

SOLAPUR UNIVERSITY, SOLAPUR



B.Sc.-III Electronics

Choice Based Credit System
(CBCS)

(June,2018)

Solapur University, Solapur

Syllabus for B.Sc. III Electronics (CBCS Pattern)

To be implemented from Academic Year 2018-19

1. Preamble:

Bachelor of Science (B.Sc.) in Electronics is the course disseminating knowledge of the subject from fundamental concepts to State-of- technologies. Indeed, the curriculum encompasses knowledge of various themes such as Microcontroller and Embedded System, Instrumentation, Communication Electronics, Power Electronics, Medical Electronics, Virtual instrumentation etc. The Choice Based Credit System (CBCS) is implemented for this course. Out of 4 theory papers, in each semester, 3 papers are of core. However, students have to opt 1 paper from DSE papers. The curriculum is designed to ensure better job opportunities in industrial sector.

2. Objectives of the course:

Following are objectives of the course.

- To provide exposure to the students to the recent technologies.
- To provide the knowledge of design and implementation of instrumentation of significant preciseness.
- To inculcate awareness among the student to perform the projects of industrial standards, which could also, ensures the interdisciplinary approach.
- To enhance the competencies by offering significant credit to the laboratory work.

3. Course Structure:

Paper No.	Code	Title of the course	Marking Scheme			L	T	P	Credits
			UA	CA	Total				
Semester –V Electronics									
IX	Core 1	Linear Integrated Circuits and Applications	70	30	100	3	-	-	3
X	Core 2	Fundamentals of Microcontroller	70	30	100	3	-	-	3
XI	Core 3	Sensors and Transducers	70	30	100	3	-	-	3
XII	DSE-1	Biomedical Electronics	70	30	100	3	-	-	3
XII	DSE-2	Electronics Communication	70	30	100	3	-	-	3
Total			280	120	400	12	-	-	12
Semester –VI Electronics									
XIII	Core 1	Power Electronics	70	30	100	3	-	-	3
XIV	Core 2	Embedded System Design	70	30	100	3	-	-	3
XV	Core 3	Electronics Instrumentation	70	30	100	3	-	-	3
XVI	DSE-1	Virtual Instrumentation	70	30	100	3	-	-	3
XVI	DSE-2	Modern Communication Systems	70	30	100	3	-	-	3
Total			280	120	400	12	-	-	12
Practicals	Core 1	Practical IV	70	30	100	-	-	5	5
	Core 2	Practical V	70	30	100	-	-	5	5
	Core 3	Practical VI	70	30	100	-	-	5	5
	DSE	Practical VII	70	30	100	-	-	5	5
			Project						
Practical Total			280	120	400	-	-	20	20
Grand Total			840	360	1200	12	-	20	44

4. Nature of theory question paper

The nature of theory question paper is as follows.

Total Marks 70.

Q. 1 Multiple choice questions (One mark each)	:14
Q. 2 Short answer question (Any Seven)	:14
Q. 3 A Short answer question (Any two)	:10
3. B Short answer question (one compulsory)	: 04
Q. 4 Short answer question (Any two)	:14
Q. 5 Long answer question	:14
OR	
Q. 5 Answer any one	:14
A.	
B.	

5. Distribution of Practical Marks (400) :

Sr. No.	UA (280)	CA (120)	
1.	Practicals (50 x 4Practicals)	200	Circuit Test (15 + 15) 30
2.	Project (Project-40,Report-10,Oral-10)	60	Practical Test (30 + 30) 60
3.	Journal	20	Seminar 15
4.			Industrial visit/ Industrial Case Study /Job training/ Visit to industrial exhibition /Participation in Conference/ Workshop/seminars 15
	Total	280	Total 120
			Total 400

A) University Assessment :

- **Practical Marks may be as given below.**

- | | |
|--|--------------------------------------|
| a) Circuit diagram/ Flow Charts -10 | d) Calculations,graph / printout -10 |
| b) Assembly of the circuit/Programming -10 | e) Result / comment -05 |
| c) Understanding/Observations -10 | f) Oral -05 |

- Flexibility should be given to the students to write code of respective experiments.
- **Project:** Every student should take up a project and submit the report of the work carried out. The project work will be assessed independently at the time of practical examination.
- It is mandatory for the students to produce certified journal at the time of practical examination.

