Bharatiya Vidya Bhavan

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

Course Name: Circuit Analysis–Course Code:EL 124

(60 Hours)

Course Objectives:

This course aims to-

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 (15)

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 (15)

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 (15)

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 (15)

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

CHAIRPERSON
BOS in Electronics
Bhavan's Vivekananda College
Sainikpuri.

Dr. M. PRASAD
Associate Professor
Dept. of Physics
University

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).

Course Outcomes:

Upon successful completion of this course, the 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

CHAIRPERSON
BOS in Electronics
Bhavan's Vivekananda College
Sainikpuri.

Professor
of Physics
Universi
abad - T.S

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

Semester II

Course Name: Semiconductor Devices-Course Code: EL 224

(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 **(15)**

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 **(15)**

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 network, h-parameter model and itshybrid 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 **(15)**

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;

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B.Sc. Electronics
Bhavan's Vivekananda College
Sainikpuri.

Dr. M. PRASAD
Associate Professor
Dept. of Physics
Osmania University
Hyderabad - T.S

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 (15)

Silicon Controlled Rectifier (SCR): Construction and working of SCR. Two transistor representation, characteristics of SCR. Application of SCR in half wave and full wave rectifiers for power control.

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

Course Outcomes:
Upon successful completion of this 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 - Bhargava, 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

CHAIRPERSON
BOS in Electronics
Bhavan's Vivekananda College
Sainikpuri.

Dr. M. PRASAD
Associate Professor
Dept. of Physics
Osmania University
Hyderabad - T.S

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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: *Understand Basic Circuits using active devices.*
COB2: *Learn function of basic circuit components used in linear circuits.*
COB3: *Understand basic construction, equivalent circuits and characteristics of basic electronics devices.*
COB4: *Students understand basic linear electronic circuits and their working principle.*

UNIT - I (15)

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 (15)

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 (15)

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.

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UNIT – IV (15)

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

Multivibrators: Astable and Monostable and Bistable multivibrators – Qualitative Analysis only.

Course Outcomes:

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

***CO1**: Design a dc regulated power supply.*

***CO2**: Develop the ability to understand working of the BJT and FET.*

***CO3**: Design amplifiers using BJT and study frequency responses.*

***CO4**: Observe the effect of positive feedback and design different oscillators using BJTS.*

***CO5**: Develop the skill to build and troubleshoot analog circuits.*

Text books:

1. Basic Electronics and linear circuits - Bhargava, Kulshreshta & Gupta TMH
2. Electronic Devices and Circuits - Millman and Halkias (TMH)

Reference Books:

1. B.Sc Electronics II year, Telugu Akademy
2. A first course in Electronics - AA Khan and KK Dey-PHI
3. Pulse Digital and switching waveforms - Millman and Taub
4. Electronic Devices and Circuit Theory - Robert L Boylestad & Louis Nashelsky

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BOS in Electronics
Bhavan's Vivekananda College
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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)

Hours/Week: 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: To give basic knowledge of analog communication.

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

UNIT - I (15)

Operational Amplifiers: Differential amplifier, Block diagram of OpAmp. Ideal characteristics of OpAmp; OpAmp 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 (15)

Applications of Op-Amps: 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 monostable and astable multivibrator.

UNIT - III (15)

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.

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BOS in Electronics
Bhavan's Vivekananda College
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UNIT - IV (15)

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 (concept only).

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: *Learn basic functions of operational amplifier, and their mathematical application*

CO3: *Design basic electronic circuits using OpAmp IC and IC 555.*

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

Text books:

1. Linear Integrated Circuits- D Roy Choudhury & Shail B Jain
2. Electronic Communication Systems- George Kennedy & Bernard Davis

Reference Books:

3. B.Sc Electronics II year, Telugu Akademy
4. Op Amps and linear Integrated Circuits – Ramakant Gayakwad, PHI
5. Principles of Electronic Communication Systems-Louis E Frenzel, TMH
6. Schaum's Outline of Analog and Digital Communications - Hwei P. Hsu

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B.S in Electronics
Bhavan's Vivekananda College
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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) Digital Electronics & Microprocessor (60 Hours)

Paper Code: EL 524A

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 **(15)**

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 and ECL logic circuits.

UNIT-II **(15)**

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 **(15)**

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

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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007. T. S.

UNIT-IV (15)

Introduction to 8085 Microprocessor & its architecture: Architecture of 8085 microprocessor – CPU – Timing & Control Unit – Instruction cycle, Fetch Cycle, Execute cycle (Timing diagram), Machine cycle and clock states. 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.

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 8085by 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 byR.Singh and B.P.Singh, *New Age International.*

23/05/2022

Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007. T. S.

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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) Introduction to IoT with Arduino (60 Hours) **– Paper Code: GE 524 A**

Course Objective: *The objective of this course is to*

COB1: *study fundamental concepts of IoT using a low-cost device Arduino.*
COB2: *Includes insights of Arduino, basic programming, types of sensors and actuator.s*
COB3: *Learn different protocols used for IoT design.*
COB4: *Acquire ability to make industrial, engineering and home automation related projects.*

UNIT- I **(15)**

Introduction to IoT: The impact of IoT in industry and daily life, Understanding the IoT ecosystem: devices, platforms, and applications. Overview of IoT Components - Analog sensors, Digital Sensors: Eg. Ultrasonic Sensor, PIR Motion Sensor, Moisture Sensor, Temperature Sensor, Touch Sensor, Infrared Sensor, Servo Motor.

