CBCS Syllabus: 4-Semester M.Sc. in Electronic Science

(Effective from 2019 Entry Batch)

Acharya Prafulla Chandra College
New Barrackpoe
(affiliated to)

West Bengal State University

Grand Total Marks: 1200 (92 Credits).

Semester	Type of course	Credit	Marks	Total
I	Analog Circuits and Systems Solid State Electronic Devices & Materials Mathematical Methods in Electronics Lab 1: Analog Circuits Lab 2: Characterization of Devices & Materials AECC :Basics of Microwave and Mobile Communication	4 4 4 4 4 2	50 50 50 50 50 50	Marks : 300 Credits : 22
II	Digital Circuits and Logic Design Network Analysis and Synthesis Microprocessor Fundamentals Qunatum and Nano-Electronics: Physics and Materials Lab 3: Digital Circuits SEC : Instrumentation and Power Electronics	4 4 4 4 4 2	50 50 50 50 50 50	Marks : 300 Credits : 22
III	Optoelectronics Electronic Communication Systems Control System DSE 1/2:Microelectronic Technology and charactersation techniques / Mobile Communication Lab 4: Electronic, Fiber Optic and Microwave Communication GEC : Mobile Communication	4 4 4 4 4 4	50 50 50 50 50 50	Marks : 300 Credits : 24
IV	Electromagnetic Field and Radiation Digital Signal Processing DSE 3/4: Quantum Computing / VLSI Design Lab 5: Microprocessor and Microcontroller Project	4 4 4 4 8	50 50 50 50 100	Marks : 300 Credits : 24

Semester I

	Paper title	Paper Code	Full Marks	credit
CORE	Analog Circuits and Systems	ELTPCOR01T	50	4
	Solid Electronic Devices and Materials	ELTPCOR02T	50	4
	Mathematical Method in Electronics	ELTPCOR03T	50	4
	Lab1: Analog Circuits	ELTPCOR04P	50	4
	Lab 2: Characterization of Devices and Materials	ELTPCOR05P	50	4
AECC	Basics of Microwave and Mobile Communication	ELTPAEC01M	50	2

Semester II

	Paper title	Paper Code	Full Marks	credit
CORE	Digital Circuits and Logic Design	ELTPCOR06T	50	4
	Network Analysis and Synthesis	ELTPCOR07T	50	4
	Microprocessor Fundamentals	ELTPCOR08T	50	4
	Qunatum and Nano-Electronics: Physics and Materials	ELTPCOR9T	50	4
	Lab 3: Digital Circuits	ELTPCOR10P	50	4
SEC	Instrumentation and Power Electronics	ELTPSEC01M	50	2

Semester III

	Paper title	Paper Code	Full Marks	credit	
CORE	Optoelectronics	ELTPCOR11T	50	4	
	Electronic Communication Systems	ELTPCOR12T	50	4	
	Control System	ELTPCOR13T	50	4	
	Lab 4: Electronic, Fiber optic and Microwave Communication	ELTPCOR14P	50	4	
DSE 1	Microelectronic Technology and charactersation techniques	ELTPDSE01T	50	4	One out of ELTDSE222 201 & ELTDSE222 202
DSE2	Mobile Communication	ELTPDSE02T	50	4	
GEC	Mobile Communication	ELTPGEC01T	50	4	

Semester IV

	Paper title	Paper Code	Full Marks	credit	
CORE	Electromagnetic Field and Radiation	ELTPCOR15T	50	4	
	Digital Signal Processing	ELTPCOR16T	50	4	
	Lab 5: Microprocessor and Microcontroller	ELTPCOR17P	50	4	
DSE 3	Quantum Computing	ELTPDSE03T	50	4	One out of ELTDSE222 203 & ELTDSE222 204
DSE4	VLSI Design	ELTPDSE04T	50	4	
	Project	ELTPCOR01M	100	4+4	

Semester - I

Semester – I: ELTPCOR01T Analog Circuits and Systems

Course Outcome:

Students after successfully completion of the course will be able to:

- Impart knowledge on analog circuits
- Impart knowledge on circuit operation and functionality
- Impart knowledge on analog circuit to solve real-life problems
- Impart knowledge in making electronic systems

1. Diode applications :clipper, clamper and voltage multiplier circuits; Zener as a voltage regulating element
2. Amplifiers-Circuit models, frequency response
3. BJT-Small signal operation and models, single stage amplifier, BJT internal capacitance and high frequency model;Biasing techniques of Bipolar junction transistors and FETs.
4. Single stage Integrated Circuit Amplifier-Concept of OTA
5. IC biasing –Current sources, current mirrors-(implementation using BJT, MOSFET) Differential amplifier, Cascade Amplifier
6. **Amplifiers:** Single stage and multistage amplifiers, Feedback in amplifiers.
7. **Op-Amp:**Stages of Op-Amp (level shifter current mirror etc),,Analysis of dual-input balanced output differential amplifier ,Op-Amp characterization, Deviations from ideal behavior and corrections due to finite gain and infinite input and output impedance, current and voltage offsets, concept of slew rate and its effects, Gain sensitivity, distortion reduction, effect of feedback on distortion and noise, power dissipations, Saturation, OPAMP characterizations, frequency response, gain-bandwidth, etc.
8. **Op-Amp applications:**
   (a)Mathematical operations using OP-Amp , precision rectifier , Instrumentation Amplifier;Switched capacitor circuits, multivibratorActive filters (Butterworth filters, Chebychev filters, Sallen-Key Configuration, State variable analysis and state variable filter
   (b)Comparator and Oscillator: Comparator and Control Circuits, zero crossing detectors, Schmitt trigger circuits, AC-DC converters, sample and hold amplifiers. Generalized impedance converter (FDNR), instrumentation Amplifiers,Function generators (sin, triangular), Multivibrators.
9. **Power Supply : Linear and switched-mode power supply**
10. **Timer Circuit :** Internal Structure and apllications of IC 555

Recommended Books:

1. Electronic Principles, A. Malvino, D. J. Bates, Tata McGrawHill
2. Microelectrnic Circuits , Sedra Smith, Oxford
3. Electronic Circuits, Donald A Neamen, Tata McGrawHill
4. Electronic Devices and Circuits , Boylstead and Nashelsky
5. Analog Filters , Schumann and Valkenburg
6. Op-Amp and Linear Integrated Circuits , Gawakwad

Semester – I: ELTPCOR02T: Solid State Electronic Devices & Materials

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand the physics that influences the presence of charge carriers in a semiconductor
- Describe the factors that influence the flow of charge in semiconductors
- Describe the operation of semiconductor devices
- Calculate voltage and current changes in semiconductor devices
- Understand the nature of semiconducting materials

