**ROE033/ROE043: LASER SYSTEMS AND APPLICATIONS**

UNIT I

Basic Principle of Modern Physics: Black body radiation, Atomic structure, Spectral series of hydrogen atom, Polarization, Absorption and florescence of X-ray, Energy distribution in electrons, Probability of distribution of free electrons, Free electron in metals, Energy level in free electrons, Application of Schrodinger equation in potential well, potential step, tunneling effect.

UNIT II

Elements and Techniques of Laser: Concept of coherence, Temporal and Spatial coherence, Coherence length and time, Brightness and Intensity, Directionality and Monochromacity. Absorption, Spontaneous and Stimulated Emission process and Einstein’s coefficients. Population inversion, Pumping and pumping schemes, laser gain, Optical cavities and its types.

UNIT III

Principle of Laser & General Lasers: Main components of Laser, Principle of Laser action, Introduction to general lasers and their types. Three & four level Lasers, Continuous Wave Lasers, Pulsed Lasers, Q-switch lasers.

UNIT IV

Systems Types of Laser: Solid state Lasers: Neodymium laser, Nd-Yag laser, Nd-Glass laser and Alexandrite laser. Liquid Lasers: Dye laser, Tuning in Dye laser, Model-Locked Ring Dye laser. Gas Laser: Ionic lasers, Argon ion laser, Krypton ion laser, He-Cadmium laser, Copper vapour laser, Carbon dioxide laser and Excimers laser. Semiconductor Laser: Characteristics of semiconductor lasers, Semiconductor diode lasers, Hetrojunction lasers, Homojunction lasers, Quantum well lasers.

UNIT V

Laser Applications: Material Processing: Material processing with lasers, Interaction mechanism, Material processing mechanism, Drilling, Cutting and Welding process with laser. Laser hardening. Medical Science: Medical lasers, Laser diagnostic, Laser in ophthalmology, laser in glaucoma, Laser for general surgery, Laser in dermatology, laser in dentistry, Laser in medicine. Optical Communication: Optical source for fiber optical communication, powering and coupling, Transmission, Hologram their characteristics. LIDAR.

Reference Books: 1. KR Nambiar, “Laser Principles, Types and Application” New Age International.

2. SA Ahmad, “Laser concepts and Applications” New Age International. 3. AK Katiyar, CK Pandey and Manisha Bajpai, Fundamentals of Laser Systems and Applications.