**Subject : Numerical analysis and Engineering**

 **Units: 4**

**Weekly Hours : Theoretical : 2**

 **Experimental: −**

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| **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 |

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|  |  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: −**

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| **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. |

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| 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 excitationMechanism 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**

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| **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 |

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|  |  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 |
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**Subject : Power electronics**

 **Units: 4**

**Weekly Hours : Theoretical : 2**

 **Experimental: −**

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| **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 |

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| 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: −**

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| **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 |

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| 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: −**

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| **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+ Molecule2 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 TreatmentRotation 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: −**

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| **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 |

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|  |  Orders of magnitude in atomic physics Hilbert spaces of finite dimension Linear operators on 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: −**

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| **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**

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