6TH SEMESTER

DISCIPLINE SPECIFIC ELECTIVE (DSES)

OPTION-I

ELT616DA: ELECTRONICS: PHOTONIC DEVICES AND POWER ELECTRONICS

CREDITS: THEORY-4, LAB-2

(Theory: 60 Lectures)

Unit-I photonic Devices

Classification of photonic devices, Interaction of radiation and matter, Radiactive transition and optical absorption. Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity, heterostructure and quantum well devices. Charge carrier arid photon confinement, line shape function. Threshold current Laser diode.

(15 Lectures)

Unit-II: Photo Detectors

Photo detectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors, quantum efficiency and responsivity. Photomultiplier tube. Solar Cell: Construction, working and characteristics LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

(15 Lectures)

Unit-III: Power Electronics

Power Devices: Need for semiconductor power devices, Power MOSFET (Qualitative). Introduction to family of thyristors. Silicon Controlled Rectifier (SCR) - structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Gate-triggering circuits. Diac and Triac- Basic structure, working and V-I characteristics

. **(15 Lectures)**

Unit- IV Applications of SCR:

Phase controlled rectification, AC voltage control using SCR and Triac as a switch. Power Inverters- Need for commutating circuits, and their various types, dc link inverters, Parallel capacitor commutated invertors, Series Invertors, limitations and its improved versions, bridge inverters.

(15 Lectures)

Reference Books:

1. J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996).
2. S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009).
3. AK Ghatak & K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998).
4. Power Electronics, P.C. Sen., Tata McGraw Hill.
5. Power Electronics, M.D.Singh & K.B. Khanchandani, Tata McGraw Hill.
6. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H. Rashid, Pearson Education.
7.. Optoelectronic Devices and Systems, Gupta, 2nd edn., PHI learning.
8. Electronic Devices and Circuits, David A. Bell, 2015, Oxford University Press.

Practical (lab) Credits-2

At least 10 experiments from the following

1. To determine wavelength of sodium light using Michelson's Interferometer.
2. Diffraction experiments using a laser.
3. Study of Electro-optic Effect.
4. To determine characteristics of (a) LEDs, (b) Photo voltaic cell and (c) Photo diode.
5. To study the Characteristics of LDR and Photodiode.
6. To measure the numerical aperture of an optical fiber.
7. Output and transfer characteristics of a power MOSFET.
8. Study of I-V characteristics of SCR
9. SCR as a half wave and full wave rectifiers with Rand R L loads.
10. AC voltage controller using TRIAC with UJT triggering.
11. Study of I-V characteristics of DIAC
12. Study of l-V characteristics of TRIAC

Reference Books:

1. AK Ghatak & K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998)
2. Power Electronics, M.D. Singh & KB. Khanchandani, Tata McGraw Hill
3. Power Electronics Circuits, Devices & Applications, 3rd Edn. M.H.Rashid, Pearson Education **4.** A Textbook of Electrical Technology-Vol-II, B.L. Thareja, A.K. Thareja, S.Chand.

6TH SEMESTER
DISCIPLINE SPECIFIC ELECTIVE (DSES)

OPTION-II

ELT616DB: ELECTRONICS: VERILOG & FPGA BASED SYSTEM DESIGN

CREDITS: THEORY-4, LAB-2

(Theory: 60 Lectures)

Unit- I Digital logic design flow.

Review of combinational circuits. Combinational building blocks: multiplexors, demultiplexers, decoders, encoders and adder circuits. Review of sequential circuit elements: flip-flop, latch and register.

(15 lectures)

Unit- II Finite State Machines:

Mealy and Moore. Other sequential circuits: shift registers and counters. FSMD (Finite State Machine with Data path): design and analysis. Micro-programmed control. Memory basics and timing. Programmable Logic devices.

(15 lectures)

Unit-III Programmable logic devices.

PAL,PLA and GAL.CPLD and FPGA architectures. Placement and routing. Logic cell structure, Programmable interconnects, Logic blocks and I/0 Ports. Clock distribution in FPGA. Timing issues in FPGA design. Boundary scan.

(15 lectures)

Unit- IV Verilog HDL:

Introduction to HDL.Verilog primitive operators and structural Verilog Behavioral Verilog. Design verification. Modeling of combinational and sequential circuits (including FSM and FSMD) with Verilog Design examples in Verilog.