B) College Assessment :

- **Circuit Diagram Test :** Two circuit diagram tests, each of 15 marks.
- **Practical Test :** Two practical tests, semester-wise, each of 30 marks.
- **Seminar:** Every student of B.Sc. III, Electronics will have to deliver one seminar of at least 20 minutes on any advanced topic in Electronics using ICT(power point presentation) and submit the report of presentation.
- **Industrial visit / Local industry case study / Job training/ Visit to industrial exhibition/ Participation in the Conference/ Workshop/seminars :** In order to give the exposure of industry/ Research Institute and advances in the field of Electronics, industrial visit should be arranged and submit the report. OR he should submit the report of the case study of local industry or on job training (minimum four days) OR he may visit to an industrial/ Science exhibition OR participate in conference / Seminar / workshop and produce certificate of participation .

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Semester -V
Paper-IX:Linear Integrated Circuits and Applications

Total Marks: 100

(45 Periods)

- 1. Fabrication of Integrated Circuits:** **9**
Advantages of IC's, Epitaxial process, Fabrication of monolithic components: npn and pnp, transistors, diodes, resistors and capacitors.
- 2.Non linear Application of Op- amp** **8**
Precision full wave rectifier, Active peak detector, Sample and hold circuit, Clipper and Clamper, Log and Antilog Amplifier.
- 3.Active Filters** **8**
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 Lowpass and High pass filters, Band pass, Band stop filters (narrow and wide).
- 4. Regulated Power Supply** **8**
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.
- 5. Phase Locked Loop** **12**
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 asFrequency multiplier, FM demodulator, FSK demodulator using IC 565.V to F converter and F to V converter (LM 331)

Reference Books:

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

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B.Sc.-III (Electronics)
CBCS Pattern
Semester -V
Paper-X: Fundamentals of Microcontroller

Marks:100

(45 Periods)

- 1) Architecture of Microcontroller (15)**
Comparison of Microprocessor and Microcontroller, 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.
- 2) Instruction Set of 8051 (10)**
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.
- 3) Assembly Language Programming with 8051 (8)**
Assembly Language Programming for Data Transfer, Arithmetic and Logical operations. Branching and Looping, I/O Port Programming and Bit manipulation, Time Delay Subroutine.
- 4) Timer and Interrupt Programming in 8051 (6)**
Configuration of timers as a timers in various modes, Configuration of Timer as a Counter, Time delay generation, square wave generation. Programming of the interrupts: ALP for interrupt (external and internal) execution.
- 5) Serial Port Programming in 8051 (6)**
Basics of serial communication, Serial port of 8051, RS-232 standard and IC MAX-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.

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. Microcontroller by Ajay Deshmukh
4. Microcontroller by D. S. Dhote

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Semester –V
Paper: XI Sensors and Transducers

Marks:100

(45 Periods)

- 1. Fundamentals of sensors and transducers (10)**
The measurand, basic needs of measurements, Block diagram of measurement system, Characteristics of measurement Systems, static characteristics, dynamic characteristics and responses, Need of system calibration.
Definition: Sensor and Transducer, Principle of transduction, Basic difference between sensor and transducer, Types of sensor, Static and Dynamic characteristics, Classification of transducers, Basic requirement of transducers, Selection criteria for transducer. Concept of Active and Passive Sensors.
- 2. Resistive transducers (8)**
Principle of operation, Potentiometer, Resistance pressure transducer, Resistive position transducer, Strain gauge, Temperature transducer: RTD, Thermistors.
- 3. Inductive transducer (6)**
Principle of operation, Variable reluctance type transducer, Differential transducer: Linear Variable Differential Transducer (LVDT) and Rotary Variable Differential Transducer (RVDT)
- 4. Capacitive transducer (6)**
Principle of operation, Variable Area Type, Variable Air Gap type, Variable Permittivity type, Capacitor microphone.
- 5. Electronic Transducers and Actuators (15)**
Transducers: Thermocouple, Piezoelectric transducer, Hall Effect transducers, Photo electric transducer: LDR, Photo-voltaic cell, Photo diode, Photo transistor. Pyrometers. Smart Sensors: Temperature sensor (LM35), LPG sensor (N26), PIR sensor. Actuators : Electromagnetic Relay, Solenoid, Opto-couplers.

Reference Books

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

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Semester –V
Paper:XII- (DSE-1)-Biomedical Electronics

Marks:100

(45 Periods)

- 1. Bioelectric signals** (7)
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.
- 2. Study of Bioelectric electrodes** (7)
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
- 3. Fundamentals of biomedical instrumentation system** (7)
Basic architecture of medical instrumentation system, preamplifiers, differential amplifiers, instrumentation amplifiers, Isolation amplifier, Sources of the noise.
- 4. Monitoring system** (8)
Electrocardiograph (ECG): Basic principle, block diagram of ECG.
Electroencephalograph (EEG): Basic principle, block diagram of EEG.
Electromyograph (EMG): Basic principle, block diagram of EMG
- 5. Imaging system** (6)
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, PHI 1993.
3. Biomedical Instrumentation and Measurements –Cromwell, Weibell& Pfeiffer, PHI 2nd Ed.

