# M.C.E. Society's
# Abeda Inamdar Senior College, Pune
(Autonomous)

Syllabus under Autonomy
S.Y. B. Sc.
Electronic Science
(For Computer Science)

Academic Year
(2022-2023)

( Under the faculty of Science and Technology )

# Syllabus under Autonomy
# S.Y. B. Sc.
# Electronic Science
# (For Computer Science)

## Titles of Papers and Scheme of Study

| SEM | Paper / subject code | Paper | Paper Title | Credits | Lectures/ practical per week | Evaluation | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | C.A. | U.E. | Total |
| III | 21SBCS231E | I | 8051 Microcontroller and Programming | 2 | 3 | 20 | 30 | 50 |
| | 21SBCS232E | II | Electronic Communication | 2 | 3 | 20 | 30 | 50 |
| | 21SBCS233E | III | Electronics Lab-III | 2 | 4.5 | 20 | 30 | 50 |
| IV | 21SBCS241E | I | Embedded System Using Raspberry Pi | 2 | 3 | 20 | 30 | 50 |
| | 21SBCS242E | II | Internet of Things and Wireless Technology | 2 | 3 | 20 | 30 | 50 |
| | 21SBCS243E | III | Electronics Lab-IV | 2 | 4.5 | 20 | 30 | 50 |

**NOTE:**

1. One practical per week (each practical of 04 hours & 20 minutes)
2. Per batch maximum 12 students.

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**S.Y. B. Sc.(Comp. Sc.) Electronic Science**

**(CBCS – Autonomy 21 Pattern)**

| | |
|---|---|
| **Course/ Paper Title** | 8051 Microcontroller and Programming |
| **Course Code** | 21SBCS231E |
| **Semester** | III |
| **No. of Credits** | 2 |

**Aims & Objectives of the Course:**

| Sr. No. | Objectives |
|---|---|
| 1 | To study the basics of 8051microcontroller |
| 2 | To understand the internal architecture of 8051 Microcontrollers. |
| 3 | To understand and acquire knowledge in programming 8051 Microcontroller using assembly and Embedded C |
| 4 | To study the interfacing techniques of 8051microcontroller |

**Expected Course Specific Learning Outcome**

| Sr. No. | Learning Outcome |
|---|---|
| 1. | Understands basics and architecture of 8051 Microcontroller |
| 2. | Write 8051 Assembly level programs using 8051 instruction Set and C |
| 3. | Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports. |
| 4. | Design 8051 Microcontroller based applications for simple real-world applications. |
| 5. | The students can design mini project based on 8051 microcontrollers using Assembly and/or C language. |

**Syllabus**

| Unit No | Title with Contents | No. of Lectures |
|---|---|---|
| **Unit I** | **The Intel Microcontroller 8051** | **9** |
| | 1. Introduction to the concepts of microprocessors, microcontrollers | 1 |
| | 2. Features of 8051microcontroller | 1 |
| | 3. Block diagram of 8051 | 2 |
| | i) A and B Register ,Program Status Word (PSW) | |
| | ii) Program Counter, DPTR | |
| | iii) Memory Organization – RAM & ROM | |
| | iv) Register Banks and Stack | |
| | 4. Functional Pin out diagram and description of pins | 2 |
| | 5. Special function registers (SFRs) | 1 |
| | 6. I/O port organization | 1 |
| | 7. Interrupts | 1 |
| **Unit II** | **Instruction Set of 8051 & Addressing modes** | **6** |
| | 1. Classification of Instruction Set with syntax and function | |
| | i) Data transfer group | 1 |
| | ii) Arithmetic group | 1 |
| | iii) Logical group | 1 |
| | iv) Branching group | 1 |
| | v) Bit Manipulation Group. | 1 |
| | 2. Addressing modes - Immediate, register, direct, register indirect and indexed addressing modes | 1 |
| **Unit III** | **8051 Programming in Assembly Language and C** | **10** |
| | 1. Features of machine language, assembly language, middle-level and high-level languages. Introduction to embedded C | 2 |
| | 2. Data types & directives. | 1 |
| | 3. Programs using Assembly Language | 4 |
| | i) Arithmetic Operations | |
| | ii) Sum of n-numbers | |
| | iii) Block transfer | |
| | iv) Finding smallest and largest number from a set of numbers. | |
| | v) Assembly language programming for interfacing LED | |

