

“Education for knowledge, science and culture”

-Shikshanmaharshi Dr. BapujiSalunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Department of Electronics

B. Sc. Part - III

CBCS Syllabus with effect from June, 2023

B.Sc-III Electronics Course structure

Semester	Paper code	Title of Paper	Type of Paper	No. of Credits
Sem-V	DSE 1005E1	Fundamentals of Instrumentation, 8051 Microcontroller Interfacing and Embedded C	Elective	4
	DSE 1005E2	Antenna and Wave Propagation, Programmable Logic Controller(PLC)	Elective	4
	SEC 3	Renewable energy	Compulsory	2
Sem-VI	DSE 1005F1	Industrial Instrumentation , Advanced Microcontroller	Elective	4
	DSE 1005F2	Power Electronics, FPGA & VHDL Programming	Elective	4
	SEC 4	Introduction to Arduino and IOT	Compulsory	2

B. Sc. Part – III Electronics
Subject: Semester: V Paper- DSE 1005E1
Fundamentals of Instrumentation,
8051 Microcontroller Interfacing and Embedded C

Mark: 70

Teaching Hours 72

Credits 4

Course Objective:

- To make students understand the performance characteristics of instruments as well as errors in the measurement.
- To make students study the basic structure of PMMC mechanism and get the knowledge transducers and actuators.
- To make students design circuits and systems for particular applications using transducers, actuators and 8051 Microcontroller.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Understand the working principle, construction, operation, characteristics and features of sensors and transducers.

CO2: Apply fundamental knowledge of Instrument for electrical measurements.

CO3: Develop software and hardware for embedded systems using microcontroller.

CO4: Select the appropriate transducer/interfacing modules to build a given application.

Section – I Fundamentals of Instrumentation,

Unit	Contents	Hours
1	Fundamentals of Measurement Introduction, Performance characteristics: Static and Dynamic characteristics of instruments, Error: Types of Errors (Gross error, systematic error, and random error), Impedance loading and matching, Calibrations: Definition and classification, Standards of measurement: Definition and types of Standard	(10)
2	Basic Analog Measuring Instruments DC galvanometer, PMMC and Moving Iron instruments, Voltmeter, Ammeter, RMS and True RMS concept, Extension of range of ammeter, design of multirange ammeter, extension of range of voltmeter, design of multirange voltmeter, series and shunt type ohmmeter, Single phase wattmeter: construction and working.	(10)
3	Transducers Definition, Classification of Transducers, Selection criterion for Transducers, Detail Study of Transducers: Thermister, RTD, Thermocouple, Semiconductor sensor(LM 35/AD590), Strain gauge, LVDT, Capacitive transducer (microphone), Opto-electric transducer – LDR, Photo diode, PIR , Loud speaker, Piezoelectric transducer, Proximity sensor- Inductive, capacitive.	(08)
4	Actuator Definition, Principle, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators Electrical actuating systems: Solid-state switches, Relay, Solenoids, Electric Motors- Principle of operation Electromechanical: Servo, DC motor, Stepper motor.	(08)

Section – II 8051 Microcontroller Interfacing and Embedded C

Unit	Contents	Hours
1	Introduction to embedded C Advantages and disadvantages of programming in 8051-C & Assembly Language. Data types, operators and loops, I/O programming, Accessing SFR addresses, Logical operation. Data conversion programs, Accessing ROM space, programming for Time delay generation (using timer), external interrupts (Level and edge triggering).	(10)
2	Real World Interfacing of 8051 Interfacing to output devices – LED, Relay, LCD, seven segment display, seven segment display (multiplexing mode), DC Motor, Stepper Motor. Interfacing to input devices – Switch, 4X4 matrix keyboard, opto-coupler, thumb wheel switch. Interfacing to DAC0808 and ADC0804.	(15)
3	Serial communication in 8051. Serial Port : Serial port of 8051, RS-232 standard and IC MAX-232, Concept of Baud rate, Baud rate in 8051, SBUF register, SCON register, various modes of serial port, Importance of TI and RI flags, programming for data transmission and reception.	(05)
4	Applications of 8051 Case study's: i) Gate Emulator (Logic Gate study using microcontroller) ii) Water level controller iii) speed control of DC motor iv) Temperature measurement using LM35, ADC0804, LCD. v) Bluetooth module interfacing. Vi) Speed control of Stepper Motor	(06)

