SYLLABUS FOR DAT

Photonics:

Optics

Geometrical Optics:, Refraction of light,Snell's law, total internal reflection and its applications, refraction at spherical surfaces, lenses, thin lens formula, lensmaker's formula

Wave optics: Interference and diffraction of light,concept of coherence, polarization, Jones vectors, Muller matrices

Optoelectronics

Optical processes in semiconductors: electron-hole pair formation and recombination, absorption in semi-conductors, Electron states in direct gap and indirect gap semiconductors.

Properties of Photons and Electrons, PN junction, carrier recombination and diffusion, injection efficiency, heterojunction, internal quantum efficiency, external quantum efficiency.

Basic optoelectronic devices: LED and Laser diodes

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Different types of optoelectronic materials and applications. Luminescence, Phosphorescence and Fluorescence

Fiber Optics

Step index and graded index fibres, single mode and multimode fibres, Numerical aperture, cut off wavelength, V-Parameter. Transmission characteristics of optical fibre, attenuation, absorption and scattering losses.

Electronics:

Analog Electronics: P-N Junction diodes, Biasing, Applications of diodes, Bipolar Junction Transistors, Transistor Configurations, Field Effect Transistors,

Differential amplifiers, Common mode and differential mode gain, Operational amplifiers, Applications of operational amplifiers, Waveform generators, Silicon Controlled Rectifier (SCR), DIAC, TRIAC, LASCR, GTO, UJT.

Digital Electronics: Different number systems and their inter conversion, Logic gates, Boolean algebra, Flip-flops: R-S, J-K and J-K Master Slave Flip-Flops.

A/D and D/A converters

Modern Physics

Particle properties of waves, Wave properties of particles, Bohr atom model, Uncertainty principle and its applications, Schrodinger equations, Postulates of quantum mechanics, Applications of Schrodinger equations (particle in a box, harmonic oscillator, finite and infinite potential barriers, Hydrogen atom), Angular momentum, Perturbation theory, Variational methods, WKB approximation, Time-dependent perturbation theory, Fermi's golden rule, Scattering theory. Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions.

Spectroscopy:
Rutherford model, Bohr atom model, Hydrogen spectral series, Ritz combination principle, Bohr's correspondence principle, Sommerfield relativistic atom model, Wilson Sommerfeld modification, Vector atom model, Quantum numbers, Larmor theorem. Atomic orbitals and their shapes, LS coupling, jj coupling, Pauli's exclusion principle, Hund's rule of multiplicity, selection rules, intensity rules, Spectra of one and two electron systems, Zeeman effect, Paschen-Back effect, Stark effect, Mosely's law, Rotational energy levels of rigid and non rigid diatomic molecules, IR spectroscopy, Raman spectroscopy, electronic spectroscopy, spin resonance spectroscopy, Mossbauers spectroscopy

Solid state Physics

Crystal systems and symmetry elements; Reciprocal lattice, crystal diffraction and Braggs Law, lattice vibrations, phonon spectra, lattice specific heat; Free electron theory and electronic specific heat; Band theory of solids, Fermi level, origin of bands, Bloch theorem, classification of materials based on band gap, electrical conduction in metals and semiconductors, effect of doping on Fermi level in semiconductors.

Magnetic properties of solids, dia, para and ferromagnetism (classical and quantum view), Dielectric properties of solids: polarisability, local electric field of an atom, ferroelectric crystals. Superconductors, TypeI and Type II superconductors, Meissner effect, BCS Theory of superconductivity.

Electromagnetic Theory

Electrostatics: Gauss' Law and its applications, Laplace and Poisson equations. Magnetostatics: Biot-Savart law, Ampere's theorem, electromagnetic induction. Maxwell's equations in free space and linear isotropic media, boundary conditions on fields at interfaces, Scalar and vector potentials, Electromagnetic waves in free space, dielectrics and conductors. Reflection and refraction, polarization, Fresnel's Law, Dispersion relations in plasma, Radiating electric dipole.