Estd. 1962

NAAC 'A' Grade

Shivaji University, Kolhapur

Faculty of Science and Technology

Syllabus for

B.Sc. Electronics

Part- III (Semester- V & VI)

Choice Based Credit System

(To be implemented from June 2020 onwards)

Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- V Paper- IX
DSE-E17: Electronics Instrumentation-I and Mechatronics
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand the basics, advantages, disadvantages and applications of mechatronics.
CO2	Understand construction, working and applications of different types of transducers.
CO3	Understand different types of applications of Op-amp.
CO4	Understand basics of first order active filters.

Unit	Contents	Hours Allotted
1.	**Introduction** Mechatronics System: definition, advantages, disadvantages, features, applications, role of engineering discipline in mechatronics, components of mechatronics, design process (stages, modeling systems, traditional and mechatronics design), Performance terminology, Static Characteristics, Errors in measurement, Types of Errors, Sources of errors, Dynamic Characteristics and Response , Standard and International Standards,	**09**
2.	**Sensors and Transducers** Classification of sensors, basic requirement/characteristics of electric sensors, smart sensors, potentiometer sensor, capacitive element, pressure sensors (strain gauge, piezoelectric), LVDT(Linear Variable Differential Transformer), eddy current proximity sensor, optical encoders, pneumatic sensors, proximity switches, hall effect sensors, load cell (force sensor), pyroelectric sensor, IR and PIR sensors, temperature sensors (Bimetallic strips, RTD, Thermocouple, thermistor, IC sensor LM35), light sensors (photodiode & photovoltaic sensor)	**09**
3.	**Signal Conditioning -I** Introduction, Op-Amp applications: log amplifier, antilog amplifier, Schmitt Trigger, peak detector, sample and hold circuit, precision rectifier, clipping and clamping circuit, V to I and I to V converter, voltage follower, Instrumentation Amplifier, Strain Gauge, Bridge Amplifier	**09**
4	**Signal Conditioning -II** Advantages of active filter over passive filter, types of active filter, design of first order low pass, band stop filter and band pass filter, block diagram of PLL, PLL applications (frequency multiplier, frequency synthesizer and FM), Grounding, Shielding and Isolation Techniques. Data Acquisition System (computer with plug in board, data Loggers)	**09**

Reference Books

1. Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering- W Bolton Pearson Publication
2. Instrumentation, Measurements and Analysis- B.S. Nakara and K K Chaudhry(TMH)
3. A text book of Mechatronics : R. K. Rajput (S. Chand)
4. Electronic instruments and measurement techniques- W. D. Cooper and A.D.Helfrick (PHI)
5. Electronic Instruments- K.S. Kalsi (Tata Mc-Graw Hill)
6. Op-Amps and Linear circuits - Ramakant Gaikwad (PHI)
7. Operational Amplifiers and Linear ICs - Caughlin and Driscoll (PHI)
8. Operational Amplifier with Linear Integrated Circuit – W. D. Stanley (CBS Publications)

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- V Paper- X
DSE-E18: Antenna and Wave Propagation
Credits: 02 (Marks: 40 +10); 03 Lectures Per Week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand basic antenna parameters.
CO2	Understand construction and working of HF, VHF, UHF and Microwave antennas.
CO3	Understand construction and working of monopole, dipole and patch antennas.
CO4	Understand different modes of propagation of radio waves, critical frequency, skip distance, virtual height etc.

Unit	Contents	Hours Allotted
1.	**Antenna Basics** Introduction, Radiation Mechanism, Antenna Parameters-Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain, Impedance, Antenna Apertures, Aperture Efficiency, Effective Height.	**06**
2.	**Antenna Types** **HF, VHF & UHF ANTENNAS**: Traveling wave radiators–basic concepts, Long wire antennas, V-antennas, Rhombic Antennas and Design Relations, Small Loop antennas-, Helical Antennas, Yagi-Uda Arrays, Log periodic antennas. **MICROWAVE ANTENNAS:** Reflector Antennas, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors, Cassegrain Feeds. Slot antennas, Microstrip antennas, Horn antennas, Lens antennas (Qualitative treatment only)	**12**

