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Course	Name of the Course	Lect./ Hrs./ Week	Internal Marks	External Marks	Total Marks	Course Credits
ELE-401	Linear IC's and their applications	4	30	70	100	4
ELE-402	Digital system design & Microprocessor-I	4	30	70	100	4
ELE-403	Electronic Communication-I	4	30	70	100	4
ELE-404	Solid State Physics & Instrumentation	4	30	70	100	4
ELE-405 PR ELE-406 PT	Practicals Projects	6 6	30 30	70 70	100 100	4 4
TOTAL		**28**	**180**	**420**	**600**	**24**

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ELE– 401: LINEAR IC's AND THEIR APPLICATIONS

Linear IC's is a very important area in the study of Analog Electronics and many experiments based on this paper are included in practical. This provides good understanding and is useful to develop circuits.

UNIT I : Comparators & Power Amplifiers :
Comparators : Comparator characteristics, Limitations of OpAmp as comparator, Voltage Limiters, High Speed and Precision type Comparator, Window detector - IC LM 1414, IC-BB 4115.
Level detector for photodiode using LM311, ON/OFF Temperature controller using LM 339
Power amplifier: IC LM 380 and LM 384.

UNIT II : Waveform Generators and Converters:
Waveform Generators: Phase shift Oscillators, Wein bridge Oscillators, Quadrature Oscillators, Square Wave Generator, Triangular Wave Generator, Saw-tooth Wave Generator.
Voltage Controlled Oscillator - IC 566 , Function Generator - IC 8038
Converters : V to F and F to V converters - IC 9400

UNIT III: Signal processing circuits:
Active Filters -Second & Higher order band pass filter (wide/narrow), Band reject filter (Wide/narrow), All pass filter. Universal Active Filter, FLT-U2, Switched Capacitor Filter, MF-5

UNIT IV : Special Purpose Amplifiers:
Opamps using FET input stages, tone controls and graphic equalizers, Video Amplifiers LM 733 and RCA 3040, Norton's OpAmp-LM 3900, Norton OpAmp in inverting and Non inverting configuration.

Reference Books:
1. **Ramakant Gayakwad,** OpAmp. and Linear Integrated circuits, PHI. (3rd Ed.)
2. **K.R. Botkar,** Integrated circuits, Khanna Prakashan, (8th Ed).
3. **Coughlin and Driscoll,** Operational Amplifiers and Linear integrated circuits, PHI

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ELE– 402: DIGITAL SYSTEM DESIGN & MICROPROCESSOR–I

Digital logic design forms a backbone of digital electronics. It aims to enhance the designing skills of students for combinational and sequential logic circuits. Modern concept of designing using VHDL is introduced. The microprocessor study provides the student in depth knowledge of hardware of computers.

UNIT I : Logic System Design

a. Combinational Logic Design : Design of code converters : BCD to Decimal, Decimal to BCD using universal gates
b. Design of synchronous sequential digital circuits : Concepts of excitation (transition) tables, Synthesis rules of transition tables, Design of MOD-3, MOD-5, Decade Counter using J-K Flip Flop
c. Design of Driver circuits : Seven segment decoder driver, Multiplexed display
Introduction to HDL, Overview of Digital System Design using HDL, Verilog HDL : VHDL Code, Gate level implementation, VHDL Operators, Basic Combinational logic circuits

UNIT II : Sequential logic circuit design and specialized ICs

a. Design of 1Hz precise clock generators using conventional and special IC’s.
b. Design of a preset timer using magnitude comparator, counter, decoder and display with 1 Hz precise clock.
c. Design of digital stop watch using CMOS IC's.
d. Design of time base circuit to obtain 1 MHz, 100 kHz , 10 kHz, 1 kHz, 100 Hz, 10Hz, 1 Hz, 0.1 Hz, 0.01 Hz.
e. Design of frequency counter/period measurement
f. Design of Real time digital clock using special IC's.