| | | |
|---|---|---|
| | 4. Programs in embedded C-<br>i) Write a program to load three numbers into Accumulator and send them to port<br>ii) Write a program to send hex values for ASCII Characters to port<br>iii) Program to send values 00-FF to Port | 3 |
| **Unit IV** | **Timer / Counter , Interrupts in 8051 and Interfacing of Peripheral** | **11** |
| | 1. Timer registers - Timer0, Timer1<br>2. Configuration of TMOD (Timer Mode)<br>3. TCON (Timer Control) registers<br>4. Timer modes- Mode1, Mode2 programming<br>5. Programming for time delay using mode 1 and mode 2.<br>6. Interrupts and its Type<br>7. Interfacing of Devices : LED and Switch ,ADC 0804, DAC for waveform generation, LCD Module, DC Motor, Stepper motor | 1<br>1<br>1<br>1<br>1<br>1<br>5 |

**References:**


1) Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay , The 8051 Microcontroller and Embedded Systems – using assembly and C, Pearson.
2) Kenneth J. Ayala, The 8051 Microcontroller, 3rd Edition, Delmar Cengage Learning
3) Manish K Patel ,The 8051 Microcontroller Based Embedded Systems , McGraw Hill
4) Raj Kamal ,Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education.
5) Rao, Dr. K Uma, The 8051 Microcontrollers: Architecture, Programming and Applications, Pearson Education India, New Delhi

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**S.Y. B. Sc.(Comp. Sc.) Electronic Science**

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| **Course/ Paper Title** | **Electronic Communication** |
|---|---|
| **Course Code** | 21SBCS232E |
| **Semester** | III |
| **No. of Credits** | 2 |

**Aims & Objectives of the Course:**

| **Sr. No.** | **Objectives** |
|---|---|
| 1 | To introduce to all aspects of electronic communication system |
| 2 | To introduce various Analog and digital modulation schemes |
| 3 | To identify the need of data coding and error detection/correction mechanism. |
| 4 | To study bandwidth utilization techniques as multiplexing and Spectrum spreading. |
| 5 | To Know working of wireless technologies such as Mobile communication, GSM, GPRS. |

**Expected Course Specific Learning Outcome**

| **Sr. No.** | **Learning Outcome** |
|---|---|
| 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) | To understands the working of wireless technologies such as Mobile communication, GSM, GPRS. |

**Syllabus**

| Unit No | Title with Contents | No. of Lectures |
|---|---|---|
| **Unit I** | **Introduction to Electronic Communication** | **9** |
| | **1) Introduction to Communication**: | 1 |
| | • Need of electronic Communication System<br>• History of electronic Communication System | |
| | **2) Block Diagram of Electronic Communication System** | 1 |
| | • Elements of Communication system<br>• Types of noise sources | |
| | **3) Electromagnetic spectrum, signal and channel bandwidth** | 1 |
| | **4) Information Theory**: | 2 |
| | • Information entropy<br>• Rate of information (data rate, baud rate),<br>• Channel capacity<br>• Nyquist theorem,<br>• Hartley Theorem<br>• Signal to Noise ratio<br>• Noise Figure<br>• Shannon theorem | |
| | 5) **Types of Communications:** | 2 |
| | • Simplex<br>• Half duplex<br>• Full duplex<br>• Baseband<br>• Broadband | |
| | 6) **Serial Communication**: Asynchronous and Synchronous, | 1 |
| | 7) **Error Handling Codes**: Necessity, Hamming code, CRC | 1 |
| **Unit II** | **Modulation and Demodulation** | **5** |
| | 1. **Introduction to Modulation and Demodulation:** | 1 |
| | • Concept and need of modulation and demodulation, | |
| | 2. **Types of Modulation Techniques:** | |
| | • **Analog Modulation Techniques**: AM , FM and PM | 2 |
| | • **Pulse Modulation Techniques** : PAM, PCM | 1 |
| | • **Digital Modulation Techniques**: ASK,FSK | 1 |
| **Unit III** | **Multiplexing, Spectrum Spreading and Media Access Control** | **13** |
| | 1. **Multiplexing Techniques:** | 3 |
| | • Frequency division Multiplexing<br>• Wavelength Division Multiplexing<br>• Time Division Multiplexing | |

