<table>
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<tr>
<th>Course</th>
<th>Name of the Course</th>
<th>Lect./ Hrs./ Week</th>
<th>Internal Marks</th>
<th>External Marks</th>
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<tr>
<td>ELE-507</td>
<td>Integrated Circuit Technology</td>
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<tr>
<td>ELE-508</td>
<td>Control Systems-II and Power and Industrial Electronics-II</td>
<td>4</td>
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<td>ELE-509</td>
<td>Fiber Optics and its Applications</td>
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<td>ELE-510</td>
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<td>ELE-512 PT</td>
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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 overview of silicon IC technology. VLSI techniques are also included.

UNIT 1: 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 2: 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 3: DOPING, METALLIZATION AND PACAGING

UNIT 4: VLSI DESIGN AND FABRICATION REQUIREMENTS

Reference Books:

3. Peter Gise and Rechard Blanchard, Modern Semiconductor Fabrication Technology (Reston Book - Prentice Hall)


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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 1:
Stability Analysis:
System stability bounds, Location of poles and stability, Relative stability and range of stability, Hurwitz criterion, Ruth’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 2:
Frequency Response analysis using Bode plot:
Log scales, standard form for GH(jω), Bode plots of standard factors, Advantage of Bode plots, Frequency domain specifications, Determination of resonant frequency (ωp) and Resonant peak (Mp), Relative stability, All pass and minimum pass functions, calculation of transfer function from Bode plots.

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 3:
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 : 4
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:
2. **B.C.Kuo**, Automatic Control Systems PHI
4. **M.D.Singh & K.B.Khancandani**, Power electronics, THM.
5. **M.H.Rashid**, Power electronics, PHI.
6. **P.S.Bimbhra**, Power electronics, KP
7. **H.C.Rai**, Power electronics, devices and system,
8. **P.C.Sen**, Power electronics,
9. **G.K.Mittal**, Industrial electronics, KP
10. **Chute & Chute**, Electronics in industry,
11. **H.C.Rai**, Industrial and power electronics, Umesh P
12. **Benedict and Weiner**, Industrial electronic circuits and applications, PHI
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 1: 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, 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.

**Unit 2: Optical fibers fabrication, fiber couplers and connectors**
Fiber material requirements, Fabrication methods : liquid phase techniques, Double crucible technique, Vapour phase deposition technique – Outside vapour phase oxidation (OVPO), Vapour Axial deposition (VAD), flourried glass fiber, 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 3: Optical fiber measurements**
Attenuation, dispersion, refractive index profile, cutoff wavelength, numerical aperture, reflectance and optical return loss, OTDR.
**Applications** : medical, astronomy, industry.

**Unit 4:**
**Communication Systems I:** Optical transmitter circuit, optical receiver circuit, digital systems, analog systems -direct intensity modulation.
**Communication Systems II:** Basic system, detection principles, practical constraints, modulation formats, demodulation schemes, receiver sensitivities, single and multicarrier systems.

**Reference Books:**
2. **R.P. Khare**, Fiber Optics and Optoelectronics, Oxford University Press 2004


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 1:
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 Serial Interfaces
Serial Communication, Serial interface Standards, PC serial port, Microcontroller Serial Interfaces, USB, IEEE1394, Remote I/O Modules

UNIT 2:
Data Acquisition Using GPIB
Overview of GPIB, GPIB Commands, GPIB Programming, Expanding GPIB, IEEE-488.2, SCIP 417, HS488 Protocol

UNIT 3:
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.


UNIT 4:
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
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ELE– 511: PRACTICALS

LIST OF PRACTICALS:

1. FIBER OPTICS       Numerical aperture
2. FIBER OPTICS       Communication System
3. LASER              Grating Element
4. LASER              Wavelength
5. Power Electronics  RC Triggered Ckt for SCR connected in a Bridge
6. Power Electronics  UJT trigger controlled SCR firing
7. Power Electronics  DIAC/TRIAC dimmer
8. Antenna Radiation Pattern
9. PHASE SHIFT KEYING  (Modulation & Demodulation)
10. FREQUENCY SHIFT KEYING      ( --- do--- )
11. PULSE CODE MODULATION      ( --- do--- )
12. DELTA & ADAPTIVE DELTA     ( --- do--- )
13. BALANCED MODULATOR        ( --- do--- )

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

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ELE– 512: PROJECT