SEMESTER V & VI

B. SC. PHYSICAL SCIENCES

(ELECTRONICS)

Semester V
CEL 503 (i)
Discipline Specific Course I (Electronics)
Electronic Instrumentation - I
(Credits: 02; 30 Hrs (2Hrs /week))
Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Measurements:
Accuracy and precision. Significant figures. Error and uncertainty analysis. Shielding and grounding. Electromagnetic Interference.

Basic Measurement 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.

UNIT-II **(7 Hours)**

Basic Measurement Instruments:
Measurement of Impedance (A.C. bridges), Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De Sauty's bridge), Measurement of frequency (Wien's bridge).

UNIT-III **(7 Hours)**

Oscilloscope:
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, (Qualitative only).

UNIT-IV **(8 Hours)**

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).

Reference Books:

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

CEL 503 (ii)
Discipline Specific Course I (Electronics)
Signal and System
(Credits: 02; 30 Hrs (2Hrs /week))
Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Introduction to Signal

Classification of Signals, Basic operations**:** Time Shifting, Time Reversal, Time Scaling, Signal representation in terms of singular functions, Correlation of Signals and its Properties, Representation of a Continuous-Time Signal by its Samples: The Sampling Theorem, Reconstruction , Aliasing.

UNIT-II **(7 Hours)**

System & its Properties

classification of Systems: Linear & Nonlinear ; Static & Dynamic , Causal & Non-causal , Stable & Unstable System, Time variant & Time Invariant Systems with examples,
Linear Time-Invariant Systems: Definition and Properties, Impulse Response, Representation of LTI systems using Differential and Difference equations.

UNIT-III **(7 Hours)**

Fourier Series:

Introduction to Frequency domain Representation, Fourier Series Representation of Periodic Signals, Convergence of Fourier Series, Properties of Fourier Series

UNIT-IV **(8 Hours)**

Fourier Transform:

Need for Fourier Transform, Fourier Transform for periodic and Aperiodic signals, Convergence of Fourier Transform, Properties of Fourier Transform, Applications of Fourier Transform.

Reference Books:

- Signals and systems, A. V. Oppenheim, A. S. Willsky, PHI
- Signals and systems, Tarun K. Rawat, Oxford University Press.
- Signals & Systems, Farooq Husain, Umesh Publications.
- Digital Signal Processing, S. Salivahanan, A. Vallavraj, Tata McGraw Hill.
- Principles of Signal Processing and Linear Systems, B.P. Lathi, Oxford University Press.
- Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.
- Digital Signal Processing Principles Algorithm & Applications, J.G. Proakis and D.G. Manolakis, 2007, 4th Edition, Prentice Hall.
- K.A. Navas and R Jayadevan, Lab Primer Through MATLAB, PHI

CEL 503 (iii)

Discipline Specific Course I (Electronics)

Semiconductor Devices Fabrication

(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80

Marks for Internal Exam: 20

Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I (7 Hours)

Introduction of Semiconductor Process Technology: Semiconductor materials, Crystal growth techniques- Czochralski technique, Float Zone Process, Wafer preparation, Clean room.

Oxidation: Thermal oxidation process- Kinetics of growth for thick and thin oxide, Dry and Wet oxidation. Effects of high pressure and impurities, Impurity redistribution during oxidation, Masking property of silicon oxide, Chemical vapour deposition of silicon oxide, Properties of silicon oxide, Step coverage, P-glass flow.

UNIT-II (7 Hours)

Etching: Wet chemical etching- Basic process and few examples of etchants for semiconductors, insulators and conductors, Dry etching using plasma etching technique.

Epitaxy Deposition: Epitaxial growth by vapor phase epitaxy (VPE) and molecular beam epitaxy (MBE). **Diffusion:** Basic diffusion process- Diffusion equation, Diffusion profiles, Extrinsic diffusion concentration dependent diffusivity, Lateral diffusion, Doping through Ion implantation and its comparison with diffusion.