| | | |
|---|---|---|
| | 2. **Spread Spectrum Techniques:**<br>• Frequency Hopping Spread Spectrum<br>• Direct Sequence Spread Spectrum<br>3. **Media Access Control (MAC):**<br>• Random Access Protocol:<br>• ALOHA<br>• CSMA<br>• CSMA/CD<br>• CSMA/CA<br>4. **Controlled Access Protocols:**<br>• Reservation, Polling, Token Passing<br>• Channelization Protocols: FDMA<br>• TDMA, CDMA. | 3<br><br><br><br><br><br>4<br><br><br><br><br>3 |
| **Unit IV** | **Wireless Communication: Cellular Telephony** | **9** |
| | 1. **Overview of wireless communication**<br>2. **Overview of Cellular Telephony generations**: 1G to 5G,3G (W-CDMA, UMTS), 4G(LTE)<br>3. **Introduction of cellular telephony system**:<br>• Frequency reuse<br>• Handoff strategies,<br>• Co-channel and Adjacent channel interference<br>• Block Diagram of Mobile Handset<br>4. **GSM** : Architecture, Frame structure, Mobility Management<br>5. **GPRS** : Architecture, Applications | 1<br>3<br><br>2<br><br><br><br><br><br>2<br>1 |

**References:**


1) Electronics Communication systems, Fourth Edition, Tata McGraw Hill publication.
2) Electronic Communication, Dennis Roddy and John Coolen.
3) Communication Electronics: Principles and Applications, Frenzel, Tata McGraw Hill publication, 5th edition.
4) Wireless Communications Principles and Practice, Rappaport, Pearson publication.

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**(CBCS – Autonomy 21 Pattern)**

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|---|---|
| **Course/ Paper Title** | Electronics Laboratory-III |
| **Course Code** | 21SBCS233E |
| **Semester** | III |
| **No. of Credits** | **2** |

**Aims & Objectives of the Course:**

| Sr. No. | Objectives |
|---|---|
| 1 | To get hands on training of Embedded C |
| 2 | To study experimentally interfacing of 8051 microcontroller |
| 3 | To design, build and test modulator and demodulators of digital communication |
| 4 | To build and test experimentally various techniques of wired communication |

**Expected Course Specific Learning Outcome :**

| Sr. No. | Learning Outcome |
|---|---|
| 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. |

The practical course consists of 10 experiments. After studying the theory and practical student can design and develop working models using 8051 Microcontroller

- The practical course consists of 10 experiments out of which ONE (Compulsory) will be working model using 8051 Microcontroller.

- These will be evaluated in an oral examination for 15% marks at internal and external semester examination.
- Each Practical batch will have maximum 12 students.
- **List of Major Equipment/ Instrument with Broad Specifications**
  - i) Microcontroller 8051 trainer Kit
  - ii) 8051 Simulator software (Free downloadable )
  - iii) Computer System(p-IV and latest version)
  - iv) Peripheral Interfacing Trainer kits

