

Gujarat University
M. Sc. (Electronics Sciences) Semester - IV
(Effective from – 2017-2018)

Course	Name of the Course	Lect./ Hrs./ Week	Internal Marks	External Marks	Total Marks	Course Credits
ELE-507	Integrated Circuit Technology	4	30	70	100	4
ELE-508	Control Systems-II and Power and Industrial Electronics-II	4	30	70	100	4
ELE-509	Fiber Optics and its Applications	4	30	70	100	4
ELE-510	Electronic Communication – II	4	30	70	100	4
ELE-511 PR	Practicals	6	30	70	100	4
ELE-512 PT	Project	6	30	70	100	4
TOTAL		28	180	420	600	24

GUJARAT UNIVERSITY

M. Sc. (Electronics Sciences) Semester - IV (Effective from – 2017-2018)

ELE– 507: Integrated Circuit Technology

Modern micro electronic fabrication technology with relevant example based on silicon has been covered in depth. The course gives an over view of silicon IC technology. VLSI techniques are also included.

UNIT - I: SILICON GROWTH TECHNOLOGY

Classification of IC's, Electronic grade Silicon, Czochralski and Float zone crystal, Growing Methods, Oxygen and carbon in silicon, segregation coefficients, silicon shaping and wafer preparation, Different silicon orientation. Epitaxy : Vapour Phase epitaxy.

UNIT - II: OXIDATION , LITHOGRAPHY AND ETCHING

Oxidation-Thermal, Dry and Wet, High pressure and plasma oxidation, Lithography - Optical Lithography, Photomask, Photo resist and process, Electron Lithography, Ion beam Lithography. Etching - wet chemical Etching, Reactive Plasma etching,

UNIT - III: DOPING, METALLIZATION AND PACAGING

Impurity Doping – Diffusion : Models of Diffusion in Solids, Fick's One dimensional Diffusion equations, Measurement Techniques, Ion implantation, Metallization - Desired properties of metals for contact and interconnect metallization, Metallization choices, AlSi and AlSiCu Alloy for shallow junction devices, Electromigration resistance. Packaging: Package types, Design considerations of Typical ICs, Die Bondings.

UNIT - IV: VLSI DESIGN AND FABRICATION REQUIREMENTS

Integrated Elements, Isolation of circuits, Bipolar Technology NPN Transistors, Integrated Diodes, Semiconductor resistor and capacitor. MOS Technology: NMOS & CMOS IC Technology. Non silicon Technology (GaAs ICs), Future trends. Fabrication Facilities and Environment-pure water system and clean room. Causes of IC failures - Electrostatic Discharge Damage and Alpha particle Induced soft errors

Reference Books:

1. **S.M.Sze**, VLSI Technology (Tata McGraw Hill 2nd Edition).
2. **W.R. Wesley and K.E. Bean**, Semiconductor Integrated, Integrated Circuit Processing technology (Addison - Wesley Publishing Co.).
3. **Peter Gise and Recharad Blanchard**, Modern Semiconductor Fabrication Technology (Reston Book - Prentice Hall)
4. **I.P.Stepanenko**, Fundamentals of Microelectronics (MIR Publishers).
5. **James W. Mayer and S.S.La**, Electronic Materials Science: For Integrated circuit in Si and GaAs (McMillan Publishing Co., New Delhi).
6. **Hong H. Lee**, Fundamentals of microelectronics processing, (McGraw Hill publishing Co.).
7. **S.M.Sze**, Semiconductor Devices: Physics and Technology (John Wiley and Sons).
8. **Douglas A. Packness and Kamran Eshraghian**, Basic VLSI Design: Systems and circuits (Prentice Hall of India New Delhi).

GUJARAT UNIVERSITY
M. Sc. (Electronics Sciences) Semester - IV
(Effective from – 2017-2018)

ELE– 508: Control Systems-II & Power and Industrial Electronics-II

In Sem-III the students are already made familiar with the components and characteristics of control systems. The study of control system by root locus design, stability analysis and frequency response analysis using Bode plots are being taken up here. Students will also learn about different control actions used in industrial controllers. Characteristics and applications of various thyristors widely used in industry are included here.