(15 lectures)

Reference:

1. Lizy Kurien and Charles Roth. Principles of Digital Systems Design and VHDL.Cengage Publishing. ISBN-
2. 13:978131505748
3. Palnitkar, Samir, Verilog HDL. Pearson Education; Second edition (2003).
4. Ming-Bo Lin. Digital System Designs and Practices: Using Verilog HDL and FPGAs. Wiley India Pvt Ltd.
5. ISBN-13: 978-8126536948
6. Zainalabedin N avabi.., Verilog Digital System Design.TMH; 2ndedition. ISBN-13: 978-0070252219
7. Wayne Wolf. FPGA Based System Design. Pearson Education.

Practical (lab) Credits-2

At least 10 experiments from following.

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtract or using basic and derived gates.
4. Design and simulation of a 4 bit Adder.
5. Multiplexer (4x1) and Demultiplexers using logic gates.
6. Decoder and Encoder using logic gates.
7. Clocked D, JK and T Flip flops (with Reset inputs)
8. 3-bit Ripple counter
9. To design and study switching circuits (LED blink shift)
10. To design traffic light controller.
11. To interface a keyboard
12. To interface a LCD using FPGA
13. To interface multiplexed seven segment display.
14. To interface a stepper motor and DC motor.
15. To interface ADC 0804.

Reference books:

1. W.Wolf, FPGA- based System Design, Pearson, 2004
2. U. Meyer Baese, Digital Signal Processing with FPGAs, Springer, 2004
3. S. Palnitkar, Verilog HDI.r- A Guide to Digital Design & Synthesis, Pearson, 2003
4. Verilog HDL primer-]. Bhasker. BSP, 2003 II edition

6TH SEMESTER
DISCIPLINE SPECIFIC ELECTIVE (DSES)

OPTION-III

ELT616DC: ELECTRONICS: SEMICONDUCTOR DEVICES FABRICATION

CREDITS: THEORY-4, LAB-2

(Theory: 60 Lectures)

Unit I: Introduction:

Review of energy bands in materials. Metal, Semiconductor and Insulator. Doping in Semiconductors, Defects: Point, Line, Schottky and Frenkel. Single Crystal, Polycrystalline and Amorphous Materials. Czochralski technique for Silicon Single Crystal Growth.

(15 Lectures)

Unit II: Thin Film Growth Techniques and Processes:

Vacuum Pumps: Primary Pump (Mechanical) and Secondary Pumps (Diffusion, Turbo-molecular, Cryopump, Sputter - Ion) - basic working principle, Throughput and Characteristics in reference to Pump Selection. Vacuum Gauges (Pirani and Penning).

(15 Lectures)

Unit III Semiconductor Devices:

Review of p-n Junction diode, Metal-Semiconductor junction, Metal-Oxide-Semiconductor (MOS) capacitor and its C-V characteristics, MOSFET (enhancement and depletion mode) and its high Frequency limit. Microwave Devices, Tunnel diode.

(13 Lectures)

Unit IV: VLSI Processing:

Introduction of Semiconductor Process Technology, Clean Room Classification, Line width, Photolithography: Resolution and Process, Positive and Negative Shadow Masks, Photoresist, Step Coverage, Developer. Electron Beam Lithography. Idea of Nano-Imprint Lithography. Etching: Wet Etching. Dry etching (RIE and DRIE).Basic Fabrication Process of R, C, P-N Junction diode, BJT, JFET, MESFET, MOS, NMOS, PMOS and CMOS technology. Wafer Bonding, Wafer Cutting, Wire bonding and Packaging issues (Qualitative idea).

(17 Lectures)

Reference Books:

1. Physics of Semiconductor Devices, S. M. Sze. Wiley-Interscience.
2. Handbook of Thin Film Technology, Leon I. Maissel and Reinhard Glang.
3. Fundamentals of Semiconductor Fabrication, S.M. Device and G. S. May, John-Wiley and Sons, Inc.
4. Introduction to Semiconductor materials and Devices, M. S. Tyagi, John Wiley & Sons 5. VLSI Fabrication Principles (Si and GaA.s), S.K. Gandhi, John Wiley & Sons, Inc.

