Subject : Numerical analysis and Engineering

Units: 4

Weekly Hours : Theoretical : 2

Experimental: –

week	Syllabus
1-6	Laplace Transformation • Properties, Forward and Inverse transformation and associated theorems. • Convolution and Translation and their properties. • Solving differential equations using Laplace transformation. • Applications
7-12	General power series methods • Convergence of the power series. • Solution of differential equations • Legendre equation, Legendre polynomials. • Bessel equation, Bessel functions
13-18	Function of complex variables. • Cartesian and polar coordinates of complex numbers. • Analytical function, Cauchy-Riemann equations. • Cauchy integral theorem. • Integration in the complex plane.
19-24	Matrix Theory • Definitions, Ad joint, Inverse of a matrix, sum and multiply of matrices. • System of linear equations. • Characteristic equation, Eigen values and Eigen vectors

	• Matrix differential equations
25-30	Fourier series and Transformation • Derivation of Fourier series • Odd and Even Functions • Half-wave Fourier series • Frequency spectra of different time functions, Fourier transformation • Applications

Subject : Laser physics

Units: 4

Weekly Hours : Theoretical : 2

Experimental: –

week	Syllabus
1-10	Laser Gain • Fluorescence line shape of the laser • Fluorescence linewidth. • Mathematical expressions of fluorescence linewidth • Laser Gain curve • Broadening the fluorescence line. • Natural broadening. • Doppler broadening. • Pressure broadening • Loop Gain. • Calculating loop gain (GL) without losses. • Calculating loop gain (CL) with losses. • Calculating gain threshold (GL)th. • Hole Burning in the laser gain curve • Active medium gain with lasing and without - Hole Burning • Saturation gain in a continuous wave laser • Gain and Output power of CW laser • Continuous wave laser • Pulsed laser • Pulse shape out of a pulsed Ruby laser.

11-20	Laser Radiation Properties • Radiometry and units measuring electromagnetic radiation. • Spatial distribution of the emitted radiation at the output coupler. • Transverse electromagnetic modes of the laser radiation. • Gaussian Laser Beam. • Beam Divergence. • Divergence Angle. • Near field and far field. • Rayleigh range and Gaussian beam divergence • Diffraction through a circular hole. • Fresnel number. • Beam focusing. • Characteristics of Laser Radiation Pulses • Single pulse of laser radiation. • Excitation of the laser with pulsed energy. • Different types of pulses. • Special mechanisms for creating short pulses • Control of the duration of the laser radiation pulse by the excitation Mechanism • Q-switched lasers. • Q (Quality) factor. • Q switch • Different methods for Q Switching • Cavity Dumped Lasers • Mode-Locked Lasers

21-30	Controlling the laser radiation properties • Controlling the transverse optical modes of the beam. • Some common laser resonators • Plane-plane optical cavity. • Circular mirrors with large radius of curvature. • Confocal optical cavity • Circular optical cavity • Half circular optical cavity. • Unstable optical cavity. • Controlling the wavelength spectrum emitted from the laser Selective excitation of the active medium. • Selective coating on the cavity mirrors. • Special optical element inside the optical cavity • Prism. • Diffraction Grating • Etalon

Subject : Electronics II & Wireless communication systems

Units: 6

Weekly Hours : Theoretical : 2

Experimental: 2

week	Syllabus
1	Introduction: Communication and propagation systems
2-10	Modulation • Analogue Modulation • AM Modulation • FM Modulation • PM Modulation • Digital Modulation systems • Pulse modulation systems (PM) • A/D and D/A convertors • PCM • TDM • FDM • ASK • FSK • PSK • PSK & BPSK
11-15	Noise • External noise figure • Internal noise figure

	• Maximum power transfer • SN ratio • Nosie figure and noise factor • Noise temperature • Carrier to noise ratio • BER
16-20	Transistor and amplifiers properties
20-25	Rectifier, Thyristor, and trigger
25-30	Power supply, generator, and Max generator

Subject : Power electronics

Units: 4

Weekly Hours : Theoretical : 2

Experimental: −

week	Syllabus
1	Introduction
2-5	Power Electronics Defined and power diodes • Key Characteristics • Trends in Power Supplies • Conversion Examples • Tools For Analysis and Design • Diode as a Switch • Some Properties of PN Junction • Common Diode Types • Typical Diode Ratings • Snubber Circuits for Diode • Series and Parallel Connection of Power Diodes • Typical Applications of Diodes
6-10	Thyristors and Gate Trun-OFF Thyristors • Basic Structure and Operation • Static Characteristics • Dynamic Switching Characteristics • Thyristor Parameters • Types of Thyristors • Gate Drive Requirements • PSpice Model • Gate Turn-Off Thyristors; Basic Structure and Operation • GTO Thyristor Models • Static Characteristics • Switching Phases • SPICE GTO Model

11-20	• Power Bipolar Transistors • Basic Structure and Operation • Static Characteristics • Dynamic Switching Characteristics • Transistor Base Drive Applications • SPICE Simulation of Bipolar Junction Transistors • BJT Applications • The Power MOSFET • The Need for Switching in Power Electronic Circuits • General Switching Characteristics • The Power MOSFET • MOSFET Structure • MOSFET Regions of Operation • MOSFET PSPICE Model • Comparison of Power Devices
21-30	• Insulated Gate Bipolar Transistor • Basic Structure and Operation • Static Characteristics • Dynamic Switching Characteristics • IGBT Performance Parameters • Gate-Drive Requirements • Circuit Models • MOS Controlled Thyristors (MCTs) • Equivalent Circuit and Switching Characteristics • Comparison of MCT and Other Power Devices • Gate Drive for MCTs • Protection of MCTs. • Generation-1 and Generation-2 MCTs • N-channel MCT • Base Resistance-Controlled Thyristor • MOS Turn-Off Thyristor • Applications of PMCT

