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 2024-2025 under

National Education Policy 2020

Preamble of the Syllabus:

The systematic and planned curricula in Electronics for B.Sc. Comp Sc. shall motivate and encourage the students to know Fundamentals of Electronics in Computer organization and advanced technologies and techniques of Electronics in the Computer field. The knowledge acquired through this curriculum will help students gain skills to efficiently use computers and design computing systems for dedicated applications.

Introduction:
At **first year of under-graduation:** The basic topics related to the fundamentals of electronics necessary for computer Science students are covered during second semester minor courses. The Skill Enhancement course for semester I 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 in the computer field, the theory and practical courses under minor vertical are designed to focus on digital communication , Computer Networks , Computer System on Chip. The Skill Enhancement course for semester IV is designed to give an idea of embedded systems and their use.

At Third year under-graduation: Courses in Electronics for B.Sc. Comp. Sc. at this stage are designed a step ahead to give idea of small computing systems viz embedded system, Wireless communication and 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

SYLLABUS OF

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

Choice Based Credit System
To be implemented from A.Y. 2024-25 under NEP 2020

Semester	Paper Code	Paper	Paper title	No. of Credit	Lectures/ Week	Evaluation CIE	ESE	Total
III	CELE 23201	I	Communication Systems for IOT	2	2 (each lecture of 55 minutes)	20	30	50
	CELE 23202	II	Electronics Practical Course I: Practical on Communication & Networking	2	4 1 pract / week (each practical of 04 hours)	20	30	50
	CELE 23402	IKS	IKS : Contribution of India to the field of Electronics and computer: Ancient to Modern	2	2 (each lecture of 55 minutes)	20	30	50
IV	CELE 24201	I	System on Chip Programming	2	2 (each lecture of 55 minutes)	20	30	50
	CELE 24202	II	Electronics Practical Course II: Practical on 8051 Microcontroller	2	4 1 pract / week (each practical of 04 hours	20	30	50
	CELE 24401	SEC2	Instrumentation Systems & Programming using ARDUINO	2	2 (each lecture of 55 minutes)	20	30	50

Semester III

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

Theory Paper- Communication Systems for IOT

Course Code: CELE 23201 Credits: 2Cr.

Course Objectives:

1. To introduce to all aspects of data communication system
2. To introduce various digital modulation schemes
3. To identify the need for data coding and error detection/correction mechanisms.
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 for 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 (10)

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 & communication Techniques (12)

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, 16-QAM.

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 3: Computer Networking and Introduction to IOT (08)

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.

Introduction to IOT: Definition of IOT, Basic working steps of IOT, explanation with one example

Recommended books:

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

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Electronics Practical Course-I : Practical on Communication & Networking

Course Code: CELE 23202 Credits: 2Cr.

Course Objectives:

1. To test modulator and demodulators of digital communication
2. 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 digital communication based projects.
2. To acquire skills of observing signals/waveforms
3. To know multiplexing and modulation techniques useful in developing wireless application
4. To build and test the network using simulation software.

Guidelines for Practical:

- Practical batch size: 12
- Minimum no of Practical to be performed: 11

Course Content

List of Experiments

1. Study of Logic gates
2. Study of Multiplexer/De multiplexer
3. Study of Encoder (Decimal to BCD)
4. Study of Decoder
5. Study of sample and hold circuit.
6. Study of Hamming Code.
7. Study of Frequency Shift Keying.
8. Study of Time Division Multiplexing.
9. Study of Frequency Division Multiplexing
10. Study of Amplitude Modulation
11. Networking practical using Packet Tracer (simulation software).
12. PCM (Pulse Code Modulation) simulation
13. Project /Activity/Seminar (equivalent to 3 practicals)

Indian Knowledge System

Theory Paper : Contribution of India to the field of Electronics and computer: Ancient to Modern

Course Code: CELE 23402 Credits: 2Cr.

Course Objectives :

1. To make students aware about our heritage in science.
2. To introduce revolutionary technologies in the field of electronics and contribution of Indian

Course Content

Unit 1: Vedic Roots of Advanced techniques in communication and computation (10L)

Binary Bits and Pingala,
Dhuli karma-Dust Abacus :Single address accumulator , Place value notation and mechanization of arithmetic algorithms
Complement method of subtraction , Modulo Checks for error detection and correction in Coding theory and Concept of parity ,

Unit 2: India's contribution in communication electronics (10 L)

Revolutions in the field of communication ,
Radio waves and it's importance in wireless communication., Sir J.C Bose :Public Demonstration of Electromagnetic waves ,
Sir J.C Bose and Worldwide Patent of Solid state Diode Detector(Built using galena Crystal) to detect EM waves
Padma Vibhushan Dr. Narinder Singh Kapany and his pioneering work in Fiber Optics technology. Concept of Total Internal Reflection of Light. Role of optical fiber in Networking.

Unit 3: Inventions by Indian in Computer field (10L)

Vinod Dham(Father of Intel Chip) : Role of Processor in computing system. Performance parameters of computer systems , Transformation in computer field due to Intel Pentium Chip
AJay Bhatt and his invention : Need of USB, USB specifications .