1. **Introduction to Semiconductor** : Energy bands in solids, Concept of effective mass, Mass-action law, Direct and indirect band-gap semiconductors, Degenerate and non-degenerate semiconductors, Density of states, Fermi levels, Carrier concentrations at equilibrium, Conductivity, Resistivity and mobility, Effect of temperature and doping on mobility.
2. **Carrier transport:** Diffusion and drift processes, Einstein relation, Effect of recombination, Poisson and the continuity equation, Steady state carrier injection.
3. **PN junction:** Diode equation and diode equivalent circuit, Junction capacitance, Breakdown in diodes, Zener diode, Tunnel diode, Metal-semiconductor junction– Ohmic and Schottky contacts.
4. **Metal semiconductor junctions and Devices:** Schottky and Ohmic Contact, Schottky barrier Diode, I-V and C-V Characteristics , MESFET –Modes of operations, Semiconductor hetero junctions:- Energy Band Diagram, 2-D electron Gas, C-V characteristics.
5. **Bipolar junction transistors:** Minority Carrier Distributions, non idealaffects,(base Width Modulation , Early Effect , High injection) ,Small signal Operations and models, I-V characteristics, BJT internal capacitances- transient and ac conditions, switching , frequency limitations ,Equivalent circuit models (Ebers-Moll, Gummel -Poon).
6. **Metal-Oxide-Semiconductor Systems:** Inversion, Threshold Voltage, MOS Capacitance, C-V relations. Transverse Field Effect Devices- JFET-Structure, Characteristics, non-ideal

effects, equivalent circuits, MOSFET-Structure, I-V Characteristics, transconductance and substrate bias effect, Scaling and Small Geometry effect, Frequency Limitations,.

7. **Semiconductor power device-** PNPN device- structure and operation of SCR, DIAC, TRIAC, IGBT
8. **Materials for Semiconductor Devices:** Elementary and III-V & II-VI compound materials for semiconductor devices, Graphene, Carbon Nano tube (CNT).

Recommended Books:

1. Solid State Electronic Devices, Ben G. Streetman and Sanjay Kumar Banerjee, **PHI Learning Pvt. Ltd.**
2. Physics of Semiconductor Devices, S. M. Sze, **Wiley.**
3. Semiconductor Physics and Devices, Islam, **Oxford.**
4. Physics of Semiconductor Devices, Shur, **PHI.**
5. The Physics of Low- dimensional Semiconductors An Introduction, John N. Davies, **Cambridge University Press**

Semester – I: ELTPCOR03T: Mathematical Methods in Electronics

Course Outcome:

Students after successfully completion of the course will be able to:

- Analyze real world scenarios to recognize when vectors, matrices, or linear systems are to be used for modeling
- Analyze linear algebra concepts that are encountered in the real world, understand Complex variable
- Acquire knowledge about derivative and partial derivative
- Acquire knowledge about Laplace transform and Fourier series, Fourier Transform

1. **Linear Algebra**: Matrix Algebra, Eigen values and eigen vectors, Rank, Solution oflinear equations existence and uniqueness.
2. **Transform Theory**: (a) Laplace transform: Time domain response of circuits, Convolution integral and its application to circuits, (b) Fourier Analysis: Steady state response, (c) Fourier transform: Frequency domain transform.
3. **Differential equations**: First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method, some applications in electronics.

4. **Calculus**: Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems, Methods of numerical differentiation and integration, Interpolation and extrapolation,Taylor series.
5. **Complex variables**: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, Residue theorem.
6. **Probability and Statistics**: Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

Recommended Books:

1. Mathematical Methods for Physicists, George B. Arfken and Hans J. Weber, **Elsevier**
2. Introduction to Mathematical Physics, Charlie Harper, **PrenticeHall of India**
3. Mathematical Methods for Physics and Engineering, by Ken F. Riley, Mike P. Hobson and Stephen J. Bence, **Cambridge University Press**
4. Higher Engineering Mathematics, B. S. Grewal, **KhannaPublication**
5. Mathematical Physics, B. D. Gupta,**Vikas**

Semester – I: ELTPCOR04P: Lab 1: Analog Circuits

Course Outcome:

Students after successfully completion of the course will be able to:

- Impart knowledge on analog circuits
- Impart knowledge on circuit operation and functionality
- Impart knowledge on analog circuit to solve real-life problems
- Impart knowledge in making electronic systems

The following or similar experiments will be offered under this Practical Paper.

1. Experimentation of basic Op-Amp characteristics.
2. Experimentation of 1st order low pass filter.
3. Experimentation of 1st order high pass filter.
4. Experimentation of 1st order band pass filter.
5. Experimentation of 1st order band stop filter.
6. Experimentation of 2nd order low pass filter. (Chebyshev, Butterworth, Bessel).
7. Experimentation of 2nd order high pass filter. (Chebyshev, Butterworth, Bessel).
8. Experimentation of on Square and Triangular wave generation using Op-Amp.

9. Experimentation of Regulated power supply (78XX or79XX).
10. Experimentation of Regulated power supply (317).
11. Experimentation of Instrumentation amplifier.
12. Study the characteristics of Zero crossing detector.

Semester – I: ELTPCOR05P: Lab 2: Characterization of Devices & Materials

Students after successfully completion of the course will be able to:

- Impart knowledge on Solar Cell
- Impart knowledge on Photoconductor
- Impart knowledge on p-n junction

1. Study the basic characteristics of SCR.
2. Study the basic characteristics of DIAC.
3. Study the basic characteristics of TRIAC.
4. Study the basic characteristics of MOSFET.
5. Study the basic characteristics of Solar cell.
6. Estimate the band gap of an unknown semiconductor using four-probe method.
7. Estimate the resistivity of an unknown semiconductor using four-probe method.