3.	**Radiating wire Structures** (Qualitative treatment only**)** Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna. Basics of Patch Antenna and its design. Examples of Patch antenna like bowtie, sectoral, fractal, etc.	**06**
4.	**Wave Propagation** Concepts of Propagation, frequency ranges and modes of propagations. *Ground Wave Propagation*: Characteristics, Parameters, Wave Tilt, Flat and Spherical Earth Considerations. *Sky Wave Propagation*: Formation of Ionospheric Layers and their characteristics, Mechanism of Reflection and Refraction, Critical Frequency & its expression, MUF & Skip Distance, Virtual Height. *Space Wave Propagation*: LOS & Radio Horizon, Effect of Earth's Curvature, Field Strength Calculations, Duct Propagation, and Tropospheric Scattering.	**12**

Reference Books:

1. Antenna and Wave propogation- K.D.Prasad (Pragati Prakashan, 2009)
2. Electromagnetic waves and radiating sytems- Jordan and Balmian (PHI)
3. Microwave Devices and Cricuits - Y. Liao, (PHI)
4. Foundation of Microwave Engineering – Collin -2nd cd. McGraw Hill, 1992
5. Reich, "Microwave principles", CBS, 1996.
6. Microwave Semiconductor Devices and Their Circuit Applications- Watson (McGraw Hill)
7. Antennas- J.D.Krauss (TMH)
8. Microwave Engineering - S.Kulkarni (Umesh Publication,2009).

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- V Paper- XI
DSE- E19 : 8051 Microcontroller Interfacing and Applications
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand different types of interrupts in 8051 programming
CO2	Understand real world interfacing of 8051 microcontrollers.
CO3	Understand different applications of 8051 microcontrollers.
CO4	Understand basics of modern microcontrollers and their applications.

Unit	Contents	Hours Allotted
1.	**Interrupts Programming in 8051** Interrupts vs polling, Sources of interrupts, vector table, enabling and disabling, TCON and IE registers, interrupt priority, IP register, programming external interrupts (Level and edge triggering), programming serial communication interrupts (Mode1) and timer interrupts (mode1) (Use ALP and C during programming)	**06**
2.	**Real World Interfacing of 8051** Interfacing Relay, solenoid switch, opto-coupler, thumb wheel switch and seven segment display, seven segment (multiplexing mode), DAC0808 and ADC0804. Speed Control of DC motor by PWM technique, TRIAC drive circuit (Use ALP/C during programming)	**10**
3.	**Applications of 8051** Digital Voltmeter, Water level controller, Traffic Light controller, speed measurement of motor, Gate Emulator (Logic Gate study using microcontroller),Temperature measurement using LM35, ADC0804 & LCD, automatic basin control (using IR and solenoid switch), motion detection system using PIR sensor, Automatic Street light control System (Use ALP/C during programming)	**10**
4	**Modern Microcontroller Features and Development Tools** Features: Watch Dog Timer (WDT), Brownout detector, I^2C bus, SPI bus, analog comparator, low power devices, RTC, current sink and source capability, sleep mode, LCD and motor drivers, CAN and ZigBee interface. Architectures: Harvard vs.Von Neumann architecture, CISC and RISC, Software development tools: text editor, assembler/compiler, simulator, IDEs, high level language simulator. Hardware development tools: development boards, device programmer, in-circuit debugger, in-circuit emulators	**10**

Reference Books:

1. The 8051 Microcontroller -K. J. Ayala, (Penram International)
2. The 8051 Microcontroller and Embedded Systems, M. A. Mazadi,J. G. Mazadi, Pearson Education, Asia
3. Advanced PIC microcontroller projects in C from USB to ZigBee with the PIc18F series Dogan Ibrahim, Newnes
4. *PIC microcontroller and Embedded Systems using assembly and C for PIC 18,* Muhammad Ali Mazadi et al. Pearson Education publication,1st Edition, Fourth Impression 2011(Indian Edition).
5. C and the 8051: Programming and Multitasking, Schultz, P T R Prentice-Hall, Inc. Embedded C, Michael J. Pont,

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- V Paper- XII
DSE –E20 : Power Electronics Devices and Applications
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand construction, working and applications of semiconductor power devices.
CO2	Understand structure, characteristics operation of IGBT and thyristors.
CO3	Understand basics of uncontrolled and controlled rectifiers.
CO4	Understand applications of power devices.

