S.Y.B.Sc. Computer Science (Electronics)
Revised Syllabus
To be implemented from A.Y. 2020-21

(CBCS Pattern)

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

Semester	Paper Code	Paper	Paper title	No. of Credit	Lectures/Week			Evaluation		
					Th	Tut	Pr.	CA	UE	Total
III	EL-211	I	Microcontroller Architecture & Programming	2	3	--	---	15	35	50
	EL-212	II	Digital Communication and Networking	2	3	--	---	15	35	50
	EL-213	III	Practical Course I	2	--	---	4	15	35	50
IV	EL-221	I	Raspberry Pi	2	3	---	---	15	35	50
	EL-222	II	Wireless Communication and Internet of Things	2	3	---	---	15	35	50
	EL-223	III	Practical Course II	2	--	--	4	15	35	50

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

Paper-I: Microcontroller Architecture & Programming (EL 211)

Objectives:

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

UNIT- 1: Basics of Microcontroller & Intel 8051 architecture [08]

Introduction to microcontrollers, difference in controller and processor.
Architecture of 8051, Internal block diagram, Internal RAM organization, SFRS, pin functions of 8051, 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 example, 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, Serial Communication & Programs using 'C' [12]

Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.
Interrupts: Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE,IP),
Serial Communication : Synchronous and asynchronous serial communication

UNIT- 4: Interfacing, programming using 'C' [06]

Programming serial port without interrupt, Use of timer to select baud rate for serial communication.
Interfacing : ADC, DAC, LCD, stepper motor.

Recommended books:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi, Mazidi and McKinley, Pearsonpublications
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and AndhePallavi, Pearsonpublications.

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

Paper-II, Digital Communication and Networking, EL- 212

Objectives:

1. To understand basics of communication systems
2. To study modulation techniques used in digital communication system
3. To study bandwidth utilization techniques : multiplexing and Spectrum spreading
4. To know data link layer protocol: Media Access Control
5. To know operating technologies of networking
6. To study OSI and TCP/IP models of Networking.

UNIT 1: Introduction to Electronic Communication (9)

Elements of Communication system, need of antenna and it's radiation pattern and operating frequency, wired and wireless medium, 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- Hamming code, CRC, checksum,

UNIT 2: Modulation and Demodulation (5)

Concept and need of modulation and demodulation,
Digital Modulation techniques: Pulse Code Modulation (PCM), FSK, QPSK, QAM, OFDM.

UNIT 3: Multiplexing, Spectrum Spreading and MAC (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/CS,
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 : Repeaters, switch, Networking cables, Routers, Bridge, Hub, Brouter, gateway
Wired LANs: Ethernet:
Ethernet protocol, standard Ethernet, 100 MBPS Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet,
Computer network model: OSI and CP/IP,

References:

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 (EL-213)

Objectives:

1. To get hands on training of Embedded C
2. To study experimentally interfacing of microcontroller
3. To design and build modulator and demodulators of digital communication
4. To build and test experimentally various techniques of wired communication
5. To develop practical skills of network setup

Guidelines for Practical:

- No of students per batch : 12
- No of total Practicals : 10
- At least five practical from each Group
- Electronics lab should have set up for embedded programming (Computers and microcontroller target and interfacing boards)

Practical List:

Group A: (Any 5)

1. Arithmetic, logical & code conversion problems using assembly/C programming
2. Interfacing the thumbwheel & seven segment display.
3. Traffic light controller using microcontroller.
4. Interfacing LCD to Microcontroller.
5. Waveform generation using DAC Interface.
6. Event counters using opto- coupler using seven segment display / LCD.
7. Speed Control of stepper motor using microcontroller

Group B: (Any 5)

1. Study of 3 or 4 Bit Pulse Code Modulation technique.
2. Study of Frequency Shift Keying system.
3. Study of Time Division Multiplexing.
4. Study of Frequency Division Multiplexing.
5. Study of Code Division Multiple Access System.
6. Study of Error detection and correction by using Hamming code technique.
7. Study of Computer network components : Cables, Connectors, Routers, Switches, Ethernet and related interfacing cards.

8. To study Configuration of IP and MAC address and to study Local Area Network setup.

S.Y.B.Sc. (Computer Science), Electronics, Semester IV, EL-221

Paper I, Fundamentals of Technology Systems using Raspberry Pi

Unit 1: Introduction to Raspberry Pi **(08)**

Raspberry Pi Series, types, Comparison of Raspberry Pi models,
Specifications of Raspberry Pi : Power source, I/O devices (Storage, display, keyboard and mouse), Network access devices

Unit 2: Architecture of Rasberry Pi **(08)**

Architecture of Rasberry Pi : SoC architecture, Basic version Broad Com processor, Pin Description,
Architectural features : CPU Overview, CPU Pipeline stages, CPU Cache Organization, Branch Prediction & Folding (Concept), GPU Overview

Unit 3:Programming of Rasberry Pi using Python **(10)**

Configuration of Rasberry Pi, Overview of Rasberian OS, Installation, different types of OS
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 ( ).

Unit 4 Interfacing of Rasberry Pi using Python Programming **(10)**

Basic interfacing: LED, Switch, LCD
Internal Advanced: Bluetooth, Wifi, Ethernet,
External advanced: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, Finger Print reader.

Reference: (NEED to give publishers)

1. Rasberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk
2. Python Crash Course: A Hands-On, Project-Based Introduction to Programming Raspberry Pi Robotic Projects - Third Edition Machine Learning For Absolute Beginner
3. Rasberry Pi User Guide By Eben Upton, Greath Halfacree
4. Learning Python with Rasberry Pi By Alex Bradbury, Ben Everard
5. Learn Raspberry Pi programming with Python By Wolfram Donat

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

Paper II: Wireless Communication and Internet of Things (EL222)

Rationale: Wireless communication provides mobility, flexibility, convenience. Wireless communication systems have wider domain of applications which includes Multimedia applications, healthcare, food industry, automobile manufacturing, etc. Wireless communication has opened up many areas for research as many new features are added up with the emerging technologies.

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**

Unit 1: 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)
Cellular technologies: GSM: architecture, frame structure, mobility management,
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 (4)

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

References:

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

Program Outcome:

- Understand mobile and wireless network systems such as 2G/3G/4G/5G mobile telephony/data networks,
- Understand GSM and GPRS
- Understand the working of wireless local area network, Bluetooth.

S.Y.B.Sc.(Computer Science.)
Sem II, Electronics-III, Practicals Syllabus
To be implemented from 2020-2021

Practical Course

Objectives:

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

- Total Practical to be conducted 10.
- 8 experiments compulsory: At least four practical from Group A and B.
- 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: Rasberry Pi boards, Arduino/LoRa boards

Group A (any 4)

1. Program the Raspberry Pi to control light emitting diodes (LEDs) attached to the GPIO pins
2. Program the Raspberry Pi to get feedback from a switch connected to the GPIO pins
3. Program the Raspberry Pi to get the temperature from a sensor connected to the GPIO pins
4. Program the Raspberry Pi to detect room light from a photocell censor connected to the GPIO pins
5. Program the Raspberry Pi for Motion detection using Raspberry pi
6. Program the Raspberry Pi for interfacing the Camera to grab the image.

GroupB (any 4)

1. Study of GSM system (Message transmission & Reception).
2. To study working of SIM card in GSM handset SIM card detection.
3. Study of GPRS system
4. Study of Zig-bee for one application
5. Study of RFID system
6. Introduction to Python programming.
7. To study Arduino based LED switching using mobile.
8. Temperature and humidity sensing using Arduino
9. LoRa Interfacing.