Data flow modeling of HDL, Basic arithmetic and combinational logic circuits using VHDL

UNIT-III Code Conversion, BCD Arithmetic, 16- Bit Data Operations and Interrupt

BCD-to-Binary Conversion, Binary-to-BCD Conversion, BCD-to-Seven-Segment-LED Code Conversion, Binary-to-ASCII-to-Binary Code Conversion, BCD Addition , BCD Subtraction, Introduction to Advanced Instructions and Applications, Multiplication, Subtraction with Carry, the 8085 Interrupt.

UNIT-IV Programmable Interface Devices: 8155 I/O and Timer; 8279Keyboard/Display Interface

Basic Concepts in Programmable Devices, The 8155: Multipurpose Programmable Device, The 8279 Programmable Keyboard/Display Interface.

General - Purpose Programmable Peripheral Devices

Introduction to the 8255A Programmable Peripheral Interface (PPI), Illustration: Interfacing Keyboard and Seven-Segment Display, Illustration: Bidirectional Data Transfer Between Two Microcomputers, The 8254 (8253) Programmable Interval Timer, The 8259A Programmable Interrupt Controller Direct Memory Access (DMA) and the 8237 DMA Controller.

Reference Books:

1. **M. Morris Mano,** Digital Design, 3rd Ed., Pearson Education Asia.
2. **D.P. Leach, A.P. Malvino, G. Saha,** Digital Principles and Applications 6th Ed., McGraw Hill Companies.
3. **Thomas Bartee,** Digital computer fundamentals, 6th Ed. T MH
4. **John F. Wakerly**, Digital Design principles and practices,
5. **Bhasker,** A VHDL Primer, 3rd edition - PHI, New Delhi, 2007
6. **Sudhakar Yalamanchili,** Introductory VHDL : From Simulation to Synthesis, Pearson Ed.
7. **Charles H. Roth Jr**, Digital Systems Design using VHDL, PWS Pub.,1998
8. **R.S.Gaonkar,** Microprocessor Architecture, programming and applications,
9. **P.K. Ghosh & P.R. Sridhar**, 0000 to 8085 Introduction to microprocessors for engineers and scientists.
10. **B.Ram,** Microprocessors and Microcomputers, Dhanpatrai and Sons.

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ELE– 403: ELECTRONIC COMMUNICATION –I

This paper covers elements of transmission lines and waveguides; radio wave propagation, microwave communication and antenna designing. It also includes digital communication. This paper provides good grounding in electronic communication

UNIT I : Transmission Lines & Microwave Waveguides:
Transmission Lines: Introduction, Primary Line Constants, Phase Velocity and Line Wavelength, Characteristic Impedance, Propagation Coefficient, Phase and Group Velocities, Standing Waves, Lossless Lines at Radio Frequencies, Voltage Standing-wave Ratio, Slotted-line Measurements at Radio Frequencies, Transmission Lines as Circuit Elements, quarter wave line, stub line Smith Chart, Time-domain Reflectometry.
Microwave Waveguides: Introduction, Rectangular waveguides : solution of wave equation, rectangular coordinates, TE modes in rectangular waveguides, TM modes in rectangular waveguides, power transmission in rectangular waveguides, excitation of modes in rectangular waveguides, characteristics of standard rectangular waveguides, circular waveguides : solution of wave equation in cylindrical coordinates, TE and TM modes in circular waveguide.
UNIT II: Radio wave Propagation :
Propagation in Free space: mode of propagation, Tropospheric Propagation : mode of propagation, radio horizon, attenuation in atmosphere, Ionospheric Propagation : ionospheric layers, mechanism by which ionsophere effects wave propagation, plasma frequency and critical frequency, refraction of radiowaves, Secant law and MUF, skip distance, virtual height, effects of earth's magnetic field, service range, ionospheric irregularities and fading, Surface Wave : mode of propagation, ground wave
UNIT-III: Antenna Theory & Designing:
Hertzian dipole, half wave dipole, quarter wave monopole antenna, small loop antenna, Antenna characteristics, Antenna arrays. Antenna with parabolic reflectors, Horn antenna, log periodic antenna
UNIT-IV: Digital communication:
Synchronization, probability of Bit error, bit error rate, QAM, Bandwidth efficiency, carrier recovery, clock recovery, DPSK, error performance of various digital communication systems, Eye diagrams.

