DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc./Electro./CBC&GS/90/2024

It is hcrcby inform to all conccrncd that, thc syllabus prepared by the Board of Studies and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted the B.Sc. Electronics (Optional) Vth & VIth semester (Third Year)** under the Faculty of Science & Technology as per Norms of Choiced Based Credit Grading System run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2024/ 25972-80
Date:- 09.05.2024.

★★★★★

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

B.Sc.Electronics (Optional)

Vth and VIth semester

(Third Year)

Course Structure and Curriculum

Choice Based Credit & Grading System.

From the Academic Year 2024-25 & Onwards/-

Dr. Babasaheb Ambedkar Marathwada University,

Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Syllabus

B.Sc. 3rd Year Electronics (Semester –V and VI)

Structure for Semester –V and VI								
Semester V								
	Course Code	**Course Title**	**Total Periods (Teaching periods /week**	**Credits**	**Scheme of Examination**			
					Max Marks	**CIA**	**UA**	**Min Marks**
Optional I (DSE-1 A) Discipline Specific Elective	ELE-511	DSE-1A(1) (Theory Paper-IX) (Select any one paper from A1/B1) **A1 : Power Electronics** **B1 : Programmable Logic Controllers**	2	2	50	10	40	20
	ELE-512	DSE-1A(2) (Theory Paper-X) (Select any one paper from A2/B2) **A2 : Microcontroller – I** **B2 : Fiber optics Communication**	2	2	50	10	40	20
	ELE-521	Lab course 6 (based on ELE-511)	3	1.5	50	10	40	20
	ELE-522	Lab course 7 (based on ELE-512)	3	1.5	50	10	40	20
Skill Enhancement course (SEC-3)	ELE-513	SEC-3 Any one skill to be chosen out of two SEC-3(E) , SEC-3 (F) **SEC-3 (E) : Mobile Application. Development** **SEC-3 (F) : Solar Devices**	2	2	50	10	40	20
Non-credit Course (Will not be reflected on Mark Sheet)	XXX-514	Professional Ethics and Moral Values (Examination and assessment of this course will have to be done by respective college)	2					
			14	9	250	50	200	100
Total Credits for Semester V : 9 (Theory : 06 ; Laboratory : 03)								

Semester VI								
	Course Code	**Course Title**	**Total Periods (Teaching periods /week**	**Credits**	**Scheme of Examination**			
					Max Marks	**CIA**	**UA**	**Min Marks**
Optional I (DSE-1 B) Discipline Specific Elective	ELE-611	DSE-1B(1) (Theory Paper-XI) (Select any one paper from A3/B3) **A3 : Microcontroller – II** **B3 : Sensors and Systems**	2	2	50	10	40	20
	ELE-612	DSE-1B(2) (Theory Paper-XII) (Select any one paper from A4/B4) **A4 : Instrumentation** **B4 : Advanced Microcontroller**	2	2	50	10	40	20
	ELE-621	Lab course 8 (based on ELE-611)	3	1.5	50	10	40	20
	ELE-622	Lab course 9 (based on ELE-612)	3	1.5	50	10	40	20
Skill Enhancement course (SEC-4)	ELE-613	SEC-4 Any one skill to be chosen out of two SEC-4(G) , SEC-4 (H) **SEC-4(G) : Design and Fabrication of PCB** **SEC-4 (H) : Internet of Things and Applications**	2	2	50	10	40	20
			12	9	250	50	200	100
Total Credits for Semester VI : 09 (Theory : 06 ; Laboratory : 03)								
Total Credits for three years : Sem I (11.5) + Sem II (11.5) + Sem III (15) + Sem IV (15) + Sem V (09) + Sem VI (09) = 71 Credits								

Semester V

B.Sc. III Semester -V

ELE-511: A1: Power Electronic

Total Credits-2 Contact Hours: 30

Marks: 50

Course Outcomes:

After the successful completion of the course, student should be able to:

1. Analyze and test the power semiconductor devices and their applications.
2. Compare and contrast various power semiconductor devices according to their applications.
3. Have confidence in dealing with high-power Equipments and upgrade their performance.
4. Use the knowledge acquired through this lab to design circuits which are useful in day-day life.

