Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Autonomous

Academic Year 2021-2022

T.Y.B.Sc. Electronic Science

To be implemented from June 2021

Course Structure

Semester	Paper Code	Title of Paper	No. of Credits
V	ELE3501	Advanced Digital System Design using Verilog	3
	ELE3502	8051 Microcontroller	3
	ELE3503	Analog Circuit Design and Applications of Linear ICs	3
	ELE3504	Principles of Semiconductor Devices	3
	ELE3505	Fundamentals of 'C' Programming	3
	ELE3506	Optical Fiber Communication	3
	ELE3507	Practical Course I	2
	ELE3508	Practical Course II	2
	ELE3509	Practical Course III (Project)	2

Question paper : Theory - • For Internal Examination 40 Marks

• For Semester Examination 60 Marks

Practical - • For Internal Examination 40 Marks

• For Semester Examination 60 Marks

Paper I : Semester V

ELE 3501: Advanced Digital System Design using Verilog

A) Learning objectives :

1. To introduce VERILOG
2. To understand sequential and combinational logic design techniques.
3. To learn various digital circuits using VERILOG
4. To learn VLSI devices and memories

B) Learning Outcomes:

1. The main outcome of this course is to acquaint students with different programmable devices, designing of digital circuits and VERILOG language.

Unit 1: Programmable Logic Devices [08]

Introduction, fixed function IC's, ASICs, Introduction of Programmable Logic Devices (PLD), ROM as PLD, SPLD- PLA, PAL, CPLD, FPGA

Unit 2: Digital System Design [12]

Design flow for logic circuits, Mealy & Moore sequential machine models, state machine notation, state equivalence, state reduction, Equivalence classes, Implication charts, state reduction of incompletely specified state tables, Merger graphs, ASM symbols

Unit 3: Introduction to Verilog Hardware Description Language [10]

Importance of HDL's, features of Verilog HDL, Overview of Digital Design with Verilog HDL, Hierarchical modeling concepts, Basic concepts of Verilog- Operators, comments, Number specifications, strings, Identifiers& keywords, Data types, system tasks & Compiler Directives, Modules & ports.

Unit 4: Modeling of Digital systems [18]

Gate level Modeling- Gate types, Gate delays, Examples
Data flow modeling- Continuous Assignments, Delays expression, operators & operands, Examples
Behavioral Modeling- Structured Procedures, Assignments, Timing Controls, Conditional statements, Multiway Branching, Loops, Examples
(Examples of Verilog Design- Multiplexer, Demultiplexer, Encoder, Decoder, Adder, Subtractor, Flip Flop, Counter, and Shift register, Traffic light controller, Stepper motor sequence generator)

Recommended Books:

1. Digital logic: Applications & design by John M. Yarbrough, cengageLearningIndia(Thompson)
2. Verilog HDL A guide to digital design & synthesis By Samir Palnitkar, Pearson SecondEdition
3. A VHDL Synthesis Primer J. Bhaskar BS Publications Hyderabad
4. Fundamental of digital logic with Verilog By Stephen Brown,

   ZvonkoVranesic, Tata McGrawHill
5. Digital fundamentals By Floyd, Thoms, Jain R.P.,Pearson

Paper II : Semester V

ELE3502: 8051 Microcontroller

A) Learning objectives :

1. To learn architecture of 8-bit microcontroller.
2. To use instruction set and addressing modes of microcontroller.
3. To develop assembly language programming skills.
4. To interface memory and I/O devices.

B) Learning Outcomes:

1. The course is helpful to the students in understanding various instruction sets development tools.
2. Will be able to enhance the knowledge of assembly language programming and interfacing different I/O devices.

Unit 1: Microcontroller architecture [16]

Introduction to microcontroller, 8051 microcontroller block diagram, 8051 Oscillator and clock, Program counter, Datapointer, A and B CPU registers, Flags and PSW, Internal RAM and ROM, Stack and stack pointer, SFRs, I/O ports, Clock and reset circuitry, External memory , Counters and timers , Serial Data I/O,Interrupts.