Semester – I: ELTPAEC01M: Basics of Microwave and Mobile Communication

Course Outcome:

Students after successfully completion of the course will be able to:

- Impart knowledge about the different technologies of Mobile Communication
- Impart knowledge regarding the operation of Microwave tubes and solid state devices
- Impart knowledge on Microwave Circuits
- Principles of Microwave LOS communication

1. **Mobile Communication:** Introduction, Frequency band, SIM number, Architecture of communication, Block diagram of mobile phone, 2G 3G 4G concept GPS, GSM, CDMA, TDMA, FDMA technologies.
2. **Microwave Devices and Circuits:** Microwave: Introduction to microwaves and their applications; Klystron amplifiers: operation and analysis, Power and efficiency, Multi cavity klystron, Reflex klystrons: operation and analysis, Electronic admittance, Electronic tuning, Power output and efficiency, Magnetrons: operation and analysis,

Travelling wave tubes: operation, gain bandwidth, Coupling and focusing methods, applications, Avalanche Diode, Gunn effect and Gunn diode oscillators, Solid state microwave amplifiers, Oscillators (IMPATT & MESFET) and mixers, Microwave components: attenuator, Phase shifter, Slotted lines, Frequency meter, Directional couplers, E-plane Tee, Magic Tee and Ferrite devices; Basic measurements of frequency, SWR, Impedance and power at microwave frequencies; Principles of microwave LOS communication, Introduction to RADAR-Block diagram, Frequencies and power used in Rader, Ranging equation.

Scope of Employment:

1. Mobile design making Company
2. Telecommunication Company
3. Technology based digital Industry
4. Careers in Space Industry

Recommended Books:

1. Mobile Communications Engineering, William C. Y. Lee, **McGraw-Hill**
2. Wireless & Cellular Communications, Sanjay Sharma, **S. K. Kataria & Sons**
3. Microwave Devices and Circuits, Samuel Y. Liao, **Pearson**
4. Microwave Engineering, Monojit Mitra, **Dhanpat Rai & Company**

Semester – II

Semester – II: ELTPCOR06T Digital Circuits and Logic Design

Course Outcome:

Students after successfully completion of the course will be able to:

- Acquire the basic knowledge of digital logic levels and understand digital electronics circuits
- Convert different type of codes and number systems which are used in digital communication and computer systems
- Impart knowledge on design of Digital Circuits

1. **Introduction:** Number System and Computers codes, Basic logic gates and their properties, Boolean switching algebra, Minimization of functions using Boolean identities and Karnaugh map, Logic Families, Implementation of Switching function using basic logic gates,

Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoder, Comparator, Arithmetic Logic Circuits (ALU): Adder, Subtractor, Multiplier, Divider,Latches and Flipflops, Counters: Asynchronous, Synchronous, Hybrid, Ring and Johnson Counter, Registers & Shirt Registers, Design and analysis of fundamental mode state machines: State Variable, Table and State diagram.

2. **Memories**: RAM, ROM, PROM, EPROM, EEROM, SRAM, DRAM.
3. **Programmable Logic Devices (PLD):** Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field-Programmable Gate Array (FPGA), Complex Programmable Logic Device (CPLD).
4. **Data Converters:** Sample and Hold circuit, DAC: Weighted Resistor & R-2R Ladder Network, ADC: Counter type, Successive approximation type, Flash Type etc.
5. Analysis and Design of digital circuits using Hardware Description Language (HDL).

Recommended Books:

1. Digital Circuits (Vol.1 and Vol.2), D. Raychaudhuri, **PlatinumPublishing**
2. Fundamental of Digital Circuits, Aanad Kumar,**PHI**
3. Digital Design, M. Morris Mano,**PHI**

Semester – II: ELTPCOR07T: Network Analysis and Synthesis

Course Outcome:

Students after successfully completion of the course will be able to:

- Apply the fundamental concepts in solving and analyzing different Electrical networks
- Select appropriate and relevant technique for solving the Electrical network in different conditions
- Apply mathematics in analyzing and synthesizing the networks in time and frequency domain
- Estimate the performance of a particular network from its analysis.

1. **Basic Concepts**: Circuit Elements: active, passive; Energy and power of circuit elements, Response of passive circuit elements for different waveforms; Resonance: series, parallel, Q-factor, Bandwidth, Magnification factor.
2. **Network topology:** Series and parallel, Wye and delta, Simple filter, Bridge. Network graphs: Node, Mesh, Loop, Tree, co-tree, Links; Matrices associated with graphs: incidence, Fundamental cut set and Fundamental circuit matrices.
3. **Kirchhoff's laws in circuit theory, Network solution methods:** Nodal and mesh analysis; Wye and Delta transformation, Steady state sinusoidal analysis using phasors; Time domain

analysis of simple linear circuits.

4. **Network Theorems**: Special network configurations; Superposition; Reciprocity; Generalised maximum power transfer theorems; Generalised Thevenin's, Norton's, Millman's and Tellegen's theorems;Applications.
5. **Two-Port Networks:** Equivalent circuits, Two-port parameters (Impedance, admittance, transmission and hybrid parameters), Topological descriptions of different commonly used networks, π to T and T to π conversions, Reduction of complicated network, Symmetrical network; Matrix forms of input-output relations; Cascade, Parallel and series connection of two ports; Iterative and image impedances; Characteristic impedance, Driving point impedance and transfer impedances, Propagation function; Balanced and unbalanced networks; Bartlett' s bisection theorem and its applications; Nonreciprocal and terminated two-ports, Gyrator; Negative Impedance Converter.
6. **Filter circuits:** L filter, π filter, Methods of development of different filters like high pass, Low pass, Band pass and band stop filter circuits.
7. **Transient Response of Circuits:** Laplace transformation; Transform of linear combinations and damped functions; Shifting, Differentiation, Integral, Initial and final value theorems; Applications; RL, RC, RLC and multimesh circuits; Characteristic equation; Impulse response and transfer function; Convolution integral; s-domain circuit analysis; Time domain response from pole-zero plots; Fourier analysis for periodic signals; Fourier transform; Energy calculation in frequency domain.

Recommended Books:

1. Linear Circuit Analysis, DeCarlo & Lin
2. Electric Circuits, Nahvi, Edminister, **McGrawHill**
3. Circuit Analysis, David R. Cunningham& John A. Stuller
4. Fundamentals of Electric Circuits, Charles K. Alexander&Matthew N. O. Sadiku
5. Electric Circuit Theory, D. Chattopadhaya, P. C. Rakshit, **S.Chand**

Semester – II: ELTPCOR08T: Microprocessor Fundamentals

Course Outcome:

Students who successfully complete the course will be able to:

- Describe the general architecture of a microcomputer system and architecture & organization of 8085 and understand the difference between 8085 and advanced microprocessor
- Understand and realize the Interfacing of memory & various I/O devices with 8085

microprocessor

- Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming
- Understand the architecture and operation of Programmable Interface Devices and realize the programming & interfacing of it with 8085 microprocessor
- Understand basic architecture of 16 bit and 32 bit microprocessors
- Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design
- Understand techniques for faster execution of instructions and improve speed of operation and performance of microprocessors
- Understand RISC and CISC based microprocessors