Reference Books:

1. **D. Roddy & J. Coolen,** Electronic Communications, (4th Ed.), Prentice Hall of India
2. **Samuel Y. Liao,** Microwave Devices and circuits, Prentice Hall of India.
3. **D.C.Sarkar,** Microwave Propagation and Technique, S.Chand and Company Ltd. New Delhi.
4. **George Kennedy,** Electronics and Communication systems, McGraw Hill Int. Edition.
5. **Edward C. Jordan and Keith G. Balman,** Electromagnetic waves and Radiating systems, Prentice Hall of India.
6. **Robert E.Collins,** Antennas and radiowave propagation, McGraw Hill Book Company, India.
7. **Wayne Tomasi**, Advanced electronic communication systems. PHI.
8. **Mathew N.O. Sadiku,** Elements of Electromagnetics, Oxford Uni. Press.

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ELE– 404: SOLID STATE PHYSICS & INSTRUMENTATION

Fundamentals solid state physics is included in this course. It covers the conduction in metal crystals and several properties of solids. In unit II, concepts and detailed theory of superconductors are covered. Bioelectrical Potentials are very useful to understand medical instruments. Spectrophotometers and special purpose oscilloscopes are also included.

UNIT I : Energy Bands:
Introduction, nearly free electron model, Origin of the energy gap, Magnitude of energy gap, Bloch function, The Kroning-Penney model, Wave Equation of electron in a periodic potential, solution of central equation, approximate solution near a zone boundary, No. of orbitals in a band.

UNIT II : Superconductivity :
Introduction, Meissner effect, heat capacity , energy gap, isotope effect, thermodynamics of super conducting transitions. London equation, coherence length, BCS theory of superconductivity, Flux quantization, Type I and Type II superconductors, Single particle tunneling,, Josephson superconducting tunneling(AC and DC), macroscopic quantum interference.

Unit III: Bioelectric potentials :
The Electrocardiogram. Electrodes : Electrode theory, Biopotential Electrodes : Microelectrodes, Body surface electrode, Needle electrodes, Electrocardiography : History, Electrodes and leads : Electrodes, Leads, ECG Recorder principles. Measurement of blood pressure using - sphygmomanometer, programmed Electrosphygmomanometer, Electronic sphygmomanometer.

UNIT IV: Spectrophotmeters :
Radiation sources, Monochromator, Sample counters, detectors, Indicators, UV, Visible and IR spectrophotometers (Single beam and double beam).

Special purpose oscilloscopes : Multi beam oscilloscope, Multi trace oscilloscope, sampling oscilloscope, Impulse waveform oscilloscopes, scanning oscilloscope, Digital storage oscilloscope, power scope, spectrum analyzer, electron microscope, synchroscope

Reference Books:

1. **C. Kittel,** Introduction to solid state physics: 7th ed. Johj Wiley pub. Ltd.
2. **R.S.Khandpur,** Handbook of Analytical Instruments, TMH
3. **R.S.Khandapur,** Hand Book of biomedical Instrumentation, TMH
4. **A.K. Sawhney,** Electrical and electronic measurements and Instrumentation, Dhanpatrai & sons.
5. **Leslie Cromwell, Fred Weibell,** Biomedical Instrumentation and measurements, PHI.
6. **Bennedict and Weiner,** Industrial Electronics
7. **G.K. Mittal,** Industrial Electronics , Khanna Pub..
8. **H.S. Kalsi,** Electronic Instrumentation, TMH
9. **Joseph J. Carr,** Elements of Electronic Instrumentation and measurement Restor Book PH.

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ELE– 405PR : PRACTICALS

LIST OF PRACTICALS:

1. Astable multi-vibrator using OP-AMP
2. R-C Phase shift oscillator using OP-AMP
3. PLL Application Synthesizer,
4. PLL Application AM Demodulator, FM Demodulator
5. Schmitt trigger using OP-AMP
6. Non linear characteristics of OP-AMP
7. Active filter using OP-AMP
8. Hall Effect
9. Transistorized mixer circuit
10. Counter using microprocessor I
11. microprocessor Experiment II
12. ExpEyes based experiments I
13. ExpEyes based experiments II
14. Study of Transmission Line
15. Design of frequency counter and time period measurement

15% of new experiments can be introduced AND / OR replaced as per the need, with the permission of the Head.

