Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE

Syllabus

for

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

[Pattern 2019]

(B.Sc. Semester-III and Semester-IV)

From Academic Year

2020-2021

Deccan Education Society's
Fergusson College (Autonomous), Pune

S.Y. B.Sc. (Computer Science) Electronics (Pattern 2019)

From academic year 2020-21

Particulars	Name of Paper	Paper Code	Title of Paper	No. of Credits
S.Y. B.Sc. (CS) Semester III	Theory Paper - 1	ELC2301	Microcontroller	2
	Theory Paper - 2	ELC2302	Digital Communication	2
	Practical Paper - 1	ELC2303	Electronics Practical III	2
S.Y. B.Sc. (CS) Semester IV	Theory Paper - 3	ELC2401	Single Board Computer	2
	Theory Paper - 4	ELC2402	Wireless Communication	2
	Practical Paper - 2	ELC2403	Electronics Practical IV	2

S.Y. B.Sc. Semester III		
Title of the Course and Course Code	**Microcontroller (ELC2301)**	**Number of Credits : 02**
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe features of 8051 Microcontroller architecture.	
CO2	Differentiate between microprocessor and microcontroller.	
CO3	Illustrate the programs to interface various devices with microcontrollers.	
CO4	Classify instructions used in assembly language programming.	
CO5	Determine the role of interrupts in microcontrollers.	
CO6	Create different microcontroller based application interfaces.	

Unit No.	Title of Unit and Contents	No of Lectures
I	**Basics of Microcontroller & Intel 51 family architecture** Introduction to microcontrollers, difference in controller and processor. Architecture of 8051, Internal block diagram, Internal RAM organization, SFRS, pin diagram of 8051, I/O ports structure & operation, External Memory Interface.	8
II	**Assembly language Programming** Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives - features with example, I/O Bit & Byte programming using assembly language for LED and seven segment display (SSD) interfacing.	10
III	**Timer / Counter, Serial communication, Interrupts** TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode1 and mode2. Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register(IE,IP), Synchronous and asynchronous serial communication.	12
IV	**I/O Interfacing** Introduction 8051 programming in C, Programming serial port without interrupt, Use of timer to select baud rate for serial communication. Interfacing ADC, DAC, LCD, stepper motor.	6

References:

1. 8051 microcontroller and Embedded system using Assembly and C - Mazidi, Mazidi and McKinley, Pearson Education, 2nd Edition
2. The 8051 microcontroller - Architecture, programming and applications: K. Uma Rao and Andhe Pallavi, Pearson publications, First Edition
3. Programming and Customizing the 8051 Microcontroller - MykePredko, Tata McGraw-Hill Publishing Company Ltd, Tata McGraw-Hill Edition 1999

S.Y. B.Sc. Semester III		
Title of the Course and Course Code	**Digital Communication (ELC2302)**	**Number of Credits : 02**

Course Outcomes (COs) **On completion of the course, the students will be able to:**	
CO1	Describe elements, parameters of electronic communication system, Nyquist theorem and Shannon theorem.
CO2	Differentiate between Synchronous and Asynchronous communication. Compare different computer network models.
CO3	Apply digital modulation techniques for different applications.
CO4	Explain working of modulator and demodulator circuits using circuit / block diagrams.
CO5	Evaluate Multiplexing and Multiple access techniques.
CO6	Specify different digital communication systems for mobile application.

Unit No.	**Title of Unit and Contents**	**No of Lectures**
I	**Introduction to Electronic Communication** Elements of Communication system, Electromagnetic spectrum, Serial and Parallel transmission. Modes of communication: asynchronous and synchronous, Data transmission modes: simplex, half duplex and full duplex, Concepts of communication system: Signal bandwidth, channel bandwidth, channel capacity, data rate, baud rate, Nyquist theorem, Signal to Noise Ratio, Shannon theorem, Information entropy, Noise Figure.	**8**
II	**Data Transmission Techniques** Analog Transmission: ASK,FSK,BPSK, QPSK,QAM Digital Transmission: PCM,PAM, Delta modulation	**8**
III	**Data Communication** Study of multiplexing: FDM, WDM, TDM, Introduction to multiple access: FDMA, TDMA, CDMA, Spread Spectrum techniques: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS)	**14**
IV	**Network Models** Comparison of computer network models: OSI model, TCP/IP model and IEEE reference model Physical Layer: Transmission Media - Twisted pair, Coaxial and Fiber optic cable, Data Link Layer: Media Access Control (MAC), Hamming code, CRC	**6**

References:

1. Communication Electronics Principles and Applications – Louis E. Frenzel, Tata McGraw Hill Education Private Limited, 3rd Edition.

