MAULANA AZAD NATIONAL INATITUTE OF TECHNOLOGY, BHOPAL - 462003

Name of Program	**B.Tech. & Dual Degree**	**Year: First Year**	**Semester: 1st and 2nd**	**Academic Year: 2025-26 onwards**		
Name of Course	Physics					
Course Code	PY 1102 / PY 1202					
Core / Elective / Other	Core					
Concerned Department/ Section/Centre	Physics					
Credits	**3**	**Periods per week**		**L**	**T**	**P**
				3	**0**	**0**

Prerequisite:	
	Students must have the basic knowledge of physics with emphasis on optics, types of static/dynamic forces, Newton's law of motions, basic semiconductor devices, nuclear physics and knowledge of Engineering mathematics involving differentiation and integration.
Course Outcomes: Upon successful completion of the course the student will be able to:	
1.	**Understand basic physical fundamentals and the key vocabulary to describe them:** Interference and Diffraction of light, Energy band gaps, Quantum effect, Particle accelerator, Fission & Fusion, LASER, Fiber optics communication, Theory of Relativity and Electron ballistics.
2.	Apply an understanding of these concepts to various systems and devices.
3.	Acquire problem solving skills, mathematical techniques, and the ability to apply conceptual understanding of the Physics to general real-world situations.
4.	To design and conduct new experiments and to analyze the data interpretation.
Description of Contents in brief:	
1.	**Wave Optics:** Interference and Diffraction, Michelson's interferometer
2.	**Solid State and Semi-Conductor Physics:** Energy bands in solids, Electron and hole mobility, Hall effect, PN junction transistor, Transistor parameters, Photo cell and Solar cell
3.	**Quantum Mechanics:** Schrodinger wave equation, Particle in a box, Harmonic oscillator, Tunnel effect
4.	**Nuclear Physics:** Nuclear properties, Nuclear models, Particle accelerator, Fission & Fusion, Chain reaction, Nuclear reactor, Particle detectors
5.	**Laser and Fiber Optics:** Laser phenomena, Ruby and He-Ne laser and applications, laser holography, Types of optical fibers, Attenuation, Fiber losses, Fiber optics communication
6.	**Theory of Relativity:** Transformation equations, Time dilation mass energy equation
7.	**Electron ballistics:** Motion of charged particles in electric and magnetic field, Electron microscope, Mass spectrographs
List of Text Books:	
1.	Engineering Physics: M.N. Avadhanulu, P.G.Kshirsagar, T V S Arun Murthy, (S. Chand)
2.	Engineering Physics: Hitendra K Malik, A. K. Singh, (Tata McGraw-Hill)
3.	Concepts of Modern Physics: Arther Beiser (McGraw-Hill)
4.	Principles of Optics: Brijlal Subramanyam (S. Chand)

List of Reference Books:

1.	Modern Physics: Kenneth Krane, (John Wiley Eastern)
2.	Modern Physics: Paul A. Tipler & Ralph A. Llewellyn, (W. H. Freeman)
3.	Quantum Mechanics Concepts and Applications: Nouredine Zettili (Wiley)
4.	Optics: Ajoy K. Ghatak, (Tata McGraw-Hill Education)
5.	Fiber Optics & Lasers The Two Revolutions: Ajoy Ghatak & K. Thyagarajan , (Macmillan India Limited)
6.	Quantum Mechanics Concepts and Applications: Nouredine Zettili (Wiley)
7.	Quantum Mechanics Concepts and Applications: Nouredine Zettili (Wiley)
8.	Essentials of Quantum Mechanics by Fozia Z. Haque (Asian Books)
9.	University Physics: H.D. Young, Roger A Freedman, (Pearson)
10.	Solid State Electronics: B. G. Streetman, (Prentice Hall India)
11.	Solid State Physics: S. O. Pillai, (New Age International Publishers)
12.	A Textbook of Optics: N Subrahmanyam, Brij Lal & M N Avadhanulu, (S. Chand)

URLs:

	https://www.youtube.com/watch?v=i_CijGuk7fw
	https://www.youtube.com/watch?v=Kp-jS6NHsB8