1. Introduction to Microprocessors: The evolution of microprocessors, basic architecture of 8-Bit, 16-bit and modern microprocessors. programmer's model. data format.
2. Instruction sets and addressing modes: Instruction categories of different 8-Bit and 16-Bit processors, addressing modes for different processors.
3. Programming the Microprocessor: Program writing like- addition, subtraction, multiplication and division using different algorithms. Different searching and storing algorithms, concepts of look-up table. Programs for stack related problems. Programs of different I/O operations. DMA operation.Concept of assembler, monitor program.
4. Hardware Specifications: Pin-out and pin-functions of the different processors, clock generator, bus buffering and latching, bus timing, ready and wait state, minimum and maximum mode. Memory Interfacing.
5. PPI-8255, USART, Programmable Timer/Counter.
6. Introduction to Microcontrollers: 8051 microcontroller, 8051 pin description connection, I/O ports memory & memory organization. Addressing modes & instruction set. General programming example, Timer/Counter programming examples, Interfacing examples.
7. Architecture of 8086/8088 microprocessors: 8086-pin Configuration, Bus Interface Unit, Execution Unit, Memory organization.
8. Instruction Set: Addressing modes, software model, instruction sets, classification of instructions, Instruction Templates.
9. Interfacing: Basic concept in interfacing, Memory interfacing, I/O interfacing, Interfacing of support chips, Interfacing of ADC, DAC , Keyboards, Displays etc.
10. Interrupts of 8086: Classification of Interrupts, Classification and response of Interrupts of 8086.

Recommended Books:

1. Microprocessor Architecture, Gaonkar, **PRI**
2. Microprocessor Architecture, Programming & Application, R. Gaonkar, **Wiley**
3. Microprocessors and Microcontrollers, N. Senthil Kumar, M. Saravanan, S. Jeevanathan, **Oxford University Press**
4. 8086/8088 Family, The Design, Programming and Interfacing, Uffenbeck, **PHI**

Semester – II: ELTPCOR09T Qunatum and Nano-Electronics: Physics and Materials

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand the different quantum Mechanical approaches for solution of potential of low-dimensional structures
- Learn about properties of low-dimensional quantized systems
- Understand working principle of different quantum effect devices

1. Elements of quantum Mechanics:Fundamental Postulates and definition, Coordinate and momentum representation,Schrodinger and Heisenberg picture, approximate methods: Time dependent and time independentperturbation, variation method, WKB approximation, Concept of identical particles. interactionofradiationwithmatter, introduction to second quantization.
2. Low dimensional systems- Introduction to nanoelectronics, quantized structures, band structures of different semiconductors in the presence of 1D, 2D and 3D quantization of the wave vector space, magnetic quantization, quantum size effects, band engineering with quantum size effects.
3. Quantum effect devices :nanowire FETs, quantum wire FETs, carbon nanotube FET, quantum dot array for memory, single electron transistor (SET).
4. Nano-photonics: optoelectronic properties of Quantum wires, optical application of quantum dots.
5. Non-volatile memory devices, FAMOS, flash memory devices, memristors, switching resistor and PRAM.

Recommended Books:

1. Quantum Mechanics, Ajoy Ghatak
2. Applied Quantum Mechanics, A.F.J.Levi

3. Fundantals of Nanoelectronics, George Hanson
4. Introduction to Nanoelectronics, Vladimir V. Mitin, Viatcheslav A. Kochelap and Michael A. Stroscio, **Cambridge University Press**
5. Manasreh – Semiconductor Heterojunction and Nanostructure – McGraw Hill
6. The Physics of Low- dimensional Semiconductors An Introduction, John N. Davies, Cambridge University Press

Semester – II: ELTPCOR10P: Lab 3: Digital Circuits

Course Outcome:

Students after successfully completion of the course will be able to:

- Design Combinational circuits
- Design Sequential circuits

The following or similar experiments will be offered to students under this Practical paper.

A. Combinational

1. Design a multiplier circuit using the 4-16 line decoders (74154) that will multiply two bit binary number
2. Keyboard encoder design using a decoder and a multiplier.
3. Using parallel connection method of 7485 IC chips to compare two 9 bit binary numbers.
4. Design a parallel binary multiplier for the multiplication of two 4 bit numbers , using the 4 bit CLA address IC 7483 or 74283 and a number of sufficient number of NAND gates.
5. Design a four digit multiplexed LED display using a single common anode BCD to seven segment decoder drive(7447).
6. Design a logic circuit using a decoder and necessary logic gates to allow the 4 bit binary numbers that are divisibly by three but less than or equal to 12 and greater than two.
7. Construct a circuit that add two BCD numbers and produces a BCD sum.

B. Sequential

8. Design a 4 bit synchronous counter which should start continue from 5 when the power is switched on to the counter and should count up to 10 ,after which should count down to 5 again. This process of counting from 5 to 10 and back should continue so long as power is on. Draw and explain the logic circuit & logic diagram for this circuit.
9. Implement a logic circuit of hybrid MOD-10counter.

10. Mod 64 BCD counter using 74160ICs.
11. Design a MOD-10 counter using 74190 counters .Use both up & down counting mode. Show the counters sequence.
12. A 4 bit up/down counter using Ex-OR gates between two consecutiveT-flip-flops.
13. 4 bit bidirectional shift register using 4 D-flip-flops & 4-2:1multiplexer.
14. Shift register Experiments
15. Ring counter experiment

Semester – II: ELTPSEC01M: Instrumentation and Power Electronics

Course outcome:

Students after successfully completion of the course will be able to:

- Impart knowledge on electronic measurement system
- Impart knowledge on the methods of measuring different physical quantities
- Impart knowledge on measuring instruments
- Know the principle of operation, design and synthesis of different power conversion circuits and their applications

A. Instrumentation

1. **Measuring Equipment** – Characterization-Accuracy, Precision, Fidelity, speed of response etc., Classification of errors, Measurement of R, L and C, voltage, current, power, energy, frequency/time, phase, Time domain instruments-CRO, Digital Storage Oscilloscope, Frequency domain instruments-Distortion Analyzer, Wave and Spectrum Analyzer, Signal generators, Digital instruments- Digital Multimeters, Time and frequency measurements.
2. **Transducers and Sensors** – Introduction and Classification of transducers, Basic characteristics of transducers, Active and passive transducers, Resistive, Inductive and Capacitive transducers-measurement of force, strain etc., Piezoelectric transducer, Measurement of temperature/Thermoelectric devices-RTD, Thermistors, Semiconductor IC sensors etc. and Photoelectric devices/Light transducers-Photo-emissive, photo-conductive and photo-voltaic devices, photodiodes and photo-transistors etc., Sensors-Semiconductor diode temperature sensor, Introduction to IC type temperature sensors, Basic level ON-OFF temperature controller, Measurement of translational and rotational displacement, velocity and acceleration, Measurement of pressure-manometers, diaphragm, bellows etc.