Reference Books:

1. Electronic Instruments- K.S. Kalsi 2nd Edition, TataMc-Graw Hill, (2006)
2. Transducers & Instrumentation - by D V S Murty, 2nd Edition, PHI, (2011)
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, 3rd Edition ,Tata McGrawHill (2012).
4. The 8051 Microcontroller -K. J. Ayala, Penram International Publishing (India) , (2007)
5. The 8051 Microcontroller and Embedded Systems, M. A. Mazadi, J. G. Mazadi, Pearson Education, Asia (2008)
6. Programming and customizing the 8051 Microcontroller - M.Predko, TMH, New Delhi, (2002)

B. Sc. Part – III Electronics
Subject: Semester: V Paper- DSE 1005E2
Antenna and Wave Propagation,
Programmable Logic Controller(PLC)

Mark: 70

Teaching Hours 72

Credits 4

Course Objectives:

- Students will be introduced to antennas, their principle of operation, analysis and their applications.
- To introduce the student to wavepropagation over ground, through troposphere and ionosphere, propagation effects in radio frequencies.
- To provide knowledge levels needed for PLC programming.
- To train the students to create ladder diagrams from process control descriptions.
- To make the students understand PLC functions

Course Outcomes:

At the end of the course, a student will be able to:

C01:To give insight of the radiation phenomena of antenna.

C02:To get familiarize with different parameters of antenna.

C03:To get familiarize with application of antenna according to types of antenna.

C04:To create awareness about the different types of propagation of radio waves at different frequencies.

C05:Describe typical concepts and components of a Programmable Logic Controller.

C06: Use timer, counter, and other intermediate programming functions.

C07: Design and program basic PLC circuits for entry-level PLC applications.

C08:Explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.

Section-I:Antenna and Wave Propagation

Unit	Contents	Hours
1	<p>Antenna Basics :Antenna Definition and Function of antenna.Introduction to types of antennas, Radiation Mechanism,current distribution on thin wire antenna.</p> <p>Antenna Parameters: Radiation pattern, Main Lobe and Side Lobes, Half-power beam width, Radiation intensity, Antenna efficiency, Directivity, Gain, effective area, effective length, Bandwidth, Polarization, input impedance, radiation efficiency.</p>	(10)
2	<p>Antenna as a Transmitter/Receiver</p> <p>Power delivered to antenna, Input impedance. Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Reactive, Induction and Radiation fields, Power density and radiation resistance for small current element and half wave dipole .</p>	(10)

3	<p>Radiating wire Structures (Qualitative idea only) Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna.</p> <p>Microstrip Antennas: Basics of Microstrip Antennas and its characteristics, feeding methods, design of rectangular.</p> <p>Concept of smart antenna: Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming.</p>	(08)
4	<p>Radio Wave Propagation Different Modes of Wave Propagation, Structure of atmosphere, Ground wave propagation, effect of Earth's Curvature on Ground wave propagation.</p> <p>Space Wave propagation.</p> <p>Sky Wave Propagation - Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, Virtual Height and Skip Distance, Relation between MUF and skip Distance, Multi-hop Propagation.</p>	(08)

Section – II

Programmable Logic Controller(PLC)

Unit	Contents	Hours
1	<p>Introduction to control system: Significance Transfer Function, Types and order of transfer function (Open loop and Close loop transfer system), Block diagram of Control System and reduction rules, Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, comparison closed-loop system and open-loop control, feed-forward control system, adaptive control system, classification of control system. ON-OFF controller, proportional control, PI controller, PD controller and PID control. Introduction to Fuzzy Controller.</p>	(10)
2	<p>Components of Control System: Op-amp as a zero crossing detector, non-inverting comparator, inverting comparator, two position control using op-amp, proportional controller, integral controller using Op-amp , derivative controller, PI controller, PID controller.</p>	(06)
3	<p>Introduction to PLC : Programmable logic controller (PLC) basics: Definition, overview of PLC systems, block diagram of PLC, input/output modules, power supplies, isolators, features like scan time, system scale, user interface. Modular PLC and Redundant PLC and Applications. Industrial Communication Buses: RS485, Profibus .Distributed control system, DCS components/block diagram, SCADA, adaptive control system.</p>	(10)
4	<p>Ladder Programming basics Basic components: fuse, pushbutton, selector switches, limit switches, indicators, relay, timedelay relays functions and symbols. General PLC programming procedures, programming on-off inputs/ outputs. Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions. Ladder Programming: Programs for Boolean logic and flip-flops, counters , timers, flasher. Application program Bottle filling plant, elevator control, washing machine control.</p>	(10)