Unit 2: Instruction set [16]

Addressing modes, Different groups of instructions- Data transfer instructions, Logical instructions,Arithmetic instructions, Jump and call instructions.Programs based on data transfer, logical, arithmetic, Jump and call instructions.Delay generation and waveform generation using timer

Unit 3: Development tools and Integrated Development Environment [4]

Algorithms, Flow charts, Program Designing, Editors, Assemblers, Compilers, Cross compiler,Linkers,Simulator, Emulator and Debugger.

Unit 4: Interfacing memory and I/O devices [12]

LED, LCD, Seven segment display, Relay, DC motor , Stepper motor, DAC, Switch, Thumb wheelSwitch , Keys ,Matrix keyboard.External memory interfacing – RAM, ROM, EPROM

Recommended Books :

1. The 8051 Microcontroller Architecture, Programming and application [Second Edition] Kenneth J.Ayala, Penram International (1999)
2. The 8051 Microcontroller and Embedded Systems using Assembly and C M.A.Mazidi,J.G.Mazidi,R.D.Mckinlay. Pearson Education Second Edition 2009
3. The 8051 Microcontroller and Embedded Systems using Assembly and C, Kenneth J. Ayala,Dhananjay V. Gadre. Cengage Learning
4. Microcontrollers [Theory and Applications] Deshmukh Ajay V. TMH

Paper III : Semester V

ELE3503: Analog Circuit Design and Applications of Linear ICs

A) Learning objectives:

1. To study the practical design aspects while using Op- amps
2. To study the basic application circuits of Op -amps
3. To Learn the specifications and selection criterion for linear ICs
4. To obtain information about different special purpose ICs and their applications
5. To refer and understand data manuals.

B) Learning Outcomes:

1. Knowing important concepts like filters, amplifiers and rectifiers and will be able to design and analyse the various analog circuits.
2. Also understanding special purpose ICs used in multivibrators , function generators and regulators.

Unit 1: Practical Considerations for Op-amp Circuit Design [10]

Practical consideration with Op-amps: selecting Op-amps for dc, low frequency and high frequency applications, earth loops, interference noise/ shielding and guarding, supply bypassing, offset compensation / balancing techniques, stability of op-amp circuits and technique for frequency compensation.

Unit 2: Basic Application Circuits using Op-amp [12]

Design of basic and practical integrator and differentiator circuits Active filters: 2^{nd} and higher order, Design of LP, HP and BP filters
Log and antilog amplifiers: transdiode configuration and diode connected transistor configuration for log amplifier, Practical log and antilog amplifiers, Precision half wave rectifier, precise full wave rectifiers with equal resistor and one with high input impedance, peak detectors, sample and hold circuits.

Unit 3: Basic Application Circuits using Linear ICs [14]

Voltage comparators using op-amp as well as comparator IC (LM311), design of inverting and non-inverting Schmitt trigger, Astable and mono stable multivibrators using op-amp. Timer IC555: Block diagram, astable and mono stable multivibrators Function generators: LM 566, ICL8038

Unit 4: Voltage Regulators and Phase Lock Loops [12]

Voltage references: band gap reference, LM385
Linear Regulators: Fixed three terminal regulators ICs-78XX, 79XX; Adjustable Three terminal regulators ICs LM317, LM337, PWM controller IC3524
Phase lock loop (PLL): Monolithic IC LM565, operating principle, block diagram, PLL characteristics.

Recommended Books:

1. George Clayton and Steve Winder, “Operational Amplifiers,” 5th Edition Newnes An Imprint of Elsevier
2. Sergio Franco, “Design With operational Amplifiers and analog integrated circuits,”TMH
3. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits,” 4th EditionPHI
4. R.F. Coughlin, F.F. Driscoll, “Operational Amplifiers and Linear Integrated Circuits,” PrenticeHall.
5. James M Fiore, “Operational Amplifiers and Linear Integrated Circuits,” JaicoPublishinghouse.

