

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Four Years B.E. Course

Scheme of Examination B.E. First year (All Branches of Engineering)

First Semester

Sub Code	Subjects	Workload in hrs			Credits	Marks					Minimum Passing	
		L	T/A	P		Theory		Practical		Total	Marks	
						Internal	Uni	Internal	Uni		Theory	Practical
BSE1-1T	Mathematics-I	3	1	-	4	30	70	-	-	100	45	-
BSE1-2T	Applied Physics	3	2	-	4	30	70	-	-	100	45	-
BSE1-3T	Energy and Environment	2	2	-	3	30	70	-	-	100	45	-
BSE1-4T	Communication Skills	2	-	-	2	15	35	-	-	50	23	-
BSE1-5T	Engineering Graphics	1	-	-	1	15	35	-	-	50	23	-
BSE1-6T	Basics of Civil & Mechanical Engineering	4			Audit	50	-	-		Audit	-	-
BSE1-2P	Applied Physics Lab	-	-	3	1.5			25	25	50	-	25
BSE1-3P	Energy and Environment Lab	-	-	2	1			25	25	50	-	25
BSE1-4P	Communication Skills Lab	-	-	2	1			25	25	50	-	25
BSE1-5P	Engineering Graphics Lab	-	-	4	2			25	25	50	-	25
Three weeks Induction Program												
	Total	15	11		19.5	120*	280	100	100	600		

- L- Lecture , P-Practical, T- Tutorial , A- Activity (Half Credit per Hour)

B. Tech. Semester I Applied Physics (Total Credits: 4)

Teaching Scheme

Lectures: 3hr/Week,

Activity/Tutorial: 2 hr/Week

Examination Scheme

T (U): 70 Marks T (I): 30 Marks

Duration of University Exam. : 3 Hours

Unit 1: Wave optics (09 Hours) 14 Marks

Huygen's principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting, Interference in thin films, Interference in Wedge shape thin film, Newton's rings, Anti-reflection coating.

Fraunhofer diffraction from a single slit and a circular aperture, Diffraction grating and its resolving power.

Unit 2: Quantum Mechanics (10Hours) 14 Marks

Planck's Hypothesis, Properties of Photons, Compton Effect: Equations for energy and momentum conservation, Expression for Compton shift & its interpretation. Concept of wave-particle duality, de-Broglie Hypothesis, Matter Waves, Davisson-Germer Experiment; Bohr's Quantization condition.

Wave function Ψ and normalization condition, concept of wave packets, Heisenberg Uncertainty Principle. Schrodinger wave equation (time dependent and time independent), Application to one dimensional infinite potential well.

Unit 3: Crystal Structure (08 Hours) 14 Marks

Crystal structure, Meaning of lattice and basis, Unit cell: primitive and non primitive unit cell; Cubic crystal structure: Simple, Body and Face centered cubic structures, Unit cell characteristics: Effective number of atoms per unit cell, atomic radius, nearest neighbor distance, coordination number, atomic packing fraction, void space, density.

Crystal planes and Miller indices, Inter-planar distance and its co-relation with Miller indices and lattice parameter, Bragg's law of X-ray diffraction.

Unit 4: Optical Fiber (08 Hours) 14 Marks

Optical fibers: Propagation by total internal reflection, structure and classification (based on material, refractive index and number of modes), Modes of propagation in fiber, Acceptance angle, Numerical aperture, Attenuation and dispersion.

Light sources and Detectors, Applications of optical fiber as Sensors - i) Temperature Sensor ii) Pollution / Smoke detector iii) Liquid level sensor, Fiber optic communication system.

Unit 5: Electron Optics (07 Hours) 14 Marks

Basic idea of motion of charged particle in electric and magnetic fields, Velocity selector, Bethe's law of electron refraction, electric focusing, Construction & working of Electrostatic lens.

Devices: Cathode Ray Tube, Cathode Ray Oscilloscope and its applications, Block Diagram, Function & working of each block, Bainbridge mass spectrograph.

Course Outcomes

Students will be able to

CO1. Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications

CO2. Learn the basic concepts of dual nature of matter and wave packet and apply them to analyze various relevant phenomena and to solve related numerical problems

CO3. Recall the basic concepts of crystal structure and apply them in solving numerical problems based on them and in relating to applications for determination of crystal structure.