2. Data Communications and Networking – Behrouz A Forouzan, Tata McGraw Hill Education Private Limited, Fourth Edition
3. Wireless Communication and Networks – William Stallings, Pearson Education, Second Edition.

S.Y. B.Sc. Semester III		
Title of the Course and Course Code	**Electronics Practical III (ELC2303)**	**Number of Credits : 02**
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe instructions, syntaxes of assembly and embedded C language programs.	
CO2	Discuss modulation and multiplexing techniques required in communication systems.	
CO3	Apply the knowledge to interface different input / output devices.	
CO4	Analyze output using assembly or C language programs.	
CO5	Test output of a circuit and compare with the expected output.	
CO6	Construct application based circuits using microcontroller and other semiconductor devices.	

List of practicals (Compulsory 10 + 2 Activity)

Sr No.	Title of experiment
1	Arithmetic, logical & code conversion problems using Assembly / C language programming
2	Interfacing Thumbwheel & Seven segment display using Assembly / C language programming
3	Traffic light control using Assembly / C language programming
4	Interfacing LCD using Assembly / C language programming
5	Waveform generation using DAC Interface using Assembly / C language programming
6	Event counters using Opto-coupler with seven segment display / LCD
7	Speed and direction Control of stepper motor using Assembly / C language programming
8	Pulse Code Modulation
9	Frequency Shift Keying
10	Time Division Multiplexing

11	Frequency Division Multiplexing
12	Amplitude Shift Keying
13	Code Division Multiple Access
14	Error detection and correction using Hamming code

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	**Single Board Computer (ELC2401)**	**Number of Credits : 02**

Course Outcomes (COs) **On completion of the course, the students will be able to:**	
CO1	List components on Raspberry Pi-3B+ model single board computer and its interfacing devices.
CO2	Discuss the Architecture of Raspberry Pi.
CO3	Demonstrate the use of Raspberry Pi in various applications.
CO4	Analyze and compile the Python programs to interface various devices with Raspberry Pi.
CO5	Determine the role of I/O, Time and Library functions.
CO6	Create different application based electronic systems using Raspberry pi.

Unit No.	**Title of Unit and Contents**	**No of Lectures**
I	**Introduction to Single board computer** Basics of Single board computer, Introduction to ARM Cortex Processor, Raspberry Pi Series and Model, Comparison of various models of Raspberry Pi, Detailed specifications of Raspberry Pi 3B+: CPU, Storage devices, GPIO, Ethernet, Wi-Fi, Bluetooth, Power supply, Ports: USB, Display, Camera etc.	**8**
II	**Architecture of Raspberry Pi-3B+** Block diagram of Raspberry Pi-3B+, Functions of each block, features of Broadcom processor, Pin Description, CPU Architecture: Pipeline stages, Cache Organization, Concept of branch Prediction & Folding, GPU Overview	**10**
III	**Programming of Raspberry Pi using Python** Benefits of Operating system, different types of OS, Overview of Raspberian OS, OS Installation, Configuration of Raspberry Pi, Installation of libraries, Basic Python Programming (Script programming), Functions: I/O function (GPIO, Digital), Time functions (Delays), Library functions Basic Arithmetic Programs	**8**
IV	**Interfacing & Python Programming** Basic**: LED** and Switch, LCD, Relay and Buzzer Advanced: Internal : Bluetooth, Wi-Fi, Ethernet, I^2C, SPI External: Camera interfacing, Serial Communication, GSM, Ultrasonic Sensor, PIR, Fingerprint reader.	**10**

References:

1. Raspberry Pi Cookbook: Software & Hardware problems and Solutions by Simon Monk, O'Reilly Media, 3rd Edition.
2. Python Crash Course: A Hands-On, Project-Based Introduction to Programming Raspberry
3. Pi Robotic Projects - Third Edition Machine Learning For Absolute Beginner
4. Raspberry Pi User Guide ByEben Upton, GreathHalfacree, 3rd Edition.

