



**Progressive Education Society's ,
Modern College of Arts, Science and Commerce,
Ganeshkhind,Pune-411016**

Faculty of Science

S.Y.B.Sc. Computer Science, Electronics

**Choice Based Credit System Syllabus of an autonomous college
To be implemented from Academic Year 2023-2024**

Preamble of the Syllabus:

The systematic and planned curricula for first year and second year Electronics shall motivate and encourage the students for pursuing higher studies in Electronics and Computer and for becoming an entrepreneur.

Introduction:

At **first year of under-graduation**: The basic topics related to the fundamentals of electronics necessary for computer Science students are covered. The practical course is intended to achieve the basic technical skills required for computer science students.

At **second year under-graduation**: Since electronics is an inherent part of technological advancements, the level of the theory and practical courses shall be one step ahead of the first year B.Sc. Courses. Concepts of Communication, embedded system, Internet of things will be introduced at this stage.

Objectives:

- To provide knowledge of technological and practical aspects of electronics.
- To familiarize with current and recent technological developments.
- To enrich knowledge through activities such as industrial visits, seminars, projects etc.
- To train students in skills related to computer industry and market.
- To create foundation for research and development in Electronics/ Computer Science.
- To develop analytical abilities towards real world problems
- To help students to build-up a progressive and successful career.

SYLLABUS OF
S. Y. B. Sc. (Computer Science), Electronics
Choice Based Credit System
To be implemented from A.Y. 2023-24

Structure of S. Y. B. Sc.(Computer Science) Electronics

Semester	Paper Code	Paper	Paper title	No. of Credit	Lectures/Week	Evaluation		
						CA	UE	Total
III	23-ELC-231	I	Microcontroller Architecture & Programming	2	3 (each lecture of 50 minutes)	15	35	50
	23-ELC-232	II	Digital Communication and Networking	2	3 (each lecture of 50 minutes)	15	35	50
	23-ELC-233	III	Practical Course I	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50
IV	23-ELC-241	I	Embedded System Design	2	3 (each lecture of 50 minutes)	15	35	50
	23-ELC-242	II	Wireless Communication and Internet of Things	2	3 (each lecture of 50 minutes)	15	35	50
	23-ELC-243	III	Practical Course II	2	1 practical / week (each practical of 04 hours & 20 minutes)	15	35	50

S.Y.B.Sc.(Computer Science), Electronics- Semester III**Paper-I: Microcontroller Architecture & Programming (23-ELC-231)****Objectives:**

1. To study the basics of 8051 microcontroller
2. To study the Programming of 8051 microcontroller
3. To study the interfacing techniques of 8051 microcontroller
4. To design different application circuits using 8051 microcontroller

Course Outcomes : On completion of the course, student will be able

1. To develop general systematic approach on study , design and develop system around any microcontroller.
2. To write programs for 8051 microcontroller.
3. To interface I/O peripherals to 8051 microcontroller and program them for various tasks.
4. To design small microcontroller based projects.

COURSE CONTENTS**UNIT- 1: Basics of Microcontroller & Intel 8051 architecture**

[08]

Introduction to microcontrollers, difference in controller and processor.

Architecture of 8051: Internal block diagram, pin functions of 8051, Internal RAM organization, SFRS, I/O port structure & Operation, External Memory Interface.

UNIT-2: Programming model of 8051

[10]

Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END), features with examples, I/O Bit & Byte programming using assembly language for LED and seven segment display (SSD) interfacing. Introduction to 8051 programming in C.

UNIT- 3: Timer /Counter, Interrupts

[10][8]

Timer / counter: TMOD, TCON, Timer modes, programming for time delay using mode 1 and mode 2.

Interrupts: Introduction to interrupt, Interrupt types, their vector addresses and default priority, Interrupt enable register and interrupt priority register (IE, IP), Examples on Finding values of IE and IP for given priority

UNIT- 4: Serial Communication and Interfacing

[08][10]

Serial Communication: Synchronous and asynchronous serial communication, SCON, SBUF, PCON Registers, Use of timer to select baud rate for serial communication Programming of serial port without interrupt

Interfacing : ADC, DAC, LCD, stepper motor.

Recommended books:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

S.Y.B.Sc.(Computer Science), Electronics, Semester III

Paper-II, Digital Communication and Networking,(23-ELC- 232)

Objectives:

1. To introduce to all aspects of data communication system
2. To introduce various digital modulation schemes
3. To identify the need of data coding and error detection/correction mechanism.
4. To study bandwidth utilization techniques : multiplexing and Spectrum spreading
5. To know data link layer protocol: Media Access Control
6. To study OSI and TCP/IP models of Networking.

Course Outcomes : On completion of the course, student will be able

1. Define and explain terminologies of data communication
2. Understand the impact and limitations of various digital modulation techniques
3. To acknowledge the need of spread spectrum schemes.
4. Identify functions of data link layer and network layer while accessing communication link
5. To choose appropriate and advanced techniques to build the computer network.

