Raspberry Pi", O'Reilly, 2017
- Sean McManus, Mike Cook, "Raspberry Pi for Dummies", A Wiley Brand, 26 March 2013
- Simon Monk, "Programming the Raspberry Pi", Second Edition, McGraw-Hill, 2016
- Stephen Smith, "Raspberry Pi Assembly Language Programming", Apress, 2019

Websites:

- <https://www.raspberrypi.org/>
- <https://www.python.org/>
- <https://python.fossee.in/python-workshops/>
- <https://epgp.inflibnet.ac.in/Home/ViewWSubject?catid=7>

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St.Mira's College for Girls, Pune
(S.Y.B.Sc (CS) 2020-23)

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Faculty	Anitha Menon		<i>P.A. Menon</i> 20/3/21
VC Nominee (SPPU)	Dr. Neha Deshpande	<i>Neha Deshpande</i> 20/3/21	
Subject Expert (Outside SPPU)	Dr.R.K.Kamat		<i>R.K. Kamat</i> 20/3/21
Subject Expert (Outside SPPU)	Dr. Sangeeta Kale	<i>Sangeeta Kale</i> 20/3/21	
Industry Expert	Amber Mukherjee		<i>Amber Mukherjee</i> 20/3/21
Alumni	Supriya Palande	<i>Supriya Palande</i> 20/3/21	

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