UNIT-III (8 Hours)

Lithographic Processes: Optical lithography, Exposure tools, Masks, Photoresist, Pattern Transfer, Resolution Enhancement Techniques- Electron beam lithography, X-ray lithography and Ion beam lithography, Comparison between various lithographic techniques.

Metallization: Uses of Physical Vapor Deposition and Chemical Vapor Deposition technique for Aluminum and Copper metallization.

UNIT-IV (7 Hours)

Process Integration: Passive components- Integrated circuit resistor, Integrated circuit inductor, Integrated circuit capacitor, MOSFET technology-Basic fabrication process of NMOS, PMOS and CMOS technology.

Characterization: introduction to Various characterization methods for structural, electrical and optical properties, Basic idea of X-ray diffractometer (XRD), Scanning electron microscope, (SEM) Transmission electron microscope(TEM) and UV-VIS-NIR spectrophotometer (Atomic force microscopy).

Reference Books:

- Physics of Semiconductor Devices, S. M. Sze. Wiley-Interscience.
- VLSI Fabrication Principles (Si and GaAs), S.K. Gandhi, John Wiley & Sons, Inc.
- Basic VLSI Design, D A Pucknell, PHI.
- Silicon VLSI Technology, James Plummer, Pearson
- Handbook of Thin Film Technology, Leon I. Maissel and Reinhard Glang.
- Fundamentals of Semiconductor Fabrication, S.M. Device and G. S. May, John-Wiley
- The science and Engineering of Microelectronics Fabrication, Stephen A. Champbell, 2010, Oxford University Press.
- Introduction to Semiconductor materials and Devices, M. S. Tyagi, John Wiley & Sons

CEL 504 (i)
Discipline Specific Course II (Electronics)
Electronic Instrumentation - II
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Lock-in-amplifier:
Basic Principles of phase locked loop (PLL), Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor), lock and capture. Basic idea of PLL IC (565 or 4046). Lock-in-amplifier, Idea of techniques for sum and averaging of signals.

UNIT-II **(7 Hours)**

Virtual Instrumentation:
Introduction, Interfacing techniques (RS 232, GPIB, USB), Idea about Arduino microcontroller and interfacing software like LABVIEW.

UNIT-III **(8 Hours)**

Transducers:
Classification of transducers, Basic requirement/characteristics of transducers, Active and Passive transducers, Resistive (Potentiometer- Theory, temperature compensation & applications) and Capacitive (variable air gap type) transducers

UNIT-IV **(7 Hours)**

Transducers:
Inductive (LVDT) & piezoelectric transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells).

Reference Books:

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

CEL 504 (ii)
Discipline Specific Course II (Electronics)
Programming with Scilab/Matlab
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Basics:
environment, Basic computer programming, Variables and constants, operators and simple calculations, Formulas and functions, toolboxes.

Matrices and Vectors:
Matrix and linear algebra review, Vectors and matrices,Matrix operations and functions

UNIT-II **(7 Hours)**

Programming:
script file and function file (m-files), If-else statement, For loop, while loop, 2d Plotting, 3d plotting

UNIT-III **(7 Hours)**

Statistics programming
Mean and median of a vector, standard deviation and variance of a vector, largest element of a vector, percentiles

UNIT-IV **(8 Hours)**

image processing: Basic idea of digital images, Basic image processing, image arithmetic, adding noise to images, filtering
Numerical Analysis : Numerical integration, differentiation, ordinary differential equation

Reference Books:

- Hema Ramachandran, Achuthsankar S. Nair, SciLab : A free software to Matlab, S Chand
- Tejas Seth, SciLab : A practical introduction to programming and problem solving
- Rachna Verma, Arvind Verma, Introduction to Scilab
- Rudra Pratap, Getting started with MATLAB, Oxford
- Amos Gilat, MATLAB: An Introduction with applications, Wiley
- Raj Kumar Bansal, Ashok Kumar Goyal, MATLAB and its application in engineering, Pearson

CEL 504 (iii)
Discipline Specific Course II (Electronics);
Antenna Theory
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(7 Hours)**

Introduction:
Antenna as an element of wireless communication system, Antenna radiation mechanism, Types of Antennas, Fundamentals of EMFT: Maxwell's equations and their applications to antennas.