Course Contents:

Unit - I: Thyristors

Silicon Controlled Rectifiers, Unijunction Transistors, Diac, Triac, IGBTs {Construction, Operation, Equivalent Circuit, Characteristics};

Unit - II: Detection Sensors

Limit Switches, Proximity Detectors, Inductive Proximity Switches {Ports, Output Stages, Operation}: Capacitive Proximity Switches, Photoelectric Sensors, Methods of Detection, Operating Specifications, Sensor Interfacing (Electromagnetic Relays, Resistive Load, Inductive Load, Solid State Relay, Two Wire System)

Unit - III: D C Drives

DC Drive Fundamentals, Variable Voltage DC Drive, Motor Braking

Unit - IV: A C Drives

AC Drive Fundamentals, AC Drive System, Drive Controller Internal Circuitry, Circuit Operation of AC Drive, PWM Control Methods, Control Panel Inputs Drive functions, Inverter Self – Protection Function, Motor Braking,

Unit - V: Tutorials and Assignments

Books Recommended:

1. Industrial Electronics {Circuits, Instruments and Control Techniques} – Terry Bartelt, DELMAR, Cengage Learning India Pvt. Ltd. Delhi, 2009

2. Introduction to Power Electronics – V Jagannathan, PHI, New Delhi, 2004

3. Power Electronics – M D Singh and K B Khanchandani,

ELE-521 : Lab Course 6 Based on Paper ELE-511 A1

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments

1. Study of SCR characteristics.
2. Study of UJT characteristics.
3. Study of DIAC characteristics.
4. Study of TRIAC characteristics.
5. Half wave rectifier using SCR.
6. Study of firing of two SCRs using one UJT for power control.
7. Study of Triac as light dimmer.
8. Diac operated temperature sensitive switch using thermistor.
9. UJT relaxation oscillator.
10. Study of IGBT characteristics

B.Sc. Semester -V

ELE-511-B1 : Programmable Logic controllers

Total Credits-2 Contact Hours: 30

Marks: 50

Course Outcomes

After completion of course students will be able to:

1. Describe typical components of a Programmable Logic Controller
2. Explain the basic concepts of a Programmable Logic Controller
3. State basic PLC terminology and their meanings.
4. Explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction
5. Use ladder language programming for real applications
6. Explain the concept of basic digital electronics and data manipulation.

Course Contents:

Unit -I Introduction to programmable controllers

Industrial motor control circuits, Relay Ladder logic circuits, Building a Ladder Diagram, Rack assembly, Power Supply, PLC Programming Unit, Input /Output section, Processor Unit, Addressing, Relationship of Data File Adress to I/O modules

Unit -II Fundamental PLC Programming

PLC program execution, Ladder diagram programming Language, Ladder diagram programming, Relay logic instructions Timer instruction, counter instruction, Data manipulation instructions, Arithmetic operations, writing a program

Unit -III Advanced programming

Jump command, Data manipulation, Discrete input/output modules, troubleshooting I/O interfaces

Recommended Books

1. Industrial Electronics- Terry Bartelt, DELMAR, Cengage Learning India Pvt Ltd. Delhi 2009
2. Introduction to Power Electronics - V Jagannathan, PHI, New Delhi, 2004
3. Power Electronics -M D Singh and K B Khanchandani,
4. Mano, M. Morris. Digital logic and computer design. Pearson Education India, 2017.
5. Kamel, Khaled, and Eman Kamel. Programmable logic controllers: Industrial control. McGraw Hill Professional, 2013.
6. Handbook, P. L. C. "Practical Guide to Programmable Logic Controllers." Automation Direct. com.

ELE- 521- Lab Course 6 (Based on ELE-511-B1)

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by The Head of the Department.

1. Study of Water Level Controller, Using PLC Simulator.
2. Study of Traffic Light Control, Using PLC Simulator.
3. Study of Horizontal Motion of Conveyor Belt using Limit Switches, Using PLC Simulator.
4. Study of Lift Control, Using PLC Simulator.
5. Study of Bottling Plant with Counter, Using PLC Simulator.
6. Study of PLC field device interface module
7. Study reversal of DC motor direction using PLC simulator
8. Study of pump control, 10 sec ON. And 20 sec OFF using PLC simulator
9. Study of mathematica operation on PLC using simulator

Semester V

ELE-512 A2: Microcontroller-I

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course outcomes:

