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Syllabus - B Sc I Year Electronics
(wef academic year: 2020-21)

Course Name: Circuit Analysis
Hours/Week: 4 **Course Code: EL124**(60 Hours)
Credits: 4

Course Objectives: *This course aims.*
COB1:To develop an understanding of the basic circuit laws and elements of electric circuits
COB2: To introduce the basic concepts of DC and AC circuit behavior
COB3: To make the students proficient in analyzing any given electrical network by applying basic circuit laws and network theorems.
COB4: To become familiar with the working principle of CRO and its operation

Unit - I **(15Hrs)**

AC Fundamentals: Periodic waveforms, sine wave – average and RMS values; the j-operator, polar and rectangular forms of complex numbers, phasor diagram; complex impedance and admittance.

Kirchhoff's Current and Voltage Laws: Concept of voltage and current sources - KVL and KCL- application to simple circuits consisting of resistors and sources – Node voltage analysis and Mesh analysis.

Unit-II **(15Hrs)**

Network Theorems: Statement and explanation of theorems - superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem - application to simple networks (DC and AC).

Reciprocity Theorem, Millman's Theorem, application to simple networks. T and π networks, conversions between them.

Unit-III **(15Hrs)**

RC and RL Circuits:

Transient response of RC and RL circuits with step input, time constant.

Frequency response of RC and RL circuits, types of filters – low pass filter and high pass filter, differentiating and integrating circuits.

Unit-IV **(15Hrs)**

Resonance: RLC circuit - series and parallel resonance – resonant frequency – Q Factor- Bandwidth - Selectivity.

Cathode Ray Oscilloscope: CRO block diagram, Cathode Ray Tube (CRT) and its working, Electron gun focusing, deflection sensitivity, florescent screen, measurement of amplitude, time period, frequency and phase.(Qualitative only)

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Course Outcomes:

By the end of the course, students will be able to-

CO1: Apply the knowledge of basic circuit laws and simplify the network using reduction techniques.
CO2: Analyze the circuits using Kirchhoff's laws and Network theorems.
CO3: Infer and evaluate transient response and steady state response of RC and RL circuits.
CO4: Analyze the frequency response of circuits containing RC, RL and RLC.
CO5: Understand the working of the most commonly used equipment CRO and use it for measurement of electrical quantities.
CO6: Simulate to study the transient and frequency response of RC, RL and RLC circuits using appropriate software.

Recommended Books:

1. B Sc I Year Electronics – Telugu Akademi.
2. Grob's Basic Electronics – Mitchel E Schultz, Tata McGraw Hill.
3. Electric Circuits – Mahmood Nahvi and Joseph Edminister, Schaum's outlines 5th Ed. Mc Graw Hill Education (India) Pvt. Limited.
4. Engineering Circuit Analysis - William H. Hayt, Jack E. Kemmerly, Steven M. Durbin.
5. Applied Electronics - R S Sedha - S. Chand Publications.
6. Circuit Analysis - P.Gnanasivam - Pearson Education.
7. Circuit and Networks - A. Sudhakar& S. Pallai - TMH

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Course Name: Circuit Analysis Lab **Course Code: EL124P**

(45 Hours – 15 sessions)

Hours/Week: 3 **Credits: 1**

Course Objectives: This course aims to-

COB 1: Introduce the fundamental concepts of ac and dc signals

COB 2: Learn different theorems for simplification of basic linear electronic circuits

List of experiments:

1. Familiarization of CRO - measurement of amplitude, time period, frequency and phase angle.
2. Verification KCL and KVL.
3. Verification of Thevenin's and Norton's theorems
4. Verification of maximum power transfer theorem
5. RC circuits – Frequency response (Low pass and High pass filters).
6. RC circuits – differentiation and integration – tracing of waveforms.
7. LCR – Series resonance circuit – frequency response – Determination of f_o, Q and band width.
8. Simulation:
   i) Verification of KVL and KCL.
   ii) Transient response of RC and RL circuits
   iii) Frequency response of RC and RL circuits
   iv) Frequency response of RLC circuits (series and parallel).

Note: Student must perform minimum of SIX experiments. Experiment no. 8 is compulsory.

Course Outcomes: Upon successful completion of this course, the students will be able to -

CO1: Understand proportional relationship between a signal and a voltage or current that represents the signal.

CO2: Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems including the use of computer simulation.

CO3: Synthesize the network using passive elements.

Reference Books:

1. Basic Electronics – A Text Lab Manual - Zbar, Malvino, Miller.
2. Lab manual for Electronic Devices and Circuits, 4th Edition - David A Bell – PHI

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Syllabus - B Sc I Year Electronics
(wef academic year: 2020-21)
Semester II

Course Name: Semiconductor Devices **Course Code: EL224**(60 Hours)
Hours/Week: 4 **Credits: 4**

Course Objectives: This course aims to -
COB1: To familiarize students with the fundamentals of Semiconductor Physics
COB2: To make them understand the operation of various semiconductor devices
COB3: To train them to apply the devices for common applications.
COB4; To provide an understanding of the capabilities and limitations of various semiconductor devices

Unit- I **(15Hrs)**

PN Junction: Basics of semiconductor physics, formation of PN junction, depletion region, junction capacitance, VI characteristics of a PN junction diode, diode equation (no derivation), effect of temperature on reverse saturation current.

Working and characteristics of i) Zener diode, Application of Zener diode as voltage regulator ii) Tunnel diode and iii) Varactor diode.

Unit-II **(15Hrs)**

Bipolar Junction Transistor (BJT): PNP and NPN transistors, current components in BJT, BJT static characteristics (input and output), Early effect, CB, CE, CC configurations of transistor, transistor as an amplifier.

BJT in CE configuration as two port networks, h – parameter model and its hybrid equivalent circuit. Determination of h-parameters from the characteristics; load line analysis (DC and AC), transistor biasing - Fixed, and self-bias, stability factor.

Unit- III **(15Hrs)**

Field Effect Transistor (FET): Construction and working of JFET, drain and transfer characteristics of FET, determination of FET parameters. Application of FET as Voltage Variable Resistor (VVR), advantages of FET over BJT;

MOSFET - Construction and working of enhancement and depletion mode MOSFET, output and transfer characteristics; Application of MOSFET as a switch.

Uni Junction Transistor (UJT): Construction and working of UJT and its characteristics. Application of UJT as relaxation oscillator.

Unit- IV **(15Hrs)**

Silicon Controlled Rectifier (SCR): Construction and working of SCR. Two transistor representation, characteristics of SCR. Application of SCR as power controller.