UNIT-II **(8 Hours)**

Antenna Parameters:
Antenna parameters: Radiation pattern (polarization patterns, Field and Phase patterns), Field regions around antenna, Radiation intensity, Beamwidth, Gain, Directivity, Polarization, Bandwidth, Efficiency and Antenna temperature.

UNIT-III **(8 Hours)**

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.

UNIT-IV **(7 Hours)**

Radiating wire Structures :
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, etc.

Reference Books:

- Constantine A. Ballanis, Antenna Theory, John Wiley & Sons
- John Kraus, Ronald Marhefka, Antenna and Wave Propagation, McGraw Hill
- Warren Stutzman and Gary Thiele, Antenna Theory and Design, Wiley
- R.L.Yadava Antenna and Wave Propagation, PHI Learning.
- Edward Jordan and Keith Balmain, Electromagnetic Waves and Radiating Systems, Pearson

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Semester V

CEL 505 (i)
Skill Enhancement Course II(Electronics)
Design and Fabrication of Printed Circuit Boards
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 50
Marks for Internal Exam: 50
Time: 2 Hours

Paper setter is required to set 5 questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each unit. The student is required to attempt three questions in all selecting one question from each unit and Question no. 1 is Compulsory.

UNIT-I **(15 Hours)**

PCB Fundamentals:

PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD), Data sheets, Classification of PCB-single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards.

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

UNIT-II **(15 Hours)**

Technology OF PCB:
Design automation, Design Rule Checking, Exporting Drill and Gerber Files, Drills, Footprints and Libraries, Adding and Editing Pins, copper clad laminates, materials of copper clad laminates, properties of laminates (electrical and physical), types of laminates, Film master preparation, Image transfer, photo printing, Screen Printing.
Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls.

Reference Books:

- R.S Khandpur, Printed Circuit Board: Design, Fabrication, Assembly and Testing, Tata McGraw Hill.
- Walter Bosshart, Printed Circuit Boards: Design and Technology, Tata McGraw Hill.

CEL 505 (ii)
Skill Enhancement Course II(Electronics)
Robotics
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 50
Marks for Internal Exam: 50
Time: 2 Hours

Paper setter is required to set 5 questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of ten short answer type questions each of 2 marks. The remaining four questions is to be set uniformly having two questions from each unit. The student is required to attempt three questions in all selecting one question from each unit and Question no. 1 is Compulsory.

UNIT-I **(15 Hours)**

Robot defining Criteria , basic components of a robot - sensor, actuator, controller, end effector Arduino control Board for robots, installing arduino software on windows, interfacing arduino with computer, installing arduino IDE on android devices.

Sensors:

Analog and digital sensors, active and passive sensors, attributes of sensors, sensor calibration Ultrasonic sensor (modes, accuracy, limitations, calibration), light sensor, Position encoders, Gyroscope and Accelerometer, Temperature and humidity sensor (DHT 11)

UNIT-II **(15 Hours)**

Actuators:

Motor characteristics (voltage, current, speed, torque, resistance), DC Motors, speed and torque, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations.

Interfacing and other operations of robotics:

programming Arduino for DC motor control, programming Arduino for servo motor, sensor interfacing to arduino.