CO4. Relate the basic idea of total internal reflection to the propagation of light in an optical fiber and make use of the fiber concepts to solve numerical problems and relate to applications in engineering

CO5. Find how to extend the basic concepts of motion of charged particles in electric magnetic fields to solve numerical problems and to relate to applications in electron optic devices and CRO

List of activities

1. Compilation of information regarding interference in day to day life.
2. Comparative study of interference pattern of Newton's ring using Plano convex lens of different radii.
3. Comparison of diffraction patterns of various obstacles such as razor, coin, knife, etc.
4. Biography of Compton & de-Broglie in any electronic form (ppt./video).
5. Understanding the concept of micro and macro bodies, its identification and phenomenon observable using it with reason.
6. Justification of Heisenberg's Uncertainty Principle using thought experiment.
7. Applications of Heisenberg's Uncertainty Principle to prove electron does not exist in the nucleus.
8. Model making such as voids, planes, Miller Indices, FCC, BCC and SC.
9. Exhibition of variety of crystals in nature or day to day life.
10. Tyndall's demonstration.
11. Total Internal Reflection with the help of glass of water & laser source.
12. Collection of optical fibres to understand the internal structure.
13. Determination of ' λ ' for various types of waves using CRO. (square, rectangular, sinusoidal)
14. Verification of $v = \frac{E}{B}$ using Thomson's experiment.

Note : Performance of at least one activities is compulsory in a semester.

Modes of Conducting/ Performing the activities

1. Quiz
2. Demonstration
3. Seminar
4. Group discussion
5. Assignment
6. Study of business model
7. Case study
8. Model making
9. Industry/research lab visit
10. Technical or research paper writing (for conference)
11. PPT making (Power Point Presentation)
12. Mini project

Suggested Text Books &Reference Books

1. *P. M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata Mc Graw Hill (1977).*
2. *J. L. Powell and B. Crasemann, Quantum Mechanics, Narosa Publishing House (1993).*
3. *Charles Kittel, Introduction to Solid State Physics, Wiley Eastern, 5th edition, (1983).*
4. *A. J. Dekker, Solid State Physics, Prentice Hall of India (1971).*
5. *A Textbook of Engineering Physics, Dr. M. N. Avdhanulu, Dr. P. G. Kshirsagar, S. Chand Publication*
6. *Text book of Applied Physics, Dr. D. S. Hardas, Dr. D. S. Bhounik, Dr.S. Shastri, Das Ganu Publication ISBN-978-93-84336-59-2 (2021)*
7. *Applied Physics, M. N. Avdhanulu, Shilpa A. Pande, Arti R. Golhar, Mohan Giriya, S. CHAND*
8. *A Text Book of Engineering Physics Dr. Devashree Hardas & Dr. Ashish Panat, Das Ganu Publication ISBN-978-81-921757-7-5 (2011)*
9. *Applied Physics, - Dr. (Mrs)S.P. Wankhede, Dr.Shruti Patle, Dr.(Mrs.)S.U.Bhonsule and Dr.N. S. Ugemuge DNA Publication ISBN-978-81-945174-6-7 (2020)*
10. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles by R. Eisberg and R. Resnick, Wiley and Sons*
11. *Engineering Physics, second edition, Sanjay Jain, G. Sahasrabudhe, University's Press(India) Pvt. Ltd.(2016)*
12. *D. J. Griffiths, Quantum mechanics, Prentice Hall of India Private Limited, New Delhi*
13. *L. I. Schiff, Quantum Mechanics, TMH Publications*
14. *David Halliday, Robert Resnick, Jearl Walker, Principles of Physics, 10th Edition, John Wiley and Sons (2017)*
15. *Advanced physics - Dr.Shruti Patle, Dr.(Mrs).S.U.Bhonsule, Dr.Ashish N. Bodhaye, Dr.Manohar D.Mehare DNA Publication (2019)*
16. *Engineering Physics - Dr.N. S. Ugemuge, Dr.(Mrs.)S.U.Bhonsule and Dr.Shruti Patle DNA Publication(2019)*

B. Tech. Semester I Applied Physics (Practical) (Total Credits: 1.5)

Teaching Scheme

Lectures: 3hrs/Week

Examination Scheme

P (I): 25 Marks P (U): 25 Marks

List of Experiments

1. Interference in thin films: Study of wedge shaped thin film.
2. Radius of curvature of a plano convex lens by Newton's Rings
3. Diffraction due to plane diffraction Grating
4. Determination of principal refractive indices of a prism
5. Determination of Plank's constant by using LEDs.
6. Comparative study of cubic crystal structure (with the help of model)
7. Determination of NA for optical fiber
8. Determination of e/m of an electron by bar magnet method (Thomson's method)
9. Calibration of Time Base circuit of CRO and determination of frequency of electrical signals
10. Determination of phase of electrical signals using CRO.
11. Determination of AC and DC voltage using CRO.

Note: Performance of at least **six** experiments is compulsory in a semester.