Practical (lab) Credits-2

At Least 05 Experiments from the Following:

1. Fabrication of alloy p-n Junction diode and study its I-V Characteristics.
2. Study the output and transfer characteristics of MOSFET
3. To design and plot the static & dynamic characteristics of digital CMOS inverter.
4. Create vacuum in a small tube (preferably of different volumes) using a Mechanical rotary pump and measure pressure using vacuum gauges.
5. Deposition of Metal thin films/ contacts on ceramic/ thin using Thermal Evaporation and study IV characteristics.
6. Selective etching of Different Metallic thin films using suitable etchants of different concentrations.
7. Wet chemical etching of Si for MEMS applications using different concentration of etchant.
8. Calibrate semiconductor type temperature sensor (AD590, LM 35, LM 75).
9. Quantum efficiency of CCDs.
10. To measure the resistivity of a semiconductor (Ge) crystal with temperature (upto 150oC) by four• Probe method.
11. To fabricate a ceramic and study its capacitance using LCR meter.
12. To fabricate a thin film capacitor using dielectric thin films and metal contacts and study its capacitance using LCR meter.
13. Study the linearity characteristics of
    (a) Pressure using capacitive transducer (b)
    Distance using ultrasonic transducer

Reference Books:

1. Physics of Semiconductor Devices S. M. Sze. Wiley-Interscience.
2. Handbook of Thin Film Technology, Leon I. Maissel and Reinhard Glang.
3. The science and Engineering of Microelectronics Fabrication, Stephen A Champbell, 2010, Oxford University Press.

6TH SEMESTER
DISCIPLINE SPECIFIC ELECTIVE (DSES)
OPTION-IV

ELT616DD: ELECTRONICS: EMBEDDED SYSTEM DESIGN

CREDITS: THEORY-4, LAB-2

(Theory: 60 Lectures)

Unit I: Introduction

Embedded systems and processors: Introduction to embedded systems, c9mponents of an embedded system, types of embedded system, levels of embedded system, Embedded System applications, Embedded system design considerations, Embedded Processors: Microprocessors, Microcontrollers, DSP and ASICs, Comparative Assessment of Embedded Processors. Embedded memory devices and Embedded I/0, Embedded high and low-level programming. Microcontrollers: Microcontrollers for embedded systems, classes of .microcontrollers, and types of microcontrollers, introduction to microcontroller platforms: ARM, ATMEL/ AVR, PIC, ARDUINO, Raspberry and 8051, Choosing a Microcontroller for an embedded application.

Unit II: 8051

8051 Architecture: 8051 Microcontroller hardware, internal Architecture, input/ output pin and port architecture, bare minimum system with external circuits, other members of 8051. Instructions and Programming: Addressing modes: accessing memory using various addressing mode, Jump, Loop and call instructions, time delay generation and calculation, Single bit instructions and programming, I/ 0 port programming: I/ 0 programming, bit manipulation.

Unit 111: Interfacing

8051 Timers, Counters, Serial Communication, Interrupts and their Programming: Timer and counter architecture in 8051, programming 8051 timers, counter programming, pulse frequency and 'pulse width measurements. Serial communication in 8051: Basics of serial communication, 8051 connection to RS232, 8051 serial communication programming. Interrupts programming: Interrupts of 8051, programming timer interrupts, programming external hardware interrupts, and programming serial communication interrupts.

Unit IV: Applications

Application of 8051 Microcontroller: Interfacing memory with 8051, Programmable peripheral interface (PPI)-8255, programming 8255, · 8255 interfacing with 8051. Interfacing Keyboard, Interfacing LED/ LCD, Interfacing A/D & D / A converters.

Recommended Books:

1. Embedded Systems: Design and Applications 1 e, S.F. Barrett & Daniel J Pack, Pearson
2. The 8051 Microcontrollers and Embedded Systems, Muhammed Ali Mazidi
3. The 8051 Microcontrollers Architecture, Programming & Applications, Kenneth]. Ayala
4. Design with PIC Microcontroller, John P e t ma n

PRACTICAL (lab) credits-2

At least 10 experiments from the following:

1. To perform 8-bit addition using accumulator
2. 8 bit addition using memory register
3. 8 bit subtraction using accumulator
4. 8-bit subtraction using memory register
5. Addition of BCD number
6. 16-bit addition using accumulator
7. 16-bit addition using register pair
8. 16-bit subtraction using accumulator
9. BCD subtraction
10. 8-bit multiplication using memory register
11. Hexadecimal division
12. Adding an array of data
13. Smallest element in an array
14. Largest element in an array
15. Fibonacci series
16. Arrange elements in ascending order
17. Arrange elements in descending order

Recommended Books:

5. Embedded Systems: Design and Applications le, S.F. Barrett & Daniel] Pack, Pearson
6. The 8051 Microcontrollers and Embedded Systems, Muhammed Ali Mazidi
7. The 8051 Microcontrollers Architecture, Programming & Applications, Kenneth]. Ayala
8. Design with PIC Microcontroller, John Petman