Photo electronic Devices: Construction and Characteristics of Light Dependent Resistor (LDR), Photo voltaic Cell, Photo diode, Photo transistor and Light Emitting Diode (LED).

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Course Outcomes: By the end of the course, the students will be able to -

CO1: Study and analyze the behavior of semiconductor devices
CO2: Differentiate the behavior of BJT in CB, CE and CC configurations
CO3: Bias BJT for application in amplifier circuits
CO4: Use Zener diode, BJT, FET, UJT and SCR in simple applications
CO5: Simulate PN junction diode, Zener diode, BJT and JFET to study their characteristics using appropriate software

Books Recommended:

1. B Sc First Year ELECTRONICS - Telugu Akademi
2. Electronic Devices and Circuits - Jacob Millman and Christos C Halkias (TMH)
3. Basic Electronics and Linear Circuits - Bharghava, Kulsreshta, Gupta (TMH)
4. Principles of Electronics - V.K.Mehta & Rohit Mehta
5. Electronic Devices and Circuits - Allen Mottershed (PHI)
6. Electrical Technology Vol. I and II, B L Theraja, A K Theraja, S. Chand

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Course Name: Semiconductor Devices Lab **Course Code: EL224P**

(45 Hours - 15 sessions)

Hours/Week: 3 **Credits: 1**

Course Objectives: This course aims to –

COB1: To understand operation of semiconductor devices.

COB2: To verify the theoretical concepts through laboratory and simulation experiments.

List of experiments:

1. V-I characteristics of a Junction diode and determination of cut-in voltage, forward and reverse resistances.
2. Zener diode a) VI Characteristics – Determination of Zener breakdown voltage.
   b) Voltage regulator (line and load) using Zener diode.
3. BJT-input and output characteristics (CE configuration) and determination of 'h' parameters.
4. Drain and transfer characteristics of FET-determination of FET parameters.
5. UJT characteristics-determination of intrinsic stand-off ratio 'η'.
6. UJT as relaxation oscillator.
7. V-I Characteristics of LDR/Photo diode/Photo transistor/Solar cell.
8. Simulation: i. Diode (PN junction diode and zener diode) characteristics
   ii. Study of transistor I/P characteristics.
   iii. Study of transistor O/P characteristics.
   iv. FET-Characteristics

Note: Student has to perform minimum of SIX experiments.

Course Outcomes: Upon successful completion of this course student will be able to -

CO1: Understand the current voltage characteristics of semiconductor devices.

CO2: Understand component symbol, working principle, classification and specification.

CO3: Understand basic circuits using Active Devices

Reference Books:

1. Lab manual for Electronic Devices and Circuits - 4th Edition by David A Bell - PHI
2. Experiments in Electronics by S V Subramaniyam - Mac Millan India Limited
3. Basic Electronics - A Text lab manual by Zbar, Malvino, Miller.

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Syllabus - B Sc II Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2021 – 22

Semester III

Course Name: Analog Circuits **Course Code: EL324** (60 Hours)

HPW: 4 **Credits: 4**

Course Objectives: This course aims to -

COB1: learn the working principle of DC power supply
COB2: design and analyze the regulated DC power supplies
COB3: understand the methods of biasing transistors to design and analyze single stage transistor amplifier circuits
COB4: apply positive feedback in amplifiers for the design of oscillators and multivibrators

Unit - I **(15Hrs)**

Rectifiers: Rectifier– half wave, full wave and bridge rectifiers, Ripple factor, Efficiency, regulation, harmonic components in rectified output.

Filters: choke input (inductor) filter, Shunt capacitor filter, L section and π section filters.

Unit - II **(15Hrs)**

Regulated Power Supplies: Zener regulation, Block diagram of regulated power supply, Series and shunt regulated power supplies.

IC regulators - three terminal regulators (78XX and 79XX), variable voltage regulators.
Principle and working of switch mode power supply (SMPS). UPS –Principle and working.

Unit– III **(15Hrs)**

Transistor amplifier: Classification of amplifiers, Hybrid π model of a transistor, RC coupled CE amplifier – frequency response – analysis.

Feedback in amplifiers: Positive and negative feedback- Effect of negative feedback on gain, bandwidth, noise, input and output impedances. Emitter follower and Darlington pair.

Unit – IV **(15Hrs)**

Oscillators: Barkhausen criterion for sustained oscillations, RC oscillators - RC phase shift and Wein's bridge oscillators, LC oscillators - Hartley and Colpitts, crystal oscillator.

Multivibrators: Astable, Monostable and Bistable multivibrators.

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Course Outcomes: *At the end of this course, students will be able to-*

CO1: *Design and construct a dc regulated power supply*

CO2: *Design amplifiers using BJT and study frequency responses*

CO3: *Understand the effect of positive feedback and construct different oscillators*

CO4: *Develop the skill to build and troubleshoot analog circuits*

Reference Books:

1. Electronic Devices and Circuits by Millman and Halkias - TMH
2. Basic Electronics and linear circuits by Bhargava, Kulshreshta & Gupta - TMH
3. A first course in Electronics by AA Khan and KK Dey-PHI
4. Electronic Devices and Circuit Theory by Robert L Boylestad & Louis Nashelsky

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Course Name: Analog Circuits Lab **Course Code: EL324P**

(45 Hours – 15 sessions)

HPW: 3 **Credits: 1**

Course Objectives: This course aims to –

COB1: Understand and design the analog circuits

COB2: Learn the circuit simulation for the analysis of electronic circuits.

List of experiments:

1. Study of HWR, FWR and bridge rectifier, determination of ripple factor.
2. Series inductor, shunt capacitor, L-section and π-section filters; determination of ripple factor.
3. Study of voltage regulator using IC 7805 & 7905.
4. RC coupled amplifier
5. Emitter follower.
6. RC Phase shift oscillator.
7. Astable multivibrator.
8. Simulation experiments
   a) Rectifiers
   b) RC coupled amplifier
   c) Wein's bridge oscillator
   d) Colpitts oscillator
   e) RC phase shift oscillator
   f) Astable multivibrator

Note: Student must perform minimum of SIX experiments. Experiment no. 8 is compulsory.

Course Outcomes:

Upon successful completion of this course student will be able to -

CO1: Design analog circuits and evaluate their performance characteristics.

CO2: Simulate and analyze analog circuits for different electronic applications.