Lecture Plan (about 40-50 Lectures):

Lecture No.	Topic
Lecture 1	Introduction to syllabus, Interference: Introduction, Coherence, Types of Interference, Interference in thin (parallel surfaced) films
Lecture 2	Wedge shaped film, Newton's rings Experiment, Numerical Problems
Lecture 3	Michelson's Interferometer: Theory and applications, Numerical Problems
Lecture 4	Diffraction: definition, types and diffraction, Single slit diffraction
Lecture 5	Double slit diffraction p, missing order
Lecture 6	Diffraction through n-slit, Transmission Grating, Numerical Problems
Lecture 7	Tutorial of wave optics
Lecture 8	Semiconductor Physics: Free electron theory, Band theory of solids
Lecture 9	Fermi Energy and Fermi Energy level in Intrinsic and Extrinsic Semiconductors
Lecture 10	Charge carrier concentration in intrinsic semiconductor, electron hole mobility and conductivity, Numerical Problems
Lecture 11	P- N junction diode, Photocell
Lecture 12	Solar cell and its applications
Lecture 13	Hall effect and its applications, Numerical Problems
Lecture 14	Introduction to transistor: CE, CB and CC mode.
Lecture 15	Transistor parameters (α, β, γ and their relation), Numerical Problems
Lecture 16	Tutorial of semiconductor Physics
Lecture 17	Quantum Mechanics: Introduction to Quantum Mechanics, de-Broglie hypothesis, Concept of wave packet, Heisenberg's uncertainty principle, Postulates of Quantum Mechanics
Lecture 18	Properties of matter wave, Probabilistic interpretation of wave function
Lecture 19	Schrodinger's time dependent and time independent wave equation.

Lecture 20	Particle in a box (1D and 3D), Tunnel effect (α-decay)
Lecture 21	Harmonic Oscillator, Zero-point energy, Numerical Problems
Lecture 22	Tutorial of quantum mechanics
Lecture 23	Nuclear Physics: Nuclear properties, Mass defect, Semi-empirical mass formula, binding energy and Numerical Problems
Lecture 24	Nuclear Models: Liquid drop model and its success & failure
Lecture 25	Shell model
Lecture 26	Particle accelerators: Cyclotron, synchro-cyclotron, Numerical Problems
Lecture 27	Betatron and Numerical Problems
Lecture 28	Nuclear fission and fusion, Chain reaction and Nuclear reactor
Lecture 29	Nuclear particle detectors (GM counter), Numerical problems
Lecture 30	Mass Spectrographs (Bainbridge and Aston)
Lecture 31	Tutorial of Nuclear Physics
Lecture 32	LASER: Absorption and Emission process, Einstein's A & B coefficient
Lecture 33	Pumping Scheme and its types, component of LASER
Lecture 34	Ruby laser and He-Ne Laser
Lecture 35	Laser Holography and applications
Lecture 36	Fibre Optics: Introduction to optical fibre, Acceptance angle.
Lecture 37	Types of fibre, V-number, Losses in optical fibre, Uses & applications of fibre
Lecture 38	Tutorial of LASER and optical fibre
Lecture 39	Theory of Relativity: Introduction, Michelson-Morley Experiment, Postulates of special theory of relativity
Lecture 40	Galilean transformation and Lorentz transformation equation
Lecture 41	Length contraction and time dilation
Lecture 42	Theorem of addition of velocities, Principle of simultaneity
Lecture 43	Mass energy equivalence relation, Relativistic mass, Numerical problems
Lecture 44	Tutorial of theory of relativity
Lecture 45	Electron Ballistic: Motion of charged particle (electron) in uniform electric field when the field is parallel, perpendicular and at an angle to velocity of electron
Lecture 46	Motion of charged particle (electron) in uniform magnetic field when the field is parallel, perpendicular and at an angle to velocity of electron
Lecture 47	Electron Optics: Bethe's law, electrostatic lens
Lecture 48	CRT, Electron microscope and Numerical Problems
Lecture 49	Tutorial of electron ballistic