After completion of the course students will be able to -

1.Design and develop automated system based on 8051 Microcontroller

2.Apply the basics of number system to solve arithmetic and logical operations of 8051 microcontrollers

3.Develop assembly language programming for 8051 microcontrollers

4.Analyse and debug assembly language programme for 8051 microcontroller

5.Interface I/O devices

Course Contents:

Unit - I: 8051 Microcontroller

Introduction: microprocessors and microcontrollers, comparing microprocessors and microcontrollers, a microcontrollers survey, development system for microcontrollers, embedded versus external memory devices, 8-bit and 16-bit microcontrollers, CISC and RISC processer, Harvard and Von Neumann architecture, commercial microcontroller devices, Features of 8051 Microcontroller, MCS-51 architecture, Registers in MCS-51, 8051Pin description, Memory Organization.

Unit - II: Addressing Modes and Instructions

8051 Addressing Modes, MCS-51 Instruction set, 8051 Instructions and simple programmes, Using stack pointer.

Unit - III: Interrupts, Timer/Counters and Serial Communication

Interrupts, Interrupts in MCS-51, Timers and Counters, Serial communication.

Unit- IV: Applications of MCS-51

Pin diagrams of 89C51 and 89C2051, square wave generation, pulse generation, staircase ramp generation, pulse width measurement.

Unit- V: Tutorials and Assignments

Books Recommended:

1. Microcontrollers [Theory and Applications]- Ajay Deshmukh, TMH, New Delhi,2009
2. The 8051 microcontroller and embedded system – Mazidi M. A., Mazid J. G. I and McKinlay R. D- Pearson PHI,2009
3. The 8051 Microcontroller- K. J. Ayala, DELMAR, Cengage Learning India Pvt,Ltd Delhi,2008.

ELE-522 : Lab Course 7 Based on Paper ELE-512 A2

Marks :50 **Credits:1.5**

Every candidate appearing for university examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments

1. Write a program to blink LED with 0.5 Hz frequency and implement it using Atmel 89C51.
2. Write a program for 8-bit up counter and implement it using Atmel 89C51.
3. Write a program for 8-bit binary down counter and implement it using Atmel 89C51.
4. Write a program to interface a switch and 8 LEDs for binary up counter when switch is closed and pause the counter when switch is open, implement it using Atmel 89C51.
5. Write a program to generate square waveforms using Atmel 89C51 and implement it.
6. Write a program for pulse generators using Atmel 89C51 and implement it.
7. Write a program for pulse width measurement using Atmel 89C51 and implement it.

Semester V

ELE-512 B2: Fiber optics Communication

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course outcomes:

After completion of this course students will be able to -

1. demonstrate a comprehensive understanding of the principles underlying optoelectronics, including the interaction of light with semiconductor materials, the generation and detection of light signals, and the operation of optoelectronic device.
2. to apply optoelectronic components and systems to solve practical engineering problems encountered in various industrial sectors, including telecommunications, medical devices, and automotive, aerospace, and renewable energy.
3. develop analytical and problem-solving skills necessary to analyze complex optoelectronic systems, troubleshoot issues, and optimize performance in industrial settings

Course Contents:

Unit –I

Lamps and illumination systems, LEDs – working principle and applications, LED lighting, Display devices, indicators, numeric, alphanumeric and special function displays, Liquid Crystal Display elements, Plasma Displays, Multimedia projectors.Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers, Distributed Bragg Reflection (DBR) lasers

Unit –II

Photodetectors types and applications, PN and PIN Photodiodes, Avalanche Photodiodes (APD) Optocouplers, Opto interrupters, LASCR. used in safety interlocks, power isolators, rotary and linear encoders and remote control. Intrinsic and Extrinsic Fiber optic sensors.

Unit –III

Optical Fiber Theory, Parameters of Optical Fibers, Types of Optical Fibers-Single Mode and Multi-Mode Fibers, Step Index & Graded Index Fibers. Modal Properties-Waveguide Parameter (V Number), Cut-off wavelength, Dispersion-Intermodal and Intramodal dispersion

Unit –IV

Loss Mechanism in Optical Fibers-Adsorption and Scattering, Fresnel Reflection, Micro bending & Macro bending, Connector types and Splices, Misalignment and Mismatch losses. **Fiber-Optic transmitters and receivers**, Direct Modulators, External Modulators-Electro-Optic Modulators, Electro-Absorption Modulators, Noise in detection process, Noise Equivalent Power (NEP).

