Shri Sangameshwar Education Society's

Sangameshwar College, Solapur [Autonomous]

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 4(4.2)
26th March, 2022

UG Science Programme: B.Sc.-III to be implemented from A.Y. 2022-2023

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in: ELECTRONICS

Objectives of the course:

The aim of the course is to generate trained manpower with adequate theoretical and practical knowledge of the various facets of electronic circuits and systems. Due care is taken to inculcate conceptual understanding in basic phenomena, materials, devices, circuits and products and development of appropriate practical skills suitable for industrial needs.

Structure of Choice Based Credit System for Undergraduate Science **Program B.Sc. III (Electronics)** to be implemented from **A.Y.2022-2023**

Table:5

Semester	Course		Course Code	Teaching Scheme/week		
				Hours	Lectures	Credits
V	AECC-C	ENGLISH FOR COMMUNICATION-III	2231501	3.2	4	2
	DSE-1A	Theory Paper-IX: Linear Integrated Circuits and Applications	2231551	2.4	3	3
		Practical-IV: Electronic Practical Group A	2231656	4	5	2
	DSE-2A	Theory Paper-X: Fundamentals of Microcontroller	2231552	2.4	3	3
		Practical-V: Electronic Practical Group B	2231657	4	5	2
	DSE-3A	Theory Paper-XI: Electronic Communication	2231553	2.4	3	3

		Practical-VI: Electronic Practical Group C	2231658	4	5	2
	ANY ONE from DSE-4A (1) & 4A (2)					
	DSE-4A (1)	Theory Paper-XII: Electronic Instrumentation	2231554	2.4	3	3
		Practical-VII: Electronic Practical Group D	2231659	4	5	2
	DSE-4A (2)	Theory Paper-XII: Biomedical Electronic Instrumentation	2231555	2.4	3	3
		Practical-VII: Electronic Practical Group D	2231659	4	5	2
	SGSEC-3	Theory Paper-III: Circuit Design & Simulation and PCB Fabrication	2231556	2.4	3	2
		Total		**31.2**	**39**	**24**
VI	AECC-D	ENGLISH FOR COMMUNICATION-IV	2231601	3.2	4	2
	DSE-1B	Theory Paper-XIII: Power Electronics	2231651	2.4	3	3
		Practical-IV: Electronic Practical Group A	2231656	4	5	2
	DSE-2B	Theory Paper-XIV: Embedded System Design	2231652	2.4	3	3
		Practical-V: Electronic Practical Group B	2231657	4	5	2
	DSE-3B	Theory Paper-XV: Modern Communication Systems	2231653	2.4	3	3
		Practical-VI: Electronic Practical Group C	2231658	4	5	2
	ANY ONE from DSE-4B (1) & 4B (2)					
	DSE-4B (1)	Theory Paper-XVI: Single Board Computer and Applications	2231654	2.4	3	3
		Practical-VII: Electronic Practical Group D	2231659	4	5	2
	DSE-4B (2)	Theory Paper-XVI: Virtual Instrumentation	2231654	2.4	3	3
		Practical-VII: Electronic Practical Group D	2231659	4	5	2
		Total		**28.8**	**36**	**22**
Total Semester V and VI				**60**	**75**	**46**

Table: 6

Semester	Course		EXAMINATION			Credits
			Marks			
			CA	SEE	Total	
V	AECC-C	ENGLISH FOR COMMUNICATION-III	15	35	50	2

	DSE-1A	Theory Paper-IX: Linear Integrated Circuits and Applications	30	70	100	3
	DSE-2A	Theory Paper-X: Theory Paper-X: Fundamentals of Microcontroller	30	70	100	3
	DSE-3A	Theory Paper-XI: Electronic Communication	30	70	100	3
	ANY ONE from DSE-4A (1) & 4A (2)	Theory Paper-XII: Biomedical Electronic Instrumentation	30	70	100	3
	SEC-3	Theory Paper-III: Circuit Design & Simulation and PCB Fabrication	15	35	50	2
	Total		**135+15**	**315+35**	**450+50**	**16**
VI	AECC-D	Theory-V: ENGLISH FOR COMMUNICATION-IV	15	35	50	2
	DSE-1B	Theory Paper-XIII: Power Electronics	30	70	100	3
	DSE-2B	Theory Paper-XIV: Embedded System Design	30	70	100	3
	DSE-3B	Theory Paper-XV: Modern Communication Systems	30	70	100	3
	ANY ONE from DSE-4B(1) & 4B(2)	Theory Paper-XVI: Single Board Computer and Applications Theory Paper-XVI: Virtual Instrumentation	30	70	100	3
	DSE-1A & DSE-1B	Practical-IV: Electronic Practical Group A	30	70	100	4
	DSE-2A & DSE-2B	Practical-V: Electronic Practical Group B	30	70	100	4
	DSE-3A & DSE-3B	Practical-VI: Electronic Practical Group C	30	70	100	4
	DSE-4A & DSE-4B	Practical-VII: Electronic Practical Group D	30	70	100	4
	Total		**240+15**	**560+35**	**800+50**	**30**
Total Semester V and VI			**405**	**945**	**1350**	**46**

CA: Continuous Assessment SEE: Semester End Examination

Note:

The above structure (Table-5 and Table-6) is for Sem-V and Sem-VI of the undergraduate B.Sc.-III programmes* under science faculty.