Paper IV: Semester V

ELE3504 : Principles of Semiconductor Devices

A) Learning Objectives:

1. To introduce crystal structure with reference to semiconductors
2. To study the theory of metal-semiconductor and p-njunctions
3. To understand the characteristics of semiconductor devices
4. To introduce theoretical background of BJT and FETs

B) Learning Outcomes:

1. The course is helpful to the students in understanding crystal structure and characteristics of semiconductor devices such as BJT and FET.
2. Knowing the important concepts such as Fermi level, breakdown mechanism and equilibrium conditions.

Unit 1 : Fundamentals of Semiconductors [14]

Crystal structure: Basic Lattice Types, Basic Crystal Structures, Miller Indices, bulk semiconductor growth and epitaxial growth techniques Photoelectric effect, Bohr model, hydrogen atom
Electronic levels in semiconductors bonding forces and energy bands in semiconductors, metal semiconductors and insulators, direct and indirect semiconductors, charge carriers, Fermi level and temperature dependence, carrier drift in electric and magnetic field
Excess carriers in semiconductors: optical absorption, photo and electro-luminescence.

Unit 2 : Junctions [12]

Equilibrium conditions: contact potential, space charge at junction. Forward and reverse bias junctions: steady state
Reverse bias breakdown: Zener and avalanche breakdown mechanism
Metal Semiconductor Junction: Schottky barriers, Current Flow across a Schottky Barrier, rectifying contacts, Ohmic Contacts

Unit 3 : Bipolar Junction Transistors [10]

BJT structure and operation, BJT Characteristics, Minority carrier distributions and terminal currents, current transfer ratio. Coupled diode model (Ebers-Moll Model).
Switching: cutoff, saturation, switching cycle.
Effects: Drift in the Base region, Avalanche Breakdown, base resistance and emitter Crowding Effect.

Unit 4 : Field Effect Transistors (FETs) [12]

Junction FETs (JFETs) and Metal Semiconductor FETs (MESFETs): The Ohmic Region, Pinch-off and saturation, GaAs MESFET, Current-Voltage Characteristics.

MOSFET: Basic operation of Metal Insulator Semiconductor FETs, Metal-Oxide-Semiconductor Capacitor, Capacitance-voltage relation of MOS structure
Output and transfer Characteristics of MOSFET, Mobility model, control of threshold voltage, Electrical equivalent circuit of MOSFET.

Text / Reference Books:

1. Solid State Electronics Devices, Ben G. Streetman and Sanjay Kumar Banerjee, PHI, 6thEdition.
2. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3rdEdition.
3. Semiconductor Device Physics and Design, Umesh K. Mishra and Jasprit Singh, Springer.
4. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education.

Paper V: SemesterV

ELE3505: Fundamentals of 'C' Programming

A) Learning Objectives:

1. To understand fundamentals of C language.
2. To develop algorithm/flowcharts for problem solving and writing programs.
3. To learn to use functions, arrays, pointers and file handling in C language.
4. To understand basics of graphics.

B) Learning Outcomes:

1. Concepts of character set , I/O functions , loops and derived data types which are helpful in designing and developing C programs.
2. Will be able to develop basic C graphics programs by knowing the concepts as initialization, graphics commands etc.

Unit 1: C- Fundamentals [16]

Introduction, structure of C,character set, constants and variables, Key words, Symbolic constant, statements, entering and executing C program, input and output simple and formatted functions, operators and expressions, control structures and loops and programming examples.

Unit 2: Functions, Arrays and Pointers [14]

Defining a function,accessing a function, function prototype, passing argument, recursion and programs.
Defining and processing of an array, passing array to a function, Pointer's declarations, passing pointers to a function and programming examples.