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ELE– 406PT : PROJECT

- In-house project work of 4-credit to be performed by each student.
- Alternatively, MOOC, Swayam or any other UGC recognized online course in Electronic Sciences of at least 03 weeks duration will also be considered for 4-credit in this course.

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Course	Name of the Course	**Lect./ Hrs./ Week**	**Internal Marks**	**External Marks**	**Total Marks**	**Course Credits**
ELE-407	Microwaves-I & Semiconductor Devices	**4**	**30**	**70**	**100**	**4**
ELE-408	Microprocessor-II and Programming in C Language-I	**4**	**30**	**70**	**100**	**4**
ELE-409	Microcontroller-I and Power and Industrial Electronics-I	**4**	**30**	**70**	**100**	**4**
ELE-410	Optoelectronics and Control System-I	**4**	**30**	**70**	**100**	**4**
ELE-411 PR ELE-412 PT	Practicals Projects	**6** **6**	**30** **30**	**70** **70**	**100** **100**	**4** **4**
TOTAL		**28**	**180**	**420**	**600**	**24**

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ELE– 407: Microwaves-I & Semiconductor Devices

To make students familiar with the characteristics and applications of microwave passive components and tubes.
Transmission lines form an important part of a communication system. Student of this course were made familiar with the conventional transmission line in semester -I. In continuation of this study another type of transmission lines known as strip lines have been introduced. This will familiarize the students about the types, structures and properties of the planar transmission lines which forms the basis of the present day complex microwave systems.
Detailed analysis of BJT and fabrication process of FET and MOSFET are useful in designing and building circuits.

UNIT I : Microwave components : Microwave cavities (Rectangular cavityresonators, circular cavity resonator and semicircular cavity resonator, Q-factor ofa cavity resonator), Microwave hybrid circuits (Waveguide Tees, magic Tees, hybrid rings, waveguide corner bends and twists). Directional couplers (Two hole directional couplers, S-matrix of directional coupler, hybrid couplers), Circulators and Isolators (microwave circulators and microwave isolators).
STRIP LINES : Microstrip lines (Characteristics impedance of microstrip line, Effective dielectric constant, Transformation of rectangular conductor into equivalent circular conductor, characteristic impedance equation, Losses in microstrip lines, Quality factor Q of microstrip lines).Parallel strip lines (Distributed parameters, characteristic impedance, Attenuation losses), coplanner strip lines, shielded strip lines.

UNIT II:
Microwave Tubes: Conventional Vacuum triodes, tetrodes & pentodes (Lead inductance and interelectrode-capacitance effect, transit angle effect, Gain band, Width limitations).
Klystrons (Reentrant cavities, velocity modulation process, bunching process, output power and beam loading, state of the art), Multicavity Klystron amplifiers, beam current density, output current and output power of two cavity Klystron). Reflex Klystrons (Velocity modulation, power output and efficiency, electronic admittance). Helix Travelling-Wave Tubes TWTs (Slow wave structures, amplification process, convection current, axial electric field, wave modes, Gain considerations). Magnetron Oscillators (Cylindrical magnetron, equation of electron motion, cyclotron angular frequency, power output and efficiency).
MMIC: Monolithic microwave integrated circuits (Materials, substrate materials, conductor materials, Dielectric materials, Resistive materials), MMIC Fabrication techniques, Fabrication examples, Thin Film Formation (Planner resistor Film, Planer inductor Film, Planer capacitor Film), Hybrid integrated circuit fabrication.

UNIT-III : BJT: BJT fabrication, Switching- Cut-off, Saturation, Switching cycle, Specification for switching transistors. Gummel-Poon model, Kirk-effect, Frequency limitations of transistors- Capacitance and Charging time, Transit time effect, Webster effect, High frequency transistors.