Reference Books:

1. Basic Electronics – A Text Lab Manual by Zbar, Malvino, Miller.

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Syllabus - B Sc II Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2021 – 22

Semester III

Course Name: PC Hardware and Networking **Course Code: SE324A**(30 Hours)
HPW: 2 **Credits: 2**

Course Objectives: The course aims to -
COB1: Familiarize with the type of devices/components that may be mounted on Motherboard
COB2: know network architecture and various protocols

Unit – I **(15Hrs)**

Hardware Identification: Chipsets - North bridge, south bridge,
Motherboard-components, form factors (AT, ATX, BTX),
CPU (Intel Processors specifications: Pentium-IV, i3, i5, i7),
I/O cards – PCI, PCIe, VGA, Ethernet Card and Sound Card, Memory –RAM and ROM,
Disk drives– CD, DVD, HD, USB flash drives.

Unit– II **(15Hrs)**

Network: Introduction to network, Cables and Connectors, topologies and transmission media. Introduction to LAN, MAN, WAN.
Protocol: Need for protocol architecture, Introduction to OSI reference model, TCP/IP model.
Internet protocol: IP addresses, classification, differences between IPV4 and IPV6.Network Devices: Switches, Bridges, Hubs, Routers,
Introduction to Bluetooth and WiFi.

Course Outcomes: At the end of this course, students will be able to -
CO1: apply the knowledge of computer assembling and trouble shooting
CO2: troubleshoot network issues.

Suggested Books:

1. Upgrading and Repairing PCs by Scott Mueller.
2. PC Hardware: A Beginner's Guide by Ron Gilster – McGraw Hill Education
3. Peter Norton's Introduction to computers - Tata McGraw Hill, 5th Edition.
4. Data and computer communication by William Stallings - PH Publications 7th Edition

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Syllabus - B Sc II Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2021 – 22

Semester III

Course Name: Instrumentation Skills **Course Code: SE324B** (30 Hours)
HPW: 2 **Credits: 2**

Course Objectives: This course aims to -
COB1: get exposure with various aspects of instruments and their usage
COB2: learn basic concepts of the bridge configurations and their applications.

Unit-I **(15Hrs)**

Basics of Measurement: Instruments - accuracy, precision, sensitivity, resolution, range, etc. Errors in measurements and loading effects. Multimeter - Principles of measurement of de voltage and de current, ac voltage, ac current and resistance.

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. Frequency meter (block diagram only) - timer/counter, phase.

Unit -II **(15Hrs)**

Sensor Technologies: AC Bridge Theory-Circuit and balance equations, bridges for measurement of R, C, L and frequency, Wien's Bridge, De Sauty's, Scherring Bridge, Maxwell Bridge; Q-meter, power and energy measurement - Wattmeter.
Sensors: Resistive, capacitive, inductive, piezoelectric, photo electric and ultrasound sensors; Transducers for instrumentation: displacement, force, vibration, pressure, flow, temperature, liquid level and pH measurement.

Course Outcomes: After completion of this course, students will be able to-
CO1: Employ appropriate instruments to measure given sets of parameters.
CO2: Construct and test measuring setups for electronic systems.

Suggested Books:

1. Electronic Instrumentation and Measurements by David A. Bell; Oxford University Press
2. Instrumentation Devices and Systems by C S Rangan, G R Sarma, V.S. Mani; McGraw Hill.
3. Electronic Instrumentation and Measurement Techniques by W. D. Cooper
4. Measurement and Instrumentation Theory and Application by Allen S Morris, Reza Langari; Academic Press

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Syllabus - B Sc II Year Electronics
(To be implemented for the students joined in 2020 – 21)
wef the academic year: 2021-22

Semester IV

Course Name: Operational Amplifiers and Communications **Course Code: EL424**(60 Hours)
HPW: 4 **Credits: 4**

Learning Objectives: The course aims to -

COB1: Provide the basic education in the working of linear integrated circuits

COB2: Understand the Op Amp ICs - construction, characteristics, parameter limitations and its applications

COB3: Give basic knowledge of analog communication.

COB4: Become proficient with computer simulation skills for the analysis and design of circuits.

Unit - I **(15Hrs)**

Operational Amplifiers: Differential amplifier, Block diagram of Op Amp. Ideal characteristics of Op Amp.; Op Amp. parameters – Input resistance, Output resistance, Common mode rejection ratio (CMMR), Slew rate, Offset voltages, Input bias current, Frequency response of Op Amp.

Basic Op Amp circuits– Inverting Op Amp, Virtual ground, Non-inverting Op Amp, Applications of Op Amp: Summing amplifier, subtractor, Comparator, Voltage follower, Integrator, Differentiator.

Unit- II **(15Hrs)**

Applications of Op Amp: Logarithmic amplifier, Sine wave [Wien Bridge] and square wave [Astable] generators, Triangular wave generator, Monostable multivibrator, Solving simple second order differential equation. Basic Op Amp series regulator and shunt regulator,

IC 555 Timer [Block diagram and its working], IC 555 as Astable and monostable multivibrators.

Unit - III **(15Hrs)**

Modulation: Need for modulation-Types of modulation- Amplitude, Frequency and Phase modulation.

Amplitude modulation: Analysis of Amplitude modulation, side bands, modulation index, AM modulator, Demodulation – diode detector.

Unit - IV **(15Hrs)**

Frequency modulation: Analysis of FM. Working of simple frequency modulator- varactor diode and reactance modulator; detection of FM waves–balanced slope, ratio detector. Advantages of frequency modulation.

AM and FM radio transmitters and receivers [block diagram approach].

Pulse modulation: PAM, PWM, PPM; PCM and Delta modulations.

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Course Outcomes: *At the end of this course, students will be able to-*

CO1: *Understand basic differential amplifier and applications in linear Integrated circuits*

CO2: *Construct various circuits using Op Amp*

CO3: *Design multivibrators using IC 555*

CO4: *Be familiar with the fundamental concepts of analog communications, working of transmitter and receiver.*

Reference Books:

1. Op amps and linear Integrated Circuits by Ramakant Gayakwad - PHI
2. Linear Integrated Circuits by D Roy Choudhury & Shail B Jain
3. Electronic Communication Systems by George Kennedy & Bernard Davis - PHI
4. Principles of Electronic Communication Systems by Louis E Freznel - TMH

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Course Name: Operational Amplifiers and Communications Lab **Course Code: EL424P**

(45 Hours – 15 sessions)

HPW: 3 **Credits: 1**

Course Objectives: This course aims to –

COB1: Design and testing of analog circuits using Op Amps

COB2: Use of circuit simulation for the analysis of electronic circuits

List of experiments:

Using Op Amp

1. Inverting and non-inverting amplifiers
2. Comparator (Zero crossing detector)
3. Wien's bridge oscillator
4. Astable multivibrator
5. Astable multivibrator using IC 555
6. Monostable multivibrator using IC 555.
7. AM modulator and detector
8. **Simulation of all the above experiments using Op Amp:**
   a) Inverting and non-inverting amplifiers
   b) Summing amplifier and comparator
   c) Integrator/ Differentiator
   d) Wein's bridge oscillator
   e) Astable multivibrator
   f) Astable multivibrator using IC 555

Note: Student must perform minimum of SIX experiments. Experiment no. 8 is compulsory.