Unit 3: String and File handling [10]

Declaring and initializing string,Operations on string, string length, string size, string copy, string concatenation, string compare, programming examples.
Defining file, Operations on file, Opening and closing of data file, read and write data file, input and output functions on files - getc and putc ,fscanf and fprintf , processing data file and append data file, programming examples.

Unit 4: Introduction to C- Graphics [08]

Concept of graphics, Graphics initialization,graphics commands, getpixel, putpixel,line, Polyline,lineto, circle,arc,ellipse,rectangle,polygon, bar, getmax x, getmax y, setcolor,fillpatternetc.And programming examples. Programmes for drawing electronic components.

Recommended Books:

1. J. JayasriThe ‘C Language Trainer with C Graphics and C++ WILEY
2. Byron. S. Gottfried Schaum’s Outline of Programming with C TMH
3. E Balaguruswamy Programming in ANSI C The McGraw Hill publication
4. Stephens Cochan Programming in C Prentice hall of India Ltd
5. V. Rajaraman Computer Programming in C Prentice hall of India Ltd.
6. MadhusudanMothe C for Beginner

Paper VI : Semester V

ELE3506: Optical Fiber Communication

A) Learning Objectives:

1. To understand the principles of fiber optic communication system.
2. To learn different parameter of optical fibers.
3. To understand essential optical components of Fiber Optic Communication.
4. To study measuring equipments

B) Learning Outcomes:

1. Understanding concepts of fiber optics, its types, different optical sources and detectors.
2. Will be able to knowing concepts attenuation and losses in fiber used in optical communication.

Unit 1 : Introduction [12]

The evolution of fiber optic systems, advantages and applications of optical fiber communication, Ray theory transmission, total internal reflection, acceptance angle, numerical aperture and skew rays. Single mode and multimode fibers, linearly polarized modes. Types and specification of single mode, multimode, step index, graded index.

Unit 2 : Optical Sources and Detectors [12]

Coherent and non-coherent sources, quantum efficiency, modulation capability of optical sources.LEDs: Working principle, structure and characteristics, Laser diodes: Working principle, structure and characteristics
PIN and APD: Working principle and characteristics of detectors, noise analysis in detectors. Comparison of photo diodes

Unit 3 : Fiber Optic Losses [12]

Fiber splices, fiber connectors and fibercouplers.Dispersion, Intra model dispersion, Inter model dispersion. Attenuation in optical fibers, material or impurity losses, scattering losses, absorption losses, bending losses. Fiber optic link structure and link losses, connector and splicing losses.

Unit 4: Optical Fiber communication [12]

Block diagram of optical fiber communication, Repeaters, optical fiber amplifiers, OPTICAL NETWORKS: Introduction, SONET. OTDR Working Principle and characteristics.

Recommended Books:

1. G. Kaiser Optical fiber communication McGraw Hill
2. SubirkumarSarkar Optical fibers and fiber optic communication systems S.Chand and Company

3. R. P. Khare Fiber optics and optoelectronics oxford University Press
4. John M. Senior Optical fiber communications Principles and Practice, (2nd edition) PHI
5. AjoyGhatak and K. Thyagarajan Introduction to fiber optics Cambridge University Press
6. D. C. Agarwal Fiber optic communication wheeler Publication

T.Y. B.Sc. (Electronic Science)

Paper VII ELE3507: Practical Course- I

General Electronics

There are 10 Experiments in Paper VII ELE3507 : Practical Course- I

One activity as directed in practical course which will be equivalent to 2experiments

Internal Practical Examination (Out of 40)

· 32 Marks to Experiments, 08 Marks to Activity

Semester Practical Examination (Out of 60)

· One experiment - 3 hours duration (60 Marks)

· 44 Marks to Experiment, 16 marks toactivity

Objectives:

1. To refer the various datasheets of the electronic devices and integrated circuits

2. To learn how to select the devices, sensors, actuators and ICs for a particular application

3. To develop the basic skills required to handle the various instruments

4. To learn the designing aspects of circuits/ systems

Total 8 Experiments

Group 1: Total 4 Experiments

Analog Circuit Design and Applications of Linear ICs

1. Wave shaping circuits (Integrator / differentiator circuit)
2. Op-amp based clipper and clampers
3. Log amplifier using opamp
4. Regulated power supply using IC 723 (Low and High Voltage,1A Current)
5. Function generator using 8038/2206 or any equivalent IC
6. Astable and monostable multivibrator using IC555.