UNIT-IV: JUNCTIONS, FET, MOSFET: Introduction to Fabrication of p-n junctions- Thermal oxidation, Diffusion, ion implantation, Etching, Metal – Semiconductor junctions- Schottky barriers, Rectifying contacts, Ohmic contacts, Typical Schottky barriers, Heterojunctions. FET and MOSFET: Introduction to JFET, JFET and MESFET, I-V characteristics, MOSFET structure and fabrication, MOS capacitor.

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Reference Books:

1. **Samuel Y.Liao,** Microwave Devices and circuits, Prentice Hall of India.
2. **R.E.Coolins,** Foundation of Microwave Engineering, McGraw Hill Book Company.
3. **D.C.Sarkar,** Microwave Propagation and Techniques, S.Chand and Company Ltd.
4. **M.Kulkarni** Microwave and Radar Engineering**,** Umesh Publications.
5. **Dennis Roddy and John Coolen,** Electronic Communications, Prentice Hall of India, (4^{th} Ed.)
6. **Robert E.Collins**, Antennas and radiowave propagation, MGH.
7. **George Kennedy**, Electronics and Communication systems, MGH Inter. Edition.
8. **Edward C. Jordan and Keith G. Balman**, Electromagnetic waves and Radiating systems, PHI
9. **H.A.Atwater,** Introduction to Microwave Theory, McGraw Hill Book Company.
10. **H.A.Watson**, Microwave semiconductor Devices and their circuit Application, McGraw Hill Book Company.
11. **Om P.Gandhi,** Microwave Engineering and Applications, Macmillan International Edition.
12. **Jaspreet Singh**, Semiconductor devices (basic principles) John Wiley & sons (Asia) pvt Ltd.
13. **Ben G. Streetman and S. Banerjee,** Solid state electronic devices, Prentice Hall of India.
14. **S.M. Sze,** Physics of semiconductor devices**,** Wiley Eastern Limited, New Delhi.
15. **Dennis Le Croissette,** Transistors, Prentice Hall of India.
16. **G.N.Garud and L.C.Jain,** Electronic devices and linear circuits, Tata McGraw-Hill Pub.
17. **S.S. ISLAM,** Semiconductor Physics & Devices, Oxford University Press

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ELE-408: Microprocessor–II & Programming in C-Language-I

To describe basic concepts of constants, variables, data types, operators.
To explain fundamentals on various control structures
To describe arrays and various techniques of array handling.
To write programs using various logics based on above concepts.

UNIT I : Serial I/O and Data communication:
Basic concepts in serial I/O, Transmission format, Introduction, Types of Communication Systems, Transmissions Standards, Serial Transmission Format, Data Communication over long distances, Block Diagram of Typical Modem device, Modulation Techniques
Interrupt System & Controller:
Features of 8259, Pin configuration of 8259, Functional block diagram of 8259, initialization command words of 8259
8253/8254 Programmable Internal Timer: Introduction Features of Programmable. Interval Timer, Pin Configuration, Functional Block Diagram, Control word register Format, Modes of Operation, Write Operation, Read Operation, Interfacing, Problems.

UNIT II: Microprocessor Application:
Measurement of electric quantities
Frequency Measurement, Interface of frequency measurement, Program flow chart for frequency measurement, Frequency measurement using SID line
Measurement of physical quantities
Temperature Measurement & Control, Water Level Indicator, Measurement of Display of speed of motor, Interfacing of Stepper Motor, Microprocessor based Traffic Control.
INTEL 8086 Microprocessor:
Introduction, INTEL 8086, Pin diagram and Pin Description, Operating Modes, Block Diagram, Pin Description of Minimum Mode/Maximum Mode, Operation of 8086, Register of Intel 8086, Interrupts, Addressing Modes of Intel 8086.

UNIT III: Overview of C: Importance of C, programming style and execution.
Constants, Variables and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration, assignment, symbolic constants.
Operators, Expressions: Arithmetic, relational, logical, assignment, increment and decrement, conditional, bitwise and special operators, evaluation of expressions, type conversions, operator precedence and associativity, mathematical functions.
I/O operations : Reading and writing a character, formatted I/O.
Decision making and branching/looping: if statements, nesting of if- else statements, else if ladder, switch statement, conditional operator, goto statement, while, do and for statements, jumps in loops.

