# Department of Applied Physics

**Delhi Technological University**

**Bawana Road, Delhi-110 042**

## AP-101-Physics–I (Aug.- Nov. 2019) B.Tech. First Semester (All Groups)

| Unit | Detailed topics of the syllabus |
|---|---|
| 1. | **Relativity:**<br><br>➢ Basic ideas about frames of reference, relative motion.<br>➢ Michelson- Morley experiment- Clearly mentioning its Aim, Assumptions, Observations and Conclusions. Derivation of fridge shift.<br>➢ Galilean Transformations (Only transformation equations):<br>(i) For spatial and time coordinates<br>(ii) For velocity components<br>➢ Lorentz Transformations for spatial and time coordinates (Derivation not required)<br>(i) Both Standard form and Inverse form<br>(ii) For Non-relativistic velocities ($v << c$ ), Lorentz transformations converts into the Galilean transformations<br>(iii)Relevant numericals.<br>➢ Einstein's special theory of relativity-:<br>(i) Statement of the two postulates.<br>(ii) Explanation of the two postulates.<br>➢ Law of addition of velocities:<br>(i) Both Standard form and Inverse form<br>(iv)For Non-relativistic velocities ($v << c$ ), Lorentz transformation equations converts into the Galilean transformation<br>(ii) Show that these are consistent to the second postulate of Einstein's special theory of relativity.<br>(iii)Show that no two velocities can add up to a velocity which is greater than c.<br>(iv)Relevant Numerical.<br>➢ Physical Effects of the Lorentz transformation:<br>(i) Concept of Simultaneity- Simultaneity is frame dependent.<br>(ii) Length Contraction: Proper and Improper length, Derivation of relation between proper and improper length, variation of improper length wrt the velocity (graph), Relativity of Volume, relevant numerical |

| | |
|---|---|
| | (iii) Time dilation: Proper and Improper time interval, Derivation of relation between proper and improper time interval, Twin paradox, relevant numerical<br>(iv) Mass variation with velocity, relativity of density, relevant numerical<br>(v) Inter- relation among relativistic mass, relativistic momentum and relativistic energy: Concept of massless particles, relevant Numerical |
| 3. | **Physical Optics:**<br><br>**Interference:**<br><br>➢ Basics of Interference: constructive and destructive interference and their conditions, optical and geometrical path length, condition for sustained interference, production of coherent light source: division of wavefront and division of amplitude, YDSE (Derivation not required)<br>➢ Interference in Thin films:<br>(i) Parallel thin films: derivation for the conditions for constructive and destructive interference in reflected light, interference in transmitted light, relevant numerical<br>(ii) Wedge shaped films: conditions for constructive and destructive interference in reflected light, Interference pattern, Applications of interference in wedge shaped films- (i) determination of wavelength of the source, (ii) determination of thickness of the spacer, relevant numerical<br>➢ Newton's rings:<br>(i) conditions for bright and dark fringes, Interference pattern, Derivation for the diameter of dark rings, arrangements to get bright centre, Applications of Newton's rings - (i) determination of wavelength of the source, (ii) determination of refractive index of the liquid, relevant numerical<br>➢ Michelson Interferometer:<br>(i) Experimental set up, conditions for bright and dark fringes (Normal adjustment), Interference pattern, Applications of Michelson Interferometer, (i) determination of wavelength of the source, (ii) determination of refractive index or thickness of a thin sheet, (iii) resolution of spectral lines, relevant numerical<br>➢ Fabry-Perot Interferometer:<br><br>**Diffraction:**<br><br>➢ Fraunhofer diffraction: single slit and N-slit/ grating<br>➢ Resolving power of grating. |
| 2. | **Oscillations:**<br>➢ Simple harmonic oscillator, |

| | |
|---|---|
| | ➢ Damped harmonic oscillator: Equation of motion and its solution, Types of damping- heavy, critical and light damping, Logarithmic decrement, Relaxation time and Q – factor, Energy dissipation,<br>➢ Forced oscillator: Equation of motion and its solution, Mechanical impedance, variation of velocity, displacement and power with driving force frequency. Power supplied to oscillator by the driving force, variation of average power with frequency (absorption resonance curve), Q-factor in terms of (i) resonance absorption bandwidth and (ii) amplification factor. |
| 5. | **Laser optics:**<br>➢ Important characteristics of laser, Transition between energy states: Absorption, spontaneous and stimulated emission, Relation among Einstein's coefficients,<br>➢ Population inversion and pumping, Metastable states, Brief working principle of lasers,<br>➢ Types of Lasers: Working of Ruby laser and He-Ne laser.<br>➢ Applications of lasers. |
| 6. | **Optical Fibres:**<br>➢ Introduction to optical fibres, Classification of optical fibers, Refractive index profile<br>➢ Core cladding refractive index difference, Numerical aperture of optical fiber,<br>➢ Pulse dispersion in optical fiber (ray theory). Introduction to optical fiber communication system. |

# Text Books

| S.No. | Name of Books/Authors | Year of Publication/ Reprint |
|---|---|---|
| 1. | Perspective of Modern Physics, by Arthur Beiser | 1969/ McGraw-Hill US |
| 2. | Optics, by A. Ghatak | |
| 3. | Optics, by Brijlal and Subramaniyam | |
| 4. | Perspective of Modern Physics, by Arthur Beiser | 1969/ McGraw-Hill US |

**Dr. Vinod Singh**
**Coordinator, B.Tech. –I Year (All Groups)**
**Associate Professor,**
**Department of Applied Physics, DTU**

**Dr. Nitin K. Puri**
**Coordinator, B.Tech. –I Year (All Groups)**
**Associate Professor,**
**Department of Applied Physics, DTU**