DETAILED SYLLABUS

under

Choice Based Credit System (CBCS) Scheme

for

B.Sc. Programme (Electronics)

(Academic Session 2019 and onwards)

APPROVED BY BOS, HELD ON 17-02-2020

UNIVERSITY OF KASHMIR
Hazratbal, Srinagar, 190006

B. Sc. Electronics Course Outline

Course Structure						
Semester	**Course Title**	**Course Code**	**Course Type**	**Credits**		
				Theory	**Lab**	**Total**
1	Networks Analysis and Analog Electronics	ELE-DSC-1A	Core	4	2	6
2	Linear and Digital Integrated Circuits	ELE-DSC-2A	Core	4	2	6
3	Communication Electronics	ELE-DSC-3A	Core	4	2	6
	Skill Enhancement Courses					
	) Electrical Circuits and Networking Skills	ELE-SEC3A	Skill Enhancement Elective	2	2	4
	) Repair & Maintenance of Power Supply, Inverter & UPS	ELE-SEC3B				
4	Microprocessor and Microcontroller	ELE-DSC-4A	Core	4	2	6
	Skill Enhancement Courses					
	Programming & Problem Solving	ELE-SEC4A	Skill Enhancement Elective	2	2	4
	PC Assembly, Maintenance and Upgradation	ELE-SEC4B				
5	Discipline Specific Electives					
	Electronic Instrumentation	ELE-DSE-5A	Discipline Specific Elective	4	2	6
	Digital Signal Processing	ELE-DSE-5B				
	Antenna Theory and Wireless Networks	ELE-DSE-5C				
	Programmable Logic Devices and ASICs	ELE-DSE-5D				
	Skill Enhancement Courses					
	EDA/Simulation Tools	ELE-SEC5A	Skill Enhancement Elective	2	2	4
	Repair & Maintenance of Mobile Phones	ELE-SEC5B				
6	Discipline Specific Electives					
	Photonic Devices & Power Electronics	ELE-DSE-6A	Discipline Specific Elective	4	2	6
	Verilog and FPGA Based System Design	ELE-DSE-6B				
	Semiconductor Device Fabrication	ELE-DSE-6C				
	Embedded System Design	ELE-DSE-6D				
	Skill Enhancement Courses					
	Digital Logic Design using VHDL	ELE-SEC6A	Skill Enhancement Elective	2	2	4
	Introduction to Nano-materials	ELE-SEC6B				

Semester- I

ELE-DSC-1A-: NETWORK ANALYSIS AND ANALOG ELECTRONICS

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, lab: 60 Hours

Learning Objectives:

- To prepare the students to have a basic knowledge regarding analysis of electrical networks.
- To relate various two port parameters and transform them.
- To understand the basics of semiconductors and diodes.
- To understand the operation of BJT, JFET and MOSFET.
- To know about the basics of amplifiers and oscillators.

Unit-I: Circuit Analysis

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis. Star and Delta networks, Star-Delta Conversion. Principal of Duality. Superposition Theorem. Thevenin's Theorem. Norton's Theorem. Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion. **(15 hrs)**

Unit-II Semiconductor Devices-I

Junction Diode and its applications: PN junction diode (Ideal and practical)- I-V characteristics, dc load line analysis, Quiescent (Q) point. Zener diode, Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped and bridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Zener diode as voltage regulator, Introduction to Tunnel diode, metal contact diode **(15 hrs)**

Unit-III Semiconductor Devices - II

Bipolar Junction Transistor: Review of the characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β. dc load line and Q point. Unipolar Devices: JFET and MOSFET. Construction, working and I-V characteristics (output and transfer), Pinch-off voltage. **(15 hrs)**

Unit-IV Amplifiers and Oscillators

Transistor biasing and Stabilization Circuits-Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S. Transistor as a two-port network, h-parameter equivalent circuit. Small signal analysis of single stage CE amplifier. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers. Cascaded Amplifiers, two stage RC Coupled Amplifier and its Frequency Response. Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only). Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation. **(15 hrs)**

Reference Books:

1. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
2. Network, Lines and Fields, J.D.Ryder, Prentice Hall of India.
3. Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
4. Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
5. Electrical Circuit Analysis, Mahadevan and Chitra, PHI Learning
6. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
7. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
8. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline.

ELE-DSC- 1A LAB: NETWORK ANALYSIS AND ANALOG ELECTRONICS LAB

At Least 10 Experiments From The Following.

1. To familiarize with basic electronic components (R, C, L, diodes, transistors),
2. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
3. Verification of (a) Thevenin's theorem and (b) Norton's theorem.
4. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode.
7. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR).
8. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR.
9. Study of the I-V Characteristics of UJT and design relaxation oscillator.
10. Study of the output and transfer I-V characteristics of common source JFET.
11. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
12. Design of a Single Stage CE amplifier of given gain.
13. Study of the RC Phase Shift Oscillator.
14. Study the Colpitt`s oscillator.

Reference Books:

1. Networks, Lines and Fields, J.D.Ryder, Prentice Hall of India.
2. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
3. Allen Mottershead, Electronic Devices and Circuits, Goodyear Publishing Corporation.

ELE-DSC-2A: LINEAR AND DIGITAL INTEGRATED CIRCUITS

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, lab: 60 Hours

Learning Objectives:

- To study the basic principles, configurations and frequency response of OP-AMP.
- To analyze and design OP-AMP based oscillators and filters.
- To understand the basics of digital integrated circuits.
- To acquire knowledge about number systems and their interconversion and study basics of Boolean algebra.
- To understand the analysis and design of various combinational and sequential circuits.