UNIT- II **(15)**

Basics of Networking: Communication Protocols
Overview of IoT Communication - Wi-Fi, Bluetooth, RFID, I2C and SPI
Wireless Sensor Networks: History and Context, the node, Connecting nodes, Networking Nodes, WSN and IoT.

Wireless Technologies for 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- III **(15)**

Types of Arduino devices, Introduction to Arduino Uno and Nano. Understanding Arduino UNO Board and Components Installing and working with Arduino development environment (Arduino IDE), Programming Arduino devices, exploring the Arduino language (C/C++) syntax, Coding, compiling, and uploading to the microcontroller.

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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007, T.S.

Integration of Sensors and Actuators with Arduino, perform experiments using Arduino Uno to Learn, interfacing of sensors and actuators: temperature, pressure, humidity, luminous, soil moisture, relays and motors, LCD, LED.

Unit- IV **(15)**

Working with Arduino Communication Modules: Bluetooth Modules, WiFi Modules, RFID Modules. Introduction to Nano 33 IoT, nodemcu ESP8266, Architecture of nodemcu and GPIO pins, establishing WiFi Connection with nodemcu.

Implementation of Cloud, interface cloud with IoT Devices, LED Blinking, and Implementation of Project based on IoT - creating an IoT Temperature and Humidity Sensor System with DHT-22 Sensor Using a Mobile App to Control Arduino IoT.
Applications: Home automation, Industrial automation, Smart lighting, Smart agriculture.

Course outcomes:

On completion of the course, student will be able to

CO1: *understand various concepts, terminologies and architecture of IoT systems.*
CO2: *use sensors and actuators for design of IoT.*
CO3: *understand and apply various protocols for design of IoT systems.*
CO4: *understand various applications of IoT and implement as Do it yourself projects.*

Recommended Books:

1. Embedded/ Real-Time Systems: Concepts, Design & Programming, Black Book by K. V. K Prasad, Dreamtech Press, 1st Edition, 2003.
2. Internet of Things (A Hands-on-Approach) by Arshdeep Bahga, Vijay Madisetti, VPI publisher, (1st edition), 2016.
3. *Introduction to IoT* by S. Misra, A. Mukherjee, and A. Roy, Cambridge University Press. 2020.

Reference Books:

1. ARM System-on-Chip Architecture by Steve Furber, Pearson Education, 2016.
2. Sensors and Transducers by D Patranbis, P. H. India, Pvt. Ltd, (2nd edition), 2003.
3. The Internet of Things: Enabling Technologies, Platforms, and Use Cases" by Pethuru Raj and Anupama C. Raman, CRC Press.
4. Introduction to Industrial Internet of Things and Industry 4.0. by *S.* Misra, C. Roy, and A. Mukherjee, CRC Press. 2020.

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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007. T. S.

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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 – 1B) 8051 Microcontroller and Applications (60 Hours)

Paper Code: EL 624B

HPW: 4 **Credits: 4**

Course Objective: *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 **(15)**

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 **(15)**

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 calculations.

Unit-III **(15)**

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.

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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007. T. S.

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

Unit-IV **(15)**

Applications of Micro controller: DAC - R-2R ladder, Interfacing of DAC 0808 to microcontroller, ADC - Dual slope ADC, successive approximation ADC, Interfacing of ADC 0804 to microcontroller, interfacing a temperature sensor, displaying information on a LCD, Interfacing a keyboard. Interfacing a stepper motor.

Course Outcomes:

At the end of this course, students will be able to

CO1: *Define terms applicable to microcontrollers and*
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 JaniceGillipsie Mazidi – Pearson Education Asia, 4 Reprint, 2002.
2. The 8051 Microcontroller - architecture, programming and applications by Kennth J. Ayala-Penram International Publishing, 1995.

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 (2011).

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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007. T. S.

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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 (60 Hours) - Course Code: EL 624_O
HPW: 4 **CREDITS: 4**

Course Objective:
The students will learn:
COB1: *A hardware description language (HDL) for the specification, simulation, synthesis and implementation of digital logic systems.*
COB2: *To identify the differences between behavioral and structural coding styles*
COB3: *To write code targeting Xilinx devices specifically and FPGA devices in general.*
COB4: *To apply the information gained to any digital design by using a top-down synthesis design approach.*

Unit-I (15)

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 behavioral, dataflow and structural models.

Unit-II (15)

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 (15)

Packages and Use Clauses: Package Declarations, Package Bodies and Use Clauses.

Combinational Circuit Design: VHDL Models and Simulation of combinational circuits such as Half and Full adders, multiplexers, demultiplexer, encoders, decoders, code converters, comparators, implementation of Boolean functions.

Unit-IV (15)

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.

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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007. T. S.

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

Recommended books:

1. VHDL- Primer by J Bhasker; *PHI*
2. The Designer's Guide to VHDL by Peter J. Ashenden, 2nd Ed., 1stIndian Reprint, Harcourt India Pvt. Ltd., 2001.

Reference books:

1. VHDL by Douglas L. Perry, *Mc Graw Hill Publications*.
2. Digital System Design using VHDL by Charles. H.Roth ; *PWS (1998)*.
3. VHDL-Analysis & Modeling of Digital Systems by Navabi Z, *McGraw Hill*.
4. Logic and Computer Design Fundamentals, 2/E, 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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Dr. M. PRASAD
Professor
Department of Physics
Osmania University
Hyderabad-500 007, T.S.