Unit- V: Tutorials and Assignments

Reference Books

1. Optical Engineering Fundamentals B.H. Walker, PHI

2. Electro-Optical Instrumentation Sensing and Measuring with Lasers: SilvanoDonati, Pearson

4. Fiber optics and Optoelectronics: R.P. Khare, Oxford Press.

5. Optical Fiber Communication Principles and Systems A. Selvarajan, S.Kar and Srinivas, TMH

6. Optical Fiber Communications G. Keiser, TMH

ELE-522 : Lab Course 7 Based on Paper ELE-512 B2

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments

1. Light Emitting Diodes (LEDs)
2. Light Depended Resistors (LDRs)
3. Infrared LED's and Sensors
4. Optocouplers
5. Photodiodes and Phototransistors
6. Optical Communication - Optical Fiber Training Set
7. To establish analog link using Optical Fiber.
8. To establish voice link using optical fiber.
9. To Transmit and receive Pulse Amplitude Modulated (PAM) signal using Optical fiber.
10. To measure Propagation loss in optical fiber

Semester V

ELE-513 SEC-3 (E): Mobile Application Development

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course outcomes:

After completing the course student will be able to

1. Understand the different platforms for mobile application development.
2. Develop an application for interfacing mobile with different devices and sensors.
3. Control the instrument and appliances for industry or automation.

Course Contents :

Unit I: Mobile application

Mobile application and device platforms- Alternatives for building mobile apps,-comparing native vs hybrid application- the mobile application development lifecycle- the mobile application front end. The mobile application backend, key mobile application services- what is android-android version history- obtaining the required tools- launching your first android application- Exploring the IDE- Debugging your application- Publication your application.

Unit II: Basics of Electrical and Electronics:

AC - DC Voltage, Domestic Electric supply, Transformer, Power consumption,wire, electric tester, clamp meter, Fuse, circuit breaker,Inverter, Electric consumption meterreading, BEE rating, Resister, Color code, Inductor, Capacitor, Soldering techniques,LED,Display HD, Full HD and UHD. Basic electronics, Semiconductor theory, Diodes, Filter circuits, Transistor, Function of Oscilloscope.

Unit II: ARDUINO based Embedded System

Embedded System design: Basics, Learning Arduino Platform, The basic sensorsand actuators using Arduino, Project based on embedded system design usingArduino board, calling bell design, LED lighting system design.

Unit III: Interfacing with Motors and Sensors

Introduction to Robotics and home automation, Concept of robotics and their mechanism, Basic applications using robot and home, Types of motors & sensors, Interfacing of motors & sensors with microcontroller, Application of motors & sensors in robotics field, Usage of motors & sensors in robotics vehicle and product.

Unit IV: Internet and app development

Arduino uno and sensors interface concept and Mobile apps using MIT app Inventor, Basics of IOT and application development, Github for MIT, Google creative lab.

Unit V: Test & Tutorials based on unit I to IV

Reference books:

1. Mobile Application Development - The basic codes of mobile application development by Chandra Parvesh Publisher: Notion Press Edition: 1, 2022
2. MOBILE APPLICATION DEVELOPMENT USING ANDROID by Monica Deshmane and Sonia R Dhotre, Nirali Prakashan, edition 2022.
3. Android Programming for Beginners: Build in-depth, full-featured Android apps starting from zero programming experience by John Horton Packet Publication 3rd edition 2021

Semester V

ELE-513 SEC-3 (F): Solar Devices

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course outcomes:

After completion of this course students will be able to –

1. Understand the concept of various laws related to solar engineering were studied in detail
2. Understand the basic behind radiation and the solar energy collecting devices were learnt in detail.
3. Explain the concept of various laws related to solar engineering.
4. Outline the basic idea of solar energy collecting as well as energy storage devices.

Course Contents:

UNIT I Introduction

Basics of solar energy - Brief History of solar energy utilization - Various approaches of utilizing solar energy - Blackbody radiation- Relation between radiation field energy density and radiation spectrum- Planck's formula in energy unit - Maximum spectral density - Planck's formula in wavelength unit - Wien displacement law - Stefan - Boltzmann law - Photoelectric effect - Einstein's theory of photons - Einstein's derivation of the black-body formula.