**List of Practical (Minimum 08, 4 from each group)**

| Sr. No. | Title of Experiment |
|---|---|
| | **Group-A** |
| 1 | Assembly language programs based on Arithmetic Instructions<br>i) Addition of two 8-bit numbers (Using Registers & Memory)<br>ii) Subtraction of two 8-bit numbers. (Using Registers & Memory)<br>iii) Multiplication of two 8-bit numbers using MUL instruction.<br>iv) Division of two 8-bit numbers using DIV instruction. |
| 2 | Logical & code conversion problems using assembly programming<br>i) Code Conversion<br>ii) Transfer block of data from one memory locations to another memory locations<br>iii) Sum of two arrays. |
| 3 | Traffic light controller using 8051 microcontroller |
| 4 | Interfacing LCD to 8051Microcontroller |
| 5 | Speed Control of stepper motor using 8051 microcontroller |
| 6 | Develop a 4 bit binary counter with 8051 and display out put on LCD |
| 7 | Waveform generation using DAC Interface to 8051Microcontroller |
| 8 | Event counter using opto-coupler, seven segment LED/LCD display interface to 8051Microcontroller. |
| | **Group-B** |
| 1 | Study of Amplitude Modulation technique. |
| 2 | Study of Pulse Amplitude Modulation technique. |
| 3 | Study of Frequency Shift Keying. |
| 4 | Study of Time Division Multiplexing |
| 5 | Study of Frequency Division Multiplexing. |
| 6 | Study of Error detection and correction by using Hamming Code technique. |

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| | |
|---|---|
| **Course/ Paper Title** | Embedded System using Raspberry Pi |
| **Course Code** | 21SBCS241E |
| **Semester** | IV |
| **No. of Credits** | 2 |

**Aims & Objectives of the Course:**

| Sr. No. | Objectives |
|---|---|
| 1 | To understand the concept of Embedded systems. |
| 2 | To study the design flow and available tools for an Embedded system. |
| 3 | To study basics of Raspberry Pi 3 and hardware structure |
| 4 | To study Python and Library files for Raspberry Pi |
| 5 | To familiarize the students with the programming and interfacing of different devices with Raspberry Pi Board. |
| 6 | Understand basics of Raspberry Pi coding and interfacing different modules |

**Expected Course Specific Learning Outcome**

| Sr. No. | Learning Outcome |
|---|---|
| 1. | The students will be able to understand the working of Raspberry Pi and its features and how various components can be used with Pi. |
| 2. | To apply the knowledge of software development for the Embedded Hardware |
| 3. | Learn interfacing different peripherals with Raspberry Pi |
| 4. | The students will be able to design mini project based on Raspberry Pi. |

**Syllabus**

| Unit No | Title with Contents | No. of Lectures |
|---|---|---|
| **Unit I** | **Introduction to Embedded systems using single board computers (SBC)** | **8** |
| | Single boards computer block diagram, types, Comparison of SBC models, Specifications, I /O devices (Storage, display, keyboard and mouse) | |
| **Unit II** | **Getting Started with Raspberry Pi** | **8** |
| | 1. Architecture of SoC, Basic version Broad Coprocessor<br>2. Raspberry Pi – Introduction-Basics, applications, installation.<br>3. Pin Description of Raspberry Pi,<br>4. Preparing SD Card for Raspberry Pi<br>5. Different OS versions<br>6. First boot, Configuration, time setting, keyboard layout, disk expand, etc | 1<br>2<br>2<br>1<br>1<br>1 |
| **Unit III** | **Programming using Python** | **10** |
| | 1. Overview of Raspbian OS (Operating System), Installation, different types of Operating Systems.<br>2. Basic Python Programming<br>i) Variable , Keywords , Operators and Operands<br>ii) Data types<br>iii) Flow Control and Conditional statements<br>iv) Loops and importing Libraries<br>v) Functions: I/O function (GPIO, Digital),Time functions, Library functions<br>vi) Basic Arithmetic Programs: Addition, Subtraction, Multiplication, Division | 2<br><br><br>1<br>1<br>2<br>1<br>2<br><br>1 |
| **Unit IV** | **Interfacing of devices using Python Programming** | **10** |
| | 1. Function of GPIO Pins and Interfacing<br>2. Basic interfacing: LED, Switch, LCD<br>3. Internal Advanced: Bluetooth, Wifi, Ethernet,<br>4. External advanced: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, Finger Print reader. | 1<br>2<br>7 |