Unit	Contents	Hours Allotted
1.	**Power Devices -I** Definition and application of Power electronics, Need for semiconductor power devices, **Power Diode:** Construction of the diode (drift layer), conductivity modulation, I-V characteristics, Reverse recovery effect (analysis), types of diode, series and parallel connection of diode. **Power Transistors**: Structure, operation, effect of drift layer.Switching characteristics, specifications, Base drive circuits. **Power MOSFET:** MOSFET structure, characteristics, operation and drive circuits.	**09**
2.	**Power Devices -II** **IGBT:** Structure, characteristics, Operation and drive circuits, Comparison of power transistor, MOSFET and IGBT (Insulated-Gate Bipolar Transistor). **Thyristors :** Structure, I-V Characteristics, two transistor analogy, Turn ON and turn Off process, Thyristor rating, concept of di/dt and dv/dt, TRIAC, different modes of operation, rating, MOS controlled Thyristors.	**09**
3.	**Power Circuits** **Uncontrolled rectifier**:Basic and three phase supply, phase and line voltage waveforms, three phase half wave rectifier with resistive load, analysis with resistive load, three phase full wave rectifier with resistive and large inductive load, Three phase bridge rectifier with resistiveload, analysis with resistive load. Comparison of HWR, FWR, and FWBR. **Control Rectifiers:** Concept of firing angle, Half convertor with resistive load. Use of freewheeling diode, semi-converter with resistive load. Full converter with resistiveload(Analysis of all these circuits with resistive load only)	**12**
4	**Applications of Power Devices** Principle of ON/OFF control, Singlephase bidirectional controller with resistive load. (Analysis of these circuits). SMPS, UPS, Electronic Ballast, Power factor correction. Principle of induction and dielectric heating.	**06**

Reference Books

1. Power Electronics – M.H. Rashid (PHI)
2. Power Electronics- Jamil Asghar(PHI)
3. Power Electronics-P.C. Sen
4. Power Electronics-Samir K. Datta(PHI)
5. Thyristor Engineering – M.S.Berde, Khanna Publications
6. Power Electronics Principles and Applications-S. Biswas(Dhanapat Rai Publications)
7. Power Electronics- I by J.S. Katre(Tech-Max)
8. Power Electronics- Dr. P.S. Bhimbhra (Khanna publications)
9. Power Electronics- by Jalnekar(Tecchnical Publications Pune)
10. Electronics in Industry- G.M. Chute and R.D. Chute(Mc-Graw Hill

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- VI Paper- XIII
DSE- F17: Electronics Instrumentation-II and Robotics
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand construction and working of different types of modern lab instruments and meters.
CO2	Understand basics of mechanical and electrical actuation systems.
CO3	Understand basics of robotics.
CO4	Understand certain applications robots.

Unit	Contents	Hours Allotted
1.	**Data Presentation Elements** Analog and digital meters, CRO, VDU, printers, Magnetic recording, magnetic disc, optical recording, displays (LED, seven segment and LCD), instrument calibration and testing, Digital Tachometer, pH meter, spectrum analyzer (block diagram), Biomedical measurements (bioelectric potentials and blood pressure measurement), DSO, function generator basic elements, function generator using 8038	**10**

2.	**Actuation Systems** **Mechanical Systems**: uses of kinetic chains, cams, bearings, ratchet and pawl, Gears, gears trains, rotational to translational motion, belt and chain drive, types of the belt, and mechanical aspects of motor selection. **Electrical Systems:** mechanical switch(relays), solid state switches (diodes, thyristors and TRIAC, bipolar transistor, MOSFET's), solenoids, DC motors : brushless permanent magnet DC motor, AC motors, advantages of AC motor over DC, stepper motors (VR, PM and hybrid), stepper motor specifications,	**12**
3.	**Robotics - I** Definition and advantages of robotics, laws of robotics, robot: definition, applications, functions, advantages, disadvantages, types, robotics systems, basic motions of robotics, microprocessor based robotic system, robot classifications (names only), selection, control systems: non servo control and servo control, drives, comparison of drive system	**08**
4	**Robotics - II** Case studies : digital camera and autofocus, the engine management system, the automatic control of the water, shaft speed control , copy machine, solar tracker, satellite tracker (Block diagram and explanation of each Application)	**06**