UNIT II Solar cells

Formation of a pn – junction - Space charge and internal field - Quasi - Fermi levels - The Shockley diode equation - Structure of a solar cell - The solar cell equation - Fill factor and maximum power - Various electron - hole-pair recombination mechanisms - Crystalline silicon solar cells - Thin film solar cells: CIGS, Cite and a – silicon - Tandem solar cells - Dye - sensitized solar cells - Organic solar cells

UNIT III Concentration of solar energy

Three types of imaging optics: trough or linear collectors, central receiver with heliostats, and parabolic dish concentrator with on - axis tracking- Solar thermal electricity using Stirling engine or Ranking engine - Solar photovoltaic's with concentration.

UNIT IV Energy storage

Necessity of storage for solar energy- Chemical energy storage - Thermal energy storage - Thermal Flywheels - Compressed air- Rechargeable batteries.

Unit- V: Tutorials and Assignments

REFERENCES

1. Duffie, J.A., and Beckman, W.A. Solar Energy Thermal Process, John Wiley and Sons, NewYork, Jui Sheng Hsieh, Solar Energy Engineering, Prentice-Hall, 2007.

2. M. Stix, The Sun, An Introduction, Second Edition, Springer 2002.

3. Nelson, The Physics of Solar Cells. Imperial College Press, 2003.

4. Rai, G.D., Solar Energy Utilization, Khanna Publishers, N. Delhi, 2010.

5. Sukhatme S.P., Solar Energy, Tata McGraw Hills P Co., 3rd Edition, 2008.

6. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, Sixth Edition, Prentice Hall, 2006.

Professional Ethics and Moral Values

(Non-credit Course)

(Examination and assessment of this course will have to be conducted by respective college and certificate will also be issued by the respective college only. This course will not be reflected on Mark sheet)

Course Outcomes

After completion of this course student will be able to-

1. Understand basic purpose of profession, professional ethics and various moral and social issues.
2. Aware of professional rights and responsibilities, safety and risk benefit analysis
3. Understand Professional Ethical values and contemporary issues

COURSE CONTENT:

UNIT – I: Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – II: Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT – III : Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT – IV: Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights

SUGGESTED BOOKS:

Text books:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.

2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCES:

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.

2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

Semester VI

B.Sc. Third Year: Semester VI

ELE- 611 A3 : Microcontroller-II

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course outcomes:

After completion of the course students will be able to -

1. Design and develop automated system based on 8051 Microcontroller
2. Apply the basics of number system to solve arithmetic and logical operations of 8051 microcontrollers.
3. Develop assembly language programming for 8051 microcontrollers.

Unit I: 8051 Timer Programming in Assembly Language

Programming 8051 timers, counter programming

Unit II: 8051 Serial port Programming in Assembly Language

Basics of serial communication, 8051 connections to RS232, 8051 Serial Port programming in assembly language.

Unit III: Interrupt Programming in Assembly Language

8051 interrupts, programming timer interrupts, programming external hardware interrupts, interrupts priority in the 8051 / 8052.

Unit IV: LCD, Keyboard, ADC, DAC, and Sensor Interfacing

LCD Interfacing, ADC {0809}, DAC {0808} interfacing, sensor interfacing and signal conditioning {LM34 and LM35}.

Unit- V: Tutorials and Assignments

Books Recommended:

1. The 8051 Microcontroller and embedded system- M A Mazadi, J. G. Mazadi and R. D. McKinley, Pearson PHI, 2009.

2. The 8051 Microcontroller- K J Ayala, DELMAR, Cengage Learning India Pvt. Ltd. Delhi, 2008.
3. Microcontrollers [Theory and Applications]- Ajay Deshmukh, TMH, New Delhi, 2009.

ELE-621; Lab Course 8 Based on Paper ELE-611 A3 Microcontroller-II

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments

1. Write a program to generate square waveforms and implement it using Atmel 89C51 with DAC.
2. Write a program to staircase waveforms and implement it using Atmel 89C51 with DAC.
3. Write a program to generate triangular waveform with period of 1 ms and implement it using it using Atmel 89C51 with DAC.
4. Write a program for stepper motor direction control using a switch and implement it using Atmel 89C51.
5. Write a program to display Microcontroller on 2+8 LCD module and implement it using Atmel 89C51.
6. Interfacing of matrix keyboard using MCS-51.
7. Program based on MCS-51 Timer.
8. Program based on MCS-51 Counter.
9. Program based on MCS-51 Interrupts.
10. Temperature controller with MCS-51.