3. **Biomedical Instruments** – ECG, EEG, X-Rays, pH-meter, Blood Pressure Measurements-direct and indirect methods, Radio-telemetry, MEMS-pressure sensors and accelerometers and its applications Sensors for IoT applications.

B. Power Electronics

1. **Characteristics of solid state power devices:** Diac, Triac, SCR, UJT, Heat sinks for power devices.
2. **Regulated power supply:** Supply characteristics (Load & line regulation, output resistance, efficiency etc.), Shunt regulators, Series regulators, Monolithic linear IC regulators (applications of 78XX, 79XX, 89XX, 723), IC LM317-Output voltage equation.
3. **Circuits:** Full-wave rectification by SCR, Triggering, Converters, Choppers, Inverters, AC regulators, speed control of a.c. and d.c. motors.
4. **Control:** Stepper motor, Synchronous motor, Three-phase controlled rectifier, Switch mode power supply, uninterrupted power supply.

Recommended Books:

1. Instrumentation and Control Systems, Katta Narayan Reddy & Palakodeti Sri Rama Krishnudu, **Scitech Publication**
2. Modern Electronic Instrumentation & Measurement Technique, Helfrick& Cooper,**PHI**
3. Fundamentals of Industrial Instrumentation, AlokBarua,**Wiley**
4. Electrical and Electronic Measurements and Instrumentation, A. K. Sawhney, **DhanpatRai**
5. Power Electronics: Circuits, Devices & Applications,Muhammad H. Rashid,**Pearson**
6. Power Electronics, P. C. Sen, **McGraw-Hill**

Semester – III

Semester – III: ELTPCOR11T: Optoelectronics

Course Outcome:

Students after successfully completion of the course will be able to:

- Acquire fundamental understanding of the basic physics behind optoelectronic devices

- Develop basic understanding of light emitting diodes
- Develop detailed knowledge of laser operating principles and structures
- Acquire in depth understanding of photodetectors
- Describe basic laws and phenomena that define behaviour of optoelectronic systems
- Use optical fibre equipment, and data transfer using optical fiber

A. Fiber Optics

1. Introduction to Fiber Optic Communication: Fundamentals - Introduction to optical wave guiding and optical fibers, ray theory approach to optical fibers, Different types of fibers, numerical aperture. Propagation characteristics of optical fibers, analysis of signal mode and multimode fibers.
2. Different signal degradation reasons in optical fibers: Attenuation, Dispersion etc. Signal recovery techniques and Amplifiers.
3. Basic concept of nonlinearity effects in fiber optics, Optical Solitons.
4. Fabrication techniques of optical fibers and Cables.
5. Fiber joining techniques: splicing, Couplers etc.
6. Advanced Optical Fiber and applications.

B. Optical Sources, Detectors and other devices

7. Optical process in Semiconductors:Direct and indirect band gap semiconductors.Generation and recombination, radiative and non-radiative recombinations, absorption and emission spectra and characteristic, photoluminescence.
8. Different Optical Sources for Communication: LED characteristics, design and construction of LED and display devices. LED-based transmission.
9. LASER fundamentals: Theory of Laser :Spontaneous emission, Stimulated emission, Einstein‟s co-efficients, Light amplification, Lasing condition, Population inversion, Line broadening mechanisms, Three and four level systems, Different Lasers and their theory including Semiconductor LASER, Application of LASERs.
10. Photo-detectors: Photovoltaic and photoconductive modes, PIN, avalanche photodiodes, APD: structure, noise,noise reduction.
11. Photoconductors: DC and AC response, noise, MSM photo-detectors.
12. Basic idea on Modulation of Light: Electro-optic, acousto-optic and magneto-optic effects.
13. Introduction to Integrated Optics and devices: Modes in symmetric and asymmetric planar wave guides. Wave guide for integrated optics. Beam splitters, Directional couplers, Modulators and Switches, Optical and integrated circuits.
14. Optical Communication Systems - Design and Basic idea of the different stages.

Recommended Books:

1. An Introduction to Fiber Optics, A Ghatak and K. Thyagarajan, **Cambridge University Press**
2. Optical Electronics, A Ghatak and K. Thyagarajan, **Cambridge University Press**
3. Fiber-Optic Communication Systems, Govind P. Agrawal,**Wiley**
4. Optical Fiber Communications: Principles and Practice, John M. Senior, **Pearson**
5. Optical Fiber Communication, Gerd Keiser, **Mcgraw Hill**
6. Fiber Optics and Optoelectronics, R.P. Khare, **Oxford University Press**

Semester – III: ELTPCOR12T: Electronic Communication Systems

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand different blocks in communication system and how noise affects communication using different parameters
- Distinguish between different amplitude modulation schemes with their advantages, disadvantages and applications
- Analyze generation and detection of FM signal and comparison between amplitude and angle modulation schemes
- Understand PCM, DPCM, ASK, FSK, PSK

1. **Random Signals and Noise:** Probability, Random variables, Probability density function, Autocorrelation, Power spectraldensity.
2. **Analog Communication Systems:** Amplitude and angle modulation and demodulation systems, Spectral analysis of these operations, Superheterodyne receivers; Elements of hardware, Realizations of analog communication systems; TDM, FDM, signal-to-noise ratio (SNR) calculations for amplitude modulation (AM, QAM) and frequency modulation (FM) for low noise conditions, PAM, PPM, PWM, Fundamentals of information theory and channel capacity theorem.
3. **Digital Communication Systems:** Pulse code modulation (PCM), Differential pulse code modulation (DPCM), Delta modulation, Adaptive Delta Modulation, Digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), Matched filter receivers, Bandwidth consideration and probability of error calculations for these schemes, Basics of TDMA, FDMA and CDMA and GSM.

Recommended Books:

1. Principles of Communication Systems, Taub, Schilling, Saha, **Tata McGrawHill**
2. Communication Systems, Simon Haykin,**Wiley**
3. Modern Digital and Analog Communication Systems, Lathi**,Oxford**
4. Digital Communications, Ch. K. Rekha,**Scitech**

Semester – III: ELTPCOR13T: Control System

CourseOutcome:

Students after successfully completion of the course will be able to:

- Demonstrate an understanding of the fundamentals of (feedback) controlsystems
- Determine and use models of physical systems in forms suitable for use in the analysis and design of controlsystems
- Express and solve system equations in state-variable form (state variablemodels)
- Determine the time and frequency-domain responses of first and second-order systems to step and sinusoidal (and to some extent, ramp)inputs.
- Determine the (absolute) stability of a closed-loop controlsystem
- Apply root-locus technique to analyze and design controlsystems
- Communicate design results in writtenreports.