* B.Sc.-III Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology.

DSE: Discipline Specific Elective Core Course (When a Student opts a particular course[$] as principal course from the core courses opted at B.Sc.- II excluding Geography and Psychology).

$ Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology

AECC: Ability Enhancement Compulsory Course SEC: Skill Enhancement Course

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC courses.

Programmes	Total Marks	Credits
B.Sc.-I	1200+100+50	52
B.Sc.-II	1300+50	56
B.Sc.-III	1250+100	46
Total	**3750+250+50**	**154**

PROGRAM OUTCOMES OF B.Sc. PROGRAM

PO1 Acquire skill, training and knowledge to enhance thinking, comprehension and application abilities to compete, succeed and excel globally**.**

PO2 Gain knowledge and experience (through theory, experiments, tutorials, projects and industrial / field visits), to achieve ultimate progress and improvement, to be capable of employment and meet the global competencies.

PO3 Identify, formulate and analyse problems. Create, select, and apply suitable techniques, resources, and modern scientific tools to accomplish verified conclusions with an understanding of the limitations.

PO4 Apply moral principles and commit to the norms of scientific practice in every endeavour. Validate expertise to conduct wide range of scientific experiments to solve problems.

PO5 Communicate efficiently scientific events with the Scientific community and with Society at large with capability to comprehend and pen operative reports and design documentation, make effective presentations, and give and receive clear instructions.

PO6 Reveal knowledge with thoughtful expression of the scientific principles in

one's own work, as an individual member and capable leader in a team, to manage projects in multidisciplinary environments.

Program Specific Objectives are as follows:

- To design the syllabus with specific focus on key Learning Areas.
- To equip student with necessary fundamental concepts and knowledge base.
- To develop specific practical skills.
- To impart training on circuit design, analysis, building and testing.
- To prepare students for demonstrating the acquired knowledge.
- To encourage student to develop skills for accepting challenges of upcoming technological advancements.

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B.Sc.-III (Electronics)
CBCS Pattern Semester -V
DSE-1A ELECTRONICS – IX (2231551)
Title: Linear Integrated Circuits and Applications
Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Fabrication of Integrated Circuits 6

Advantages of IC's, Epitaxial process, Diffusion process: Constant source and Limited source, Oxidation (SiO_2 layer), Photolithography, Metallization

Fabrication of monolithic components: NPN and PNP, transistors, diodes, resistors and capacitors.

Unit 2. Non linear Application of Op- amp 6

Precision full wave rectifier, Active peak detector, Sample and hold circuit, Clipper and Clamper, Log and Antilog Amplifier.

Unit 3. Active Filters 9

Introduction to filters (Passive and Active), Advantage of active filters over passive filters, Classification (low pass, high pass, band pass, band stop and all pass filters),

Types of filters (Butterworth and Chebyshev) and their comparison, Second order Butterworth Low pass and High pass filters, Band pass, Band stop filters (narrow and wide).

Unit 4. Regulated Power Supply 7

Series Op-Amp regulator, Basic block diagram of IC regulator, Protection circuits for IC regulators (over current, over voltage, thermal shutdown) Voltage regulators using IC78XX, 79XX, LM 317 and LM337.Designing of regulated power supply for 5Volt.

Unit 5. Instrumentation amplifiers and PLL 8

Programmable Instrumentation amplifiers: Salient features, Block diagram and Pin description of Instrumentation amplifier AD620

VCO, Block diagram of PLL, Principle and working of PLL, Transfer characteristics, Derivation of lock range and capture range, Features of IC 565, Application of PLL using IC 565 as Frequency multiplier, FM demodulator, FSK demodulator

Reference Books:

1. Integrated Circuit (New Edition) – K. R. Botkar
2. Integrated Electronics – Millman and Halkies (MGH)
3. Linear Integrated Circuit – D Roy Choudhari, Shail Jain (Wiley Eastern Ltd)
4. Op-Amps and Linear Integrated Circuits – Ramakant Gaikwad (PHI)

- **Course Outcomes:**
  1. Understand basics of IC fabrication techniques
  2. Build and design various Non-linear Application of Op- amp
  3. Build and design various types of filters using 0p-amp
  4. Build and design different types of regulated power supplies using ICs
  5. Build and design programmable Instrumentation amplifier and PLL for suitable applications

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B.Sc.-III (Electronics)

CBCS Pattern Semester -V
DSE-2A ELECTRONICS – X (2231552)
Title: Fundamentals of Microcontroller

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Fundamentals of Microprocessor and Data Converters 9

Introduction to microprocessors: Basic system with Bus Architecture, Block diagram of microprocessor Intel 8085, concepts of T-state, Machine cycle, Instruction cycle, Limitations of Microprocessor.