COURSE CONTENTS

UNIT 1: Introduction to Electronic Communication

(9)

Introduction to Communication: Elements of Communication system, types of noise sources, Electromagnetic spectrum, signal and channel bandwidth,

Types of communication: simplex, half duplex, full duplex, baseband and broadband,

Serial communication: asynchronous and synchronous,

Information Theory: Information entropy, rate of information (data rate, baud rate), channel capacity, Nyquist theorem, Signal to noise ratio, Noise Figure, Shannon theorem,

Error handling codes: Necessity, Hamming code

UNIT 2: Modulation and Demodulation

(5)

Introduction to modulation and demodulation: Concept and need of modulation and demodulation, Definition and classification of analog Modulation (only Concept), Digital Modulation techniques: Pulse Code Modulation (PCM), FSK, QPSK, QAM.

UNIT 3: Multiplexing, Spectrum Spreading and Media Access Control (12)

Multiplexing techniques: Frequency division multiplexing, wavelength division multiplexing, Time division multiplexing

Spread Spectrum techniques: Frequency hopping Spread Spectrum, Direct Sequence Spread Spectrum

Media Access Control (MAC):

Random Access Protocol: ALOHA, CSMA, CSMA/CD, CSMA/CA,

Controlled Access Protocols: Reservation, Polling, Token passing,

Channelization Protocols: FDMA, TDMA, CDMA.

UNIT 4: Computer Networking (10)

Introduction to computer networks

Types of networks : LAN, MAN, WAN, Wireless networks, Switching, Internet,

Network topology : point to point, Star, Ring, Bus, Mesh, Tree, Daisy Chain, Hybrid

Network devices : Repeater, Switch, Networking cables, Router, Bridge, Hub, Brouter, Gateway.

Computer network model: OSI and TCP/IP.

Recommended books:

- 1.Communication Electronics: Principles and Applications, Frenzel, Tata Mc Graw Hill publication, 5th edition.
2. Data Communication and Networking, Forouzan, Mc Graw Hill publication, 5th edition
3. Computer Networks, Tanenbaum, PHI publication, 5th edition

S.Y.B.Sc.(Computer Science), Electronics, Semester III
Paper III, Practical Course (23-ELC-233)

Objectives:

1. To get hands on training of Embedded C and basic assembly language programming.
2. To study experimentally interfacing of microcontroller and applications.
3. To test modulator and demodulators of digital communication
4. To test experimentally various techniques of wired communication

Course Outcomes : On completion of the course, student will be able

1. To design and build his/her own microcontroller based projects.
2. To acquire skills of Embedded C programming
3. To know multiplexing and modulation techniques useful in developing wireless application
4. Do build and test own network and do settings.

Guidelines for Practical:

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- At least five practical from each Group
- Electronics lab should have set up for embedded programming (Computers and microcontroller target and interfacing boards)

COURSE CONTENTS

Group A:

1. Arithmetic, logical & code conversion problems using assembly/C programming
2. Interfacing of thumbwheel & seven segment display to 8051 microcontroller
3. Interfacing LCD to 8051Microcontroller
4. Waveform generation using DAC Interface to 8051Microcontroller
5. Speed Control of stepper motor using 8051 microcontroller

Group B:

1. Study of 3 or 4 Bit Pulse Code Modulation technique
2. Study of Frequency Shift Keying
3. Study of Time Division Multiplexing
4. Study of Frequency Division Multiplexing
5. Study of Error detection and correction by using Hamming Code technique

S.Y.B. Sc. (Computer Science), Electronics, Semester IV
Paper I : Embedded System Design (23-ELC-241)

Objectives:

1. To understand the concept of Embedded systems.
2. To study the design flow and available tools for an Embedded system.
3. To understand the implementation of embedded system using firmware and hardware components.
4. To acquire programming skills for the development of Embedded system design.
5. To develop practical skills for designing embedded system Applications.

Course Outcomes : On completion of the course, student will be able

1. To understand the difference between general computing and the Embedded systems.
2. To know the fundamentals of embedded systems.
3. Understand the use of Single board Computer (Such as Raspberry Pi) for an embedded system application.
4. Familiar with the programming environment to develop embedded systems and their interfaces with peripheral devices.
5. To develop familiarity with tools used to develop an embedded environment.

COURSE CONTENTS**Unit 1: Introduction to Embedded systems using single board computers (SBC) (08)**

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) on Raspberry Pi (08)

Details of Raspberry Pi board, Architecture of its SOC, Basic version BroadCOM Coprocessor, GPIO connector Pin Description, Architectural features: CPU Overview, CPU Pipeline stages, GPU Overview

Unit 3: Programming using Python (10)

Different types of Operating Systems, Overview of Rasbian OS (Operating System),

Installation,

Basic Python Programming (Script programming): Variable & data types, Operators, 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)

Basic interfacing: LED, Switch, LCD

Internal Advanced: Bluetooth, Wifi, Ethernet,

External advanced: Ultrasonic Sensor, PIR, Finger Print reader, Camera, Serial Communication GSM.