1. **Introduction to Control Systems:** Introduction to automatic control, Examples of control systems, Open and closed loop control systems, Different feedback characteristics of control systems.

2. **Laplace Transform:** Definitions and properties of Laplace transform, Basic Laplace transform theorems, Laplace transform of different functions, Inverse Laplace transform, Transfer function.

3. **Modeling of a Control System:** Block diagrams, Block diagram reduction techniques, Signal flow graph and its' construction, Mason's gain formula, Modeling of mechanical, electrical and electromechanical systems.

4. **Time Domain Analysis**: Transient and steady state response of first order and second order systems, Steady state error-Static error coefficients, Generalized error coefficients, Sensitivity.

5. **Stability** – BIBO stability criterion, Absolute and relative stability, Routh-Hurwitz criterion.

6. **Root Locus Analysis and design:** Root-locus principles; construction techniques of root-locus; properties of root-locus and root-locus design.

7. **Frequency Domain Analysis:** Frequency response of Closed Loop Systems, Frequency- Domain specifications- Gain margin and phase margin, Bode plots, Polar and inverse polar plots, Nyquist criterion, Constant M & N circles, Correlation between time and frequency response.

8. **Controllers and Compensators:** Error amplifier, on-off controller, Proportional (P), Proportional-Integral (PI), Proportional-Derivative (PD), PID controllers, Phase-Lead compensation, Phase-Lag compensator and Phase-Lag-Lead compensator.

9. **State Variable Analysis:** Basic definitions, State variable model and solution of state equation of LTI systems, State Transition Matrix(STM) and its properties, Controllability and Observability.

10. **Introduction to Digital Control system:** PLC & Application Case Studies: Speed control of DC Motors, Tempcontrol.

Recommended Books:

1. Linear Control Systems, B.S.Manke, **Khanna Publishers**
2. Control Systems engineering, Nagrath& Gopal, **NewAge**
3. Modern Control Engineering, Ogata, **PHI/Pearson**
4. Control Systems Engineering, R. Anandanatarajan&P.Ramesh babu, **Scitech**

Semester – III: ELTPDSE01T Microelectronic Technology and Charactersation Techniques

Course Outcome:

Students after successfully completion of the course will be able to:

- Get an overview the different steps of VLSI Tchnology
- Learn about different epitaxial semiconductor growth techniques
- Learbn about advanced imaging and characterisation techniques of nanostructure devices.

1. Process steps for VLSI Technology

2. Material preparation: Bulk semiconductor growth, zone melting, Czochralski growth, vertical and horizontal Bridgeman techniques, Gradient freeze technique, Liquid encapsulated Czochralski growth,
3. Epitaxial growth-VPE, LPE, MOCVD and MBE technique, growth of multiple layered structures. Cleaning,etching, Growth of insulating thin films on Semiconductors, thermal oxidation of Si, growth kinetics of Silicon dioxide films by LPCVD and PECVD techniques,
4. Process sequence in CMOS fabrication:n-well and p-well process, Design rules for CMOS layout
5. Semiconductor doping: Thermal diffusion and ion-implantation , annealing, Fabrication of practical ohmic contacts to semiconductors. Deposition of metal films , poly-silicon and nitride deposition. Thermal and electron beam evaporation sputtering.Stick diagram, chip assembly and packaging techniques. Introduction to process and circuit stimulation.
6. Nanostructure imaging: Scanning Tunneling Microscopy (STM), Transmission Electron
7. Microscopy (TEM), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM). FESEM, EDX.

Recommended Books:

1. VLSI technology, S. M. Sze, **McGraw-Hill**
2. VLSI Fabrication Principles: Silicon and Gallium Arsenide, Sorab K. Ghandhi, **Wiley.**
3. Basic VLSI Design, Douglas A. Pucknell, **PHI**
4. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM and AEM, R.F. Egerton, **Springer**
5. Characterization of Semiconductor Materials: Principles and Methods, Edited by Gary E. McGuire
6. Optical Characterization of Epitaxial Semiconductor Layers, Gunther Bauer' Wolfgang Richter (Eds.)

Semester – III: ELTPDSE02T Mobile Communication

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand the architecture of different networklayers.
- Understand the basic principle mobile communication with emphasis on GSM architecture
- Understand the basics of Wireless Communicationand different multiplexing techniques

A. Networking

1. Concepts of networking: network layers, Layered protocol architecture-OSI : TCP Physical media-topology, switching mechanism (circuit and packet switched systems) Comparison of various transmission media.
2. Transport layer-Connection less and connection oriented protocols- TCP, UDP, Data link layer-Policies on flow control, error control, MAC-Ethernet, CSMA .. CD, ALOHA, FDDI
3. Network layer-IPV4, IPV6, ICMP, IGMP.

B. Mobile communication

1. Evolution from PSTN, Cellular concept, frequency reuse, channel assignment strategies, system capacity, trucking and grade of services (1G- 7G).
2. GSM-architecture, protocols, handover, security (Network Cryptography)
3. Physical layer-Wireless media-characteristics, modes of propagation, various loss mechanisms.
4. Multiplexing and multiple access techniques-FDM, TDM, FDMA,TDMA,CDMA,WCDMA NETWORKING-Mobile IP, dynamic host configuration protocol, introductory concept of ad-hoc network
5. Mobile transport layer, wireless LAN technology standards (Wi-Fi) , Bluetooth

Recommended Books:

1. Mobile Communications Engineering, William C. Y. Lee, **McGraw-Hill**
2. Wireless & Cellular Communications, Sanjay Sharma, **S. K. Kataria & Sons**
3. Data Communications and Networking, Forouzan,**McGraw-Hill**
4. Computer Networks, Tanenbaum, **Pearson**

Semester – III: ELTPCOR14P: Lab 4: Electronic, Fiber Optic and Microwave Communication

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand the operation of Electronic Communication trainer kit
- Understand the operation of Optical Communication trainer kit
- Understand the experiments on Microwave Communication

The following or similar experiments will be offered to the students under this Practical paper.