Reference Books:

- Cameron Hughes, Tracy Hughes, Robot Programming : A guide to controlling autonomous robots, Pearson
- Vinesh Kumar, Make your first robot, Notion press.
- K S Fu, R C Gonzalez, Robotics : control, sensing, vision and intelligence, McGraw Hill
- Ashitava Ghosal, Robotics : fundamental concepts and analysis, Oxford
- Richard Blum, Arduino Programming, Pearson

CEP 509 (i)
Practical -V (Electronics)
Electronic Instrumentation Lab
(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100
Time: 4 Hours

At least 8 experiments are to be performed including at least 6 experiments from following:

1. To analyze analog and digital multi meter for various measurements.
2. To study the front panel controls of storage CRO.
3. To measure resistance by Wheatstone bridge and measurement of bridge sensitivity.
4. To measure Capacitance by De Sauty's bridge
5. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
6. To determine the Characteristics of LVDT.
7. To determine the Characteristics of Thermistors and RTD.
8. To measure temperature using Thermocouples.
9. To design regulated power supply of given rating (5 V or 9V).
10. To design and study the Sample and Hold Circuit.
11. To plot the frequency response of a microphone.
12. To measure pressure using Piezo-Electric Pick up.
13. To measure distance using LDR.
14. To study Arduino microcontroller.
15. To study RS 232 interface.

CEP 509 (ii)
Practical -V (Electronics)
Signal and System Lab
(Credits: 02; 60 Hrs (4Hrs /week)

Marks:100
Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following using numerical computation software SciLab/MatLab

1. To generate continuous and discrete unit step signal.
2. To generate ramp and exponential signal in continuous and discrete domain.
3. To perform addition and subtraction of two signal in continuous and discrete domain.
4. To find and plot even and odd components of a signal.
5. To perform time shifting and time scaling operation on signals.
6. To perform folding and multiplication operation on signals.
7. To generate a random binary signal.
8. To determine and analyze energy of a continuous and discrete signal.
9. To determine and analyze power spectrum of a signal.
10. To determine autocorrelation and cross correlation of discrete data sequences.
11. To obtain and plot convolution of a discrete signal.
12. To obtain pole-zero plot of a given transfer function.
13. To determine and plot Fourier series representation of a given function.
14. To determine and plot Fourier transform of a discrete signal.
15. To write a program for time invariant system.
16. To write a program for linear system.

CEP 509 (iii)
Practical -V (Electronics)
Electronics Skill Lab
(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100
Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following:

1. To familiarize about electronic components and their values
2. To study data sheets of diode and transistor.
3. Introduction of circuit schematic and layout tool.
4. To design schematic and layout of full wave rectifier.
5. To design schematic and layout of regulated DC power supply.
6. To design schematic and layout of clipper circuit.
7. Introduction of Design rule check (DRC) and Netlist.
8. Introduction of PCB types and standards.
9. Introduction of image transfer techniques.
10. Introduction of etching techniques.
11. Introduction of Soldering tools, materials and process.
12. To build and test full wave rectifier circuit on PCB.
13. To build and test power supply circuit on PCB.
14. To build and test clipper circuit on PCB.

Semester VI
CEL 603 (i)
Discipline Specific Course III (Electronics)
Digital System Design
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(7 Hours)**

Introduction to digital design and VERILOG:
Digital logic design flow, Benefits of CAD, Introduction to HDLs, Verilog and its capabilities, Design Methodologies, Modules, Instances, Components of Simulation and Test Bench.Basic Concepts: Data Types, System Tasks and Compiler Directives. Modules and Ports.

UNIT-II **(7 Hours)**

Combinational circuit design using Verilog:
multiplexers, demultiplexers, decoders, encoders and adder circuits.

UNIT-III **(8 Hours)**

Sequential circuit design using Verilog:
flip-flop, latch and register. Finite state machines: Mealy and Moore. shift registers and counters.

UNIT-IV **(8 Hours)**

Programmable logic devices:
Evolution of Programmable logic devices. PAL, PLA, 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

Reference Books:

- Samir Palnitkar, Verilog HDL, Pearson Education; Second edition (2003).
- Zainalabedin Navabi, Verilog Digital System Design. TMH; 2nd edition.
- J. Bhaskar, A Verilog HDl Primer, Pearson
- D.J. Laja and S. Sapatnekar, Designing Digital Computer Systems with Verilog, Cambridge University Press, 2015.
- VLSI design, Debaprasad Das, 2nd Edition, 2015, Oxford University Press.
- Lizy Kurien and Charles Roth, Principles of Digital Systems Design and VHDL. Cengage Publishing.
- Ming-Bo Lin, Digital System Designs and Practices: Using Verilog HDL and FPGAs. Wiley India Pvt Ltd.
- Wayne Wolf, FPGA Based System Design. Pearson Education.