Solapur University, Solapur
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Semester –V
Paper-XII: (DSE-2)-Electronics Communication

Total Marks: 100
(45 Periods)

1. Introduction to Communication System

06

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).

2. Modulation and Demodulation techniques

12

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 (Envelope detector & ratio detector)

Digital Modulation: Introduction to PAM, PWM, PPM, PCM, ASK, FSK, FDM & TDM

3. Antenna and Radio Wave Propagation

09

Principle of antenna, Concept of radiation pattern, Antenna parameters, Evaluation of $(\lambda/2)$ 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.

4. Radio receiver and Television

12

Radio receiver: Characteristics of receiver, Superheterodyne 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

5. Telephone System

6

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, 3rd edition, TMH.
3. Radio engineering (Applied electronics Vol.-II): by G.K.Mitthal, khanna publication.
4. Electronic Communications (4th Edition) Dennis Roddy, John Coolen

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Semester –VI

Paper-XIII: Power Electronics

Total Marks 100

(45 Periods)

1. Power Devices

(08)

Power diode: Construction, switching characteristics and applications

Effect of reverse and forward recovery time,

Power BJT and MOSFET: Construction, switching characteristics and applications),

IGBT and SIT: Construction, working, applications, Thermal considerations and heat sinks for power devices

2. Thyristor

(12)

SCR: operating principle with two transistor analogy, V-I characteristics, Latching Current (IL) and Holding Current (IH), advantages, disadvantages, and applications.

GTO and PUT: Construction, 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,

3. Controlled Rectifier

(09)

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 full wave controlled rectifier with resistive load (without mathematical treatment).

4. Invertors and Choppers

(10)

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

5. Applications of Power devices

(06)

Applications of SCR: Speed control of dc Motor, flasher circuit, battery charger circuit, emergency lighting system, block diagram and concept of UPS, block diagram and concept of 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)

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Semester -VI
Paper-XIV: Embedded System Design

Total Marks 100
(45 Periods)

- 1. Fundamentals of Embedded Systems design (5)**
Definition of an embedded system, Basic architecture of embedded system, characteristics of embedded systems, Applications of embedded systems. Minimum 89s51 based hardware for general embedded system.
- 2. Programming with the C: (15)**
Introduction to C programming: Basic Structure of C program, character set, keywords and identifiers, constants and variables, concept of global declaration and local declaration, data types and data ranges, expressions and operators. Study of IO statements, Control Statements, Arrays, Loops, User`s defined functions. Simple examples.
- 3. Fundamentals of Embedded C: (10)**
Basic Structure of Embedded C program, Need of Operating System, Concept of Super loop. An embedded C programs for
1. Generation of Time delay with and without use of timers.
 2. Square wave generation,
 3. Programming of I/O port and Serial Port
 4. Interrupts.
- 4. Interfacing of devices: The Hardware and Software (10)**
Development of both Hardware and software for interfacing of Switches, Thumbwheel switch, Relays, LEDs, Transistor, Opto-coupler, Seven Segment Display, 16 X 2 LCD, Stepper Motor, ADC 0804/0809 and DAC 0808, DAC by using PWM technique.
- 5. Designing of an Embedded System (05)**
1. Designing of microcontroller 89s51 based embedded system for Measurement of Temperature of an environment
 2. Designing of microcontroller 89s51 based embedded system for Measurement of humidity of an environment.
 3. Designing of microcontroller 89s51 based embedded system for DC motor control using PWM technique.
(Flowchart of the necessary embedded software is expected only)

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 2nd Edition, Pearson Education (Prentice Hall)
3. Microcontroller By Ajay Deshmukh

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Semester - VI

Paper-XV: Electronics Instrumentation

Total Marks: 100
(45 Periods)