Unit-I Linear Integrated Circuits and its Applications

Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open and closed loop configuration, Frequency Response. CMRR, Slew Rate and concept of Virtual Ground. Inverting and non- inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Wein bridge oscillator, Comparator and Zero-crossing detector, and Active low pass and high pass Butterworth filter (1st and second order only). (**15 hrs**)

Unit-II Number System and logic Gates

Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, BCD code. Binary, octal and hexadecimal arithmetic; addition, subtraction by 2's complement method, multiplication. Logic Gates and Boolean algebra: Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra. (**15 hrs**)

Unit- III Combinational Logic Analysis and Design

Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP). Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4- bit binary Adder/Subtractor. Multiplexers, De-multiplexers, Decoders, Encoders. (**15 hrs**)

Unit- IV Sequential Circuits

Introduction to 555 timer. Flip-Flops: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-slave JK Flip-Flop. **Shift registers**: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits). Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter. (**15 hrs**)

Reference Books:

1. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
3. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
4. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
5. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
6. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
7. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
8. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

Semester- II

ELE-DSC-2A LAB: LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

At Least 7 Experiments Each From section A, B and C

Section-A: Op-Amp. Circuits (Hardware)

1. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
2. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response
   (b) To design non-inverting amplifier using Op-amp (741,351) & study frequency response
3. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode
   (b) To study the zero-crossing detector and comparator.
4. To design a precision Differential amplifier of given I/O specification using Op-amp.
5. To investigate the use of an op-amp as an Integrator.
6. To investigate the use of an op-amp as a Differentiator.
7. To design a Wien bridge oscillator for given frequency using an op-amp.
8. To design a circuit to simulate the solution of simultaneous equation and1st/2ndorder differential
9. Design a Butterworth Low Pass active Filter (1st order) & study Frequency Response
10. Design a Butterworth High Pass active Filter (1st order) & study Frequency Response
11. Design a digital to analog converter (DAC) of given specifications.

Section-B: Digital circuits (Hardware)

1. (a) To design a combinational logic system for a specified Truth Table.
   (b) To convert Boolean expression into logic circuit & design it using logic gate ICs.
   (c) To minimize a given logic circuit.
2. Half Adder and Full Adder.
3. Half Subtractor and Full Subtractor.
4. 4 bit binary adder and adder-subtractor using Full adder IC.
5. To design a seven segment decoder.
6. To design an Astable Multivibrator of given specification using IC 555 Timer.
7. To design a Monostable Multivibrator of given specification using IC 555 Timer.
8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
9. To build JK Master-slave flip-flop using Flip-Flop ICs
10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.
11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1st order active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

Reference Books

1. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
2. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall
3. R.L.Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (199
4. Digital Electronics, S.K.Mandal, 2010, 1st edition, McGraw Hill

Semester – III

ELE-DSC-3A: COMMUNICATION ELECTRONICS

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning Objectives:

- To enable students to acquire knowledge of various analog and digital modulation techniques.
- To acquire knowledge of multiple access techniques.
- To know about basics of mobile communication systems and to study the concept of cellular system design.
- To know about mobile communication evolution of 2G, 3G and emerging technologies.

Unit-I Analog Modulation:
Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super-heterodyne receiver **(15 hrs)**

Unit-II Analog Pulse Modulation:
Channel capacity, Sampling theorem, Basic Principles-PAM, PWM, PPM, modulation and detection technique for PAM, PWM and PPM, Multiplexing. TDMA, FDMA. **(15 hrs)**

Unit-III Digital Pulse Modulation
Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of PCM, DPCM and Delta modulation, introduction to digital pass band modulation Schemes. **(15 hrs)**

Unit-IV Mobile Telephony System –
Basic concept of mobile communication, frequency bands used in mobile communication, concept of cell sectoring and cell splitting, SIM number, IMEI number, need for data encryption, architecture (block diagram) of mobile communication network, idea of GSM, CDMA, TDMA and FDMA technologies.**(15 hrs)**

Reference Books:

1. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
2. Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
3. Modern Digital and Analog Communication Systems, B.P. Lathi, 4th Edition, 2011, Oxford University Press.
4. Electronic Communication systems, G. Kennedy, 3rd Edn., 1999, Tata McGraw Hill.
5. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
6. Communication Systems, S. Haykin, 2006, Wiley India
7. Electronic Communication system, Blake, Cengage, 5th edition.
8. Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press

ELE-DSC-3A LAB: COMMUNICATION ELECTRONICS LAB

At Least 10 Experiments From The Following

1. To design an Amplitude Modulator using Transistor
2. To study envelope detector for demodulation of AM signal
3. To study FM - Generator and Detector circuit
4. To study AM Transmitter and Receiver
5. To study FM Transmitter and Receiver
6. To study Time Division Multiplexing (TDM)
7. To study Pulse Amplitude Modulation (PAM)
8. To study Pulse Width Modulation (PWM)
9. To study Pulse Position Modulation (PPM)
10. To study ASK, PSK and FSK modulators

Reference Books:

1. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
2. Electronic Communication system

ELE-SEC 3A: ELECTRICAL CIRCUITS AND NETWORK SKILLS

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning objectives:-

- To study basic circuit elements and their combinations.
- Familiarization with various sources of electrical energy and various electronic instruments
- To study working principles of various types of electrical machines.