Reference Books:

1. Antenna Theory: Analysis and design –C. Balanis ,3rd Ed.,John Wiley & Sons., 2005.
2. Antenna Theory and Design, W. L. Stutzman and G. A. Thiele, 2nd Ed., John Wiley & Sons., 1998.
3. Antenna & Wave Propagation by K.D. Prasad, ,3rd Ed, Satyaprakash-New Delhi,2007
4. Principles of Electromagnetism, M. N. O. Sadiku, Oxford University Press (2001)
5. Control System Engineering- I.J. Nagrath&M.Gopal (New Age International Pub 5th Edit 2006)
6. Feedback Control System Principles And Control System R.A. Barapate (Techmax Pub.)
7. Modern Control Engineering-Katsuhiko Ogata (Prentice Hall, 2010)
8. Computer Based Industrial Control- Krishna Kant (PHI Learning 2004)
9. Programmable Logic Control Programming And Applications - John R. Hackworth Frederic D. Hackworth (Pearson Education India fourth edition 2008)

B. Sc. Part – III Electronics**Semester: V Paper- SEC 3****Renewable energy****Mark: 40****Teaching Hours 36****Credits 2****Course Objective:**

- Understand the principles of operation of the broad spectrum of renewable energy technologies.
- The students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

Course Outcomes:

At the end of the course, a student will be able to:

- To understand the Need, importance and scope of non-conventional and alternate energy resources.
- To understand role significance of solar energy.
- To provides importance of Wind Energy.
- To understand the role of ocean energy in the Energy Generation.
- To understand the concept of energy Conservation.

Renewable energy

Unit	Contents	Hours
1	Introduction: Causes of Energy Scarcity, Solution to Energy Scarcity, Factors Affecting Energy Resource Development, Energy Resources and Classification, Renewable Energy – Worldwide Renewable Energy Availability, Renewable Energy in India.	(06)
2	Solar energy Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.	(10)

3	Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.	(06)
4	Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Geothermal Energy: Geothermal Resources, Geothermal Technologies. Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources	(08)
5	Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power	(06)

Reference Books:

1. Non-conventional energy sources, B.H. Khan, McGraw Hill
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy Sources and Emerging Technologies, Kothari et.al., 2nd Edition, PHI Learning.
4. Renewable Energy Technologies: Ramesh & Kumar, Narosa publication.

B. Sc. Part – III Electronics
Semester: VI Paper- DSE 1005 F1
Industrial Instrumentation,
Advanced Microcontroller

Mark: 70

Teaching Hours 72

Credits 4

Course Objective:

- To get familiar with basic electronics signal conditioning circuits and their applications.
- To make students understand working principle and use of different types of digital instrument
- To make students aware of the idea of embedded system, basic evaluation, implementation and designing of embedded system.
- To get familiar with embedded C programming for AVR
- Students will able to design and interface different embedded system.

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Design and study different OP-AMP circuits.

CO2: Design and implement active filter circuits.

CO3: Distinguish analog and digital instruments.

CO4: Design and implement VCO, V to F and V to F converter using different ICs.

CO5: Understand the architecture and function of each pin of AVR 8-bit Microcontroller.

CO6: Write, debug and simulate embedded C language programs.

CO7: Understand Timer operation, Interrupt environment and Serial Communication.