Basic concepts of DAC and ADC, specifications, Digital to analog conversion: Binary weighted and R - 2 R ladder networks

Analog to digital conversion: Flash, Successive approximation, dual slope ADC techniques, Study of DAC (IC 0808) & ADC (IC 0804) (Features & functional description)

Unit 2. Architecture of Microcontroller 5

Requirement of Microcontrollers, Overview and features of MCS 51 Family, Block Diagram and Pin description of 8051, Memory organization, GPRS, and SFRs, Flags, I/O Ports, study of Timer/Counter, study of Interrupts, study of Serial communication port, Clock and Reset circuit.

Unit 3. Instruction Set of 8051 7

Addressing Modes, Instruction Set, Execution of Instruction, Classification of Instruction Set - Data transfer group, Arithmetic group, Logical group, branch control group, Boolean/Single Bit Instructions, Concept of Stack and Subroutine.

Unit 4. Assembly Language Programming with 8051 6

Assembly Language Programming for Data Transfer, Arithmetic and Logical operations. Branching and Looping, I/O Port Programming and Bit manipulation, Time Delay Subroutine.

Unit 5. Timer, Serial Port and Interrupt Programming in 8051 9

Configuration of Timers in various modes, Configuration of Timer as a Counter, Time delay generation, square wave generation.

Basics of serial communication, Serial port of 8051, RS-232 standard and ICMAX–232, Baud rate in 8051, Baud rate doubling using crystal frequency and PCON register, SBUF,

SCON registers, Importance of TI and RI flags, Assembly Language Programming for serial data transmission and reception
Programming of the interrupts: ALP for interrupt (external and internal) execution.

Reference Books:

1. The 8051 microcontroller Architecture, programming and application by Kenneth J. Ayala
2. The 8051 Microcontroller and Embedded Systems, M. A. Mazadi, J. G. Mazadi, Pearson Education, Asia
3. Microprocessor Architecture, Programming and Applications with the 8085 By Ramesh S. Gaonkar
4. Digital Principles and Applications by A. P. Malvino & D.P. Leach (TMH), Delhi
5. Microcontroller by Ajay Deshmukh

- **Course Outcomes**
  1. Understand basics of microprocessor and Data converter principles
  2. Assess Microcontroller's internal architecture and its operation within the area of manufacturing and performance.
  3. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microcontroller.
  4. Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microcontroller.
  5. Write codes for microcontroller applications in assembly language

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B.Sc.-III (Electronics)

CBCS Pattern Semester -VI
DSE-3A ELECTRONICS – XI (2231553)
Title: Electronic Communication

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Introduction to Communication System 5

Introduction, Need, importance, Elements of electronic communication system, Types of communication system, analog communication system, digital communication system, concept of simplex and duplex communication, Noise in communication (S/N ratio and noise figure).

Unit 2. Modulation and Demodulation Techniques 9

Need, Types of modulation-Analog and digital modulation.
Analog Modulation: Amplitude modulation: Principle, mathematical expression, modulation index, Power distribution, frequency spectrum, Concept of DSB, SSB, VSB.
Frequency modulation: Principle, mathematical expression, modulation index, frequency spectrum, side bands.
Demodulation of AM and FM (Envelop detector & ratio detector)
Digital Modulation: Introduction to PAM, PWM, PPM, PCM, ASK, FSK, FDM & TDM

Unit 3. Antenna and Radio Wave Propagation 9

Principle of antenna, Concept of radiation pattern, Antenna parameters, Evaluation of (λ/2) antenna (without mathematical treatment)
Types of antenna: Yagi and Parabolic antennas (radiation pattern, frequency range, applications).
Radio Wave propagation: Principle, types of radio wave propagation: Ground waves, Space waves, Sky waves, Concept of skip distance and Virtual height.

Unit 4. Radio Receiver and Television 8

Radio receiver: Characteristics of receiver, Super heterodyne principle, Block diagram of AM, FM receivers, Television: Concept and block diagram of Black and White television transmission and reception, TV interlace scanning, Television standards, Band requirement, VSB, Composite video signal, Introduction to colour TV

Unit 5. Telephone System 5

Principle, telephone handset, subscriber local loop, Need of telephone exchange, Electronic telephone exchange, Different tones in telephone, DTMF dialer.

Reference books:

1. Principle of Communication Engineering by Anokh Singh, S.chand and company.
2. Communication electronics: Principles and applications by Frenzl, 3rdedition, TMH.
3. Radio engineering (Applied electronics Vol.-II): by G. K. Mitthal, khanna publication.
4. Electronic Communications (4th Edition) Dennis Roddy , John Coolen

- **Course outcomes**
  1. Understand basics of electronic communication
  2. Able to classify different types of modulation and de-modulation circuits
  3. Analyze the given wire antenna and its radiation characteristics also identify the suitable antenna for a given communication system
  4. Understand basics of Radio Receiver, Television circuits and Telephone System

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B.Sc.-III (Electronics)
CBCS Pattern Semester –V
DSE-4A (I) ELECTRONICS – XII (2231554)
Title: Electronic Instrumentation

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Fundamental of Signal Conditioning 8

General block diagram for electronics instrument design for measurement. Minimum requirements, dc and ac signal conditioning techniques, Basic Instrumentation amplifier, Bridge amplifier, chopped and modulated DC amplifiers (Transistor chopper and Diode bridge modulator).