A. ElectronicCommunication

1. Amplitude Modulation/Demodulation using TrainerKit.
2. Frequency Modulation/Demodulation using TrainerKit
3. ASK Modulation/Demodulation using TrainerKit
4. PSK Modulation/Demodulation using TrainerKit
5. PWM Modulation/Demodulation using TrainerKit
6. PAM Modulation/Demodulation using TrainerKit.
7. PCM Modulation using TrainerKit
8. FSK Modulation/Demodulation using TrainerKit

B. OpticalCommunication

9. Experiments on Analog Optical Communication using TrainerKit
10. Experiments on Digital Optical Communication using TrainerKit
11. Experiments with laser: Acquaintance of laser safety criteria, alignment of laser, setting up of a beam expander, power distribution of the beam, spot size, coherence length, divergence angle etc.

C. Microwave Communication

12. Microwave measurements: Power, Frequency, Wavelength, Impedance, Attenuation etc.

Semester – III: ELTPGEC01T : Mobile Communication

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand the architecture of different networklayers.
- Understand the basic principle mobile communication with emphasis on GSM architecture
- Understand the basics of Wireless Communicationand different multiplexing techniques

A. Networking

1. Concepts of networking: network layers, Layered protocol architecture-OSI : TCP Physical media-topology, switching mechanism (circuit and packet switched systems) Comparison of various transmission media.
2. Transport layer-Connection less and connection oriented protocols - TCP, UDP, Data link layer-Policies on flow control, error control, MAC-Ethernet, CSMA .. CD, ALOHA, FDDI
3. Network layer-IPV4, IPV6, ICMP, IGMP.

B. Mobile communication

1. Evolution from PSTN, Cellular concept, frequency reuse, channel assignment strategies, system capacity, trucking and grade of services (1G- 7G).
2. GSM-architecture, protocols, handover, security (Network Cryptography)
3. Physical layer-Wireless media-characteristics, modes of propagation, various loss mechanisms.
4. Multiplexing and multiple access techniques-FDM, TDM, FDMA,TDMA,CDMA,WCDMA NETWORKING-Mobile IP, dynamic host configuration protocol, introductory concept of ad-hoc network
5. Mobile transport layer, wireless LAN technology standards (Wi-Fi) , Bluetooth

Recommended Books:

1. Mobile Communications Engineering, William C. Y. Lee, **McGraw-Hill**
2. Wireless & Cellular Communications, Sanjay Sharma, **S. K. Kataria & Sons**
3. Data Communications and Networking, Forouzan,**McGraw-Hill**
4. Computer Networks, Tanenbaum, **Pearson**

Semester – IV

Semester – IV: ELTPCOR15T: Electromagnetic Field and Radiation

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand Maxwells's equation in time varying field
- Understand concepts of different coordinate systems, static electric and magnetic fields and methods of solving for the quantities associated with these fields, time varying fields and displacement current, propagation of electromagnetic waves and their applications in practical problems

1. **Electrostatics:** Vector Calculus, Electric flux density, Coulombs law, Electric scalar potential, Gauss's law and its applications, Boundary conditions, Laplace's and Poisson's equations.
2. **Magnetostatics:** Magnetic flux density, BiotSavart's law, Ampere's circuital law, Magnetic scalar and vector potential.
3. **Time-Varying Electromagnetic Fields:** Maxwell's equations for static EM fields and wave equations, Plane wave propagation in free space, Dielectric and conductors, Faraday's laws of inductions, Transformer and Motional EMFs, Pointing theorem, Reflection and refraction

of waves, Concept of polarization, Interference, Coherence and diffraction.

4. **Propagation of Waves:** Wave propagation in different media, Propagation through ionosphere, Effects of earth's magnetic field on ionospheric propagation.
5. **Transmission Line:** Parameters of Transmission line and its equations, Impedance, Reflections and Voltage standing wave ratio, Impedance matching process, Smith Chart and its application.
6. **Wave Guide:** Wave propagation in rectangular and cylindrical wave guides, TE,TM,TEM modes, Wave guide coupling, Excitation of modes, Impedance measurements.
7. **Electromagnetic Potentials and Spherical Waves:** Electromagnetic scalar and vector potentials, Non-uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb or transverse gauge,Hertz vector, Lorentz force in terms of electromagnetic potentials, Hertz's solution of wave equation, Hertzian oscillator, Spherical waves.
8. **Electromagnetic Radiation:** Radiation from an oscillating dipole, Radiation due to a small current element, Antenna array,Broad side array and End-fire array, Lienard-Wiechart potentials, Fields of an acclerated charge, Electric Quadrupole Radiation
9. **Antenna:** Basic antenna parameters-Gain, Directivity, Radiation intensity, Effective area, Retarded potential, Hartzian dipole Half-wave antenna, Antenna with parabolic reflectors, Horn antennas, Lens antennas, Wide band and special purpose antennas, Helical antennas, Log-periodic antennas, Loop antennas, Practical transmitting antennas, Behavior of receiving antennas, Micro strip Patch Antenna, Printed Dipole, Frii's free space receiver power equation.

Recommended Books:

1. Introduction to Electrodynamics, J.Griffiths, **Cambridge University Press**
2. Classical Electrodynamics,John David Jackson, **Wiley**
3. Electromagnetics, B.B.Loud., **New Age International Publishers**
4. Antenna Theory and Design, Elliott, **Wiley**
5. Electronic Communication Systems, William Schweber,**Prentice Hall of India**

Semester – III: ELTPCOR16T: Digital Signal Processing

Course Outcome:

Students after successfully completion of the course will be able to:

- Interpret, represent and process discrete/digital signals and systems
- Determine the discrete Fourier transform of discrete-time signals
- Design & analyze DSP systems like FIR and IIR Filter

1. **Discrete-Time Signals:** Concept of discrete-time signal, Basic idea of sampling and reconstruction of signal, Sampling Theorem sequences –Periodic,Eenergy, Power, Unit-sample, Unit-step, Unit-ramp, Real &complex exponentials, Arithmetic operations onsequences.
2. **Discrete Fourier Transform:** Brief recapitulation of Fourier Series, Concept and relations for DFT/IDFT, Twiddle factors and their properties, Computational burden on direct DFT, DFT / IDFT as linear transformations, DFT/IDFT matrices, Computation of DFT/IDFT by matrix method, Multiplication of DFTs, Circular convolutions, Computation of circular convolution by graphical, DFT/IDFT and matrix methods, Linear filtering using DFT, Aliasing error, Filtering of long data sequences – Overlap-Add & Overlap Save methods with examples and exercises.
3. **Fast Fourier Transform:** Radix-2 algorithm, Decimation –in time and decimation-in-frequency algorithms, Signal flow graphs, Butterflies, Computation in one place, Bit reversal, Examples and exercises.
4. **Filter Design:** Basic concepts behind IIR and FIR filters, Butterworth IIR analog filter, Impulse Invariant and Bilinear transforms, Design of IIR digital filter, Design of linear phase FIR filter with rectangular window.
5. **Digital Signal Processor:** Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor (any one), Writing of small programs in Assembly Language.