CO8: Understand the interfacing of various systems with AVR microcontroller

Section – I Industrial Instrumentation

Unit	Contents	Hours
1	Signal Conditioning -I: Introduction, Sample and Hold circuit, Thermister Wheatstone bridge amplifier, Instrumentation amplifier, Attenuator, Convertor: V-I, I-V, V-F and F-V.	(10)
2	Signal Conditioning -II: Introduction to Passive and active filter, Advantage of active filters over passive filters. Study of filter response (Butterworth, Chebyshev.) Different types of active filters. Study and design of low pass, high pass, band pass and band stop filters	(10)
3	Digital Instruments: Introduction to Data Acquisition System (DAS), Single channel & multi channel DAS. Data logger, digital instruments like Digital Multimeter, Digital Tachometer, Digital Capacitance meter, Digital Phase Meter, Digital Frequency Meter. Digital pH meter.	(08)
4	Application of Linear ICs: Block diagram of PLL with functioning of each block, calculation of capture range and lock range frequencies, application of PLL (frequency multiplier, FM modulator, frequency synthesizer and FSK) Study of IC565, study of function generator IC 8038, study of VCO 556	(08)

Section – II Advanced Microcontroller

Unit	Contents	Hours
1	Unit 1: Embedded Systems Design What is embedded system, embedded system basic blocks, embedded system hardware and software, embedded system characteristics, embedded system applications	(04)
2	Unit 2: Introduction to AVR microcontroller Overview of AVR family, ATmega8 pin configuration & function of each pin. AVR Microcontroller architecture, status register, Special function registers, SRAM, ROM & EEPROM space, On-Chip peripherals.	(06)
3	Unit 3: AVR programming in C AVR Data types, AVR I/O port programming, Timer programming, Input capture and Wave Generator, PWM programming, External Interrupt programming, ADC programming, Serial Port programming.	(10)
4	Peripheral interfacing and embedded system Interfacing of Switches, Relays, LEDs, seven segment display 16x2 LCD Interfacing, Stepper interfacing.	(07)
5	Designing of an Embedded System DC Motor speed control using PWM technique, Measurement of Temperature of an environment using sensor LM35, Dual channel Digital Voltmeter. (Block diagram, Schematic and Flowchart is only necessary)	(09)

Reference Books:

1. Op-amp and Linear Integrated Circuits-Ramakant Gaikwad, 3rd Edition, PHI (1994).
2. Electronic Instruments- K.S. Kalsi 2nd Edition, Tata Mc-Graw Hill, (2006)
3. Instrumentation Measurement and analysis-Nakra B C, Chaudry K, 3rd Edition, Tata McGraw Hill (2012).
4. Linear Integrated Circuits -D. Roy Choudhury, 4th edition, New Age International (2012).
5. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
6. Embedded system design with Atmel AVR microcontroller, by Steven F Barrett, Morgan & Claypool Publishers.
7. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw Hill Education.
8. AVR ATmega32 data sheet

B. Sc. Part – III Electronics
Semester: VI Paper- DSE 1005F2
Power Electronics, FPGA & VHDL Programming
Teaching Hours 72

Mark: 70

Credits 4

Course Objective:

- To understand the fundamental principles of power electronics.
- To disseminate various power electronic semiconductor devices and their characteristics.
- To develop the concept of Control rectifier and their topologies.
- To know the architectural features of programmable logic devices
- To know the basic language features of VHDL and the role of HDL in digital logic design.
- To simulate digital systems described in VHDL and implement logic on an FPGA platform.

Course Outcomes:

At the end of the course, a student will be able to:

C01: To understand basic power electronic devices and their role in power conversion

C02: Describe, analyze characteristics and compare various types of power semiconductor devices for theoretical and practical context

C03: To understand and analyze performance of controlled and uncontrolled converters.

C04: Familiarization with different applications of Power Electronics

C05: To write efficient VHDL code for FPGAs

C06: To design the combinational and sequential logic circuits using VHDL.