Reference Books

1. Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering- W Bolton Pearson Publication
2. Instrumentation, Measurements and Analysis- B.S. Nakara and K K Chaudhry (TMH)
3. A text book of Mechatronics : R. K. Rajput (S. Chand)
4. Electronic instruments and measurement techniques- W. D. Cooper and A.D.Helfrick (PHI)
5. Electronic Instruments- K.S. Kalsi (Tata Mc-Graw Hill)
6. Op-Amps and Linear circuits - Ramakant Gaikwad (PHI)
7. Operational Amplifiers and Linear ICs - Caughlin and Driscoll (PHI)
8. Operational Amplifier with Linear Integrated Circuit – W. D. Stanley (CBS Publications)

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- VI Paper- XIV
DSE- F18: Optoelectronics and IoT
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand working of LASER diode, LED, Photodiodes, and Phototransistors.
CO2	Understand OFC communication and construction - working of different types of fibers.
CO3	Understand different types of losses in optical fibers.
CO4	Understand the concept, working and applications of IoT.

Unit	Contents	Hours Allotted
1.	**Photonic Devices** Optical Sources: LASER, Basic concepts of laser, Optical emission from semiconductors, Semiconductor Injection Laser (ILD), Injection laser characteristics. LED: power and efficiency, LED structures, LED characteristics. Optical detectors: p-n photodiodes, p-i-n photodiodes, Avalanche photodiodes, Phototransistor. Optical receiver: Receiver operation, digital receiver performance and noise.	**09**
2.	**Optical Communication** Principle of optical communication, total internal reflection, optical fiber modes and configuration, step index & graded index fiber, single mode fiber, fiber materials, basic structure of optical fiber. Optical Fiber Communication system, transmission link, fiber optic transmitter and receiver, advantages and applications of optical fiber communication.	**09**
3.	**Characters of Optical Fibers** Signal degradation in optical fiber, attenuation, intrinsic & extrinsic absorption losses, scattering losses, bending losses and joint loss linear & nonlinear scattering losses, distortion in optical wave guide, fiber to fiber joints, fiber splicing technique, fiber connectors.	**08**
4.	**Introduction to IoT** Basics of internet of things (IoT), Technological trends in IoT, impact of IoT on society, review of various IoT applications domain, agriculture, healthcare, manufacturing, device, smart cities management and vehicle to vehicle communication, wearable computing devices, Introduction to architectural layers of IoT, IoT smart devices, IoT components and technologies to secure systems and devices. IoT based smart home and Nano-grid monitoring system. Google assistance IoT.	**10**

Reference Books

1. Optical Fiber Communication – G. Keiser - MGH
2. Fundamentals of Optics – Jenkins & White - MGH
3. Optical Fiber Communication – J.M. Senior - PHI
4. Optical Communication – Gagliardi & Karp - Wiley
5. Semiconductor Optoelectronics Devices-Bhattacharya &Pallab - Pearson Education.
6. Optoelectronics an Introduction to Materials and Devices - Singh, &Jasprit - McGraw-Hill
7. Fiber Optics & Optoelectronics - Khare, R.P. - Oxford Univ. Press
8. Text Book of Optical Fiber Communication & Its Applications- Gupta & S.C. Pren

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- VI Paper- XV
DSE-F19: Advanced Microcontroller: PIC
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand basics if PIC families.
CO2	Understand instruction set and programming of PIC18.
CO3	Understand facilities in PIC18.
CO4	Understand serial communication, interfacing and different type of interrupts in PIC18.

Unit	Contents	Hours Allotted
1.	**Introduction** Comparison of PIC12XX, PIC16XX, PIC18XX, PIC24XX and PIC32XX PIC families, WREG register (#18), PIC file register, SFRs, GPR, GP RAM vs EEPROM, File register and access bank in the PIC18(#21-25), PIC status register (#35-36), Pindiagram (18F458) ($ 2, 10-15), Minimum connection (Clock and reset circuit) (#280), uses of Configuration register and LIST directive(#282-292), stack and stack pointer in PIC18(#88-90), ROM width in the PIC18(#55-56),bank switching (#197-203),pipelining, instruction cycle time, branch penalty, loop inside a loop delay(#95-102).	**09**
2.	**Instruction set and programming of PIC18** Instruction set (#660-697), Addressing modes, I/O ports programming, I/O bit manipulation programming, program for square wave generation at port pin and port, reading and monitoring single bit (#109-129), BCD to ASCII, ASCII to BCD conversion(#162 to 164).	**09**