Unit 2. Recorders and Lab Instruments 8

X-T Recorder, X-Y Recorder, Magnetic recorder, Digital data recorder.
Analog CRO, Digital Storage Oscilloscope, Functional Generator, Logic analyzer
(Principle, Block diagram and working)

Unit 3. Digital Measuring Instruments 7

Voltmeter (Concept and types), Multimeter, Frequency meter, Universal Counter-Timer, Capacitance Meter, pH meter
(Principle, Block diagram and working)

Unit 4. Data Acquisition System (DAS) 8

Need of DAS, objective of a DAS, signal conditioning of inputs by ratiometric and logarithmic compression, Single channel DAS, Multi-channel DAS,

Data loggers: Basic Operation of data loggers, compact data loggers. Sensor based Computer DAS.

Unit 5. Control System 5

Basics of control system, on-off control, proportional control, offset, basic controller configuration. types of controllers.

Analog electronic process controllers, advantages and disadvantages of electronic controllers

Case study of temperature controller

Reference Books:

1. A Course in Electrical and Electronics Measurements and Instrumentation by A K Sawhney, Dhanpat Rai Publication.
2. Electronic Instrumentation by K. S. Kalsi, TMH Publication.
3. Instrumentation devices and systems, CS Rangan, JR Sharma and VSV Mani, MGH
4. Smart sensors from datasheet (LM35, N26, PIR)
5. Basic Electronics – B L Thereja S Chand.

- **Course Outcomes**
  1. Understand different instruments used in laboratory as measuring instruments
  2. Understand basics of Signal Conditioning and available techniques
  3. Understand need of data acquisition system and study various types of data loggers
  4. Interpret and apply block diagram representations of control systems and design PID controllers

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B.Sc.-III (Electronics)

CBCS Pattern Semester –V

DSE-4A (II) ELECTRONICS – XII (2231555)

Title: Biomedical Electronic Instrumentation

Total Marks: 100 Credits: 03

(36 Periods)

Unit 1. Bioelectric Signals 8

Introduction to physiological systems, Sources of biomedical signals. The origin of Bioelectric signal: Resting and Action potentials, Propagation of action potentials.
Introduction to bioelectric signals: ECG, EEG, EMG.

Unit 2. Study of Bioelectric Electrodes 8

Introduction to electrode theory, Silver-Silver Chloride electrode, Classification of bioelectric electrodes, Microelectrodes: Metal and micropipette.
Surface electrodes: Limb & Floating electrode, ECG Leads, Suction-cup electrode, fluid Column electrode, Pad electrode. Needle electrode

Unit 3. Fundamentals of Biomedical Instrumentation System 8

Basic architecture of medical instrumentation system, preamplifiers, differential amplifiers, instrumentation amplifiers, Isolation amplifier, Sources of the noise.

Unit 4. Monitoring System 7

Electrocardiograph (ECG): Basic principle, block diagram of ECG.
Electroencephalograph (EEG): Basic principle, block diagram of EEG.
Electromyograph (EMG): Basic principle, block diagram of EMG

Unit 5. Imaging System 5

Basic of Diagnostics radiology, Block diagram of x- ray machine,
Principles of Ultrasound: properties, mode of transmission and imaging.

Reference Books:

1. Handbook of Biomedical Instrumentation, -R.S. Khandpur, 2nd edition, TMH, New Delhi Reprint 2007
2. Introduction to Biomedical Equipment Technology- J.J.Carr& J.M. Brown, PHI1993.
3. Biomedical Instrumentation and Measurements –Cromwell, Weibell& Pfeiffer, PHI 2nd Ed.

- **Course outcomes**

  The student will be able to
  1. Differentiate and analyse the biomedical signal sources.
  2. Elucidate cardiovascular system and related measurements.
  3. Explain the brain and skeletal muscle systems related measurements under circuits used in various imaging system

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B.Sc.-III (Electronics)
CBCS Pattern Semester –VI
DSE-1B ELECTRONICS – XIII (2231651)
Title: Power Electronics

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Power Devices 6

Power diode: Switching characteristics and applications, Effect of reverse and forward recovery time.
Power BJT and MOSFET: Switching characteristics and applications
IGBT and SIT: Working, Safe operating area (SOA), applications,
Thermal Considerations and heat sinks for power devices

Unit 2. Thyristor 8

SCR: Operating principle with two transistor analogy, V-I characteristics, Latching Current (I_L) and Holding Current (I_H), advantages, disadvantages and applications.
GTO and PUT: Working, V-I characteristics and applications.
Concept of turn on mechanism of SCR: Forward break-over triggering (High Voltage triggering), dv/dt triggering, thermal triggering, illumination triggering, gate triggering.
Triggering circuits: R, RC, UJT and PUT (operation with waveforms),
Concept of turn off mechanism of SCR, Turn OFF methods: Class A, Class B,Class C and Class D, (Working with waveforms)
Concept of di/dt, dv/dt and its protection circuits.

Unit 3. Controlled Rectifier 8

Concept of Phase control (Firing and conduction angle), Single phase half wave controlled rectifier with resistive and inductive load, Effect of free-wheeling diode,
Single phase full wave controlled rectifier with resistive load and inductive load,
Three phase half and fully controlled rectifier with resistive load.
(without mathematical treatment).