Unit I Basic Electricity Principles:
Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel resistance combinations. AC and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. Electrical Circuits: Basic electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. **(15 hrs)**

Unit II Electrical Drawing and Symbols:
Drawing Symbols, Blueprints, Reading Schematics. Ladder diagrams, Electrical Schematics, Power circuits. Control circuits, Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. Transformers: Operation of transformers, AC/DC generators, Single-phase and three- phase DC motors: Basic design, Speed control of DC motors **(15 hrs)**

Unit III Lab Work
To verify KCL and KVL, Study the V-I characteristics of an incandescent lamp, Measurement of single phase power using: three ammeter method, three voltmeter method. To Perform short circuit test on a single phase transformer. To perform open circuit test on a single phase transformer. Measurement of three phase power by using two wattmeter method. Verification of Thevenin's theorem and Superposition theorem, To study characteristics of DC motor(speed armature, torque armature, speed torque) and DC generator (load characteristics). **(60 hrs)**

Reference Books:

1. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
2. A text book in Electrical Technology - B L Theraja - S Chand & Co.
3. A text book of Electrical Technology - A K Theraja
4. Performance and design of AC machines - M G Say ELBS Edn

ELE- SEC 3B: REPAIR & MAINTENANCE OF INVERTER UPS ANDSTABILIZER

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning objectives:-

- To familiarize students with detailed knowledge of inverters ,stabilizers and various types of UPS.
- To get familiar with the basic principle and working of CVT.

Unit I: Inverter and UPS

Introduction to inverters, Types of inverters, Pulse width modulated Inverter, Voltage cancellation in inverters, Single Phase Voltage source inverters, Single Phase Bridge Inverters, 3 Phase Inverters Introduction to UPS, Types of UPS, Offline UPS, Online UPS, Line Interactive UPS, Input components in UPS, Trap Filter in UPS , UPS Rectifier stage IGBT Type, DC system components in Online UPS, Digital Power Quality Envelope. **(15 hrs)**

Unit II: Stabilizer and CVT

Need of stabilizer, working principle, types of stabilizer, Auto-cut and automatic stabilizer, Servo Stabilizer, Study of Control Circuit of Stabilizer, Transformer employed in stabilizer, Multiwinding/ Multitaped transformer, Introduction to Constant Voltage transformer, General Circuit diagram of CVT, Working principle of CVT, EMI/RFI filter, Surge Suppressor, Repairing of CVT.**(15 hrs)**

Unit III: Lab work

To study the operation of transformers, To study the construction of stabilizer and transformer employed in stabilizer, To study the characteristics and repairing of CVT, To study the construction and characteristics of Inverter, To study different types of source generators, Design of UPS, To Design a regulated power supply, Loss estimation in a transformer using open circuit and short circuit tests **(60 hrs)**

Reference Books:

1. Power electronics: converters, applications, and design by Ned Mohan.
2. Fundamentals of Power Electronics by Robeert W Eriction.
3. Power Electronics: Circuits, Devices, and Applications by M.H. Rashid
4. Introduction to Power Electronics by Daniel W Hart

Semester- IV

ELE-DSC-4A: MICROPROCESSOR AND MICROCONTROLLER

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning Objectives:

- To introduce 8085 architecture and programming.
- To acquaint students with the basic knowledge of 8051 microcontroller and its applications in embedded systems.
- To familiarize students with I/O port programming of 8051.

Unit-I Microcomputer Organization and 8085 Architecture:
Input/ Output Devices .Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map. Main features of 8085. Block diagram. Pin-out diagram of 8085. Data and address buses. Registers. ALU. Stack memory. Program counter. (**15 hrs**)

Unit-II 8085 Programming:
Instruction classification, Instructions set (Data transfer including stacks. Arithmetic, logical, branch, and control instructions). Subroutines, delay loops. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI. Hardware and software interrupts. **(15 hrs)**

Unit- III 8051 Microcontroller Architecture:
Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions. **(15 hrs)**

Unit- IV 8051 Programming and Introduction to Embedded system:
8051 I/O port programming: Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), I/O programming: Bit manipulation, Embedded systems and general purpose computer systems. Architecture of embedded system. Classifications, applications and purpose of embedded systems. **(15 hrs)**

Reference Books:

1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
4. Microprocessor and Microcontrollers, N. Senthil Kumar, 2010, Oxford University Press
5. 8051 microcontrollers, Satish Shah, 2010, Oxford University Press.
6. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
7. Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill

ELE-DSC-4A LAB: MICROPROCESSOR AND MICROCONTROLLER LAB

At least 06 experiments each from Section-A and Section-B

Section-A: Programs using 8085 Microprocessor

1. Addition and subtraction of numbers using direct addressing mode
2. Addition and subtraction of numbers using indirect addressing mode
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Handling of 16-bit Numbers.
6. Use of CALL and RETURN Instruction.
7. Block data handling.
8. Other programs (e.g. Parity Check, using interrupts, etc.).

Section-B: Experiments using 8051 microcontroller:

1. To find that the given numbers is prime or not.
2. To find the factorial of a number.
3. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
4. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's
5. Program to glow the first four LEDs then next four using TIMER application.
6. Program to rotate the contents of the accumulator first right and then left.
7. Program to run a countdown from 9-0 in the seven segment LED display.
8. Program to interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
9. Program to toggle '1234' as '1324' in the seven segment LED display.
10. Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clockwise direction.
11. Application of embedded systems: Temperature measurement & display on LCD

Reference Books:

1. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D.
4. McKinlay, 2nd Ed., 2007, Pearson Education India.
5. 8051 microcontrollers, Satish Shah, 2010, oxford University Press.
6. Embedded Microcomputer systems: Real time interfacing, J.W. Valcano 2011, Cengage Learning.