Course Outcomes: *Upon successful completion of this course student will be able to -*

CO1: Design analog circuits using Op Amps for different applications

CO2: Simulate and analyze analog circuits using ICs for different electronic applications.

Reference Books:

1. Basic Electronics – A Text Lab Manual by Zbar, Malvino, Miller – McGraw Hill

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(To be implemented for the students joined in 2020-21)
wef the academic year: 2021 – 22

Semester IV

Course Name: Internet of Things (IoT) **Course Code: SE424A** (30 Hours)
HPW: 2 **Credits: 2**

Course Objectives: This course aims to -
COB1: Familiarize with the operating principles of IoT.
COB2: Program IoT devices and use IoT protocols for communication.

Unit-I **(15Hrs)**

Introduction to IoT: Sensing, Actuation, Introduction to Arduino Programming: Integration of Sensors and Actuators. Temperature, soil moisture, ultrasonic and proximity sensors, actuation of DC motors.

Unit-II **(15Hrs)**

Basics of Networking: Communication Protocols, Sensor Networks, Machine-to-Machine Communications, Interoperability in IoT.
Sensor-Cloud, Fog Computing, Smart Cites and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT.

Case Study: Agriculture/Healthcare/Industrial IoT activity Monitoring.

Course Outcomes: After completion of this course, students will be able to -
CO1: Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO2: Design an Application of IoT in the daily life.

Suggested Books:

1. NPTEL, Introduction to IoT https://nptel.ac.in/courses/106105166/
2. Internet of Things- A Hands on Approach by Arshdeep Bahga, Vijay Madisetti, University Press India Pvt. Ltd.
3. The Internet of Things: Enabling Technologies, Platforms and Use Cases by LOCF – Electronic Science 126 Pethuru Raj and Anupama C. Raman (CRC Press)
4. Designing the Internet of Things by Adrian McEwen, Wiley Publishers, 2013, ISBN: 978-1-118-43062-0 2.
5. The Silent Intelligence: The Internet of Things by Daniel Kellmereit 2013, ISBN 0989973700

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(To be implemented for the students joined in 2020-21)
wef the academic year: 2021 – 22

Semester IV

Course Name: Design and Fabrication of Printed Circuit Boards
Course Code: SE424B (30 Hours)
HPW: 2 **Credits: 2**

Course Objectives: This course aims to -
COB1: Familiarize with various Electronic Components, Symbols, Footprints, PCB layout technologies.
COB2: Learn Component placement & routing techniques for various technologies

Unit-I **(15Hrs)**

PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, ICs, Surface Mount Devices (SMD). Classification of PCB - single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards. PCB design considerations/design rules for analog, digital and power applications.

Unit-II **(15Hrs)**

Schematic & Layout Design: Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for library, Tracks, Pads, Vias, power plane, grounding.

Technology of PCB: Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates materials of copper clad laminates, soldering techniques. Testing and quality controls.

Course Outcomes: After completion of this course, Students will be able to -
CO1: Understand the PCB layout techniques for optimized component density and power saving.
CO2: Design and print PCB with the help of various image transfer and soldering techniques.

Suggested Books:

1. Printed circuit Board - Design & Technology by Walter C. Bosshart, Tata McGraw Hill.
2. Printed Circuit Board -Design, Fabrication, Assembly & Testing by R.S. Khandpur, TMH.

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Syllabus - B Sc III Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2022 - 23
Semester V – (DSE - 1A)

Course Name: Digital Electronics & Microprocessor Course Code: EL524A(60 Hours)
HPW: 4 **Credits: 4**

Course Objectives: The objective of this course is to -

COB1: *learn - logic gates, Boolean algebra and Karnaugh maps for designing digital circuits.*

COB2: *study combinational Logic circuits - Adders, multiplexers, encoders, etc.*

COB3: *study sequential Logic circuits - flip-flops, registers and counters.*

COB4: *become familiar with the terms - Arithmetic Logic Unit, Control Unit, Registers, Bus, Von Neumann & Harvard architecture.*

Unit- I **(15Hrs)**

Number system and Logic gates: Conversions of binary, octal, decimal & hexadecimal number systems, binary addition and subtraction (1's and 2's complement methods).

Logic gates – AND, OR, NOT, NAND, NOR, XOR gates and their truth tables – Design of basic gates using the Universal gates - NAND and NOR, Half adder, Full adder and parallel adder logic circuits. Logic families and their characteristics – TTL, CMOS circuits.

Unit-II **(15Hrs)**

Boolean algebra and Combinational logic circuits: Boolean algebra – Laws and identities, DeMorgan's Theorems. Simplification of Boolean expressions using Boolean identities - Reduction of Boolean expressions using Karnaugh Maps – Sum of Products (SOP) representation (up to 4 variables). Multiplexer, De-Multiplexer, Decoder (3 to 8) and Encoder (8 to 3).

Unit-III **(15Hrs)**

Sequential logic circuits: Flip – flops – SR, D, JK, T and Master – Slave JK; Registers - Shift Registers SISO and SIPO Registers.

Counters: 4-bit Asynchronous (Ripple) counter, Modulo – N counter, Synchronous counter. Up/down counters – ripple counter IC7493 – Decade counter IC7490 – working, truth tables and timing diagrams.

Unit-IV **(15Hrs)**

Introduction to 8085 Microprocessor & its architecture:
Architecture of 8085 microprocessor – CPU – Timing & Control Unit – Instruction cycle, Fetch Cycle, Execute cycle (Timing diagram). Interrupts – Hardware and Software, Address space partitioning – Memory mapped I/O & I/O mapped I/O.
Instruction set of 8085 microprocessors: Classification of Instructions – Data transfer, Arithmetic, logical, Branch, I/O and Machine control. Addressing modes, Stack and Subroutines, Programming examples – Addition, Subtraction, Multiplication and Division.