C07: Gain proficiency with VHDL software package and utilize software package to implement digital logic circuits

Section I -Power Electronics

Unit	Contents	Hours
1	<p>Power semiconductor devices: Definition of power electronics, Need for semiconductor power devices, Applications of power electronics, classification of power semiconductor devices, Power diode: structure, operation, conductivity modulation, I-V characteristics, Reverse recovery effect, series and parallel connection of diode, Power transistor: structure, operation, effect of drift layer. Switching characteristics, specifications, Base drive circuits. Power MOSFET : MOSFET structure, characteristics, operation and drive circuits</p>	(10)
2	<p>Thyristors Types of Thyristors, Structure of SCR, SCR Characteristics, two transistor analogy - Methods of turning ON and turning OFF, dv/dt and di/dt protection, gate protection circuits Diac and Triac: Basic structure, working and V-I characteristic, application of a Diac as a triggering device for a Triac.</p>	(08)

	IGBT: Structure, characteristics, Operation and drive circuits, Comparison of power transistor, MOSFET and IGBT.	
3	Controlled Rectifiers Basics of single and three phase supply phase and line voltage waveforms, SCR as a static switch, phase controlled rectification, single phase half wave, full wave and bridge rectifiers with resistive & inductive loads. (Analysis of all these circuits with resistive load only)	(08)
4	Power Systems Power Supplies: Switch mode power supply (DC): flyback, forward, half bridge and full bridge converters. Uninterrupted power supply (UPS), Electronic Ballast, power factor correction.	(10)

Section – II FPGA AND VHDL Programming

Unit	Contents	Hours
1	Introduction to Programmable Logic Devices Evolution of Programmable logic devices, PAL, PLA and GAL. CPLD and FPGA architectures. Placement and routing. Logic Cell structure, Programmable interconnects, Logic blocks and I/O Ports. Clock distribution in FPGA	(8)
2	Basics of VHDL Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, introduction to VHDL, data objects, classes and data types, operators, overloading, logical operators, Types of delays, Entity and Architecture declaration, Introduction to behavioral, dataflow and structural models.	(8)
3	VHDL Programming VHDL statements: Assignment statements, sequential statements and process, conditional statements, case statement, Array and loops, resolution functions, packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, Component declaration, structural layout and generics	(10)
4	Sequential and Combinational Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders ,decoders, code converters, comparators, implementation of Boolean functions etc. Sequential Circuits Design: VHDL Models and Simulation of sequential Circuits, Shift Registers, counters etc.	(10)

Reference Books:

1. Power electronics: circuits, devices, and applications, M.H. Rashid (PHI), 2nd edition, Pearson Education India,2009.
2. “Power Electronics: Converters, Applications and Design”, N. Mohan, T. M. Undeland, W.M. Robbins, Wiley India Edition, 2007
3. Power Electronics- Dr. P.S. Bhimbhra, 4th edition,Khanna Publishers, New Delhi, 2012.
4. VHDL Programming by Example, Douglas L. Perry, 3rd edition, McGraw Hill 2001.
5. Principles of Digital Systems Design and VHDL. By LizyKurien and Charles Roth. Cengage Publishing, 1st edition,2008.
6. FPGA Based System Design. Pearson Education by Wayne Wolf,2004..

B. Sc. Part – III Electronics
Semester: V Paper- SEC 4
Introduction to Arduino and IoT

Mark: 40

Teaching Hours 36

Credits 2

Course Objective:

This Course focuses on hands-on IoT concepts such as sensing, actuation and communication. It covers the development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication—to help you develop skills and experiences. The Internet of Things (IoT) is the next wave, world is going to witness. Today we live in an era of connected devices the future is of connected things.

Course Outcomes:

At the end of the course, a student will be able to:

- Students will be familiarizing with Arduino Board & Accessories.
- Students will be familiarizing with interfacing with display devices and sensors.
- Students will be able design some IoT based prototypes

Unit	Contents	Hours
1	Introduction to Arduino Board & Accessories The Arduino Platform, Block diagram, Architecture, Pin functions, overview of main features such as I/O Ports, Timers, interrupts serial port, PWM, ADC, etc..	(06)
2	Display Interfacing: Interfacing arduino to LED's- blinking single LED, blinking multiple LED's, 7 segment display , traffic light ,LED flashes ,LED dot matrix . Interfacing to LCD's- Basic LCD control, display a message on LCD screen.	(10)
3	Interfacing sensors: Sensors- Definition, Types. Interfacing arduino to different sensors- light sensor, temperature sensor, humidity sensor, pressure sensor sound sensor, distance ranging sensor, water/detector sensor, smoke, gas, alcohol sensor, ultrasonic range finder.	(10)
4	Introduction to IoT: Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.	(10)

