# Engineering Physics: Course Brief

## Engineering Physics-Theory


**Anurag Srivastava**

**Professor and Head**

**Department of Engineering Science**

Web address: https://profanurag.in

Email: profanurag@gmail.com

Visit me: Room-110, Block-E, IIITM Campus

# Syllabus

- **Physics of Materials**: Crystal structure, crystal systems, bonding in solids, P.E curve and Properties of materials, miller indices, Brillouin zones, symmetry, Atomic Packing fraction, imperfections, energy bands in solids,, classification of solids, conductivity in metals and concepts of Fermi level, effective mass and holes, concept of phonons, electron distribution function, Fermi-Dirac distribution function, properties of bulk materials and nanomaterials. Carbon materials.

- **Laser and Fiber Optics**: Principles of lasers, Einstein Coefficients and their relations, Types of Lasers and their applications. Concept of optical fibers and types of optical fibers, modes of propagation, fiber optic communication, optical fiber sensors, connector and couplers.

# Syllabus

- **Electrodynamics**: Maxwell's equations: differential and integral forms, significance of Maxwell's equations, displacement current and correction in Ampere's law, electromagnetic wave propagation, transverse nature of EM waves, wave propagation in bounded system, applications.

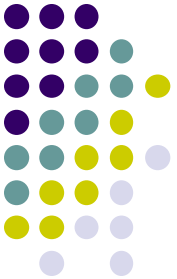
- **Quantum Physics**: Dual nature of matter, de-Broglie Hypothesis, Heisenberg uncertainty principle and its applications, postulates of quantum mechanics, wave function & its physical significance, probability density, Schrodinger's wave equation, Eigen values & eigen functions, Applications of Schrödinger equation.

# Reference Books:


- Panofsky & Phillips, *Classical Electricity & Magnetism*, 2nd ed., Dover Publications, 2005. (Text Book).
- David J Griffith, *Introduction to Quantum Mechanics,2nd* ed. , PHI, 2013. (Text Book).
- Avadhanulu, M. N, & Kshirsagar, S. G., *A Textbook of Engineering Physics*, S. Chand, 2014. (Text Book)
- Neeraj Mehta, *Applied Physics for Engineers*, PHI Learning Pvt. Ltd., 2011. (Text Book)
- Fiber optic communication- J Keiser (McGraw Hill) (Text Book)
- David J Griffith, *Introduction to Electrodynamics*, 4th ed. , PHI, 2014. (Ref.).
- Paul Dirac, *Principles of Quantum Mechanics*, 4th ed., Oxford Uni. Press, 2004. (Ref.)
- Kittel, C., *Introduction to Solid State Physics*, 8th ed., Wiley, 2014. (Ref.)
- Ohring, M., *Engineering Material Science*, Academic Press, 1995. (Ref.)

# Evaluation

| Component | Duration | Marks |
|---|---|---|
| Mid Semester Exam | Two Hour | 20 |
| Quiz/Surprise Test | One Hour | 10 |
| Assignment + Class Performance (attendance, interaction and presentation) | Whole Semester | 10 |
| Major Test | Two Hour | 40 |
| Lab | | 20 |
| **Total Marks** | | **100** |

# Engineering Physics: Brief

## Engineering Physics-Lab

# Engineering Physics Laboratory

## Block E- Ground Floor and Block-E- Ground Floor

| S.No. | Aim/Title of the Experiment |
|---|---|
| 1. | Study of Hall Effect |
| 2. | Verification of Frank Hertz Experiment |
| 3. | Bending losses of a given Optical Fiber |
| 4. | Characteristics of Solar Cell |
| 5. | Universal B-H Curve |
| 6. | Variation of Magnetic Field |
| 7. | Charging & Discharging |
| 8. | Dielectric constant |
| 9. | Plank's Constant using LED (Dark Room) |
| 10. | Laser Trainer Kit (Dark Room) |
| 11. | Dispersive power of prism/ Diffraction of Grating (Dark Room) |
| **Computational Experiments list** | |
| 12. | Material Stability Analysis: Plot total energy vs lattice constant or volume of the supercell of Si/GaAs or any other material, to determine the most stable or optimized configuration. |
| 13. | Electronic properties analysis of Metal (eg. Au/Ag/Cu), Semiconductor (eg. Si/GaAS), and Insulator (eg. SiO2/HfO2): Compute the following by considering an example from metal, semiconductor, and insulator: (a) Band structure plot (b) Density of States (DOS) profile |

# Reference Books: Lab

- Practical Physics- G L Squires
- A text book of practical physics-William Watson
- Practical Physics- C L Arora
- Text Book of practical Physics- M N Srinivasan
- Engg. Physics Practical- Rao, Krishna, Rudramamba

# Learning Objectives: Theory

1. The course has been designed in such a way so that a ICT graduate can understand the fundamental concepts of physics and chemistry of materials, Electrodynamics and Quantum Physics.

2. Besides the basic concepts, how it is useful in variety of possible applications.

3. There are few topics of future interest too, like lasers, fiber optics and 1D/2D materials, especially the wonder material graphene.

4. Lot many opportunity for those who are interested in making their career as researcher in the area of scientific computing, communication, Quantum Computing, Energy and Environment related projects.

# Learning Objectives: Lab

1. The experiments have been introduced to visualize the fundamental concepts of Physics.

2. Most of the experiments are based on the concepts, which have been taught during $12^{th}$ at a very basic level but by doing experiment they can be visualized better.

3. Few experiments are being introduced to make the students aware about new concepts and tools of modern physics and very useful for the understanding the other subjects like in Materials science, Optics, Semiconductor physics, Magnetism and Communication electronics.

# Evaluation

| Component | Duration | Marks |
|---|---|---|
| Lab-Minor 1 | One Hour | 20 |
| Lab- Project | One Hour | 20 |
| Lab Assignment + Lab Performance (attendance, interaction and presentation) | | 20 |
| Lab Major | Two Hour | 40 |
| **Total Marks** | | **100** |