ELE-SEC 4A: PROGRAMMING AND PROBLEM SOLVING THROUGH C

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning Objectives:

- To know about various approaches to problem solving.
- To get familiar with C-programming language.
- To develop ability to handle possible errors during program execution.

Unit I: Introduction to Programming and Problem Solving Using C

The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compilation, Linking and Loading, Testing and Debugging, Documentation. Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs**. (15 hrs)**

Unit II: Storage classes and Arrays

Storage Classes: Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in a multiple source files: extern and static. Conditional Statements Loops and Arrays: Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array **(15 hrs)**

Unit III: Lab work

Develop, implement and execute a C program to search a Name in a list of names using Binary searching Technique. Write and execute a C program that. Implements string copy operation STRCOPY (str1, str2) that copies a string str1 to another string str2 without using library function and Reads a sentence and prints frequency of each of the vowels and total count of consonants. Design and develop a flowchart to find the square root of a given number N. Implement a C program for the same and execute for all possible inputs with appropriate messages. Note: Don't use library function sqrt(n).Finding the largest/smallest element in an array; Two dimensional arrays, Addition/ Multiplication of two matrices. **(60 hrs)**

Reference Books:

1. R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.
2. Kanetkar Y, "Let us C", BPB Publications, 2007.
3. Hanly J R & Koffman E.B, "Problem Solving and Programm design in C", Pearson Education, 2009.
4. E. Balagurusamy, "Programming with ANSI-C", Fourth Edition,2008, Tata McGraw Hill.

ELE-SEC4B: PC ASSEMBLY MAINTENANCE AND UPGRADATION

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning objectives

- To acquire basic knowledge about computer hardware and software.
- To gain insight knowledge of various types of operating systems and their installation.
- To familiarize students with system integration of various types of computers and helping them in identifying and troubleshooting different types of faults.

Unit-I Introduction to computers and OS

Introduction to Computer and its peripherals, uses of computer and difference between Hardware & Software, Booting concept in DOS and Windows environment., Identifications of different types of motherboards, controller cards, LAN Cards, Ethernet cards. Different types of RAMs used in PC's. BIOS Setting, Formatting of Hard Disk, Installation of Operating System i.e. DOS/Windows, driver installation and various Operations On drivers. BIOS password break, Administrative password break, Data recovery, Pen Driver bootable, Sound Problem, USB Problem, LAN problem etc. **(15 hrs)**

Unit -II System Integration

System integration of different types of computers, such as PC, PCXT, PC –AT etc., Trouble shooting of different types of faults, Different computer cards identifications and trouble shooting, Power supplies: installation and trouble shooting, Different types of SMPS identifications, Hard Disk driver installation and configuration setting, Use of CD ROM and DVD Drivers, Using of FDD drives, Different types of keyboards, repairing and maintenance, different types of monitors, Monitors Repairing/Maintenance , Mouse repairing and Installation. **(15 hrs)**

Unit –III Lab work

To familiarize the computer system layout: marking positions of SMPS ,Motherboard, FDD,HDD,CD,DVD and add on cards, To study the different cabling and connecting arrangement in a computer system. Configure BIOS setup program and troubleshoot the typical problems using BIOS utility. Install harddisk and configure to Pc's. Installation and configuration of DVD.To study the different type of CARD installations on the motherboard and daughterboard. To study different type of driver installation. Study repairing of different input and output devices, Assembling and disassembling of laptop to identify the parts and to install OS and configure it. **(60 hrs)**

Reference Books:

1. Information Technology Essentials: Basic Foundations for Information Technology 2017 by Eric Frick.
2. Computer Basics Absolute Beginner's Guide by Michael Miller.
3. How Computers Work: The Evolution of Technology, 10th Edition (How It Works)Dec 18, 2014 by Ron White and Timothy Edward Downs.

DISCIPLINE SPECIFIC ELECTIVE (DSE) SELECT ONE PAPER
ELE-DSE 5A: Electronic Instrumentation

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning Objectives:

- To introduce students to the use of various electronic instruments, their construction, applications, principles of operation, standards and units of measurements.
- To study basics of A.C bridges and understand various types of power supply circuits.

Unit- I Measurements:

Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference. Basic Measuring Instruments, DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter; Block diagram, principle of measurement of I, V, C. Accuracy and resolution of measurement. **(15 hrs)**

Unit-II Bridges

Measurement of Impedance (Wheatstone and Kelvin Bridge)- A.C. bridges, Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De Sauty's bridge), Measurement of frequency (Wien's bridge) **(15 hrs)**

Unit-III Power supply:

Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) and uninterrupted power supply (UPS). **(15 hrs)**

Unit-IV Oscilloscope and Signal Generators

Block Diagram, CRT, Vertical Deflection, Horizontal Deflection. Screens for CRT, Oscilloscope probes, measurement of voltage, frequency and phase by Oscilloscope. Digital Storage Oscilloscopes. LCD display for instruments. Signal Generators: Function generator, Pulse Generator. **(15 hrs)**

Reference Books:

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. E.O. Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
3. David A. Bell, Electronic Devices and Circuits, Oxford University Press (2015).
4. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann-2008).
5. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mc graw Hill (1998).
6. Introduction to measurements and instrumentation, 4th Edn., Ghosh, PHI Learning

ELE-DSE-5A LAB: ELECTRONIC INSTRUMENTATION LAB

At Least 10 Experiments From The Following

1. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
2. Measurement of Capacitance by De Sauty's bridge
3. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement ofStrain using half and full bridge.)
4. To determine the Characteristics of LVDT.
5. To determine the Characteristics of Thermistors and RTD.
6. Measurement of temperature by Thermocouples.
7. Design a regulated power supply of given rating (5 V or 9V).
8. To design and study the Sample and Hold Circuit.
9. To plot the frequency response of a microphone.
10. To determine the Characteristics of strain gauge and RTD.