Unit - I: Stability Analysis: System stability bounds, Location of poles and stability, Relative stability and range of stability, stability criterion, Hurwitz criterion, Routh's stability criterion, Routh's criterion special cases, Application of Routh's criterion.

Root Locus: Relation between OLTF and CLTF poles and Zeros, Angle and magnitude criterion, General method for drawing root Loci.

Frequency Domain analysis: Limitation of time domain analysis, Frequency response, Performance specifications in frequency domain, Effect of adding zeros and poles.

Unit - II: Frequency Response analysis using Bode plot: Log scales, standard form for $G(j\omega)$, Bode plots of standard factors, Advantage of Bode plots, Frequency domain specifications, Determination of resonant frequency (ω_p) and Resonant peak (M_p), Relative stability

Frequency Response analysis using Nyquist plot: Polar plot, Polar plots of standard functions, Finding GM & PM from polar plots, Relative stability from polar plots, Nyquist analysis & plots, Nyquist stability plot, Nyquist stability criteria.

Control Actions: Two positions or ON-Off controllers, Proportional controller (P), Integral controller (I), Rate Feedback Controller, Proportional + Derivative controllers (PD), PI controller, PID controllers.

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. **R.A.Barapate**, Feedback Control Systems, Tech-Max Publication.
2. **S.C.Goyal & V.A.Bakshi**, Principles of control systems, Tecnical Publications
3. **I.J.Nagrath & M.Gopal**, Control System Engineering, Wiley Eastern
4. **B.C.Kuo**, Automatic Control Systems PHI
5. **M.D.Singh & K.B.Khanchandani**, Power electronics, THM.
6. **M.H.Rashid**, Power electronics, PHI.
7. **P.S.Bimbhra**, Power electronics, KP
8. **H.C.Rai**, Power electronics, devices and system
9. **P.C.Sen**, Power electronics
10. **G.K.Mittal**, Industrial electronics, KP
11. **Chute & Chute**, Electronics in industry
12. **H.C.Rai**, Industrial and power electronics, Umesh P
13. **Benedict and Weiner**, Industrial electronic circuits and applications, PHI

GUJARAT UNIVERSITY
M. Sc. (Electronics Sciences) Semester - IV
(Effective from – 2017-2018)

ELE– 509: FIBER OPTICS AND ITS APPLICATIONS

The students have completed study of LED and LASER sources. Here they study optical fiber, couplers & connectors. There is a unit on incoherent & coherent communication systems. Optical fiber measurements and other applications are also included here.

Unit - I: Optical fiber waveguide and its transmission characteristics

Step Index and graded Index fibers, Ray theory, Electromagnetic Mode theory, Group and phase velocity, Cylindrical fiber (qualitative), Normalized frequency, Single mode fiber -cutoff wavelength.

Unit - II: Optical fibers fabrication, fiber couplers and connectors

Optical fiber losses: Material absorption losses, linear scattering losses, non-linear scattering losses (qualitative), bend loss, mid-IR transmission, Dispersion: Intramodal dispersion, Intermodal dispersion, overall fiber dispersion. Stability of the fiber transmission characteristics, fiber alignment and joint losses, fiber splices : fusion splices, mechanical splices, fiber optic connectors - cylindrical and bioconical ferrule connectors, expanded beam connectors, fiber couplers, Optical fiber to Source connection techniques.

Unit - III:

Optical fiber fabrication: Fiber material requirements, Fabrication methods: liquid phase techniques, Double crucible technique, Vapour phase deposition technique – Outside vapour phase oxidation (OVPO), Vapour Axial deposition (VAD), MCVD)

Optical fiber measurements: Attenuation, dispersion, refractive index profile, cutoff wavelength, numerical aperture, reflectance and optical return loss, OTDR.

Unit - IV:

Communication Systems I: Optical transmitter circuit-LED & Laser drive circuits, optical receiver circuit-detector, AGC and receiver block diagram, digital systems, analog systems -direct intensity modulation.

Communication Systems II: Basic system, detection principles, modulation formats-ASK,FSK,PSK and Polarization Shift Keying demodulation schemes-Heterodyne synchronous detection, Heterodyne non-synchronous detection, Homodyne Detection and Phase diversity reception.