Unit 4. Invertors and Choppers 7

Classification of inverters, Transistor inverter, Series and Parallel Inverter using SCR
Basic principle of single phase half and full bridge inverter
Concept of Chopper, Basic chopper circuit, Step down and step up chopper using SCR, Jones chopper

Unit 5. Applications of Thyristor 7

Speed control of dc Motor, flasher circuit, battery Charger circuit, emergency lighting system, block diagram and concept of UPS and SMPS.

Reference Books

1. Power Electronics- M. H. Rashid (PHI)
2. Power Electronics- Dr. P. S. Bimbra, (Khanna Publication)
3. Power Electronics- P. C. Sen (TMH)
4. Thyristor Engineering- M. S. Berde (Khanna Publication)

- **Course outcomes**
  1. Build and test circuits using power devices such as SCR, IGBT and MOSFET.
  2. Analyze and design controlled rectifier.
  3. Build and test circuits for inverters and choppers
  4. Understand various applications of power devices

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B.Sc.-III (Electronics)

CBCS Pattern Semester -VI
DSE-2B ELECTRONICS – XIV (2231652)
Title: Embedded System Design

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Fundamentals of Embedded Systems design 7

Definition of an embedded system, Basic architecture of embedded system, characteristics of embedded systems, Applications of embedded systems. Minimum 89x51 based hardware for general embedded system.

Unit 2. Fundamentals of Embedded-C programming 8

Basic Structure of Embedded C program, Need of Operating System, Concept of Super loop.
Brief study of Kiel MicroVision4: Steps involved in Programming with Kiel Micro Vision 4, Simulation.
Programming tools : The flash magic as a programming tool, Steps involved in programming of the microcontroller

Unit-3: Embedded-C Programming for 80x51 Microcontroller 7

Embedded C programming for arithmetic and logical operations, data conversion programs, time delay generation and I/O port programming,
Programming of the Timer: Time delay program using timer, square wave generation, frequency measurement using counter.
Programming Serial Port: Serial data transfer from Microcontroller to PC and vice versa.

Unit 4. Real World Interfacing of 8051 microcontroller 8

Interfacing LED, LCD, Switch, Relay, 4X4 matrix keyboard, opto-coupler, thumb wheel switch and seven segment display, seven segment (multiplexing mode), Stepper Motor, DAC0808 and ADC0804, RTC, Speed Control of DC motor by PWM technique.

Unit 5. Embedded System Design with microcontroller 89x51 6

1. Temperature Measurement of an environment
2. Humidity Measurement of an environment.
3. Stepper motor control using driver
4. DC motor control using PWM technique

Reference Books

1. Embedded C - Michael J Point

2. The 8051 Microcontroller and Embedded Systems – Using Assembly and C -- Mohammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay 2ndEdition, Pearson Education (Prentice Hall)

3. Microcontroller By Ajay Deshmukh

- **Course outcomes**
  1. Understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
  2. Get familiarized with programming environment to develop embedded solutions.
  3. Program 89x51 microcontroller to perform various tasks with embedded systems such as I/O, timers, interrupts
  4. Evaluate embedded C and download the machine code that will provide solutions to interfacings of various real world devices
  5. Design electrical circuitry to the Microcontroller in order to interface it to external devices

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B.Sc.-III (Electronics)

CBCS Pattern Semester -VI
DSE-3B ELECTRONICS – XV (2231653)
Title: Modern Communication Systems

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Fiber Optic Communication 8

Need of light wave communication, working principle of fiber optic cable, Definition and terminologies: bit rate, baud rate, bandwidth, channel capacity, power budget calculation Block diagram of Optical Fiber Communication System, Fiber optic cables, types, Splicer and Connectors. Sources and Detectors; Transmitter and receivers, Applications

Unit 2. Satellite Communication 7

Satellite Orbits, Satellite Communication System, Earth Station, and Transponders, Application of Satellite communication system (TV distribution, surveillance and satellite phones)

Unit 3. Mobile Communication 7

Concept of cell, basic cellular system and its operational procedure, Hand off, power requirements, Block diagram Transmitter, receiver, Frequency synthesizer, logic unit, control unit.

Unit 4. Microwave and Radar Communication 7

Basics of microwave communication, advantages, Transmission lines, Waveguides and cavity resonators, Microwave semiconductor devices (Gunn diode) and microwave tubes (Klystron). RADAR: Concept of radar, Pulsed Radar System.

Unit 5. Computer Communication 7

Digital Data Communications Concepts, Modems: Block diagrams of QPSK and QAM Protocols., Computer Networks: LAN, MAN, WAN. Network Topologies (Star, Ring, and Bus) Concept of Internet, Bluetooth and Wi-Fi and their standards.

Reference Books

1. Communication Electronics – Frenzel (TMGH)
2. Analog and Digital Communication Systems – Martin S. Roden
3. Digital and Data Communications – Martin (PHI)
4. Hand Book of Electronic Communications – Miller
5. Optical Fiber Communication - Senior

6. Mobile Communication – Shiller

- **Course outcomes**

1. Design and build fibre optic systems for communications
2. Analyze Performance of Satellite and Cellular communication
3. Understand performance of Microwave and Radar Communication
4. Make Digital data transmission circuits of ASK, FSK, PSK, PCM.