Subject : Semiconductors

Units: 4

Weekly Hours : Theoretical : 2

Experimental: −

week	Syllabus
1	Introduction
2-10	• Energy bands in typical semiconductors • Structure of atom. • Degeneracy of energy levels in free atoms • Formation of energy bands in crystals • Filling of energy bands by electrons • Division of solids into conductors , semiconductors and Insulators • Bad structure of semiconductors • Free electrons and holes concentrations in semiconductors • Types of semiconductors (doping) • Intrinsic semiconductors (pure) • Extrinsic semiconductors (doping) • The general equations of intrinsic and Extrinsic semiconductor • Semiconductor in Equilibrium • Non- Equilibrium Excess carriers in Semiconductor • Fermi-level in semiconductor • Movement of change carrier in semiconductor (majority and minority carriers) • Hall effect and carrier density

11-20	• Elementary transport in semiconductors. • Electric field transport. • Mobility • Conduction by diffusion • Carrier lifetime • diffusion length • Contact phenomena • Electron-Hole junction. • Methods of producing pn junction. • Equilibrium state of a pn junction. • Rectifying properties a pn junction. • Breakdown of a pn junction.
21-25	• Semiconductor diode • P-N junction Zero applied bias. • P-N junction forward biasing. • P-N junction reverses biasing. • V/I characteristics of diode. • Current components in a pn junction. • Load Line. • Linear diode model equivalent circuit. • Zener diode • Zener Breakdown. • Avalanche Breakdown. • Transistor • Junction transistor. • Bipolar transistor. • Field effect transistor (JFET ,MOSFET[DE-MOSFET,EMOSFET])

26-30	• Measuring the electromagnetic spectrum, • Photo detectors • Vacuum photodetectors • Semiconductor detectors • P-N photodetectors • P-i-N diodes • Avalanche photodiode • Basic principle of photo detector • Detector arrays • CCD detector

Subject : Materials & Spectroscopy

Units: 4

Weekly Hours : Theoretical : 2

Experimental: −

week	Syllabus
1	Introduction
2-15	Adiabatic Approximation and the Concept of Molecular Potentials • Quantum-Mechanical Description of Free Molecules • Separation of Electronic and Nuclear Wavefunctions • Born-Oppenheimer Approximation • Adiabatic Approximation • Potentials, Curves and Surfaces, Molecular Term Diagrams and Spectra • Electronic States of Diatomic Molecules • Exact Treatment of the Rigid H^{+}_{2} Molecule • Classification of Electronic Molecular State • Energetic Ordering of Electronic States • Symmetries of Electronic Wavefunction

16-30	• Electronic Angular Momenta
	• Electron Configurations and Electronic States
	• The Approximation of Separated Atom
	• The “United Atom” Approximation
	• Approximation Methods for the Calculation of Electronic Wavefunction
	• The H2 Molecule
	• Quantum-mechanical Treatment
	Rotation of Diatomic Molecules
	  • The Rigid Rotor
	  • Centrifugal Distortion
	  • The Influence of Electron Rotation
	  • Molecular Vibrations
	  • The Harmonic Oscillator
	  • Vibration-Rotation Interaction
	  • The material structure
	  • PN junction
	  • P-I-N junction
	  • Hetero junction structure
	  • Alloys

Subject : Quantum mechanics

Units: 4

Weekly Hours : Theoretical : 2

Experimental: −

week	**Syllabus**
1	Introduction
2-10	• The structure of matter • Length scales from cosmology to elementary particles • States of matter • Elementary constituents • The fundamental interactions • Black-body radiation • The photoelectric effect • Wave–particle duality • Wave quantisation • Heisenberg uncertainty principle • Schrödinger’s equation • Expectation values and the momentum operator • Some properties of Wavefunctions • The variational principle
11-20	• Energy levels • Energy levels in classical mechanics and classical models of the atom • The Bohr atom

	• Orders of magnitude in atomic physics • Hilbert spaces of finite dimension • Linear operators on $\mathcal{H}$ • Linear, Hermitian, unitary operators • Projection operators and Dirac notation • Unitary operators and Hermitian operators • Operator-valued functions
21-30	• Dirac – Delta function • One dimensional Dirac – Delta function • Helm Holts theorem • Potentials

Subject : Microprocessors

Units: 6

Weekly Hours : Theoretical : 4

Experimental: −

week	Syllabus
1	Introduction
2-10	• Architecture of 8085 microprocessor: Block diagram; registers ALU; control unit. • Instructions set and programming of 8085 microprocessors • Stack and Subroutine
11-20	• Time delay and Counters • Interrupts • Addressing modes • Pin out of 8085 microprocessor, Buses system, and Control signals.
21-30	• Memories: Type of memory; storage element; memory addressing multi chips memory. • fetch and execute cycle • Interfacing I/O devices • 8086 microprocessor: Block diagram; architecture; registers; pin out; Introduction to programming.

Subject : Computer Applications

Units: 4

Weekly Hours : Theoretical :1

Experimental: 2

week	Syllabus
1	Introduction
2-15	Mat lab Design
16-30	Programming with C++ language