UNIT IV:Arrays : One dimensional arrays, declaration and initialization of arrays, two dimensional and multi-dimensional arrays.

Character strings : Declaring and initializing string variables, reading and writing strings, arithmetic operations on characters, concatenation, comparing, copying and finding length of strings, string handling functions, table of strings.

Reference books:

1. **R.S.Gaonkar,** Microprocessor architecture, programming and application, Wiley Eastern Limited.
2. **B.Ram**, Microprocessors and Microcomputers, Dhanpatrai and Sons.
3. **Borole and Vibhute,** Microprocessor Architecture, Programming, Interfacing and applications, Technowa Publications, PUNE.
4. **Balagurusamy E**., Programming in ANSI C (IIInd Ed.), TMH Pub.
5. **P. Day and M.Ghosh**, Programming in C, Oxford Univ. Press, 2007
6. **Gottfried B.S**., Programming with C
7. **Kochan S.G**., Programming in C, CBS Pub.
8. **Kenetker Y**., Let us C, BPB Pub.
9. **Kernighan B.W**. **and Ritchie D.K.,** C Programming language, PH Pub.
10. **Stan Kelly - Bootle**, Mastering Turbo C, BPB Pub.

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ELE-409: Microcontroller-I and Power & Industrial Electronics

Microcontroller 8051 and its architecture along with instructions; used in the programming are covered. Important logical operations along with programming are also part of the course. Industrially important thyristor based circuits are covered. Applications in heating, melding, relays and displays and high voltage power supplies in industries are detailed.

Unit I: Microprocessor and microcontrollers : Introduction, microprocessor and microcontroller, 4-Bit/8 Bit/16 Bits/32 Bit/ microcontrollers.
The 8051 Architecture **:** Introduction, 8051 Microcontroler Hardware, Input/output pins, ports and circuits, External memory, counters and timers, serial data input/output, interrupts.
Moving data : Introduction, Addressing modes, External data moves, code memory, Read only data moves, push and pop opcodes data exchange, example programs.
Unit II: Logical operations: Introduction, Byte-level logical operation, Bit-level logical operations, Rotate and swap operations, Example programs.
Arithmetic operations: Introduction, Flags, Incrementing and Decrementing, Addition, subtraction, multiplication and division, decimal arithmetic, example program
JUMP & CALL SUBROUTINES: Introduction, the jump and call program Range, Jump. Calls and subroutines, interrupts and returns, more details on interrupts example problems.
Unit III: Turn on methods of a thyristor, dynamic turn-on switching characteristics, Turn-off mechanism, Turn off methods, Thyristor types, Thyristor rating, di/dt and dv/dt protection. Series and parallel operation of Thyristor.
Gate triggering circuits : Firing of Thyristors pulse transformers, optical isolators, gate trigger circuits, programmable UJT (PUT), Phase control using pedestal and ramp triggering. Phase control rectifier :
Unit IV : Introduction, Phase angle control, single-phase half/full wave controlled rectifier, single phase half-controlled bridge rectifier. Thyristor applications : Overvoltage protection, Fan regulator, Automatic battery charger, zero voltage switch, Integral cycle triggering, switch mode power supplies (SMPS), Uninterruptable power supply (UPS), ARC welding, Automatic voltage regulator using relays and servomotor.

Reference Books:

1. **Kenneth J.Ayala,** The 8051 Microcontroller, Architecture, Programming & Application, Penram International.
2. **K.Padmanabhan & S.Ananthi,** Learn to use microprocessor, EFY
3. **M.D.Singh & K.B.Khanchandani,** Power electronics, TMH.
4. **M.H.Rashid,** Power electronics, PHI.
5. **P.S.Bimbhra,** Power electronics, Kedarnath & Sons
6. **H.C.Rai,** Power electronics, devices and system,
7. **G.K.Mittal,** Industrial electronics, Kedarnath & Sons
8. **Chute & Chute,** Electronics in industry,
9. **Benedict and Weiner,** Industrial electronic circuits and applications, PHI
10. **K.R.Botkar,** Integrated circuits, KP

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ELE-410: Optoelectronics and Control System-I

Optoelectronic devices with its working principles and mechanism are covered in this course. These devices provide the optical sources and detectors that allow broadband telecommunications and data transmission over optical fibers.
The study of control theory is important to understand the various types of control systems used in electronics, instrumentation and other branches of engineering .In the present paper the students are made familiar with the basics of control systems along with their components and characteristics. The basic models and techniques to analyze control systems are also introduced.