Reference Books:

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. David A. Bell, Electronic Instrumentation & Measurements, Prentice Hall (2013)
3. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
4. Basic Electronics:A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1990, Mc-Graw Hill

ELE-DSE-5B DIGITAL SIGNAL PROCESSING

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning Objectives:

- To have the knowledge of various types of signals.
- To understand the fundamental properties of LTI systems.
- To analyze various circuits using transforms.
- To study about discrete time systems and to learn about FFT algorithms.

Unit – I Introduction

Classification of Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties. Impulse Response, Commutative; Associative; Distributive; Shift; Sum Property System Response to Periodic Inputs, Relationship Between LTI System Properties and the Impulse Response; Causality; Stability; Unit Step Response. **(15 hrs)**

Unit-II Z Transform:

The *Z*-Transform: Bilateral (Two-Sided) *Z*-Transform, Inverse *Z*-Transform, Relationship Between Z-Transform and Discrete-Time Fourier Transform, Z-plane, Region of Convergence; Properties of ROC, Properties; Time Reversal; Differentiation in the *Z*-Domain. **(15 hrs)**

Unit- III Discrete Fourier Transform:

The Discrete Fourier Transform (DFT) and its Inverse, DFT as a Linear transformation, Properties; Periodicity; Linearity; Circular Time Shifting; Circular Frequency Shifting; Circular Time Reversal; Multiplication Property; Parseval's Relation, Linear Convolution Using the DFT (Linear Convolution Using Circular Convolution), Circular Convolution as Linear Convolution with aliasing. **(15 hrs)**

Unit- IV Fast Fourier Transform:

Direct Computation of the DFT, Symmetry and Periodicity Properties of the Twiddle factor (*WN*), Radix-2FFT Algorithms; Decimation-In-Time (DIT) FFT Algorithm; Decimation-In-Frequency (DIF) FFT Algorithm, Inverse DFT Using FFT Algorithms. DFT as linear transformation tool **(15 hrs)**

Reference Books:

1. Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India
2. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
3. Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edn. Oxford University Press.
4. Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L.Harris, 2005, Cengage Learning.

ELE-DSE-5B LAB: DIGITAL SIGNAL PROCESSING

At Least 10 Experiments From The Following

1. Writes program to generate and plot the following sequences! (a) Unit Sample **sequence** δ[n], [b]unit step sequence u(n), (c) ramp sequence *r(n)* {d} real valued exponential sequence xn = 0.8 lu(n) for 0≤ n ≤ 50.
2. Write a program to compute the convolution sum of a rectangle signal (or gate function) with itself for N = 5

$$= (n) = rect(n/2N) = \prod(n/2N) = \begin{cases} 1 - N \le n \le N \\ 0 \quad Otherwise \end{cases}$$

2. An LTI system is specified by the difference equation

1.

$$y(n) = 0.8y(n-1) + xn$$

(a) Determine H (e^{jw})

3. Given a casual system

$$y(n) = 0.9y\,(n-1) + x\,(n)$$

Find H(z) and sketch its pole-zero plot

4. Plot the frequency response of $\left|H\left(e^{jw}\right) and\ \le H(e^{jw})\right|$
5. Design a digital filter to eliminate the lower frequency sinusoid of x(t) sin 7t + sin 200t. The sampling frequency is $fs = 500\ HZ$Plot its pole zero diagram magnitude response, input and output of the filter.

1. Let x(n) be a 4-point sequence:

$$xn = \underset{\uparrow}{\{1,1,1,1\}} = \begin{cases} 1 & 0 \le n \le 3 \\ 0 & otherwise \end{cases}$$

Compute the DTTT *X (e^{jw})* and plot its magnitude

(a) Compute and plot the 4 point DFT of x (n)

(b) Compute and plot the 8 point DFT of x (n) (by appending *4* zeros)

(c) Compute and plot the 16 point DFT of *x* (n) (by appending 12 *zeros)*

Reference Books:

1. Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India
2. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
3. Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edn. Oxford University Press.
4. Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L.Harris, 2005, Cengage Learning.

ELE-DSE-5C: ANTENNA THEORY AND WIRELESS NETWORKS

(Credits: Theory-04, Lab-2)
Theory: 60 Hours, Lab: 60 Hours

Learning Objectives:

- To acquire knowledge of radiation phenomenon and pattern of various antennas.
- To gain insight of EMFT.
- To acquaint students with knowledge of radio wave propagation.