5. Learn Raspberry Pi programming with Python by Wolfram Donat

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	**Wireless Communication (ELC2402)**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe wired and wireless communication systems.	
CO2	Discuss and summarize developments from 1G to 5G Cellular systems.	
CO3	Apply the knowledge of different wireless systems to know the features of various technologies.	
CO4	Compare different generations of Cellular communication systems.	
CO5	Evaluate GPS system and its features.	
CO6	Design wireless smart home systems and smart irrigation systems.	

Unit No.	Title of Unit and Contents	No of Lectures
I	**Introduction to wireless communication: Mobile Communication** Need of wireless communication systems, Wired versus wireless communication, Antenna: Introduction, Need, working Principle, Parameters of antenna: Gain, directivity, Radiation pattern, Beam width, Bandwidth, Front to Back Ratio (FBR), Fundamentals of cellular system**:** Cell structure **(**Hexagonal cell geometry), Cluster, Co-channel interference, Frequency reuse concept. Cellular systems from 1G to 5G, LTE, IEEE wireless protocol 802.11 GSM: Architecture, Call routing, Mobility management, IS 95: Architecture, Channel structure, Calls processing, Hand off, CDMA versus GSM	**12**
II	**Wireless Technologies** Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure Zigbee: Architecture, devices, topologies, applications Z wave: Protocol architecture RFID: Components, types, applications, advantages & disadvantages, GPRS. LoRa: Features and applications	**8**
III	**GPS system** Introduction, Components of GPS system (space segment, control segment, user segment), GPS receiver, Applications.	**4**
	IoT Architecture & Applications / Case studies Introduction of IoT, General architecture (SOA based and API oriented architecture), IoT characteristics and need of Scalability,	

IV	reliability, Interoperability of devices, Concept of QoS, Resource Reservation and scheduling, performance measurement, AI in IoT Overview of IoT in Indoor and Outdoor Environment - Indoor issues: Sensor to Gateway communication-hardware and software, low power local area networking (LPLAN), technologies focusing on home automation. Outdoor issues: Long range, low power wide area networking (LPWAN) technologies, LoRa and sigfox in unlicensed bands, and NB-IoT, LTE, Cat –M. Case Studies: 1. Smart Irrigation system for Agricultural field. Case Studies: 2 Smart Homes in Smart Cities.	**12**

References:

1. Wireless Communications and Networks, William Stallings, Pearson Education Inc. 2nd Edition
2. Mobile Computing, Asoke K Talukder, Roopa R Yavagal, TMH
3. Mobile Communications, Jochen Schiller, Pearson Education, 2nd Edition
4. Wireless Communications and Networks, 3G and beyond, ITI SahaMisra, TMH. 2nd Edition.
5. Principle of wireless Networks by KavehPahlavan and Prashant Krishnamurthy, Pearson Education, 2002.

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	**Electronics Practical IV (ELC2403)**	**Number of Credits : 02**
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe I/O devices for interfacing Raspberry Pi.	
CO2	Discuss GPRS and Zig bee systems for data transfer.	
CO3	Applying concepts of interfacing I/O devices to Raspberry Pi by constructing circuits.	
CO4	Analyze outputs using Python programs.	
CO5	Compare observed outputs of an experimental circuit with the theoretically expected outputs.	
CO6	Reconstruct the given experimental circuit to obtain a simple application circuit.	

List of practicals (Compulsory 10 + 2 Activity)

Sr No.	Title of experiment
1	Interfacing light emitting diodes (LEDs) with Raspberry Pi
2	Interfacing Switch with Raspberry Pi to read its ON OFF status
3	Interfacing Temperature sensor with Raspberry Pi
4	Interfacing Photocell with Raspberry Pi
5	Programming Raspberry Pi for Motion detection
6	Interfacing camera with Raspberry Pi to capture the image
7	SIM card detection and Message transmission/reception using GSM / GPRS system
8	Study of GPS system
9	Study of Zig-bee for one application
10	Study of RFID system
11	Hands on Python programming.
12	LED switching using mobile.
13	LoRa Interfacing.