Group 2: Total 2 Experiments

Principles of Semiconductor Devices

1. Measurement of Efficiency and fill factor of solar cell.
2. Energy band gap measurement
3. Reverse recovery time measurement of diodes (any two).
4. Transfer characteristic of phototransistor/ Photodiode

Group 3: Total 2 Experiments

Fiber Optics and fiber optic Communication

1. Design of fiber optic Transmitter
2. Design of fiber optic Receiver
3. Study of propagation loss in optical fibers

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Paper VII ELE3508: Practical Course- II

Programming (Microcontroller, Verilog and C language)

There are 10 Experiments in Paper VII ELE3508 : Practical Course- II

One activity as directed in practical course which will be equivalent to 2 experiments

Internal Practical Examination (Out of 40)

· 32 Marks to Experiments, 08 Marks to Activity

Semister Practical Examination (Out of 60)

· One experiment - 3 hours duration (60 Marks)

· 44 Marks to Experiment, 16 marks toactivity

Objectives:

1. To learn the basic C-Programming.
2. To learn Verilog HDL to design basic combinational and sequential circuits
3. To get familiar with structural, data flow and behavioral modeling
4. 4. To learn assembly level language of 8051 microcontroller

Total 8 Experiments

Group 1: Total 3 Experiments

Assembly Programming for Microcontrollers

1. Basic exercises on arithmetic, logical and data transfer operation
2. Program to find largest, smallest of numbers.
3. Program to arrange ascending and descending order of numbers
4. Program to convert dec-hex, hex-dec.
5. Program to convert ASCII – HEX, HEX – ASCII.

Group 2: Total 2 Experiments

Digital System Design using Verilog HDL

1. Design 4 to 1 line MUX/ 1 to 4 DEMUX
   Use a) gate level b) data flow c) Structural d) Behavioral style of modeling
2. Arithmetic circuits: Half adder, Full adder (using gate level , Data flow modeling) and Parallel adder using structural modeling
3. Four bit ALU design using behavioral modeling
4. Design of flip-flops : RS, D and T using behavioral modeling

Group 3: Total 3 Experiments

C' Programming

Program to compute the following :

1. Series and Parallel equivalent resistance of n resistors.
2. Reactance of Inductorand Capacitor in Ω at given frequency.
3. To determine i) impedance of the series LR circuit.
   ii)Resonant frequency of series L(mH),C(μF)
4. Solve the given quadratic equation.
5. Determine multiplication of matrix.

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Paper IX: ELE3509 Practical Course- III

Project Work

Guideline to conduct Practical Course III

Practical Course III is a project work of 100 Marks.

- Internal project Examination (Out of 40)
- Semester project Examination (Out of 60)

The project work should be followed with following guidelines.

a) The name and subject of the project type must be well defined.
b) Planning of the work must be specified.
c) Theoretical, reference work must be provided.
d) Pilot experimentations / Preparations must be specified.
e) Typical design aspects, theoretical aspects, aim and objectives of the work must be specified in detail.
f) The actual work done must be reported along with experimentation procedures.
g) There must be observations, interpretations, conclusions, results of the project work.
h) Algorithm, program strategy, module wise description of parts etc be provided in case of projects related with development of computer software.
i) Applications, usefulness, student's contribution in it must be clearly specified.
j) Further extension work may be suggested for better outcome of the project.
k) It is recommended to present the projects in competitions / project exhibitions organized by various authorities.