UNIT-I: OPTOELECTRONICS SOURCES:
LED: Introduction, Radiative transitions, Emission spectra, Methods of excitations, LED-Structures; -Planar LED, Domed shaped LED, Heterojunction LED, Surface Emitting LED, Edge Emitting LED,; Definition of efficiencies;
LASER: Laser physics, stimulated emission and population inversion, Laser operating characteristics, Semiconductor Laser: Semiconductor laser structure

UNIT-II: DETECTORS:
Introduction, Photoconductor, Photodiodes- General consideration, quantum efficiency, response speed, device noise, p-i-n & p-n photodiodes, Heterojunction photodiode, Metal Semiconductor photodiode, Avalanche photodiode, avalanche gain, avalanche multiplication noise, Phototransistor.

Unit III : Introduction to control system:
Requirement of good control system, open and closed loop systems, feedback and feed forward system, classification of control systems, servomechanism.
Control system components: Opamp used as error detector, servopotentiometers, servomotors, Technogenerator, stepper motor; Dynamic models and responses: Transfer function, Impulse response and transfer function, properties of transfer function, Advantage and disadvantage of transfer function, poles and zeros of transfer functions.
State variable model, Modelling of mechanical systems, Dynamic models of RLC network, Analogous systems, Representation by nodal method, Gear trains.

Unit IV : Elements of control systems
Block diagram Algebra: Canonical form of feedback control system, Rules for block diagram reduction.
Signal Flow Graph: Rules, Properties, Mason gain equation, Use of Mason's gain formula for electrical network. Feedback control system Characteristics**:** Stability and sensitivity of a system, Need for standard test signal, Standard test signals, Derivation of steady state error, Analysis of first and second order systems, Role of 'ξ' in second order system, Transient response specification**.**

Reference books:

1. **S.M. SZE and Kwok K.Ng,** Physics of semiconductor devices 3rd ed. Wiley
2. **R.P.Khare ,** Fiber optics and optoelectronics Oxford university press
3. **N. Kesavamurthy and S. Naryana Iyer,** Digital signal processing, Jaico publishing house.
4. **Alan V.Oppenheim and Ronald W.Schafer,** Digital signal processing Prentice –Hall of India.
5. **S.K Mitra ,** Digital signal processing, TMH
6. **A.K. Ganguly,** Opto electronic Devices and Circuits, (NAROSA)
7. **N. Mathivanan,** PC-Based Instrumentation, PHI, 2007

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ELE– 411PR: PRACTICALS

LIST OF PRACTICALS:

1 Microwave (Guide Wavelength)
2 Optoelectronic Devices Characteristics – I
3 Optoelectronic Devices Characteristics – II
4 Peripheral IC 8155
5 Peripheral IC 8255
6 Traffic signal control using microprocessor
7 Microcontroller logic experiment-1
8 Microcontroller logic experiment-2
9 Analog Sampling
10 Mode characteristics of Klystron
11 Programming in C – I
12 Programming in C – II
13 Pulse Amplitude Modulator & Demodulator
14 Pulse Position Modulator & Demodulator
15 FSK Modulation & Demodulation

15% of new experiments can be introduces AND / OR replaced as per the need, with the permission of the Head. Total of at least 10 Practicals to be done.

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ELE– 412PT : PROJECT

- In-house project work of 4-credit to be performed by each student.
- Alternatively, MOOC, Swayam or any other UGC recognized online course in Electronic Sciences of at least 03 weeks duration will also be considered for 4-credit in this course.