Reference Books

1. Beginning Arduino, Michal Mc Roberts, Second Edition
2. Massimo Banzi, "Getting started with Arduino" 2nd Edition, Orelly 2011.
3. The internet of things - Sean Dodson and Rob van Kranenburg, 2009

GROUP A : (Instrumentation-I& II) (minimum 08)

1. Design of multi-range ammeter, voltmeter, conversion of ammeter into voltmeter
2. Study of temperature sensor RTD and Thermister
3. Automatic Porch light control using LDR and relay.
4. Measurement of displacement using LVDT.
5. Study of ON/OFF Temperature controller (LM34/LM35/AD590)
6. Solenoid
7. Study of solid state relay.
8. Function generator using IC 8038
9. Instrumentation amplifier using OPAMP
10. Study of active filter : Low and High pass
11. Study of active filter : band pass
12. Study of V to F and F to V using VCO

GROUP B: (Antenna and Power Electronics) (minimum 08).

1. Study of simple dipole $\lambda/2$ antenna
2. Study of folded dipole $\lambda/2$ antenna
3. Study of simple dipole $\lambda/4$ antenna
4. Study of Yagi-Uda with 3 and 5 element simple dipole antenna
5. Study of SCR characteristics (static)
6. SCR firing by UJT
7. AC Voltage controller
8. Speed Control of DC Motor.
9. Phase Shift control of SCR
10. Design of Single phase full wave controlled rectifier
11. To study the simulation of single phase half wave controlled rectifier with R & RL-load using MATLAB - simulink/Scilab
12. To study the simulation of single phase half controlled bridge rectifier with R using MATLAB - simulink/Scilab

GROUP C: (Microcontroller 8051 &FPGA)(minimum 08).

1. Study of Timers in 8051 Microcontroller.
2. LED, Switch and Relay interfacing to 8051 microcontroller.
3. LCD Interfacing with 8051 Microcontroller.
4. DC motor interfacing to 8051 microcontroller.
5. Stepper Motor interfacing to 8051 microcontroller.
6. DAC0808 interfacing to 8051 microcontroller.
7. ADC0804 interfacing to 8051 microcontroller.
8. Serial communication with PC using 8051 microcontroller.
9. Write VHDL code to realize basic and derived logic gates.
10. Write VHDL code to realize Half adder, Full Adder using basic and derived gates.

11. Write VHDL code to realize Half subtractor and Full subtractor using basic and derived gates.
12. Design and simulation of a 4 bit Adder using VHDL.
13. Write VHDL code to realize Multiplexer (4x1) and Demultiplexer(1x4) using logic gates.
14. Write VHDL code to realize Decoder and Encoder using logic gates.
15. Write VHDL code to realize Clocked D, JK and T Flip flops (with Reset inputs)
16. Write VHDL code to realize 3-bit Ripple counter

GROUP D: (AVR and PLC) *(minimum 08).*

1. Interfacing of Switches and LED with Arduino/AVR microcontroller.
2. LCD Interfacing with Arduino/AVR microcontroller.
3. Stepper Motor Interfacing with Arduino/AVR microcontroller.
4. Interface temperature sensor LM35 with Arduino board and display temperature on LCD.
5. Interface temperature sensor and Humidity Sensor (DHT11) with Arduino/AVR board and display temperature and humidity values on LCD.
6. Accelerometer Sensor Interfacing with Arduino/AVR microcontroller.
7. Study of PLC Simulator (TriLOGI Software)/ codesys-software/ hardware and implementing Boolean function.
8. Programming with PLC (TriLOGI Software)/ codesys-software/ hardware) for sequential logic RS -FF,JK-FF,T-FF,D-FF
9. Study of PLC timers and counters in PLC ((TriLOGI Software)/ codesys-software/ hardware)

Distribution of Marks for Practical Exam(LAB):

Group	A	B	C	D	Project	Journal	Industrial Visit	Seminar	Total
Marks	35	35	35	35	40	08	04	08	200