10ABTEC24112: APPLIED PHYSICS		
Course Frame Work		
Credits: L-T-P: 3 – 0 – 1		Total Credits: 4
Contact Hours/Week: 5	Direct Teaching Hours: 45	Total Contact Hours: 75

Course Learning Objectives: This course will enable the students to

- Provide a solid foundation in the principles and concepts of wave mechanics and quantum physics.
- Explore the properties and applications of electromagnetic waves and lasers.
- Understand the principles of optical fiber communication and its applications.
- Introduce the concepts of quantum computation and its potential applications.
- Equip students with the knowledge and tools necessary for further study or research in related fields.

Course Outcomes: On completion of the course, student would be able to:

Cos	Course outcomes	Levels
CO1	Explain the fundamental principles of wave mechanics and quantum physics.	L2
CO2	Understand the properties and applications of electromagnetic waves and lasers.	L1
CO3	Describe the principles and applications of optical fiber communication.	L2
CO4	Explain the basic concepts of quantum computation and its potential advantages over classical computing.	L2
CO5	Demonstrate a strong foundation for further study or research in related fields.	L2

Syllabus	Hours
Module-1	09

Wave Mechanics: Introduction to Wave mechanics, Planck's law, De-Broglie's hypothesis, Wave-particle duality, Heisenberg's Uncertainty Principle, Non-existence of electron inside the nucleus.

Quantum Physics: Wave function & its properties, Probability density and Normalization of wave function (definition), time-independent wave equation, Eigen values and Eigen functions. Applications of Schrödinger wave equation – energy Eigen values of a free particle, Particle in one dimensional infinite potential well with numerical examples. Quantum mechanics applications in computer science.

Module – 2	09
Electromagnetic Waves: Electromagnetic waves, their characteristics, Electromagnetic spectrum (7 types of EM waves) including elementary facts. Applications of EM waves Lasers: Lasers Interaction between radiation and matter (induced absorption, spontaneous and stimulated emission). Characteristics of laser light, Conditions for laser operation (population inversion and Meta stable state). Requisites of laser system, semiconductor laser and its applications.	
Module – 3	09
Optical fibers: Construction and light propagation mechanism in optical fibers (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Condition for wave propagation in optical fiber, Types of optical fibers, Attenuation and reasons for attenuation, Applications: Explanation of optical fiber communication using block diagram, Optical source (LED) and detector (Photo diode) and their applications. Advantages and limitations of optical communications.	
Module-4	09
Display technology: Touch screen technologies: Resistive and capacitive touch screen and Displays: CRT, Field emission display, Plasma display, LED display, OLED display, LCD display, 3D digital billboard, introduction to haptics.	
Module-5	09
Quantum Computation: Nano films (two-dimensional), Quantum wires (one-dimensional), Quantum dots (zero-dimensional). Classical bits, the idea of "Qubit", geometric visualization of the qubit via Bloch sphere, Quantum logic gates, Qubit as a two-level system.	
Text Books: 1. Griffiths, D. J. Introduction to Quantum Mechanics. Cambridge University Press, 2016. 2. Concepts of Modern Physics, Arthur Beiser, 7th Edition, Tata McGraw-Hill, 2017. 3. Yariv, A. Introduction to Optical Electronics. Oxford University Press, 2003. 4. Engineering Physics, B.K. Pandey, S. Chaturvedi - Cengage Learing. Kindle Edition, 2013. 5. Halliday and Resnick, Physics – Wiley, 12th Edition, 2021. Reference Books:	

1. Feynman, R. P. Quantum Electrodynamics. Westview Press,1989.
2. Saleh, B. E. A., & Teich, M. C. Fundamentals of Photonics. Wiley. 2019.
3. Agrawal, G. P. Nonlinear Fiber Optics. Academic Press. 2013.
4. Arthur Beiser. "Concepts of modern Physics", 8th edition, Tata McGraw Hill publications, New Delhi. 2013.
5. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand, 9th Edition, 2018.

VIDEOS

6. Quantum Mechanics Explained: https://m.youtube.com/watch?v=rf1Ye87GhZU
7. Lasers: How They Work: https://m.youtube.com/watch?v=DA7a_v96Jsw
8. Optical Fiber Communication: https://www.youtube.com/watch?v=3a7rc4mEadg
9. Quantum Computing Explained: https://www.youtube.com/watch?v=jHoEjvuPoB8
10. Introduction to Quantum Dots: https://m.youtube.com/watch?v=0EokkhdppgE topics.

SWAYAM/NPTEL/MOOCs:

1. https://www.britannica.com/technology/laser,k
2. https://nptel.ac.in/courses/115/102/115102124/
3. https://nptel.ac.in/courses/115/104/115104096/
4. .https://onlinecourses.nptel.ac.in/noc20_mm14/preview
5. Online Course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptha on NPTEL

Self-Learning Exercises:

Introduction to optics, nano devices, quantum tunneling, semiconductor energy gap. characteristics of materials used in manufacture of laptops/desktops (display, internal circuit connection), laser printer working.

APPLIED PHYSICS LAB EXPERIMENTS
1. Radiation with Temperature Change Using Stefan's Law
2. Determine the Spot size using Laser beam divergence
3. Determination of wavelength of a LASER using diffraction grating
4. Determine the wavelength of light using Newton's Rings
5. Determination of numerical aperture (N.A.) of given optical fiber
6. Energy Band Gap of Semiconductor
7. To measure specific rotation of cane sugar using Polarimeter

8. To study polarization of light using He-Ne Laser