Semester VI

ELE-611 B3: Sensors and Systems

Total Credits: 02 Contact Hours:30 (Clock Hours)

Marks: 50

Course Outcomes

After completion of the course, students will be able to

1. Appreciate the operation of various measuring and control instruments which they encounter in their respective fields.

2. Visualize the sensors and the measuring systems when they have to work in areas of interdisciplinary nature and also think of sensors and sensors systems when for a new situation they encounter in their career

3. Identify and select the right process or phenomena on which the sensor should depend on.

4. Know various stimuli that are to be measured in real life instrumentation

UNIT - I

Introduction to sensors and transducer

Need for sensors in the modern world. Different fields of sensors based on the stimuli - various schematics for active and passive sensors. Static and dynamic characteristics of sensors - zero, I and II order sensors – Response to impulse, step, ramp and sinusoidal inputs. Environmental factors and reliability of sensors.

UNIT – II

Sensors for mechanical systems or mechanical sensors - Displacement - acceleration and force - flow of fluids - level indicators - pressure in fluids - stress in solids. Typical sensors - wire and film strain gauges, anemometers, piezo electric and magnetostrictive accelerometers, potentio metric sensors, LVDT.

UNIT – III Thermal sensors

Temperature, temperature difference heat quantity. Thermometers for different situation – thermocouples thermistors – color pyrometry. Optical sensors: light intensity – wavelength and color – light dependent resistors, photodiode, photo transistor, CCD, CMOS sensors. Radiation detectors: radiation intensity, particle counter – Gieger Muller courter (gas based), Hallide radiation detectors.

UNIT –IV

Electrical sensors: conventional volt and ammeters, high current sensors, (current transformers), high voltage sensors, High power sensors. High frequency sensors like microwave frequency sensors, wavelength measuring sensors. MEMs and MEM based sensors.

Unit- V: Tutorials and Assignments

Reference Books

1. Measurement Systems: Application and Design, Doebelin, McGraw Hill Kogakusha Ltd
2. Microsensors, MEMS and Smart Devices, Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim , New York: Wiley, 2001.
3. Henry Bolte, "Sensors – A Comprehensive Sensors", John Wiley.
4. Handbook of Modern Sensors, Physics, Designs, and Applications, Jocob Fraden, Springer.
5. Intelligent Instrumentation Principles and Applications, Manabendra Bhuyan," CRC Press.
6. Understanding Smart Sensors, Randy Frank, Second edition, Artech House.

ELE-621; Lab Course 8 Based on Paper ELE-611 B3 Sensors and Systems

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments:

1. To sense the voltage across the Battery and Current through the Divider Circuit Using ARDUINO
2. To sense the Temperature and Pressure using ARDUINO
3. To Measure the Water flow rate using ARDUINO
4. To detect the Position of the Core using Arduino
5. To compute the wind speed using proximity sensor and Arduino
6. To display the distance the object is placed from the sensor using Arduino
7. To sense Light intensity using Arduino
8. To sense humidity using ARDUINO
9. To detect the rainfall level using Arduino
10. To detect the Moisture Content using Arduino

B.Sc. Third Year: Semester VI

ELE- 612 A4: Instrumentation

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course Outcomes:

After completion of this course students will be able to -

1. Understand the physics of pressure, temperature, level and flow measurement; mechanical and electrical aspects of instruments used to control dynamics of processes. Dynamics of automatic control including proportional control, automatic reset, derivative action and integral timing.
2. Demonstrate knowledge of commonly used process measurement devices, control methods and strategies, and the proper selection, identification, design, installation and operation of instrumentation.
3. Demonstrate knowledge of industrial process valve maintenance and instrumentation, including calibration, configuration, troubleshooting, and use of valves with instrumentation
4. Demonstrate knowledge of basic fundamentals, terms, and units of DC and AC electrical theory. Graduates will have the ability to use test equipment, hand tools and technical knowledge.