Recommended Books:

1. Raspberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk(O'Reilly Media Inc.)
 2. Raspberry Pi Hardware Reference by Warren Gay (Apress)
 3. Raspberry Pi User Guide By Eben Upton, Greath Halfacree (John Wiley & Sons, Inc.)
 4. Learning Python with Raspberry Pi, by Alex Bradbury, Ben Everard, John Wiley & Sons, Inc
 5. Learn Raspberry Pi programming with Python By Wolfram Donat (Apress)
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S.Y.B.Sc.(Computer Science), Electronics, Semester IV

Paper II: Wireless Communication and Internet of Things (23-ELC-242)

Objectives:

1. To learn and understand applications of wireless communication system
2. To learn and understand cellular system
3. To learn and understand architecture of short range Wireless Technologies
4. To learn and understand basics of Internet of Things
5. To study applications of IoT

Course Outcomes: Students will be able to

1. Know working of wireless technologies such as Mobile communication, GSM, GPRS
2. Become familiar with 3G and 4G Cellular Network Technologies for Data Connections.
3. Understand working principles of short range communication application
4. Get introduced to upcoming technology of Internet of Things
5. Explore themselves and develop new IoT based applications

COURSE CONTENTS

Unit1: Wireless Communication: Cellular Telephony (12)

Overview of wireless communication,

Introduction of cellular telephony system: Frequency reuse, handoff strategies, Co-channel and adjacent channel interference, block diagram of mobile handset

Overview of Cellular Telephony generations: 1G to 5G, 3G (W-CDMA, UMTS), 4G(LTE)

GSM: architecture

GPRS : architecture, application

Unit 2 : Short Range Wireless Technologies and Location Tracking

(12)

Short range Technologies :

Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure

Zigbee: Architecture, topologies, applications, Z wave: Protocol architecture, applications

RFID: working of RFID system, types of RFID tags, RFID frequencies, applications

Location Tracking: GPS system: components of GPS system (space segment, control segment, user segment), GPS receiver, Applications

Unit 3: IoT Architecture

(08)

Introduction to IOT : Evolution of IOT, M2M and/or IOT, Seven layer architecture of IoT, Role of cloud in IoT, cloud topologies, Cloud access, Protocols in IoT, Cross connectivity across IoT system components:

- Device to Gateway-short range Wireless: cellphone as gateway, dedicated wireless Access points
- Gateway to cloud: Long range connectivity, (wired, cellular, Satellite, WAN)
- Direct Device to Cloud connectivity ,

Networking technologies: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, sigfox NB-IoT, Cat –M.

Unit 4: IoT Applications

(04)

Application domains,

Challenges in IoT : Power consumption, Physical security, durability, Secure Connectivity, Secure Data Storage, Data volume, Scalability

Case studies:

Case Study 1: Smart Irrigation system for Agricultural field

Case Study 2:Home Automation

Case Study 3: Smart Cities

Recommended books:

1. Wireless Communications Principles and Practice, Rappaport, Pearson publication
 2. Mobile Communications, Jochen Schiller, Pearson publication
 3. Internet of Things : Principles and Paradigms, Rajkumar Buyya and Dastjerdi, MK publishers
 4. Internet of Things, Mayur Ramgir, Pearson publication
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S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper III, Practical Course (23-ELC-243)

Objectives:

1. To use basic concepts for building various applications of embedded electronics.
2. To build experimental setup and test the circuits.
3. To develop skills of analyzing test results of given experiments.
4. Developing Trained Personals for educating and training for upcoming graduates in wireless communication.
5. Implement basic IoT applications on embedded platform

Course Outcomes : On completion of the course, students will be able

1. To design and develop own smart applications using Raspberry-Pi SBC.
2. To write Python program for simple applications
3. To develop smart applications using wireless communication
4. To build own IoT based system

Guidelines :

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- Eight compulsory experiments: At least four practical from each Group
- One activity equivalent to 2 experiments by the student.
 - a. Continuation of F. Y. activity.
 - b. Electronics project Based on the Theory Courses learnt
 - c. Documentation type experiments
 - d. Presentation/Seminar on Electronics /advanced topic/research topics.

Prerequisite: Raspberry Pi boards, Arduino

COURSE CONTENTS

Group A

1. Programming of Raspberry Pi to get feedback from a switch connected to the GPIO pins
2. Programming of Raspberry Pi to detect temperature using temperature sensor
3. Programming of Raspberry Pi for Motion detection
4. Programming of Raspberry Pi for image detection

Group B

1. Study of GSM system (Message transmission & Reception).
2. To study working of SIM card in GSM handset
3. Study of GPRS system
4. To study Arduino based LED switching using mobile
5. Temperature and humidity sensing using Arduino