**References:**


1) Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional
2) Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", John Wiley & Sons
3) Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", John Wiley & Sons
4) Paul Gries, et al, "Practical Programming: An Introduction to Computer Science Using Python 3", Pragmatic Bookshelf, 2/E 2014
5) Charles Dierbach, "Introduction to Computer Science Using Python", Wiley Publication
6) John Paul Mueller, "Beginning Programming with Python for Dummies Paperback – 2015"
7) Beginner's Python Tutorial: http://en.wikibooks.org/wiki/A Beginner%27s Python Tutorial.

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**S.Y. B. Sc.(Comp. Sc.) Electronic Science**

**(CBCS – Autonomy 21 Pattern)**

| | |
|---|---|
| **Course/ Paper Title** | Internet Of Things And Wireless Technologies |
| **Course Code** | 21SBCS242E |
| **Semester** | IV |
| **No. of Credits** | 2 |

**Aims & Objectives of the Course:**

| Sr. No. | Objectives |
|---|---|
| 1 | To learn and understand basics of Internet of Things. |
| 2 | To learn and understand Network Technologies used in IOT. |
| 3 | To study basics of Arduino |
| 4 | To learn and understand applications of wireless communication system. |
| 5 | To learn and understand architecture of short range Wireless Technologies. |
| 6 | To study uses of Arduino in IOT. |

**Expected Course Specific Learning Outcome**

| Sr. No. | Learning Outcome |
|---|---|
| 1 | To introduce to upcoming technology of Internet of Things. |
| 2 | To understand various types of networks and short range device used in IOT |
| 3 | To understand Various Protocols used in IOT |
| 4 | To get familiar with use of Arduino Uno for IOT applications |
| 5 | Able to interface IoT based applications using Arduino |

**Syllabus**

| Unit No. | Title with Contents | No. of Lectures |
|---|---|---|
| **Unit I** | **Fundamentals of IoT** | **14** |
| | 1) Concept of IoT | 1 |
| | 2) Evolution of IoT | 2 |
| | 3) Seven Layer IoT Architecture | 1 |
| | 4) Characteristics of IoT: Power consumption, Physical security, Durability, Secure Connectivity, Secure Data Storage, Data volume ,Scalability | 1 |
| | 5) Machine to Machine and IoT | 1 |
| | 6) Role of Cloud in IoT | 1 |
| | 7) Cloud Topologies | 1 |
| | 8) Cloud Access | |
| | 9) Protocols in IoT: MQTT, CoAP, XMPP and AMQP, | 1 |
| | 10) IoT communication models | 1 |
| | 11) Cross connectivity of IoT system to wireless Devices | |
| | • Device to Gateway-short range Wireless: Use of Cellphone as gateway, dedicated wireless Access points | 1 |
| | • Gateway to Cloud: Long range connectivity, (wired, cellular, Satellite, WAN), | 1 |
| | • Direct Device to Cloud connectivity | 2 |
| **Unit II** | **Short Range Wireless Technologies and Networking** | **10** |
| | 1) Short Range Technologies: | |
| | • Bluetooth: Bluetooth architecture, Bluetooth protocol stack Bluetooth frame structure | 1 |
| | • ZigBee: Architecture, Topologies and Applications | 2 |
| | • Z-wave: Protocol Architecture and Applications | 1 |
| | • RFID: working of RFID system, types of RFID tags, RFID frequencies and Applications | 1 |
| | 2) Networking : | |
| | • Introduction to Networking | 1 |
| | • Types of Networks: PAN,LAN ,WAN, Ring | 1 |
| | • Low power local area networking (LPLAN) | 1 |
| | • Low power wide area networking (LPWAN) technologies | 1 |
| | • Comparison of LoRa, sigfox NB-IoT, Cat –M | 1 |
| **Unit III** | **Introduction to Arduino** | **8** |
| | 1) Arduino: Overview of Arduino and Arduino Family | 1 |
| | 2) Arduino Platform: | 1 |
| | • Hardware and Software | 1 |
| | • Onboard Arduino components | 1 |