References :

1. Advanced Vedic Mathematics: Rajesh Kumar Thakur
2. Vedic Mathematical Methods and Applications by Vinodkumar Pandey and Puroshottam Tiwari
3. Number Theory and ancient India by E.V.Krishnamurthi, Samskrit Sangh ,IISC, Banglore
4. Bhaskarchrya's Leelavati and Wonders of numbers: D.R.Kaprekar , Samskrit Sangh ,IISC, Banglore

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Semester IV

S.Y.B.Sc.(Computer Science), Electronics Theory Paper:

Theory Paper: System on Chip Programming

Course Code: CELE 24201 Credits: 2Cr.

Course 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: Architecture and Programming Model of 8051 Microcontroller [14]

Introduction to System on chip (SOC) and Microcontroller , difference between system based on Microcontroller and processor.

Architecture of 8051: Internal block diagram, pin functions of 8051, External Memory Interface.

Programming Model : Internal RAM organization, Special Function Registers (SFRS), Instruction classification, **Assembly Language Programming** : Instruction Format, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, Assembler directives (ORG, END), I/O Bit & Byte programming, Programming using assembly language for LED and seven segment display (SSD)interfacing.

Introduction to 8051 programming in Embedded 'C'.

UNIT- 2: Programming 8051 using Timer /Counter, Interrupts ,Serial Communication and Interfacing [10]

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

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

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

Interfacing : ADC, DAC, LCD, stepper motor.

UNIT- 3:Advanced controllers and Embedded systems [06]

Comparative study of Microcontrollers: PIC, ARM,AVR , Architecture of PIC, Introduction to Embedded System

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.
3. PIC , controller by Sloss
4. Introduction to Microprocessor Based Systems Using the ARM Processor" by Kris Schindler
5. "ARM System-on-Chip Architecture" by Steve Furber
6. Beginners Guide to AVRby Aravind EV

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Electronics Practical Course II: Practical on 8051 Microcontroller

Course Code: CELE 24202 Credits: 2Cr.

Course Objectives:

1. To get hands on training of Embedded C and basic assembly language programming.
2. To study experimentally interfacing of various i/p and o/p peripherals to microcontroller.
3. To Develop various codes for the various interfaces.

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

1. To acquire skills of Assembly Language & Embedded C programming
2. To design and build his/her own microcontroller based projects

Guidelines for Practical:

- Practical batch size : 12
- Minimum no of Practical to be performed : 11
- Required Student Computer ratio 1:1

COURSE CONTENTS

List of experiments :

1. Study of 3-bit Counter and it's use as Timer.
2. Study of Shift Register: SIPO & PISO modes .
3. Study Read Write action of RAM.
4. Logical operations (AND, OR, EX-OR ,Left & Right shift) & code conversion problems.
5. Interfacing and Programming of LED array.
6. Programming on Serial communication.
7. Interfacing of thumbwheel & seven segment display to 8051 microcontroller
8. Interfacing and programming LCD to 8051Microcontroller
9. Waveform generation using DAC Interface to 8051Microcontroller
10. Speed Control of stepper motor using 8051 microcontroller

Use of Proteus 7

11. Square wave generation using timer.
12. Sensor and ADC interface.
13. DC motor interface and speed control.

Use of Virtual Laboratories of Indian Institute of Technology(IIT)

14. Interrupt driven data transfer from ADC (IIT Kharagpur)

15. DAC interface to Microcontroller for waveform generation : Real Time Embedded System Lab IIT Kharagpur (**http://vlabs.iitkgp.ac.in/)**

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Skill Enhancement Course : Instrumentation Systems & Programming using ARDUINO

Course Code: CELE 24401 Credits: 2Cr

Course Outcomes: Students will learn to

- Learn the basics of electronics and sensors
- Learn how to prototype circuits with a breadboard
- Learn the Arduino programming language and IDE
- Program basic Arduino examples
- Develop the Project Ideas and create its prototype.

COURSE CONTENTS

List of experiments :

1) Introduction to ARDUINO

2) Arduino I/O Functions: Simple Programs (Using Library Functions)

3) Interfacing of switch and buzzer /LED to Arduino

4) Interfacing / On-Off action of LED using comparator (using Opamp) ,

5) Interfacing of Temperature Sensor to Arduino –

6) Interfacing of Ultrasonic Sensor to Arduino –

7) Interfacing of PIR Sensor to Arduino –

8) Interfacing of Optical Sensor to Arduino –(LDR)

9) Interfacing of DC Motor

10) Stepper Motor interfacing to Arduino.

11) Use of Virtual laboratory (IIT,Kharagpur) for Interfacing of an LCD display with ATMEGA16 microcontroller to display a string.

12) Use of Virtual laboratory (IIT,Kharagpur) for study of Serial communication between ATMEGA microcontroller and PC

13) Use of Virtual Laboratory(IIT,Kharagpur) to take a input from keyboard and display it on LCD

14) Project activity equivalent to 2 Experiments.

Reference Books :

1 . Instrumentation Devices and Systems - C.S. Rangan, G.R. Sharma, V.S.V. Mani
2. Integrated Circuits – K.R.Botkar
3. Opamp and Linear Integrated Circuits- Ramakant Gayakwad

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