- 1. Fundamental of Signal Conditioning (10)**
General block diagram for electronics instrument design for measurement. Minimum requirements, Block diagram of dc and ac signal conditioning techniques, Excitation, Grounding and electromagnetic and electrostatic shielding. Signal conditioners, Bridge amplifier, Pre-amplifiers, Instrumentation amplifier, Isolation amplifiers and chopper Amplifiers, Display unit.
- 2. Programmable instrumentation amplifiers: (10)**
Need of Programmable instrumentation amplifier, Salient features of Programmable Instrumentation amplifiers. Salient features, Block diagram and Pin description of Instrumentation amplifiers AD620, Salient features, Block diagram and Pin description of Precision amplifiers AD594/595.
- 3. Signal transformation and Data Acquisition System(DAS) (10)**
Offset compensation, 4-20mA current transmission, Ratiometric and logarithmic conversion. Need of DAS, Single channel DAS, Multi-channel DAS, Data loggers: Basic Operation of data loggers, compact data loggers. Computer based DAS.
- 4. Measuring Instruments and Display and Recording Devices (10)**
Digital multimeter (DMM), Signal and Function generator, Analog CRO, Digital Storage Oscilloscope, LCR Q Meter(Principle, Block diagram and working)
X-Y Recorder, Magnetic recorder, Digital data recorder.
- 5. Case Study (05)**
Study of (Principle, Block diagram and working) PH Meter, Conductivity meter and Temperature meter.

Reference Books

1. Electronic Instrumentation by K.S.Kalsi, TMH Publication.
2. Electronic Measurements by U.A.Bakshi and V.U.Bakshi, Technical Publication.
3. Instrumentation Measurement and Analysis by Nakara Choudhary(TMh)
4. Transducers Interfacing Handbook by DH Sheingold, Analog Devices Inc.
5. A Course in Electrical and Electronics Measurements and Instrumentation by AK Sawhney, Dhanpat Rai Publication.

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Semester - VI
Paper-XVI: (DSE-1)- Virtual Instrumentation

Total Marks 100
(45 Periods)

1. Fundamentals of Virtual Instrumentation. (12)

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.

2. Standard tools for Virtual instrumentation (08)

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

3. Fundamentals of LABVIEW (7)

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.

4. Development of Virtual Instrumentation with LABView(10)

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.

5. Case studies (8)

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.

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Semester -VI
Paper-XVI:(DSE-2)-Modern Communication Systems

Total Marks 100
(45 Periods)

- 1. Fiber Optic Communication (09)**
Need of light wave communication, working principle of fiber optic cable, Definition and terminologies: bit rate, baud rate, bandwidth, channel capacity, power calculation Block diagram of Optical Fiber Communication System, Fiber optic cables, types, Splicer and Connectors. Sources and Detectors; Transmitter and receivers, Applications
- 2. Satellite Communication (08)**
Satellite Orbits, Satellite Communication System, Earth Station, and Transponders, Application of Satellite communication system (TV distribution, surveillance and satellite phones)
- 3. Mobile communication (08)**
Concept of cell, basic cellular system and its operational procedure, Hand off, power requirements, Block diagram Transmitter, receiver, Frequency synthesizer, logic unit, control unit.
- 4. Microwave and Radar Communication (10)**
Basics of microwave communication, advantages, Transmission lines, Waveguides and cavity resonators, Microwave semiconductor devices (Gunn diode), microwave tubes (Klystron). RADAR: Concept of radar, Pulsed Radar System.
- 5. Computer Communication (10)**
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

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Semester –V&VI

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 LM317/337)
4. Design of Log amplifier by using Operational amplifier
5. Study of F to V converter / V to F converter (LM331)

6. Study of SCR firing by UJT
7. Study of Full Wave Controlled Rectifier
8. Design of Light Dimmer circuit by using TRIAC
9. Study of Speed control of motor using SCR
10. Study of SMPS / Study of Chopper circuits (Step- Up)

Group B

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

Group C

1. Study of strain gauge (load cell)
2. Study of temperature sensor PT 100.
3. Study of LVDT
4. Study of offset voltage compensation circuit
5. Design of circuit for measurement of electric conductivity of water
6. Design of Light activated turn ON/OFF circuit
7. Design of ON-OFF temperature controller
8. Programmable gain amplifier (AD 620)
9. Programmable gain amplifier (AD 595)
10. Instrumentation Amplifier by using LM324/TL084.

Group D-1 : Biomedical Electronics

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

Group D-2 : Electronics Communication

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

Group D-3 : Modern Communication System

1. Data communication using OFC
2. Study of FSK modulation
3. Time Division Multiplexing
4. Study of DTMF decoder
5. Study of AGC circuit

Group D-4 : Virtual Instrumentation

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

Note :

1. Minimum eight experiments from group A to C should be performed by the students.
2. Group D is Discipline specific elective (DSE-1) group. Students have to opt any two sub groups, from D1 to D4, as per elective papers and they have to perform minimum 4 experiments, each from elected two sub-groups.