CEL 603 (ii)
Discipline Specific Course III (Electronics);
Digital Signal Processing
(Credits: 02; 30 Hrs (2Hrs /week))
Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Discrete-Time Fourier Transform:
Fourier Transform representation for Discrete –Time Aperiodic & Periodic Signals, Properties of Discrete –Time Fourier Transform, Basic Fourier Transform Pairs.

UNIT-II **(7 Hours)**

Z-Transform
Introduction to Z-Transform, Region of Convergence (ROC) for Z-Transform, Z-Transform Properties, Inverse Z-Transform, Analysis of LTI Systems Using Z-Transform, Application of z transform,

UNIT-III **(7 Hours)**

Discrete Fourier Transform:
Frequency Domain Sampling (Sampling of DTFT), The Discrete Fourier Transform (DFT) and its Inverse, DFT Properties: Periodicity, Linearity, Circular Time Shifting, Circular Frequency Shifting; Linear Convolution Using the DFT
Filter Concepts:
Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Advantages and Disadvantages of Digital Filters, Simple FIR Digital Filters, Simple IIR Digital Filters

UNIT-IV **(8 Hours)**

Finite Impulse Response Digital Filter:
Desirability of Linear-Phase Filters, Frequency Response of Linear-Phase FIR Filters Rectangular Windowing Method
Infinite Impulse Response Digital Filter:
Design of IIR Filters from Analog Filters, IIR Filter Design by Impulse Invariance Method.
Reference Books:

- Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India.
- Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
- Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edition, Oxford University Press.
- Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
- Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.

CEL 603 (iii)
Discipline Specific Course III (Electronics);
Photonic Devices
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

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.

UNIT-II **(7 Hours)**

Photodetectors: Photoconductor. Photodiodes (p-i-n, avalanche) and Photo transistors, quantum efficiency and responsivity. Photomultiplier tube.

UNIT-III **(7 Hours)**

Solar Cell: Construction, working and characteristics
LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

UNIT-IV **(8 Hours)**

Introduction to Fiber Optics: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes - Single Mode Fibers-Graded Index fiber structure.

Reference Books:

- Gerd Keiser, Optical communications essentials, McGraw Hill.
- Djafar K. Mynbaev, Fiber-Optic communications technology, Pearson.
- John M Senior, Optical Fiber Communications, PHI.
- J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996).
- S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009).
- AK Ghatak & K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998).
- Optoelectronic Devices and Systems, Gupta, 2nd edition, PHI learning.

CEL 604 (i)
Discipline Specific Course IV (Electronics);
VLSI Design
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

CMOS Logic:
Inverter, NAND gate, combinational logic, NOR gate, compound gates, pass transistors and transmission gates, Tristates, Multiplexers, latches and flip flops. VLSI Design flow

UNIT-II **(7 Hours)**

MOS Transistor Theory:
Introduction, I-V characteristics, C-V characteristics, Non Ideal I-V effects - Velocity saturation, Channel length modulation, Body Effect, Subthreshold conduction. Noise Margin.

UNIT-III **(7 Hours)**

Circuit characterization and Performance Estimation:
Delay Estimation, RC Delay Models, Delay in multistage logic networks, choosing the best number of stages, static and dynamic power dissipation, Low power design, Interconnect, Design Margin

UNIT-IV **(8 Hours)**

Circuit Design:
Combinational Circuit Design: Static CMOS, Ratioed Circuits
Sequential Circuit Design: Sequencing static circuits, Conventional CMOS latches and flip-flops.

