

Syllabus of Advanced Applied Physics

Unit 1: Materials Science: Basics

Basics of crystal structures, symmetry, reciprocal lattice, Bravais lattice, imperfection in crystals, crystal diffraction, x-ray diffraction, Bragg's law, Brillouin zones. Magnetic materials-elementary ideas only. Introduction to Superconducting Materials

Materials, Type-I & II, Meissner effect, BCS theory, flux quantization. DC and AC Josephson effects; elementary idea about high Tc superconductivity.

Unit 2: Lasers: Rate equations, stability condition, characteristics of laser output, plane mirror resonator modes, spherical mirror resonator modes. He-Ne, Nd:YAG, Semiconductor lasers. Applications to material processing, Laser photochemistry and Plasma interactions.

Unit 3: Fiber Optics: TE and TM modes of symmetric step index planer waveguide, mode cut off condition, scalar wave equation and modes of fiber, modal analysis for step index fiber. Pulse dispersion, attenuation and splice loss in optical fibers. Introduction to FO sensors.

Unit 4: Growth & characterization techniques (any three techniques from each only): Czochralski, Bridgman, Flote zone and Lely growth methods, MBE, CVD, sputtering techniques, PLD, Characterization techniques: XRD, XRR, SIMS,

SEM & EDAX, AFM, PL, Lithography (top down and bottom up), Contact preparation of thin films for device fabrication.

Unit 5: Instruments and Measurement Techniques: Introduction to Synchrotron radiation sources and detection methods. Light Sources and detectors. Any four devices from the following: OTDR, OLCR, FTIR, Power and energy meters, Monochromator, CCD, OSA, Ellipsometer, Lock-in-Amplifier, BoxCar averagers.

References:

1. C. Kittel, Introduction to Solid State Physics, 5 th Ed. (Wiley Eastern Ltd., New Delhi) 1993.
2. O. Svelto, Principles of Lasers, (Plenum, New York, 1982)
3. D.C.O.'Shea, An Introduction to Lasers and their Applications (Addison-Wesley, Reading, 1978).
4. A.H. Cherin : An Introduction to Optical Fibres (McGraw Hill, 1983).
5. A. Ghatak and K. Thyagarajan, Optical Electronics (Cambridge Univ. Press, 1989).
6. B. P. Pal : Fundamentals of Fibre Optics in Telecommunication and Sensor Systems, New Age, New Delhi, 1992.
7. D. Minoli, Nanotechnology Applications to Telecommunications, John Wiley, new Jersey, 2006.

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