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Course Outcomes: Upon Successful completion of this course, students will be able to -

CO1: *use various number systems for application in digital circuits.*

CO2: *analyse various combinational and sequential circuits.*

CO3: *learn how the computer hardware has evolved to meet the needs of processing system.*

CO4: *define terms applicable to microprocessors, write programs using Assembly language.*

Recommended Books:

1. Digital Electronics by William H. Gothmann, *Prentice Hall.*
2. Digital logic Digital Design by Morris Mano, *PHI.*
3. Microprocessor Architecture, Programming and Applications with 8085 by Ramesh S. Gaonkar, *Penram International Publications.*

Reference Books:

1. Principles of Digital Electronics by Malvino& Leach, *TMH.*
2. Fundamentals of Microprocessors & Microcomputers by B. Ram, *Dhanpat Rai Publications.*
3. Introduction to Microprocessors - Aditya P. Mathur, TMH.
4. Theory and Problems of Microprocessor fundamentals-2nd Edition Roger L. Tokheim, *Schaum's outline series, McGraw Hill.*
5. Microprocessors, Interfacing and Applications by R.Singh and B.P.Singh, *New Age International.*

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Course Name: Digital Electronics & Microprocessor Lab **Course Code: EL524AP**
(45 Hours – 15 sessions)

HPW: 3 **Credits: 1**

Course Objectives: The objective of this course is to -
COB1: know the concepts of Combinational circuits.
COB2: understand the concepts of flipflops, registers and counters.
COB3: introduce the programming procedure with 8085 microprocessor kit.

Digital electronics

1. Verification of truth tables of AND, OR, NOT, NAND, NOR, EXOR Gates using IC 74XX series.
2. Construction of basic gates using NAND and NOR gates.
3. Construction of Half Adder & Full Adder using gates. Verification of truth table.
4. Verification of truth tables of flip flops: RS, D and JK using IC's.
5. Construction of binary counters using 7490 &7493

Simulation experiments:

1. 4-bit parallel adder using full adders.
2. Decade counter using JK flip flops.
3. Up/Down counters using JK flip flops.
4. Up/down counter using 7493& 7490
5. Multiplexer/De-Multiplexer.

Microprocessor (ALP)

1. Binary addition & subtraction.
2. Multiplication & Division.
3. Decimal addition (DAA) & Subtraction.
4. Using subroutines - Π value up to 5 decimal places

Course Outcomes: *Upon successful completion of this course, the students will be able to -*
CO1: Design and test combinational and sequential circuit's functionalities
CO2: Develop assembly language programs for various applications using 8085 Microprocessors

Recommended Books:

1. Digital Electronics Theory and Experiments - Virendra Kumar - New age international publishers.
2. Microprocessor 8085 Architecture, Programming and Interfacing - Ajay Wadhwa-PHI

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Syllabus - B Sc III Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2022 - 23
Semester V – (DSE –1B)

Course Name: Electronic Instrumentation **Course Code: EL 524B**(60 Hours)

HPW: 4 **Credits: 4**

Course Objective: The objective of this course is to -
COB1: *get exposure with various aspects of instruments and their usage.*
COB2: *learn basic concepts of the bridge configurations and their applications.*
COB3: *practice the construction of testing and measuring set up for electronic systems.*
COB4: *have a deep understanding about instrumentation concepts which can be applied to Control systems.*

Unit- I **(15Hrs)**

Introduction: Functional elements of a measurement system – Static characteristics – accuracy, precision, bias, linearity, threshold, resolution, hysteresis, dead space, scale readability, span, static stiffness, input impedance, repeatability and reproducibility - Errors and calculation of errors in overall system – Dynamic characteristics – Zero, first and second order instruments - Responses for step, impulse, ramp and sinusoidal inputs. Classification of standards, IEEE Standards, Elements of ISO 9001, Quality of management Standards.

Unit-II **(15Hrs)**

Transducers and Sensors: Transducer: Transducers, Factors for selection of a transducer, Definition of transducer and sensor – Classification of transducers – Pressure (strain gauge, piezoelectric transducer), displacement (potentiometric, LVDT), Ultra Sonic Transducers (ultrasonic sensors)

Microphones: Microphones and their types, temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples, temperature (thermistor) and photosensitive (Vacuum and Gas filled phototubes, photoconductive cell, photovoltaic cell, photo emissive) transducers. Flow Transducers – Flow Meter, Force Transducers – Dynamometer, Acceleration Transducer – accelerometer. Application of Transducers.

Unit- III **(15Hrs)**

Bridge Measurements: Introduction – Wheatstone bridge, Kelvin Bridge and Guarded Wheatstone Bridge. AC Bridges and their applications – Maxwell Bridge, Hay bridge, Schering Bridge and Wien Bridge

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Unit- IV **(15Hrs)**

Testing Instruments: Oscilloscopes – Block diagram, CRT vertical and horizontal deflection systems, delay line, multiple trace and Special Oscilloscopes.

Measuring Instruments: DC Voltmeters, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter protection, Extension of range, True RMS responding voltmeters, Specification of instruments.

Course Outcome: Upon successful completion of this course, students will be able to -

CO1: Employ appropriate instruments to measure given sets of parameters.
CO2: Practice the construction of testing and measuring set up for electronic systems
CO3: Relate the usage of various instrumentation standards.
CO4: Describe the bridge configurations and their applications.

Recommended Books:

1. Electronic Instrumentation and Measurements by David A. Bell; Oxford University Press
2. Instrumentation Devices and Systems by C S Rangan, G R Sarma, V.S. Mani; McGraw Hill.

Reference Books:

1. Electronic Instrumentation and Measurement Techniques by W. D. Cooper, Prentice Hall India Learning Private Limited.
2. Measurement and Instrumentation Theory and Application by Allen S Morris, Reza Langari, Academic Press

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Semester V

Course Name: Electronic Instrumentation Lab **Course Code: EL 524B P**

(45 Hours-15 sessions)

HPW: 3 **Credits: 1**

Course Objective: The objective of this course is to -

COB1*: address the underlying concepts and methods behind various measurements.*

COB2*: introduce the fundamentals of Electronic Instruments and measurements, providing an in-depth understanding of measurement errors.*

Handling various testing and measurement instruments

1. Temperature Transducer–(Thermocouple/Thermistor)
2. Pressure Transducer – Strain Gauge
3. DisplacementTransducer–LVDT(LinearVariableDifferentialTransformer)
4. Ultrasonic Transducer (Ultrasonic sensor)
5. Flow Transducer – Flow Meter
6. Force Transducer–Dynamometer
7. Acceleration Transducer–Accelerometer
8. Photovoltaic (Solar cell)
9. Passive Transducer photo cell (LDR)
10. CRO characteristics
11. DC Voltmeter / DC Current meter
12. AC Voltmeter/AC Current meter
13. Adders / Subtractors
14. Multimeter

Course Outcome: Upon successful completion of this course, students will be able to-

CO1*: learn about Bridge Measurements, CRO, Function Generator & Data acquisition systems.*

CO2*: handle various testing and measurement instruments.*

Recommended books:

1. Modern Electronic Instrumentation and Measurement Techniques by D. Helfrick and W.D. Copper, *Prentice-Hall of India, New Delhi.*
2. A Course in Electrical and Electronic Measurement and Instrumentation by K. Sawhney, - *Dhanpat Rai & Sons.*

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Syllabus - B Sc III Year Electronics
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wef the academic year: 2022 - 23

Semester V – (GE)

Course Name: Internet of Things (IoT) using Arduino **Course Code: GE524A**(60 Hours)
HPW: 4 **Credits: 4**

Course Objective: The objective of this course is to -
COB1: *Learn the basics of Embedded C programming for Arduino*
COB2: *Understand the working of sensors, actuators and their interfacing*
COB3: *Remotely monitor/acquire various parameters using WiFi modules*
COB4: *Acquire ability to make industrial, engineering and home automation related projects.*

Unit- I **(15Hrs)**
Arduino Simulation Environment
Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD

Unit- II **(15Hrs)**
Sensors & Actuators
Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light Ultrasonic Sensor, PIR Motion Sensor, Moisture Sensor, and Gas Sensor with Arduino. Interfacing of Actuators -Relay Switch and Servo Motor with Arduino.

Unit- III **(15Hrs)**
Basic Networking with ESP8266 WiFi module
Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi libraries, Web server- introduction, installation, configuration, Posting sensor(s) data to web server. Building applications with ESP 8266- blinking LEDs, automation of appliances, remote monitoring of parameters.

Unit- IV **(15Hrs)**
Internet of Things
Understanding IoT fundamentals, IoT Architecture and protocols, Various Platforms for IoT Real time Examples of IoT, Overview of IoT components and IoT Communication Technologies, Challenges in IoT, Project based on IoT.
Applications: Home automation, Industrial automation, Smart lighting, Smart agriculture

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Course outcomes: On completion of the course, student will be able to -

CO1: write codes in Arduino IDE
CO2: interface sensors and actuators to Arduino devices
CO3: apply various protocols for design of IoT systems
CO4: understand various applications of IoT and implement as Do It Yourself projects.

Recommended Books:

1. C programming for Arduino by Jelien Bayle, Packt publishing, Bermingham, UK
2. Sensors and Transducers by D Patranbis, P. H. India, Pvt. Ltd. (2nd edition), 2003
3. NodeMCU ESP8266 communication methods and Protocols – Programming with Arduino IDE by Manoj R Thakur,
4. Building Arduino Projects for the Internet of things by AdeelJaved, APress

Reference Books:

1. Internet of Things (A Hands-on-Approach) by Arshdeep Bahga, Vijay Madisetti, VPI publisher, (1st edition), 2016.
2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases by Pethuru Raj and Anupama C. Raman, CRC Press
3. S. Misra, A. Mukherjee, and A. Roy, 2020. *Introduction to IoT*. Cambridge University Press.
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html
5. https://www.arduino.cc

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Syllabus - B Sc III Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2022 - 23
Semester V – (GE)

Course Name: Basic Electronics
HPW: 4

Course Code: GE524B(60 Hours)
Credits: 4

Course Objective: The objective of this course is to -
COB1: develop an understanding of the basic circuit laws and elements of electric circuits
COB2: familiarize with the fundamentals of Semiconductor Physics
COB3: understand the operation of various semiconductor devices
COB4: explore V-I characteristics of Bipolar Junction Transistors in CB, CE and CCconfiguration.

Unit – I **(15Hrs)**

Units and Definitions: SI units, Electric charge, Electric field, Electric potential, Potential difference, Voltage, EMF.

Resistors: Concept of resistance, V-I relation in resistor, ohm's law and its limitations, types of resistors and their properties and applications, Color Codes, Combination of resistors in series and parallel.

Capacitors: concept of capacitance, V-I relation in capacitor, energy stored in capacitance, types of capacitors & their properties and applications, Color Codes, Combination of capacitors in series and parallel.

Unit-II **(15Hrs)**

Inductors: Concept of inductance, V-I relation in inductor, energy stored in inductors. Mutual inductance and coefficient of coupling, types of inductors and applications, Colour Codes, Combination of inductors in series and parallel.

Simple Circuits: Concepts of impedance and admittance, network definition, Circuit elements, branch, lumped and distributed networks, mesh and node, concepts of voltage and current both ideal and practical.

Periodic waveforms, sine wave – peak, average and RMS values, Kirchoff's Voltage Law (KVL) and Kirchoff's Current Law (KCL).

Unit-III: **(15Hrs)**

The concept of basic semiconductor: P-Material, N-Material, formation of PN junction, Depletion region, Junction capacitance, forward bias, reverse bias, Diode equation (no derivation) and its interpretation, Effect of temperature on reverse saturation current, V-I characteristics and simple applications of i) Junction diode, ii) Zener diode.

Rectifiers: Rectifiers—halfwave, full wave and bridge rectifiers, Efficiency, Ripple factor and regulation (Qualitative).

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Unit-IV: (15Hrs)

Bipolar Junction Transistor (BJT): PNP and NPN transistors, current components in BJT (I_E, I_B, I_C, I_{CO}), BJT static characteristics (Input and Output), Early effect, CB, CC, CE configurations of transistor and bias conditions (cut off, active and saturation regions).

Course outcomes: *On completion of the course, student will be able to*

CO1: *understand proportional relationship between a signal and a voltage or current that represents the signal.*
CO2: *Understand the circuits using Kirchhoff's laws and Network theorems.*
CO3: *study and analyze the behavior of semiconductor devices.*
CO4: *differentiate the behavior of BJT in CB, CE and CC configurations.*

Recommended Books:

1. Grob's Basic Electronics by Mitchel E Schultz, Tata McGraw Hill.
2. Basic Electronics and Linear Circuits by Bhargava, Kulsreshta, Gupta (TMH).

Reference Books:

1. B Sc I Year Electronics - Telugu Akademi.
2. Principles of Electronics by V.K. Mehta & Rohit Mehta
3. Electronic Devices and Circuits by Allen Mottershed - PHI
4. Electrical Technology Vol. I and II, B L Theraja, A K Theraja - S. Chand
5. Electronic Devices and Circuits by Jacob Millman and Christos C Halkias - TMH.

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Syllabus - B Sc III Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year: 2022 – 23

Semester VI – (DSE – 1A)

Course Name: Digital Communication **Course Code: EL624 A** (60 Hours)
HPW: 4 **Credits: 4**

Course Objective: The objective of this course is to -

COB1: *To understand the key modules of digital communication systems with emphasis on digital modulation techniques.*

COB2: *To get introduced to the concept and basics of information theory and the basics of source and channel coding/decoding.*

COB3: *The concept of multiple access techniques and modern communication system*

COB4: *understand the building blocks of Digital Communication System*

Unit-I **(15Hrs)**

Introduction: Need and Necessity of Digitalization, Advantages of Digital communication, Elements of Digital Communication.