Unit- I Introduction:
Antenna as an element of wireless communication system, Antenna radiation mechanism, Types Antennas, Fundamentals of EMFT: Maxwell's equations and their applications to antennas. Antenna Parameters: Radiation pattern (polarization patterns, Field and Phase patterns), Field regions around antenna, Radiation intensity, Beam width, Gain, Directivity, Polarization, Bandwidth, Efficiency and Antenna temperature. **(15 hrs)**

Unit- II Antenna as a Transmitter/Receiver:
Effective Height and Aperture, Power delivered to antenna, Input impedance. Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Reactive, Induction and Radiation fields, Power density and radiation resistance for small current element and half wave dipole antenna. **(15 hrs)**

Unit- III Radiating wire Structures (Qualitative idea only):
Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna. Basics of Patch Antenna and its design. Examples of Patch antenna like bowtie, sectoral, fractal, Horn Antenna etc. **(15 hrs)**

Unit- IV Propagation of Radio Waves:
Different modes of propagation: Ground waves, Space waves, Space Wave propagation over flat and curved earth, Optical and Radio Horizons, Surface Waves and Troposphere waves, Ionosphere, Wave propagation in the Ionosphere. Critical Frequency, Maximum usable frequency (MUF), Skips distance. Virtual height, Radio noise of terrestrial and extraterrestrial origin. Elementary idea of propagation of waves used in Terrestrial mobile communications. History of wireless communication**. (15 hrs)**.

Reference Books

1. Ballanis, Antenna Theory, John Wiley & Sons, (2003) 2nd Ed.
2. Jordan and Balmain, E. C., Electro Magnetic Waves and Radiating Systems, PHI
3. Andrea Goldsmith, Wirelerss communications, (2015) Cambridge University Press
4. D. Tse and P. Viswanathan, Fundamentals of Wireless Communication, (2014)

ELE-DSE-5C LAB: ANTENNA THEORY AND WIRELESS NETWORKS LAB

At Least 10 Experiments From The Following

1. Study Of Microwave Components
2. Mode Characteristics Of Reflex Klystron
3. Impedance Measurement
4. Directional Pattern Of Horn Antenna
5. Characteristics Of Directional Coupler
6. Study Of E Plane, H Plane And Magic Tee
7. Fiber Optic Communication Links
8. Numerical Aperture & Attenuation Measurement In Fibres
9. Charecteristics Of Laser Diode
10. Led & Photo Diode Characteristics
11. Study Of Propagation Loss & Bending Loss

Reference Books:

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. David A. Bell, Electronic Instrumentation & Measurements, Prentice Hall (2013)
3. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
4. Basic Electronics:A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1990, Mc-Graw Hill

ELE-DSE-5D: PROGRAMMABLE LOGIC DEVICES AND ASICS

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning Objectives:

- To understand the analysis and design of various combinational and sequential circuits.
- To acquaint students with the detailed knowledge of FSM and FSMDs.
- To learn about the architecture of different types of programmable logic devices .
- To study the design flow of different types of ASICs.

Unit-I: Digital logic design flow

Review of combinational circuits, Combinational building blocks: multiplexers, demultiplexers, decoders, encoders and adder circuits, Review of sequential circuit elements: flip-flop, latch and register. **(15 hrs)**

Unit-II: Finite State Machines

Mealy and Moore, Other sequential circuits: shift registers and counters, FSMD (Finite State Machine with Datapath), design and analysis, Microprogrammed control, Memory basics and timing, Programmable Logic devices. **(15 hrs)**

Unit-III: Programmable logic devices

PAL, PLA and GAL, CPLD and FPG Architectures, Placement and routing, Logic cell structure, Programmable interconnects, Logic blocks and I/O Ports, Clock distribution in FPGA, Timing issues in FPGA design, Boundary scan. **(15 hrs)**

Unit-IV: Application Specific Integrated Circuits

Introduction to ASICs, Advantages of ASICs, Disadvantages of ASICs, Types of ASICs, ASIC Design Flow. **(15 hrs)**

Reference Books:

1. Geoff Bostock, Programmable Logic Handbook, Butterworth-Heinemann Ltd.
2. John W. Carter, Digital Designing with Programmable Logic Devices, Prentice Hall.
3. Ming-BoLin. Digital System Designs and Practices: Using Verilog HDL and FPGAs, Wiley India Pvt Ltd.
4. Wayne Wolf, FPGA Based System Design. Pearson Education.
5. Michael John S. Smith, Application Specific Integrated Circuits, Pearson.

ELE-DSE-5D LAB: PROGRAMMABLE LOGIC DEVICES AND ASICS LAB

At Least 10 Experiments From The Following Topics

1. Study all the basic gates
2. Study all the basic combinational functions using only MUX
3. Study different types of Flip Flops and ICs
4. Study full adder and subtractor circuit
5. Study the different types of ASICs
6. Study the different types of FPGAs
7. Study the Different types of CPLDs
8. Study FPGA and CPLD boards.

Reference Books:

1. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall (2005).
2. David A. Bell, Electronic Instrumentation & Measurements, Prentice Hall (2013)
3. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).
4. Basic Electronics: A text lab manual, P.B .Zbar, A.P. Malvino, M.A.Miller, 1990, Mc-Graw Hill

Semester- V

ELE-SEC 5A: EDA & Simulation Tools

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning Objectives:

- To familiarize the students with MATLAB software.
- Design and simulation of basic electronic circuits using MULTISIM.