Recommended Books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G. Proakis, D.G.Manolakis,**Pearson Education/PHI**
2. Digital Signal Processors Architectures,Implementations and Applications,S.M.Kuo,W.Gan, **Pearson Education**

Semester – IV: ELTPDSE03T: Quantum Computing

Course Outcome:

Students after successfully completion of the course will be able to:

- Develop concept on quantum logic and qubit
- Develop concept on quantum gate and its operation and designing quantum circuits
- Develop concept on quantum algorithm and its application in quantum computing

- Develop concept on quantum noise, quantum error correction and detection, and quantum error correcting codes
- Develop concept on quantum teleportation and its application in quantum information processing.
- Develop concept on quantum communication
- Develop concept on quantum cryptography

1. **Introduction to quantum computing**: Quantum logic, Qubits (single qubits and multiple qubits), Bloch sphere representation of qubit, Quantum circuits.
2. **Background Mathematics and Quantum Physics**: Linear algebra, Hilbert space, Probabilities and measurements, Entanglement, Density operators and correlation, Basics of quantum mechanics; Measurements in bases other than computational basis.
3. **Quantum Circuits:** Single qubit gates, Multiple qubit gates, Design of quantum circuits.
4. **Quantum Algorithms:** Classical computation on quantum computers; Relationship between quantum and classical complexity classes; Quantum Fourier transform, Deutsch‟s algorithm, Deutsch‟s-Jozsa algorithm, Shor factorization algorithm, Grover search algorithm.
5. **Physical realization of Quantum Computer:** Condition for quantum computation, Harmonic oscillator quantum computer; Realization of qubits: Optical photon, Trapped ions, Nuclear magnetic resonance, Superconducting materials etc.
6. **Noise and error correction:** Graph states and codes, Quantum error correction, Fault-tolerant computation.
7. **Entropy and information** : Basic properties of entropy, Shannon entropy, Von Neumann entropy, Strong subadditivity.
8. **Quantum Information and Cryptography:** Comparison between classical and quantum information theory; Bell states, Quantum teleportation, Quantum cryptography, No cloning theorem.

Recommended Books:

1. Quantum Computation and Quantum Information, Chuang & Nielsel
2. The Physics of Quantum Information, **Springer**

Semester – IV: ELTPDSE04T: VLSI Design

Course Outcome:

Students after successfully completion of the course will be able to:

- Know various logic methods and their limitations as well as the circuit design using VLSI Technology
- Acquire a clear idea about fabrication process of CMOS technology

1. The physics of Field Effect Transistor
2. MOS Transistor Models (BSIM models for analog stages)
3. Elementary transistor stages for analog integrated circuit
4. Elementary stages for digital integrated circuit
5. Inverters.
6. VLSI design methodology
7. Custom and Semi-custom IC
8. Mixed signal VLSI
9. Programmed Logics and FPGAs
10. Behavioral Modeling of Operational and Transconductance Amplifier
11. Operational Amplifier design**.**

Recommended Books:

1. Principles of VLSI and CMOS Integrated Circuits, R. Jain, A. Rai, **S. Chand**
2. Fundamentals of Semiconductor Fabrication, G.S. May, S.M. Sze, **Wiley**
3. CMOS VLSI Design: A Circuit & Systems Perspective, Neil H.E. Waste, K. Haase, D. Harris, A. Banerjee, **Pearson Education**

Semester – IV: ELTPCOR17P: Lab 5: Microprocessor and Microcontroller

Course Outcome:

Students after successfully completion of the course will be able to:

- Understand the operation of typical microprocessor trainer kit
- Solve different problems by developing different programs
- Develop the quality of assessing and analyzing the obtained data

The following or similar experiments will be offered to the students under this Practical paper.

A. Microprocessor

1. Write an ALP to move data block starting at location ‘X’ to location ‘Y’ withoutoverlap.
2. Write an ALP to move data block starting at location ‘X’ to location ‘Y’ withoverlap.
3. Write an ALP to arrange 08-Bytes of data in descendingorder.
4. Write an APL to arrange 8-bytes of data in ascending order. The data is stored in memory location of which the starting address is9050H.
5. Write an APL to convert BCD number to binarynumber.

6. Write an ALP to convert binary number to BCDnumber.
7. Write an ALP to add two BCDnumbers.
8. Write an ALP to implement a counter '00-99' (UP COUNTER) inBCD.
9. Write an ALP to implement a counter 'FF-00' (UDOWN COUNTER) inHEX.
10. Write an APL to implement ‘throw a dice’ usinginterrupt.
11. Write an APL to implement a real timeclock.
12. Write an APL to implement multiplication by shift and addmethod.
13. Write an APL to find the product of two unsigned binary numbers stored at location ‘X’ and ‘X+1’ using successive addition and store theresult.
14. Write an APL to find the smallest of ‘N’ 1-byte numbers. Value of N is stored in location ‘X’ and numbers from ‘X+1’. Display the number in data field and its address field.
15. Write an APL for HEX to ASCII characterconversion.
16. Write an APL for ASCII to HEXconversion.
17. Generation and displaying of Triangular Wave in CRO by interfacing 8085-Trainer-Kit (use DAC at Port 3 of the trainer kit, connect ‘Out2’ of DAC toCRO).

B. Microcontroller

18. A set of 100 bytes of data is available in memory in the form of signed numbers. Write a program to find the sum of all positive numbers. Use 8051Trainer-Kit.
19. Solve the following expression using 8051Trainer-Kit:

$$F = \frac{C*9}{5} + 32$$

20. Write an ALP for HEX to ASCII Character conversion using 8051Trainer-Kit.
21. Write an ALP for ASCII to HEX conversion using 8051Trainer-Kit.
22. Interfacing a ‘Keyboard’ with the 8051 Microcontroller Trainer Kit. Write ALP to test the‘Keyboard’

Semester – IV: ELTPCOR01M: Project

1. **Topic:** Many seminar topics will be given to the students at the beginning of 3rd semester and or at the beginning of 4th semester and one seminar topic will be allocated to each student.
2. **Presentation:** Each student needs to present seminar on their allocated topic. Additional time will be allocated for question answer session to each student.
3. **Evaluation:** Evaluation will be based on performance in the presentation examination.