Signal analysis: Complex Fourier Spectrum, Fourier transform, Properties of Fourier transform - Random signals and noise, Correlation and Power spectrum.

Information Theory: Introduction, Information Entropy, Properties of Entropy, Information rate, Types of information Sources, Channels, Types of Channels, Joint entropy, Conditional entropy, Redundancy, Mutual in formation, Channel capacity.

Unit-II **(15Hrs)**

Digital Communication Systems: Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Amplitude (PPM), Pulse Code Modulation (PCM), Delta modulation, Adaptive delta modulation, Quantization and Noise consideration.

Digital Transmission and Reception: Timing, base band systems, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase shift Keying (PSK) and Quadrature Amplitude Modulation (QAM).

Unit-III **(15Hrs)**

Error detection and coding: Parity check, CRC, Hamming distance, Hamming codes, cyclic codes, line synchronization codes, Manchester code, NRZ coding, Walsh codes.

Unit-IV **(15Hrs)**

Case studies: cellular concepts, global positioning (GPS), Facsimile, Videotext, WiFi, Bluetooth, IoT and Cognitive radio.

Course outcomes: On completion of the course, student will be able to -

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CO1: understand basic components of Digital System
CO2: analyze the error components of digital communication system
CO3: understand principles of digital communications and digital techniques required in the rapidly expanding field of digital communication
CO4: participate in design and development installation and operation of a wide spectrum applications in the area of digital communications

Recommended books:

1. Principles of Communication Systems by H. Taub and D. Schilling - Tata McGraw Hill.
2. Communication Electronics: Principles and Applications by L. E. Frenzel - TMH.

Reference books:

1. Digital and Analog Communication Systems by L. W. Couch II - Pearson Education.
2. Analog and Digital Communications by H. P. Hsu - TMH.
3. Communication Systems by S. Haykin - Wiley India.
4. Electronic Communication Systems-Fundamentals through advanced by W. Tomasi – Pearson Education.

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Semester VI – (DSE – 1A)

Course Name: Digital Communication Lab **Course Code: EL624AP**

(45 Hours-15 sessions)

HPW: 3 **Credits: 1**

Course Objective: The objective of this course is to -

COB1: *understand the fundamental concepts on Pulse modulations, digital modulation techniques, source coding techniques and Error-control coding techniques.*

COB2:*get introduced to the digital communication systems at the practical level*

I Experiments in Internet working:

1. Pulse Amplitude Modulation
2. Pulse Code Modulation
3. Pulse Width Modulation
4. Pulse Phase Modulation
5. Amplitude Shift Keying
6. Frequency Shift Keying
7. Delta modulation
8. Phase shift Keying

II Experiments in Data Communication.

1) Study of serial communication.
2) Study of wireless communications.
3) Study of parallel communication.

Course outcomes: On completion of the course, student will be able to-

CO1:*design and implement different modulation and demodulation techniques*

CO2:*apply time division multiplexing concepts in different pulse modulation techniques*

Recommended books:

1. Electronic Communication Systemsby W. Tomasi – *Pearson Education (2004).*

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Syllabus - B Sc III Year Electronics
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wef the academic year: 2022 – 23
Semester VI – (DSE – 1B)

Course Name: 8051 Microcontroller and Applications **Course Code: EL 624B**(60 Hours)

HPW: 4 **Credits: 4**

Course Objectives: The objective of this course is to -

COB1: *learn what an Embedded System is and to understand the need of microcontrollers in embedded system*

COB2: *understand architecture and features of typical Microcontroller.*

COB3: *familiarize with Assembly Language Programming. Serial communication and Interfacing techniques of 8051 Microcontroller.*

COB4: *master in programming and debugging skills.*

Unit-I **(15Hrs)**

The Microcontroller 8051: Overview and block diagram of 8051. Architecture and pin diagram of 8051. Data types and directives, Memory Organization, register banks and Stack Pointer. PSW Register, other special function registers, I/O port organization. Interrupts and Timer/Counter modules.

Unit-II **(15Hrs)**

Instruction set of 8051 microcontrollers: Classification - Data transfer, Arithmetic, logical, bitwise operations, branching instructions and their usage. Addressing modes, Addressing and accessing memory using various addressing modes.

Programming examples of microcontroller 8051: Simple programs - Addition, Subtraction, multiplication, division, picking the smallest/largest number among a given set of numbers, arranging a given a set of numbers in ascending/descending order, Bit manipulation. Subroutines, I/O Programming – flashing LED, generating square wave form. Time delay Calculation.

Unit-III **(15Hrs)**

Timer/Counter Programming in 8051: Programming 8051 timers- basic registers of timers- Timer0, Timer1 registers. TMOD register, TCON register. Timer modes - Mode1, Mode2 programming. Counter mode programming. Program to generate time delay.

Serial communications: Serial communication, types, modes and protocols, Data transfer rates, Serial communication program- SBUF and SCON registers, RS232 standards, Programming timer interrupts.

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Unit-IV **(15Hrs)**

Applications of Micro controller: DAC - R-2R ladder, Interfacing of DAC 0808 to microcontroller, ADC - successive approximation ADC, Interfacing of ADC 0804 to microcontroller, Interfacing of LCD, Temperature Sensor and Stepper Motor.

Course Outcomes: At the end of this course, students will be able to -

CO1: Define terms applicable to microcontrollers

CO2: write programs using Assembly language

CO3: Apply knowledge and demonstrate programming knowledge using the various addressing modes and data transfer instructions of the target microcontroller.

CO4: Evaluate assembly language programs and download the machine code that will provide solutions to real-world control problems

Recommended books:

1. The 8051 Microcontrollers and Embedded Systems by Muhammad Ali Mazidi and Janice Gillipsie Mazidi – Pearson Education Asia.
2. The 8051 Microcontroller - architecture, programming and applications by Kennth J. Ayala-Penram International Publishing.

Reference books:

1. Text book of Electronics BSc III year (vol. III)-Telugu Akademi
2. Micro Controllers -Theory and Applications by Ajay V. Deshmukh, TMGH, 1st Edition, 2005.
3. Micro-controller 8051 by D. Karuna Sagar, Narosa Publications.