3.	**Facilities in PIC18 Part-I** Programming timers 0: T0CON, PIR1 register, steps to programming (ALP/C)) timer 0 in 16 bit mode and 8-bit mode, delay calculation (Timer count calculation), comparison of T0CON, T1CON, T2CON and T3CON timers of PIC18(#314-359) ADC programming in the PIC18: features of ADC, programming, ADCON0, ADCON1 register, conversion time, steps for programming (ALP/C) the ADC using polling, (#483-492), use of PIC as a digital thermometer(Display on LED).	**09**
4.	**Facilities in PIC18 Part-II** PIC18 serial communication: serial port programming, SPBRG, TXREG, RCREG, TXSTA, RCSTA register, Interfacing MAX232 to PIC18, programming(ALP/C) PIC18 to transfer and receive data serially, importance of TXIF and RCIF flag, quadrupling baud rate (#375-387) PIC18 Interrupts: Interrupt vector table in PIC18, sources of interrupts, INTCON register, interrupts enabling, programming(ALP/C)of external hardware interrupts,setting interrupt priority(#402-406,417-422,427-428,432-434).	**09**

Reference Books

1. Muhammad Ali Mazadi et al. *"PIC microcontroller and Embedded Systems using assembly and C for PIC 18,"* Pearson Education publication,1st Edition, Fourth Impression 2011(Indian Edition).
2. PIC micro 18C MCU reference manual, ww1.microchip.com/downloads/en/DeviceDoc/39500a.pdf
3. PIC18FXX8 data sheet , ww1.microchip.com/downloads/en/devicedoc/41159d.pdf
4. Peatman, John B. Design with PIC microcontrollers. Simon & Schuster Trade, 1997.

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)
Semester- VI Paper- XVI
DSE-
F20: Industrial Automation and PLC Programming
Credits: 02 (Marks: 40 +10); 03 Lectures per week (Total 45 Lectures of 48 minutes) Hours: 36

Course Outcomes After successful completion of this course, the students will be able to :	
CO1	Understand basics of control system.
CO2	Understand components of control system.
CO3	Understand programming logic controller (PLC) basics.
CO4	Understand ladder programming basics.

Unit	Contents	Hours Allotted
1.	**Introduction to Control System** Basic building of automation systems, 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,cascade control, ratio control system, adaptive control system, classification of control system: **Discrete Control System**: ON-OFF controller, multi-position control systems, PWM control **continuous control systems**: proportional control, PI controller, PD controller and PID control.	**06**
2.	**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. **Basic components:** fuse, pushbutton, selector switches, limit switches, indicators, relay, time delay relays,proximity sensors inductive, hall effect and optical, optical and magnetic encoders.**Final controlling elements:** pneumatic actuation, pneumatic cylinders, single actuating cylinders, double actuating cylinders, double rod cylinders, Tenden cylinders, multi-position cylinders, rotary cylinders, telescope cylinders. **Electric actuation:**relay, reed relay, solenoid, Thyristor, Triac, DC motor, AC motor, servo motors, stepper motor, control valves.	**12**
3.	**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, **communication protocols:** RS485, Profibus, Modbus, HART protocol, EtherCAT. PLC installation and panel	**10**

	wiring diagrams. **Advance control Algorithm:** direct digital control**,** Distributed control system, DCS components/block diagram, system architecture, distributed vs centralized control systems, advantages of distributed control system, SCADA, adaptive controlsystem.	
4.	**Ladder Programming Basics** General PLC programming procedures, Ladder diagrams instructions: special functions, data transfer and manipulation instructions, flow control operations, Boolean memories, data transfer operations, arithmetic and logical operations, flow control operations. Register basics, timer functions, counter functions. **Ladder Programming:** Programs for Boolean logic and flip-flops, single shot (monostable), holding contacts, counters, timers, flasher. **Application Program:** Bottle filling plant, automatic color mixing tank, timed sequencer washing machine control, automatic car parking system. Automatic traffic light controller.	**08**