Reference Books:

1. **J.M. Senior**, Optical fiber communication-principles and practices, Prentice Hall, 1999.
2. **R.P. Khare**, Fiber Optics and Optoelectronics, Oxford University Press 2004
3. **Gerd Keiser**, Optical fiber communications, McGraw Hill International edition, 3rd Edition 2000.
4. **S.C. Gupta**, Text Book on Optical fiber Communication and its Applications by P H I, 2005
5. **J. Gowar**, Optical communication systems by Prentice Hall, 1993.

GUJARAT UNIVERSITY
M. Sc. (Electronics Sciences) Semester - IV
(Effective from – 2017-2018)

ELE– 510: Electronic Communication - II

Modern instruments use pc based data acquisition systems. These also use microcontroller hardware and various soft wares. These areas are in this syllabus.

The students study radars and satellite communication which are backbone of communication systems. Further mobile communication is also included here.

UNIT - I:

Data Acquisition systems Analog input, Analog Output, Digital I/O, Timing I/O, Data Acquisition Configurations- Local Data acquisition, GPIB Data Acquisition, Data Acquisition Using Serial Interfaces, Networked Data Acquisition

Data Acquisition Using GPIB Overview, GPIB Commands, GPIB Programming, Expanding GPIB; IEEE-488.2, SCPI 417, HS488 Protocol

UNIT - II:

Data Acquisition Using Serial Interfaces Serial Communication, Serial interface Standards, PC serial port, Microcontroller Serial Interfaces, USB, IEEE1394, Remote I/O Modules

Unit - III:

Radar: Radar system, Basic principles, Fundamentals, Radar performance factors, Pulse system, Basic pulse Radar system, Antennas and scanning. Display methods, Pulse radar systems, Moving target indicator (MTI), Radar beacon, CW Doppler radar, FM CW radar.

Satellite communication : Introduction, Kepler's Laws, Satellite orbits, Geostationary orbit, Power Systems, Attitude Control, Satellite station Keeping, Antenna look angle and limits of visibility (description), Frequency Plans and Polarization, Satellite antenna radiation patterns, Transponders, Satellite system parameters, Uplink Power Budget Calculations, Downlink Power Budget Calculations, Overall Link Budget Calculations, Multiple-access Methods : FDMA, TDMA, CDMA, Satellite radio navigation and GPS, INSAT

Unit - IV:

Mobile communication: Cellular telephone, Frequency reuse, Interference, Cell splitting sectoring segmentation and dualization, Cellular system topology, Roaming and handoff, Cellular telephone network components, First generation analog cellular telephone, Personal communication system, Second generation cellular telephone systems, N-Amps, Digital cellular telephone. Interim standard 95, Global system for mobile communication, Personal satellite communication systems

Reference Books:

1. **N. Mathivanan**, PC-Based Instrumentation, PHI, 2007
2. **D. Roddy and J. Coolen**, Electronic Communication, PHI, 4th edition, 2005
3. **W. Tomasi**, **Advanced Electronics** Communications Systems, 6th ed., PHI, 2007
4. **G. Kennedy**, Electronic Communication system Tata M. Graw Hill, 1996
5. **M. L. Gupta**, Electronic and Radio engineering, Dhanpat Rai & Sons, 1991

M. Sc. (Electronics Sciences) Semester - IV
(Effective from – 2017-2018)

ELE– 511PR: PRACTICALS

LIST OF PRACTICALS:

1. POWER ELECTRONICS – DIAC – TRIAC
2. POWER ELECTRONICS – UJT CONTROLLED SCR FIRING
3. FIBER OPTICS – NUMERICAL APERTURE
4. FIBER OPTICS – BENDING LOSS
5. FIBER OPTICS – ANALOG COMMUNICATION SYSTEM
6. FIBER OPTICS – DIGITAL LINK
7. LASER – GRATING ELEMENT
8. LASER – WAVELENGTH
9. FSK – MODULATION – DEMODULATION
10. PSK – MODULATION – DEMODULATION
11. PCM – MODULATION – DEMODULATION
12. DELTA MODULATION – DEMODULATION
13. ADAPTIVE DELTA MODULATION – DEMODULATION
14. INTERFACING EXPERIMENT – EXPEYES -I
15. INTERFACING EXPERIMENT – EXPEYES -II

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

M. Sc. (Electronics Sciences) Semester - IV
(Effective from – 2017-2018)

ELE– 512PT: PROJECT