Reference Books:

- Neil H.E. Weste, David Harris, CMOS VLSI Design : A circuits and systems perspective, Pearson
- Jan M Rabaey, Anantha Chandrakasan & Nikolic, Introduction to Digital Integrated Circuits: A design perspective, Pearson

CEL 604 (iii)
Discipline Specific Course IV (Electronics);
Consumer Electronics
(Credits: 02; 30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Audio and Video Systems

Microphones: Construction, working principles and applications of microphones, their types viz: a) Carbon b) moving coil, c) velocity, d) crystal, e) condenser, e) cordless etc; Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid range, multi-speaker system, baffles and enclosures; Sound recording on magnetic tape, its principles, block diagram and tape transport mechanism; Digital sound recording on tape and disc CD system: Hi-Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers

UNIT-II **(7 Hours)**

Video Systems:

Different types of screens: LCD, LED, Plasma, CRT, 3d display, Digital cameras (still and video), Basic idea of principles of Black and White and colour TV and their difference, Standards Remote Control, VCD and DVD Players

UNIT-III **(7 Hours)**

Office and Home Gadgets

Basic block diagram, working of the followings: Desktop computer, Laptop, Micro SD card, Pen drive, Hard disk, Printer (inkjet and laser), Scanner, FAX machine, Photostat and Xerox machines, EPABX, Micro wave ovens, washing machine, RO, UPS/inverters, Air conditioners,Refrigerators

UNIT-IV **(8 Hours)**

Advance Gadgets:

Basic block diagram and working of the followings: Drones, Bar coding, Automated Teller Machines (ATM), Dish washer, cable TV and DTH, cable TV using internet, Electronic Ignition Systems for automobiles, Home security and CCTV, 3D Printers, LCD projector

Reference Books:

- S.P Bali, Consumer Electronics, Pearson Education
- Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press
- B.Grob, Basic Electronics,Tata Mc Graw Hill
- Thomas E. Kissell, Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls, Prentice Hall

CEP 609 (i)

Practical -VI (Electronics)

Digital System Design Lab

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following using Verilog:

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

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

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

Compute the DTFT $X(e^{jw})$ 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)

7. Let $x(n)$ and $h(n)$ be the two 4-point sequences,

$$x(n) = \underset{\uparrow}{\{1,2,2,1\}}$$

$$h(n) = \underset{\uparrow}{\{1,-1,-1,1\}}$$

Write a program to compute their linear convolution using circular convolution.

8. Using a rectangular window, design a FIR low-pass filter with a pass-band gain of unity, cut off frequency of 1000 Hz and working at a sampling frequency of 5 KHz. Take the length of the impulse response as 17.

9. Design an FIR filter to meet the following specifications:
passband edge $F_p = 2\ KHz$
stopband edge $F_s = 5\ KHz$
Passband attenuation $A_p = 2\ dB$
Stopband attenuation $A_s = 42\ dB$
Sampling frequency $F_s = 20\ KHz$

10. The frequency response of a linear phase digital differentiator is given by

$$H_d(e^{jw}) = jwe^{-j\tau w} \qquad |w| \le \pi$$

Using a Hamming window of length M = 21, design a digital FIR differentiator. Plot the amplitude response.

CEP 609 (iii)

Practical -VI (Electronics)

Advance Communication Lab

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 100

Time: 4 Hours

At least 08 experiments are to be performed including at least 06 experiments from following:

1. To study FSK modulator.
2. To study PSK modulator.
3. To study ASK modulator.
4. To study Time Division Multiplexing of two band limited signals.
5. To study Frequency Division Multiplexing of two band limited signals.
6. To study various line coding techniques
7. To study Pre-emphasis and de-emphasis
8. To study DPSK generation and detection
9. To study QPSK generation and detection
10. To measure Numerical Aperture of a given optical fiber
11. To study Analog and Digital communication link using optical fiber.
12. To study BER in optical transmitter fiber link.
13. To measure losses in a given optical fiber (propagation loss, bending loss)
14. To measure directivity and gain of Standard dipole antenna.
15. To measure directivity and gain of microstrip patch antenna
16. To measure directivity and gain of Yagi antenna