Reference Books

1. Control System Engineering- I.J. Nagrath and M.Gopal (New Age International Publication 5th Edition 2006)
2. Feedback Control System Principles And Control System R.A.Barapate (Techmax publication 10th edition)
3. Modern Control Engineering-Katsuhiko Ogata (Prentice Hall, 2010)
4. Computer Based Industrial Control- Krishna Kant (PHI Learning 2004)
5. Programmable Logic Control Programming And Applications - John R. Hackworth
6. Frederic D. Hackworth (Pearson Education India forth edition 2008)
7. 6. Introduction To Programmable Logic Controller- Gray and Dunning (2nd edition Thomson Education)

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Shivaji University, Kolhapur
B.Sc. Part- III Electronics
Choice Based Credit System (June 2020 Onwards)

LAB COURSE For Semester V & VI

GROUP A

1. Study of temperature sensor RTD and Thermister
2. Instrumentation amplifier using OP-AMP
3. Precision rectifier using OP-AMP
4. Log amplifier using OP-AMP
5. Function generator using 8038
6. Study of Photo relay
7. Study of active filter : band pass
8. Pressure measurement using transducer
9. Clipping and clamping circuit using OP-AMP
10. Schmitt trigger using OP-AMP
11. Study of solid state switches (TRAIC and MOSFET)
12. Development of application of mechatronics: rain sensor wiper
13. Development of application of mechatronics: line following robot
14. Development of application of mechatronics: solar tracker)
15. Car Engine temperature management System
16. Distance measurement using ultrasonic sensor

GROUP B

1. Voice link using optical fiber
2. OFC transmitter and OFC receiver
3. Numerical aperture
4. Optical fiber bending loss
5. LDR characteristics
6. Photodiode/ photo transistor characteristics
7. IoT system design
8. Home automation using Bluetooth
9. IoT using google assistance
10. Interfacing of wireless sensor (IR/PIR) relay with Arduino
11. RF transceiver module
12. Study of simple dipole $\lambda/2$ antenna
13. Study of folded dipole $\lambda/2$ antenna
14. Study of simple dipole $\lambda/4$ antenna
15. Study of Yagi-Uda 5 element simple dipole antenna
16. Study of Yagi-Uda 3 element folded dipole antenna

GROUP C

1. DC motor interfacing to 8051
2. Arithmetic operations using 8051-C
3. Logical operations using 8051-C
4. Thumbwheel switch and seven segment display interfacing to 8051.
5. DAC0808 interfacing to 8051
6. ADC0804 interfacing to 8051
7. Relay interfacing to 8051using optocoupler
8. Use of MPLAB simulator: Addressing modes
9. Use of MPLAB simulator: I/O port programming(Square wave generation, Toggle port)
10. Programming of PIC(PIC18XX/PIC16XX) in timer1 16-bit mode
11. Serial communication using PIC(PIC18XX/PIC16XX)
12. Programming of PIC(PIC18XX/PIC16XX) on chip ADC
13. Digital thermometer using PIC
14. Study Arduino kit and Arduino IDE
15. Study of RFID and interfacing woth 8051/ Arduino
16. Programming of PIC(PIC18XX/PIC16XX) in timer1 8-bit mode

GROUP D

1. Study of SCR characteristics (static)
2. Study of AC / DC Timer
3. SCR firing by UJT
4. AC Voltage controller
5. Phase Shift control of SCR
6. Study of ON/OFF Temperature controller (LM34/LM35/AD590)
7. DC Motor Control
8. Study of PLC Simulator (TriLOGI Software)/ codesys-software/ hardware and implementing Boolean function.
9. Programming with PLC (TriLOGI Software)/ codesys-software/ hardware) for sequential logic RS -FF,JK-FF,T-FF,D-FF
10. Study of PLC timers and counters in PLC ((TriLOGI Software)/ codesys-software/ hardware)
11. Designing and programming of SCADA using simulation software: batch processing
12. Automatic color mixer
13. Programming PLC for Bottle filling plant
14. Programming for Automatic parking Gate
15. Designing and programming of SCADA: Automatic traffic signal controller
16. Study and implementation of proportional controller using opamp.

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