Module 1

Syllabus : (**Prerequisites :** Wave front and Huygen's principle, Reflection and refraction, Diffraction, Fresnel diffraction and Fraunhofer diffraction).

Diffraction : Fraunhofer diffraction at single slit, Diffraction grating, Resolving power of a grating; Applications of diffraction grating; Determination of wavelength of light using plane transmission grating.

Module 2

Syllabus : (**Prerequisites :** Absorption, Recombination, Energy bands of p-n junction, Refractive index of a material, Snell's law).

(A) Laser : Spontaneous emission and stimulated emission; Metastable state, Population inversion, Types of pumping, Resonant cavity, Einstein's coefficient; Helium Neon laser; Nd:YAG laser; Semiconductor laser,Applications of laser- Holography.

(B) Fibre optics : Numerical Aperture for step index fibre; Critical angle; Angle of acceptance; V number; Number of modes of propagation; Types of optical fibres; Fibre optic communication system.

Module 3

Chapter 3 : Electrodynamics 3-1 to 3-26

Syllabus : (**Prerequisites :** Electric Charges, Coulomb's law-force between two point charges, Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, Gauss's law, Faraday's law)

Scalar and Vector field, Physical significance of gradient, Curl and divergence in Cartesian co-ordinate system, Gauss's law for electrostatics, Gauss's law for magnetostatics, Faraday's Law and Ampere's circuital law; Maxwell's equations (Free space and time varying fields).

Module 4

Syllabus : (**Prerequisites :** Cartesian co-ordinate system).

Special theory of Relativity : Inertial and Non-inertial Frames of reference, Galilean transformations, Lorentz transformations (Space-time coordinates),Time Dilation, Length Contraction and Mass-Energy relation.

Module 5

Syllabus : (**Prerequisites :** Scattering of electrons, Tunnelling effect, Electrostatic focusing, Magneto static focusing).

Nanomaterials : Properties (Optical, electrical, magnetic, structural, mechanical) and applications, Surface to volume ratio; Two main approaches in nanotechnology -Bottom up technique and Top down technique.

Tools for characterization of Nanoparticles : Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM).

Methods to synthesize Nanomaterials : Ball milling, Sputtering, Vapour deposition, Solgel.

Module 6

Syllabus : (**Prerequisites :** Transducer concept, Meaning of calibration, Piezoelectric effect)

Resistive sensors :

a) Temperature measurement : PT100 construction, Calibration,

b) Humidity measurement using resistive sensors.

Pressure sensor : Concept of pressure sensing by capacitive, Flex and inductive method, Analog pressure sensor : Construction working and calibration and applications.

Piezoelectric transducers : Concept of piezoelectricity, Use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement, Liquid and air velocity measurement.

Optical sensor : Photodiode, Construction and use of photodiode as ambient light measurement and flux measurement.

Pyroelectric sensors : Construction and working principle, Application of pyroelectric sensor as bolometer.

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