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B.Sc.-III (Electronics)
CBCS Pattern Semester -VI
DSE-4B (I) ELECTRONICS – XVI (2231654)
Title: Single Board Computer and Applications

Total Marks: 100 Credits: 03
(36 Hours)

Unit 1. Introduction to Single Board computers 7

Overview of Single Board computers, introduction to Raspberry pi variants, study of raspberry pi 4 and fundamentals of IoT devices and Services.

Unit 2. Basics of Python 8

Introduction, print function, variables, loops, list, tuple, dictionary, conditional statements, arithmetical and logical statements, file handling, Pickle, shelve, object oriented programming in python, numpy, scipy, panda, matplotlib.

Unit 3. Raspberry pi using Python 7

GPIO pins basics, Interfacing LED , Buzzer, DC motor, LCD display, Incorporating python time, Delay function in uSec/mSec/Sec using Library, ADC interfacing to Raspberry pi, serial/USB communication

Unit 4. Sensor Interfacing 6

Temperature Sensor, Gas sensor, Humidity Sensor, Light Sensor, IR Motion, Ultrasonic Sensor, PIR Sensor , Relay, piezo Buzzer, Servo motor, , Bluetooth

Unit 5. IoT services and applications 8

IoT services: Web server, MQTT, Blynk, things speak

Applications using IoT services: temperature monitoring and control, weather station, smart lift monitoring, Motor control, Smart irrigation and soil monitoring, Gas detection and Alert, Heat beat monitoring using IoT services.

References:

1. Learning Python: Powerful Object-Oriented Programming, by Mark Lutz, o'reilly
2. Python 3 for Absolute Beginners by Tim Hall, apress
3. python.org
4. scipy.org
5. numpy.org

6. matplotlib.org
7. pandas.py data.org
8. Raspberry Pi Cookbook, Simon Monk, o'reilly
9. Raspberry Pi User Guide, by Eben Upton and Gareth Halfacree, Wiley
10. Raspberry pi sensors, Rushi Gajjar, packet
11. raspberrypi.org

- **Course outcomes**
  1. Understand basics of Python and Raspberry pi using Python
  2. Design IOT applications in different domain and be able to analyze their performance
  3. Design sensor interfaces
  4. Implement basic IOT applications on embedded platform to develop SBC

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B.Sc.-III (Electronics)

CBCS Pattern Semester -VI
DSE-4B (II) ELECTRONICS – XVII (2231654)
Title: Virtual Instrumentation

Total Marks: 100 Credits: 03
(36 Periods)

Unit 1. Fundamentals of Virtual Instrumentation 8

Historical perspectives, Basic concept of Virtual Instrumentation, Importance of VI, Block diagram and architecture of Virtual Instrumentation, data- flow techniques, graphical programming in data flow, Comparison between Virtual instrumentation and Traditional Instrumentation, Advantages of Virtual Instrumentation.

Unit 2. Standard tools for Virtual instrumentation 7

Need of IDE for development of Virtual Instrumentation system, basic features of the tools, LabVIEW, Proteus, Circuit Maker, PSPICE. Comparative approach.

Unit 3. Fundamentals of LabVIEW 8

Introduction to LabVIEW the virtual Instrumentation software, Virtual Instrumentation programming techniques, "G" Programming Language. LabVIEW windows, front panel window, Block diagram window, Creating and saving VI, Terminals, Nodes, Functions, wires etc.

Unit 4. Development of Virtual Instrumentation with LabVIEW 9

The VI and sub-VI loops, charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file IO. Suitable examples.

Unit 5. Case studies 6

Designing of Virtual Instrumentation using LabVIEW for
1. Data Acquisition Systems for Measurement of physical parameters
2. Temperature controlling

Reference Books

1. Virtual Instrumentation by using LabVIEW- Jovitha Jerome, PHI, New Delhi,2011.
2. Graphical programming Gary Johnson, 2nd Edition, MGH, 1997.
3. LabVIEW for everyone –Lisa K wells and Jeffery Travis PHI 1997.
4. Basic concept of LabVIEW 4-Skoff-PHI 1998.

- **Course outcomes**
  1. Understand basics of virtual instrumentation
  2. Analyse tools of LabVIEW and use for designing VI
  3. Design and build user specific DAS and measurement systems

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B.Sc.-III (Electronics)

CBCS Pattern Semester –V & VI PRACTICAL (2231656, 2231657, 2231658 & 2231659)

List of Experiments

Group A

1. Study of Operational amplifier as band pass / band stop filter
2. Application of PLL (Frequency Multiplication)
3. Design of Regulated Power Supply using IC LM 317/337
4. Design of Log amplifier by using Operational amplifier
5. Study of Instrumentation Amplifier IC AD 620
6. Study of SCR firing by UJT
7. Study of Chopper circuits (Step- Up)
8. Design of Light Dimmer circuit by using TRIAC
9. Study of Speed control of motor using SCR
10. Study of SMPS