Course Contents:

UNIT - I: Qualities of Measurements

Performance Characteristics, Static Characteristics, Errors in Measurement, Types of Static Errors, Sources of Errors, Dynamic Characteristics, Standard, Atomic Frequency and Time Standards.

UNIT – II: Displays

LED display, Seven segment display, LCD display,

UNIT – IIII: Recorders

X-Y recorder, Magnetic Tape recorder, Frequency modulation recording, Digital data recording.

UNIT - IV: Transducers

Electrical transducers, selecting a transducer, Resistive transducer, Resistive position transducer, Inductive transducer, Differential output transducer, linear variable differential transducer(LVDT), capacitive transducer (pressure), Load Cell, Piezo – electric transducer. Photo electric transducers: - photo multiplier tube, photo cells, photo-voltaic cell, semiconductor photo diode, photo transistor. Temperature transducer:- RTD, Resistance thermometer, Thermistor, Thermocouple.

UNIT – V: Assignments and Tutorials

Books Recommended

1. Electronic Instrumentation –Second edition by H.S.Kalsi (Mc Graw Hill Company)
2. Transducers and Instrumentation by D V S Murty (PHI)

ELE-622; Lab Course 9 Based on Paper ELE-612 A4 Instrumentation

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments

1. Study of IC AD590 as Temperature sensor.
2. Study of PT100 as Temperature sensor.
3. Study of Thermistor as Temperature sensor.
4. Study of photo diode as light sensor
5. Study of photo transistor as light sensor
6. Study of photo voltaic cell as light sensor
7. Study of LDR as light sensor
8. Study of temperature sensing transducer.

B.Sc. Third Year: Semester VI

ELE- 612 B4: Advanced Microcontroller

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course Outcomes:

After completion of this course students will be able to-

1. Demonstrate a comprehensive understanding of the ARM architecture, including its instruction set, pipeline structure, and memory organization.
2. Develop embedded software using the C programming language for ARM-based microcontrollers, including writing code for device drivers, real-time operating systems, and application-level software.
3. Use debugging tools and techniques to identify and debug software and hardware issues in ARM-based embedded systems, as well as optimize code for performance and memory usage.

Unit I: ARM Introduction

Types of computer Architectures, ISA's and ARM, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, History of ARM microprocessor, ARM processor family, Embedded System Software and Hardwar.

Unit II: ARM Architecture and pipeline structure

The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance, The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, ARM 3 stage Pipeline, ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution, Stack implementation in ARM, Endianness, condition codes. Processor core Vs CPU core, ARM7TDMI Interface signals.

Unit III: ARM7TDMI assembly language instructions and programming

Different Types of Instructions, ARM Instruction set, data processing instructions. Shift Operations, shift Operations using RS lower byte, Immediate value encoding. Data processing Instructions. Addressing modes with examples. Instruction Timing, Swap Instructions, Swap

Register related Instructions, Loading Constants. Program Control Flow, Control Flow .Thumb Applications. Thumb Instructions, Interrupt processing. Interrupt Handling schemes, Examples of Interrupt Handlers, Co-processor instructions.

Unit IV: Embedded C Programming for ARM:

ARM Development Environment Embedded Software, Overview of C compiler and optimization, Basic C data types, C Looping structures, Register allocations, function calls, pointer aliasing, structure arrangement, bit-fields, unaligned data and Endianness, Division, floating point, Inline functions and inline assembly, Portability issues. C programs for General purpose I/O, general purpose timer, PWM Modulator, UART, I2C Interface, SPI Interface, ADC, DAC

Unit- V: Tutorials and Assignments

Books Recommended:

1. ARM Assembly Language Programming & Architecture By. Muhammad Ali Mazidi, Kindle edition 2. Arm Assembly Language, Fundamentals and Techniques, 2nd edition, William Hohl, Christppher Hinds, CRC Press.

3. Arm System Developer's Guide, Designing and Optimizing Software, Andrew N. Sloss, Dominic Symes, Chris Wwight, Elsevier

4. Arm System-on-chip Architecture, 2nd Edition, Steve Furber, Pearson publication

5. Embedded Systems By. Lyla Das, Pearson publication

ELE-622; Lab Course 9 Based on Paper ELE-612 D4 Advanced Microcontroller

Marks :50 **Credits:1.5**

Every candidate appearing for examination must produce journal showing that he/she has completed six (06) experiments during the semester. The journal must be certified at the end of the semester by the concerned teacher and Head of the department.