Unit-I Introduction to MATLAB

Introduction to MATLAB, different windows in MATLAB, Command Prompt, Mfile,Simple Expressions, Referencing Matrix elements, Assigning into Submatrices, MATRIX Concatenation. Plotting , Flow Control Statements, Multi input functions, Mathematical models. **(15 hrs)**

Unit -II MULTISIM

Introduction to the MULTISIM , DC sweep, Transient, MultiSim Environment. Schematic Capture of an Example Circuit. Simulation and Results Display. Alternative Forms of Circuit Simulation in MultiSim. Simulated Instruments Using the Breadboard Tool, design and simulate basic electronic circuits and devices such as Diode circuits, clippers, clampers, voltage regulators. BJT and MOSFET characteristics, OP-Amp Circuits. **(15 hrs)**

Unit –III Labwork

Design of Low pass, High pass Filter, Half–Wave and Full-Wave Rectifier. To study Frequency Response of CE Amplifier, CS Amplifier and CC Amplifier, Design of Wein-Bridge Oscillator Class-A Power Amplifier, Pre-emphasis and De-emphasis circuits. Design of various basic electronic circuits like clippers, clampers, voltage regulators and various combninational and sequential digital logic circuits.**(60 hrs)**

Reference Books:

1. Advanced Circuit Simulation Using Multisim Workbench by David Lopez.
2. MATLAB and SIMULINK for Engineers (Oxford Higher Education) by Agam Kumar Tyagi

ELE-SEC 5B: REPAIR AND MAINTENANCE OF MOBILE PHONES

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning Objectives:

- To enable students to acquire knowledge of various multiple access techniques
- To understand spread spectrum modulation techniques.
- To acquaint students with various tools required for repairing and maintenance of mobile handsets.
- To develop skills for troubleshooting of mobile devices.

Unit I: Introduction & Tools required for maintenance of mobile phones

Introduction to mobile phones, Generations of mobile phones, FHSS networks, GSM, Spread spectrum, CDMA, TDMA & Basic electronics components. Handset Specific operating systems, Handset features & applications, working principle of mobile handset & Components used in mobile handsets. Tools & equipment used for repairing & maintenance of mobile handsets, types of power supply & batteries, boosting a battery. **(15 hrs)**

Unit II: Troubleshooting

Troubleshooting basics, Network problems, Power failure (dead)**,** Mobile phone hardware troubleshooting (water damage, hanging, charging & keypad problems), Handsets assembly & disassembly, Soldering & Desoldering & SMD rework station, BGA IC's, Basics of Computer, Installation of software, Flashing, PC based diagnostic tools, mobile sets formatting, use of secret codes.**(15 hrs)**

Unit III: Lab work

GSM & CDMA Structure & Generation of Mobile Phone Frequency & Channels GPRS, Bluetooth, Infrared Wi-Fi, SIM, & IMEI Mobile Phone Assembly & Disassembly Electronic Components Overview Chip Level Soldering & De-soldering GSM Mobile Phone Troubleshooting Chinese Mobile phone Troubleshooting CDMA Mobile phone Troubleshooting Practically handset repairing. **(60 hrs)**

Reference Books:

1. Advance Mobile Repairing by Pandit Sanjib
2. Modern Mobile Phone Repairing by Manohar Lotia

ELE-DSE-6A: PHOTONIC DEVICES AND POWER ELECTRONICS

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning objectives:-

- To acquaint students with the detailed knowledge of photonic devices and power electronics.
- To provide students with deep insight knowledge of the working of photodetectors and switching devices with respect to their characteristics.
- To study various applications of switching devices.

UNIT-I: Photonic Devices

Classification of photonic devices. Interaction of radiation and matter, Radiative 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 and photon confinement, line shape function. Threshold current. Laser diode. **(15 hrs)**

Unit-II: Photo Detectors

Photodetectors: 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 hrs)**

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 hrs)**

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 Inverter, limitations and its improved versions, bridge inverters.**(15 hrs)**

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.

ELE-DSE-6A LAB: PHOTONIC DEVICES AND POWER ELECTRONICS LAB

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 R and RL loads.
10. AC voltage controller using TRIAC with UJT triggering.
11. Study of I-V characteristics of DIAC
12. Study of I-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 & K.B. 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.

ELE-DSE-6B: VERILOG & FPGA BASED SYSTEM DESIGN

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning objectives:-

- To review basics of various combinational and sequential circuits.
- To acquaint students with the detailed knowledge of FSM's and FSMD's.
- To familiarize students with the PAL and PLA.
- To familiarize students with verilog HDL and modeling of various combinational and sequential circuits using verilog.

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 hrs**)

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. Microprogrammed control. Memory basics and timing. Programmable Logic devices. (**15 hrs**)

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/O Ports. Clock distribution in FPGA. Timing issues in FPGA design. Boundary scan. (**15 hrs**)

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 hrs**)

Reference Books

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 Navabi. Verilog Digital System Design. TMH; 2ndedition. ISBN-13: 978-0070252219
7. Wayne Wolf. FPGA Based System Design. Pearson Education.

ELE-DSE-6B LAB: VERILOG AND FPGA LAB

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 Subtractor using basic and derived gates.
4. Design and simulation of a 4 bit Adder.
5. Multiplexer (4x1) and Demultiplexer 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 HDL– A Guide to Digital Design & Synthesis, Pearson, 2003
4. Verilog HDL primer- J. Bhasker. BSP, 2003 II edition

ELE-DSE-6C: SEMICONDUCTOR DEVICES FABRICATION

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning objectives:-

- To study techniques and processes involved in thin film growth.
- To review basics of semiconductor theory and various techniques of crystal growth.
- To review basics of MOS capacitor and various microwave devices.
- To grasp basic knowledge about Fabrication technology and steps involved in the fabrication of an IC using BJT , JFET, MOSFET and CMOS technology.

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 hrs)**

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 hrs)**

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. **(15 hrs)**

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). **(15 hrs)**

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 GaAs), S.K. Gandhi, John Wiley & Sons, Inc.