Group B

1. Data transfer operations using microcontroller
2. Arithmetic/ Logical operations using microcontroller
3. Port programming operations using embedded C
4. Square wave generation with timer using embedded C
5. Interfacing of DAC using embedded C
6. Interfacing of ADC using embedded C
7. Interfacing of 16×2 LCD display using embedded C
8. Thumb Wheel and seven segment display interface using microcontroller using embedded C
9. Serial communication with PC using embedded C
10. Interfacing of stepper motor/ dc Motor with microcontroller using embedded C

Group C

1. Study of Tuned RF amplifier
2. Study of Tuned IF amplifier
3. Study of amplitude modulation and demodulation
4. Study of Frequency Modulation
5. Study of PWM
6. Study of FSK modulation
7. Time Division Multiplexing
8. Study of DTMF decoder
9. Study of AGC circuit
10. Data communication using OFC

Group D

D1: Single Board Computer and Applications

1. Python programming: print, if else loop, list, dict, tuple.
2. Graph plotting using MATPLOT lib
3. LED interfacing to Raspberry pi
4. MCP 3008 and LM35 interfacing to Raspberry pi
5. DHT11 interfacing to Raspberry pi
6. DC motor and L293D interfacing to Raspberry pi
7. Servo motor interfacing to Raspberry pi
8. Stepper motor and ULN2003 interfacing to Raspberry pi
9. Temperature monitoring and control using IoT services
10. Smart irrigation and soil monitoring using IoT services
11. Gas detection and Alert using IoT services

D2: Biomedical Electronic Instrumentation

1. Build and test the Bio Potential Amplifier.
2. Study of instrumentation amplifier INA 126.
3. Measurement of Bioelectric Potential
4. Study of PQRS Response
5. Measurement of Heart rate

D3: Virtual Instrumentation

1. Study of front panel and block diagram windows of LabVIEW.
2. Design and simulation of instrumentation amplifier by using LabVIEW
3. Design and simulation of temperature measurement system by using LabVIEW
4. Simulation of interfacing ADC to microcontroller by using LabVIEW
5. Simulation of interfacing LCD to microcontroller by using LabVIEW

Note:

* Minimum eight experiments from group A to C & D1 should be performed by the students.
* Group D is Discipline specific elective (DSE-1) group. Students have to opt any two sub groups, from D2 & D3, as per elective papers and they have to perform minimum 4 experiments, each from elected two sub-groups.
* Few Experiments can also be done by simulation using CAD/ online Platform

Program Specific Outcomes are as follows:

- Student acquires fundamental concepts and knowledge.
- Specific practical skills developed.
- Students get training on circuit design, analysis, building and testing.
- Students can demonstrate and present the acquired knowledge.
- Students develop skills for accepting challenges of upcoming technological advancements and future study.

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SEC-3
Circuit Design & Simulation and PCB Fabrication (2231556)

Total Marks: 50 Credits: 02
Periods: 30 Hours
(Theory -15 & Practical- 15)

Overview

This is a focussed practical skill program designed for students so that with this skill-sets they are able to enter in working professional, who want to learn the art of Electronics fundamentals to design Industrial Application. It offers in-depth learning of Electronics Circuit Design and Simulation using NI Multisim & Proteous software with PCB designing & Fabrication (Single & Double side)The students shall understand about circuit designing, simulation and performing analysis on the circuits and use them practically.

Unit 1: Analogue Circuit Simulation Techniques with NI Multisim

MultiSim Environment: Design Process, Setting environment preferences. The Multisim GUI –Schematic capture of circuits, Placing components, Wiring components, simulation and result display in MultiSim

Electronic Circuit Design Using Multisim: Design of Bridge rectifier, Voltage regulator, AC voltage measurement, DC transfer curve analysis, , Op-amp based circuits, transistor based circuits, filters circuits.

Unit 2: Digital Circuit Simulation with PROTEUS

Introduction to PROTEUS Software, Description to Proteus ISIS simulator tool,

Hands on practice on available library of components working through wiring and schematic designing, Concept of Schematic designing

Basics of Proteus, Power supply design (Single and Dual), IC 555 based circuits, ADC, DAC, Digital electronics examples, Custom component and package design, TLL series IC 74XX examples (F/F, latch, logic gates, MUX and De-MUX, Shift regiters, Counters etc)

Unit 3: PCB Design using Proteus

Basics of PCBs: Need, Classification, Electronics components and their categories (discrete, ICs, \SMDs) – symbols, dimensions, packages, Connectors and cables. Types of PCBs, PCB Materials. Rules for Track and Study of IPC standards.

Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues and PCB Designing Flow chart, The Schematic, Keywords & their description, Imperial and Metric, Working to Grids, Working from the top, Tracks, Pads, Vias, Polygons and Clearances.

PCB Layers: Silkscreen, Solder Mask Mechanical Layer, Keep out, Layer Alignment, Net-lists, Rats Nest, Design Rule Checking, Forward and Back Annotation, Power Planes, Good Grounding, Good Bypassing, High Frequency Design Techniques,

Component Placement & Design: Component packages, Basic Routing, Auto Routing. Finishing Touches.

Single Sided and Design Double Sided Design.

Introduction to GERBER FILE and its Generation.