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Semester VI – (DSE – 1B)

Course Name: 8051 Microcontroller and Applications Lab **Course Code: EL624BP**
(45 Hours-15 sessions)

HPW: 3 **Credits: 1**

Course Objective: The objective of this course is to -
COB1: *write assembly language programs based on 8051 microcontrollers.*
COB2: *study interfacing of I/O devices with 8051 microcontrollers.*

Experiments using 8051 microcontrollers:

1. Addition, Subtraction, DAA for decimal addition.
2. Multiplication of two numbers using MUL command (later using counter method for repeated addition)
3. Division of two numbers using DIV command (later using counter method for repeated subtraction).
4. Pick out the largest/smallest number among a given set of numbers.
5. Arrange the given numbers in ascending/descending order.
6. Flash a LED connected at a specified-out port terminal with specific time delay using timer/counter.
7. Interface DAC and generate a staircase wave form with a step duration and number of steps as variables.
8. Interface ADC and a temperature sensor to measure temperature.
9. Interface stepper motor to rotate clock wise / anti clock wise through a given angle steps.

Experiments with Keil Software:

1. Write a program to pick out largest/smallest number among a given set of number.
2. Write a program to arrange a given set of numbers in ascending/descending order.
3. Write a program to generate a rectangular/square wave form at specified port.
4. Write a program to generate a time delay using timer registers.

Course Outcomes: At the end of this course, students will be able to -
CO1: *Select and use a standard IDE for editing, compiling, debugging and simulation of ALP (program development)*
CO2: *Understand and apply the fundamentals of assembly level programming of microcontrollers to real time problems*

Recommended books:

1. The 8051 Microcontrollers and Embedded Systems by Muhammad Ali Mazidi and Janice Gillipsie Mazidi – Pearson Education Asia.

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Syllabus - B Sc III Year Electronics
(To be implemented for the students joined in 2020-21)
wef the academic year 2022-23

Semester VI – Optional Course

Course Name: Digital System Design with VHDL **Course Code: EL624_O** (60 Hours)
HPW: 4 **Credits: 4**

Course Objective: The students will learn to -

COB1: write hardware description language (HDL) for the specification, simulation, synthesis and implementation of digital logic systems.
COB2: Identify the differences between behavioural and structural coding styles
COB3: Write code targeting Xilinx devices specifically and FPGA devices in general.
COB4: Apply the information gained to any digital design by using a top-down synthesis design approach.

Unit-I **(15 Hrs)**

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. Entity and Architecture declaration. Introduction to behavioural, dataflow and structural models.

Unit-II **(15 Hrs)**

VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement, Array and loops, concurrent statements. Types of delays, **Subprograms**: Application of Functions and Procedures, and resolution functions. Structural modelling, component declaration and structural layout.

Unit-III **(15Hrs)**

Packages and Use Clauses: Package Declarations, Package Bodies and Use Clauses.
Combinational Circuit Design: VHDL Models and Simulation of combinational circuits such as multiplexers, demultiplexer, encoders, decoders, code converters, comparators, implementation of Boolean functions.

Unit-IV **(15 Hrs)**

Sequential Circuit Design: VHDL Models and Simulation of Sequential Circuits, Flip-flops – SR, D, JK and T; Shift Registers, Counters – 4-bit ripple, up/down counter and decade counter.

Note: The students should simulate and synthesize digital logic circuits (Combinational & Sequential circuits) using Xilinx ISE 14.5 Design Suit and Xilinx FPGA Board.

Course Outcome: Upon successful completion of this course, students will be able to -

CO1: learn the syntax and behaviour of VHDL language
CO2: use development tools to design digital circuits.
CO3: simulate and debug digital systems described in VHDL
CO4: synthesize simple digital circuits in CPLD/FPGA

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Recommended books:

1. VHDL- Primer by J Bhasker - *PHI*
2. The Designer's Guide to VHDL by Peter J. Ashen den, 2nd Ed, Harcourt India Pvt. Ltd.

Reference books:

1. VHDL by Douglas L. Perry - McGraw Hill.
2. Digital System Design using VHDL by Charles. H.Roth - PWS.
3. VHDL-Analysis & Modeling of Digital Systems by Navabi Z - McGraw Hill.
4. Logic and Computer Design Fundamentals, 2/E by M. Morris Mano - Pearson Education Limited.
5. Digital Electronics Laboratory Experiments Using the Xilinx XC95108 CPLD with Xilinx by by James Stewart, Chao -Ying Wang, Pearson

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Value Added Course

Course Name: Design of PCB and Internet of Things **(30 Hours)**
HPW: 2 **Credits: 2**

Prerequisite: Knowledge of electronic components and circuit construction, basics of computer programming language.

Course Objectives: This course aims to -
COB1: Familiarize with various Printed Circuit Board (PCB) layout technologies.
COB2: learn how to develop Internet of Things (IoT) applications

Unit-I **(15Hrs)**

PCB Design fundamentals: PCB Advantages, components of PCB, Surface Mount Devices (SMD). Classification of PCBs, manufacturing of PCB, PCB standards. PCB design considerations/design rules. Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net listing, creating components for library, Tracks, Pads, Vias, power plane, grounding. Design automation, Design Rule Checking; Exporting Drill and Gerber Files.

Unit-II **(15Hrs)**

Basics of IoT: Introduction to Wi-Fi Module, Various Wi-Fi libraries, Web server- introduction, installation, configuration, Posting sensor(s) data to web server. Building applications with various IoT boards, automation of appliances, remote monitoring of parameters.
Understanding IoT fundamentals, IoT Architecture and protocols, Various Platforms for IoT, Challenges in IoT, Project based on IoT.
Use cases: Home automation, Industrial automation, Smart lighting, Smart agriculture

Course Outcomes: After completion of this course, Students will be able to -
CO1: Acquire the skills to design PCB layout for optimized component density and power saving.
CO2: develop IoT applications.

Recommended Books:

1. Printed circuit Board - Design & Technology by Walter C. Bosshart - TMH.
2. C programming for Arduino by Jelien Bayle - Packt publishing, Bermingham, UK
3. Building Arduino Projects for the Internet of things by Adeel Javed - APress
4. Internet of Things - A Hands on Approach by Arshdeep Bahga, Vijay Madisetti, VPI publisher.

Reference Books:

1. Printed Circuit Board - Design, Fabrication, Assembly & Testing by R.S. Khandpur, TMH.
2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases by Pethuru Raj and Anupama C. Raman, CRC Press.
3. Introduction to IoT by S. Misra, A. Mukherjee, and A. Roy, Cambridge University Press.
4. Sensors and Transducers by D Patranbis, P. H. India.
5. NodeMCU ESP8266 communication methods and Protocols – Programming with Arduino IDE by Manoj R Thakur

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