Experiments:

1. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations.

2. To write and simulate C Programs for ARM microprocessor in KEIL

3. To interface LED with ARM microprocessor and write program to blink LED at the interval of 1 second

4. To interface switch with ARM microprocessor and write program in C language to read status of the switch

5. To interface LCD with ARM microprocessor. Write and execute programs in C language for displaying text messages and numbers on LCD.

6. To interface DC motor with ARM microprocessor. Write program to rotate DC motor in clockwise and anticlockwise direction with different speed

7. To interface Stepper motor with ARM microprocessor. Write program to rotate motor in half step and full step mod

8. Programming NodeMCU with Arduino IDE or Micropython. Write and execute programs for device control using Android App and NodeMCU

9. Write program to control devices using webpage and NodeMCU.

10. Write program to read analog value from sensors (light, temperature, humidity etc.) using NodeMCU and upload data on cloud.

11. Student mini project based on ARM microprocessor/NodeMCU.

ELE-613-SEC-4 G (Skill Enhancement Course)

Design and Fabrication of PCB

Total Credits:02 Contact Hours:30 (Clock Hours)

Marks:50

Course Outcomes:

After completing the course, the students will be able to

1. Understand basics of PCB.
2. Know about the PCB design technology.
3. Know about different soldering techniques.

Course Contents

UNIT I:

PCB Fundamentals

PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD).

UNIT II:

Classification of PCB and Materials

Types of PCB: Single, Double, Multilayer and flexible boards

PCB Materials: Copper, Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6 ,GETEK ,BT Epoxy Glass ,Cyanate Aster , Plyimide Glass ,Teflon(explanation with reference to operating frequency of circuit), Properties of laminates (electrical & physical) and types of laminates

UNIT III:

PCB Design Concepts

PCB Designing Flow Chart: Schematic Entry, Net listing, PCB Layout Designing,

Prototype Designing: Design Rule Check (DRC), Design for Manufacturing (DFM), PCB Making, Printing, Etching o Drilling, Assembly of components

Description of PCB Layers: Electrical Layers, Top Layer, Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cutouts, Drill Details Documentation Layers, Components Outlines, Reference Designation

Text Keywords and their Description: Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track Size Calculation Formula

UNIT IV:

PCB layout design

Tools for PCB Design: Understanding the schematic Entry, Creating Library and Components, Drawing Schematic, Flat Design / hierarchical Design, Setting up Environment for PCB Design a Board, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, heat sinks and package density

Auto routing: Introduction to Auto routing, Setting up Rules, Defining Constraints, Auto router Setup Post Designing: Gerber Generation, Adding and Editing Pins.

PCB Technology: Trends, Environmental concerns in PCB industry.

Unit- V: Tutorials and Assignments

RECOMMENDED BOOKS:

1. Printed circuit Board –Design & Technology by Walter C. Bosshart, Tata McGraw Hill

2. Printed Circuit Board –Design, Fabrication, Assembly and Testing, R.S.Khandpur, TATA McGraw Hill Publisher

ELE-613-SEC-4 H (Skill Enhancement Course)

Internet of Things and Applications

Credits:2 **Contact Hours: 30**

Marks:50

Course Outcomes:

On completion of the course, student will be able to

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Use sensors and actuators for design of IoT.
3. Understand and apply various protocols for design of IoT systems
4. Use various techniques of data storage and analytics in IoT
5. Understand various applications of IoT

Course Contents:

UNIT-I - Fundamentals of IoT

Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

UNIT-II - Sensors Networks

Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components

UNIT-III - Wireless Technologies for IoT

Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT, WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols

UNIT-IV - Applications of IoT

Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Unit- V: Tutorials and Assignments

Recommended Books

1. "Internet of Things by Vijay Madisetti and Arshdeep Bahga, — (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. "The Internet of Things Connecting Objects to the Web" Hakima Chaouchi, Wiley Publications
3. "The Internet of Things: Key Applications and Protocols", Olivier Hersent, David Boswarthick, — Wiley Publications
4. Cloud Computing, Kumar Saurabh, Wiley India, 1st Edition, 2016.
5. https://onlinecourses.nptel.ac.in/noc17_cs22/course

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