PCB fabrication techniques

Unit 4: Case Studies and Project

Design Power supply PCB, Design 8051 microcontroller board, L293D Motor driver design, 7 SEGMENT AND LCD PCB design, Stepper motor driver PCB, IR Sensor PCB design

Design an embedded system for Temperature, Humidity control system using microcontroller. 8051 development boards

Reference Books:

1. Electronic devices and circuit theory by Robert L.Boylestad and Louis Nashelsky
2. Printed Circuit boards: Design and Technology, Bosshart, McGraw Hill education (1983)
3. Printed Circuits Handbook, Sixth Edition, by Clyde F. Coombs, Jr, Happy T. Holden, Publisher: McGraw-Hill Education Year: 2016
4. Introduction to System-on-Package, Rao R Tummala & Madhavan Swaminathan, MGH, 2008
5. Flexible Printed circuit board Design and manufacturing, By Robert torzwell
6. Printed Circuit Boards: Design, fabrication, assembly and Testing, R. S. Khandpur, McGraw Hill education

Reference:

1. http://www.eetimes.com/document.asp?doc_id=1272359

2. http://www.ecircuitcenter.com/Circuits/sbridge1/sbridge1.htm
3. http://www.ece.mtu.edu/labs/EElabs/EE3010/revisions/Summer2009/Multisim%20Tutorial/MULTISIM%20Tutorial.pdf

Practical

Skills to be achieved:

1. Identification of symbols, physical dimensions, packages of electronic components and devices.
2. Use of different circuit assembly techniques- tag board, general purpose board, Bread board and PCB.
3. Prepare circuit layout (e.g. use of graph paper)
4. Generate Artwork – manual process
5. Use different open source software for preparing PCB layouts
6. Transfer layout on laminates - pattern transfer or photo printing
7. Use etching techniques
8. Drilling and mounting techniques
9. Testing and troubleshooting.

List of practical

1. Introduction to Schematic Design.
2. Designing and developing Dual Power Supply +/- 15 Volt
3. Transistor Amplifier (Two stage)
4. Wien Bridge Oscillator
5. Band pass filter using Op-amp
6. Amplitude modulation/ Demodulation
7. Simple Water Level Alarm
8. 4-digit multiplexed 7-Segment Display Interface to 8051 uC
9. Designing and developing 16×2 LCD Interface to 8051 uC
10. Designing and developing Unipolar Stepper Motor Driver interface card PCB.
11. Designing and developing 8-bit DAC/ADC Interface card PCB
12. Designing and developing 4×4 matrix Keyboard Interface card PCB
13. Designing and developing PWM based DC motor drive card PCB.
14. Designing and developing DTMF based device control card PCB
15. Designing and developing uC 8051 study card PCB.

- **Course Outcome**

On completion of the course, the students will be able to:

1. The basics of Circuit Design and Simulation, student will learn with NI Multisim and with Proteus - a tool widely used in the industry.
2. Identify dimensions of electronic and mechanical components for PCB layouts.
3. Hands-on experience of Circuit Design & Simulation.
4. Hands-on experience of working with PCB Design.

5. Acquire skills to do better Minor/Major Projects.

Chairman
BOS in Electronics

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CBCS BSc. PART III SEMESTER V

AECC- C

ENGLISH FOR COMMUNICATION-III (2231501)

SEE- 35 + CA- 15 = 50 marks

COURSE CREDITS 03L+01T=04 COURSE CONTACT HOUR 60

Course Objectives:

- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:

By the end of the course the students will be able to:

- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:

Module I: Prose

1. The Gift of the Magi: O' Henry
2. The Homecoming: Rabindranath Tagore
3. The California's Tale: Mark Twain

Module II: Poetry

1. The Solitary Reaper: William Wordsworth
2. The Queen's Rival: Sarojini Naidu

3. Oh! How I faint When I
of You Do Write (Sonnet No 80) : William Shakespeare
4. The Road Not Taken: Robert Frost

Module. III: Pronunciation Skills
1) Basic Sounds in English
2) IPA Symbols
3) Phonetic Transcription
4) Stress and Intonation

Module. IV: Soft Skills
1. Types of 21st Century Skills
2. Learning Skills (4Cs)
3. Preparation for Employment

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University, Solapur (With 20% new additions & changes)

CBCS BSc. PART III SEMESTER VI

AECC- D

ENGLISH FOR COMMUNICATION-IV (2231601)

SEE- 35 + CA- 15 = 50 marks

COURSE CREDITS 03L+01T=04 COURSE CONTACT HOUR 60

Course Objectives:
- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:
By the end of the course the students will be able to:
- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations

- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:
Module. I: Prose

1. Growing Up:	Joyce Cary
2. God See the Truth, but Waits:	Leo Tolstoy
3. On the Rule of The Road:	A. G. Gardiner

Module. II: Poetry

1. Sita:	Toru Dutt
2. My Last Duchess:	Robert Browning
3. Ode to Beauty:	John Keats
4. Song: Go and Catch a Falling Star:	John Donne

Module. III: Grammar
1. Simple and Multiple Sentences
2. Direct and Indirect Speech

Module. IV: Soft Skills
1. Literacy Skills
2. Life Skills
3. Employability Skills

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University Solapur (With 20% new additions & changes)

Chairman
BOS in English