ELE-DSE6C LAB: SEMICONDUCTOR DEVICES FABRICATION

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.

ELE-DSE6D: EMBEDDED SYSTEM DESIGN

(Credits: Theory-04, Lab-02)
Theory: 60 Hours, Lab: 60 Hours

Learning objectives:-

- To acquire basic knowledge about embedded systems and its applications .
- To understand various types of microcontrollers like ARM, ATMEL and PIC.
- To familiarize students with 8051 and its I/O port programming.
- To know the importance of different peripheral devices and their interfacing with microcontrollers.

Unit I: Introduction

Embedded systems and processors: Introduction to embedded systems, components 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/O, Embedded high and low-level programming. Microcontrollers: Microcontrollers for embedded systems, classes of microcontrollers, types of microcontrollers, introduction to microcontroller platforms: ARM, ATMEL/AVR, PIC, ARDUINO, Raspberry and 8051, Choosing a Microcontroller for an embedded application. **(15 hrs)**

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/O port programming: I/O programming, bit manipulation. **(15 hrs)**

Unit III: 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. **(15 hrs)**

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. **(15 hrs)**

Reference Books:

1. Embedded Systems: Design and Applications 1e, 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 J. Ayala
4. Design with PIC Microcontroller, John Petman

ELE-DSE6D LAB: EMBEDDED SYSTEM DESIGN LAB

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

Reference Books:

1. Embedded Systems: Design and Applications 1e, 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 J. Ayala
4. Design with PIC Microcontroller, John Petman

ELE-SEC6A- DIGITAL LOGIC DESIGN USING VHDL

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning objectives

- To acquire knowledge about various hardware description languages and VHDL.
- To gain knowledge about concurrent and sequential codes , their advantages and various concurrent and sequential statements.
- To study basic concepts of finite state machines.
- To familiarize students with quartus Altera/Xinilix for implementation of various combinational and sequential circuits.

Unit I: Hardware Description Languages and VHDL

Hardware Description Languages: Introduction to VHDL, Design flow, Code structure: Library declarations, Entity and Architecture, Introduction to behavioural, dataflow and structural modeling. Data types: BIT, Standard logic, Boolean, Integer, real, Signed and Unsigned Data types, Arrays, Bit vector and Standard logic vectors, Operators and attributes: Assignment, Logical, Arithmetic, Relational and concatenation operators. **(15 hrs)**

Unit II: Concurrent, Sequential Codes and State Machines

Concurrency, Concurrent verses Sequential codes, advantages of concurrent codes, concurrent and sequential statements: WHEN (simple and selected), GENERATE, PROCESS, IF, ELSIF, WAIT, CASE, LOOP, Signal versus Variable, Bad Clocking, Brief concepts of Finite State Machines. **(15 hrs)**

Unit III: Lab Work

Familiarity with Quartus Altera/ Xilinx ISE Suite. Combinational systems Implementation: Adder, Subtractor MUX, DEMUX, Encoder, Decoder, up counter, down counter, code converters and Comparator, Boolean functions using Multiplexer. Shannon's expansion theorem etc. Sequential system Implementation: Flip Flop, Shift registers, LFSR. **(60 hrs)**

Reference Books:

1. Pedroni V. A., Circuit Design with VHDL, PHI, 2008.
2. J.Bhasker, VHDL Primer, Pearson Education, India.
3. Wakerly J. F., Digital Design – Principles and Practices, Pearson Education, 2008.
4. Brown S. and Vranesic Z., Fundamentals of Digital Logic with VHDL Design, TMH2008

ELE-SEC6B- INTRODUCTION TO NANO-MATERIALS

(Credits: Theory-02, Lab-02)
Theory: 30 Hours, Lab: 60 Hours

Learning objectives:-

- To acquire basic knowledge about nanomaterials and their properties.
- To study various methods and strategies for synthesis of nanomaterials.
- To familiarize students with ABINIT program and nanomaterials simulation toolkit for study of various atomic systems and nanotube structures.

Unit I: Introduction & Synthesis of Nanomaterials

Introduction, what are nanomaterials, where are nanomaterials found. Advances in Nanomaterial's. Classification of nanomaterials. One-dimensional, Two-dimensional and Three-dimensional nanomaterials with examples from each class. Synthesis of some nanomaterials. Discuss various methods for synthesis of nanomaterials. Preparation of some nanomaterials by solution. Nanomaterial Synthesis Strategies. Top Down and Bottom up approaches for nanomaterial synthesis **(15 hrs)**

Unit III: Properties

Casting method. General properties of nanomaterials, with special reference to optical, electrical and Mechanical properties. Photolithography, Chemical Etching, Laser Ablation, Ball milling, Solvothermal/Hydrothermal, Sol-gel route, chemical vapour deposition. **(15 hrs)**

Unit III: Labwork

Using ABINIT A program which calculates the total energy, electronic structure, and charge density of atomic systems (nuclei and electrons) using DFT, plane waves. Wavefunction visualization using ABINIT. Study Nanotube structures using ABINIT. Using Nano materials simulation Toolkit study molecular level deformations. Using Nano materials simulation Toolkit perform tensile test for ductile metal.Using Nano materials simulation Toolkit understand MD test run.Using Nano materials simulation Toolkit study deformations in nanowires. Using Nano materials simulation Toolkit understand stress vs time plot. **(60 hrs)**

Reference Books:

1. Charles P. Poole. Jr. & Frank J. ownes, Introduction to Nanotechnology .
2. Guozhong Cao, Nanostructures and Nanomaterials