| | | |
|---|---|---|
| | 3) Pin out Diagram for Arduino Uno and Significance of Pins<br>4) IDE Platform for Arduino<br>5) Arduino Sensors and Library Functions | 1<br>2<br>1 |
| **Unit-IV** | **Arduino based IoT Applications** | **4** |
| | 1) Interfacing Humidity sensing device to Arduino<br>2) Interfacing Temperature sensing device to Arduino<br>3) Interfacing RFID system using Arduino<br>4) Interfacing Zig-bee to Arduino | 1<br>1<br>1<br>1 |

**Recommended Books**:


**1.** Internet of Things : Principles and Paradigms, Raj Kumar Buyya and Dastjerdi, MK publishers

**2.** Internet of Things, Mayur Ramgir, Pearson publication

**3.** Wireless Communications Principles and Practice, Rappaport, Pearson publication

**4.** Getting Started With Arduino: by Mossimo Banzi ,2nd Edition

**5.** Arduino For Beginners: Essential Skills every Maker Needs by John Baitchal

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# S.Y. B. Sc.(Comp. Sc.) Electronic Science

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| | |
|---|---|
| **Course/ Paper Title** | Electronics Laboratory-IV |
| **Course Code** | 21SBCS243E |
| **Semester** | IV |
| **No. of Credits** | 2 |

**Aims & Objectives of the Course:**

| Sr. No. | Objectives |
|---|---|
| 1 | To get hands on training for Python Language |
| 2 | To study experimentally interfacing of Raspberry Pi |
| 3 | To educate and train students for upcoming technology in wireless communication. |
| 4 | To build Arduino based IoT system |

**Expected Course Specific Learning Outcome:**

| Sr. No. | Learning Outcome |
|---|---|
| 1. | To acquire skills of Python programming for simple applications |
| 2. | To interface various I/O peripherals to Raspberry Pi |
| 3. | To design and build Raspberry Pi based projects |
| 4. | To design and build IoT based system using Arduino. |

The practical course consists of 10 experiments. After studying the theory and practical student can design and develop working models using Raspberry Pi.

- The practical course consists of 10 experiments
- These will be evaluated in an oral examination for 15% marks at internal and external semester examination.
- Each Practical batch will have maximum 12 students.

- **List of Major Equipment/ Instrument with Broad Specifications**
  - i) Raspberry Pi Board
  - ii) Computer System(Latest version)
  - iii) Peripheral Interfacing Trainer kits

**List of Practical (Minimum 08, 4 from each group)**

| Sr. No. | Title of Experiment |
|---|---|
| | **Group-A** |
| 1 | Interfacing LEDs to Raspberry Pi using GPIO pins |
| 2 | Interfacing a switch connected to the GPIO pins and display status on LED using Raspberry Pi |
| 3 | Interfacing LCD to Raspberry Pi |
| 4 | Interfacing temperature sensor to Raspberry Pi to detect temperature |
| 5 | Interfacing photo sensor to Raspberry Pi to detect light intensity |
| 6 | Interfacing PIR sensor using Raspberry Pi for motion detection |
| 7 | Interfacing Pi Camera to Raspberry Pi |
| | **Group-B** |
| 1 | Study of GSM system (Message transmission & Reception). |
| 2 | To study and interface Zig-bee for one Application using Arduino. |
| 3 | To Study and interface of RFID system using Arduino. |
| 4 | To study and interface a Switch to Arduino. |
| 5 | To study Arduino based LED switching using Mobile/Bluetooth Device. |
| 6 | To study and interface Humidity sensor using Arduino |
| 7 | To study and interface Temperature sensing device to Arduino. |