



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: ALL

Subject Code : BE01RR0021

Subject Name : Physics

w. e. f. Academic Year:	2024-25
Semester:	I st Year
Category of the Course:	BSC

Prerequisite:	Basic understanding of Calculus, Physics and Mathematics course on Differentiate equations
Rationale:	The basic science - physics program is to prepare students for careers in engineering where physics principles can be applied to the advancement of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	The student will apply theoretical and mathematical concepts to solve problems related to properties of matter.	Apply
02	The student will apply basic principles, properties, and applications associated with Waves, Motion, and Acoustics to practical situations	Apply
03	The student will understand limitations of classical physics and origin of Quantum Physics.	Apply
04	The student will apply principles of Quantum Physics to analyze and interpret quantum phenomena.	Apply
05	The student will apply the principles of Lasers to understand their properties and applications in science, engineering, and medicine..	Apply
06	The student will apply knowledge of new engineering materials, including semiconductors, superconductors, and nanomaterials, to practical engineering problems.	Apply

**Revised Bloom's Taxonomy (RBT)*



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Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL(I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

* *Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.*

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, PA = Progressive Assessment, ESE = End-Semester Examination

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	PROPERTIES OF MATTER - Stress – Strain – Hooke's law – - Elastic Behaviour of Material – - Young's modulus by cantilever depression – - Non-uniform bending – - Uniform bending- - Application -I-shaped girders. - Torsional Pendulum – Couple per unit twist of a wire, Time period, - Application- Determination of Rigidity Modulus.	6	13
2.	WAVES, MOTION AND ACOUSTICS - Simple Harmonic motion, Free, forced, Resonance, - Damped and undamped vibration, - Damped harmonic motion, - Force vibration and amplitude resonance, - Velocity resonance and energy intake, - Wave motion, transverse and longitudinal vibration, - Sound absorption and reverberation, - Sabine's formula and usage (excluding derivation), - Acoustic of building,	8	18



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	• Ultrasonic waves - Properties - Generation – Piezoelectric method – Detection- Kundt's tube • Application of Ultrasonics in industries – NDT.		
3.	Foundations of Quantum Mechanics • Failure of classical physics: Blackbody radiation, Photoelectric effect, Compton effect • Planck's theory of black body radiation • Energy distribution function • de Broglie hypothesis, Wave-particle duality, Davisson-Germer experiment • Heisenberg uncertainty principle • Wave function and its properties	8	18
4.	Formalism and Applications of Quantum Mechanics • Time-dependent Schrödinger equation • Time-independent Schrödinger equation • Particle in a one-dimensional box, • Finite potential well, Dirac delta function • Potential barrier and tunnelling • Quantum confinement • Harmonic oscillator • Quantum tunnelling device - tunnel diode, STM	8	18
5.	LASERS • Properties of Laser, Einstein's theory of matter radiation: A and B coefficients, • Amplification of light by population inversion, • Different types of lasers, • Gas lasers (He-Ne), • Solid-state lasers (Ruby laser), • Properties of laser beams: Mono-chromaticity, coherence, directionality and brightness, laser speckles, • Applications of lasers in science, engineering, and medicine.	8	18



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6.	NEW ENGINEERING MATERIALS SEMICONDUCTOR MATERIALS: • Introduction of Group IV elements, • Properties, • Concept of carriers, • Concept of bands and band gap, • P-type, N-type materials • Introduction to P-N Junction Diode and I-V characteristics, • Zener diode and its characteristics SUPERCONDUCTING MATERIALS: • Introduction – Properties • Meissner effect • Type I & Type II superconductors • Applications. NANOMATERIALS: • Introduction • Synthesis of nano materials – Top down and Bottom up approach • Ball milling • PVD method • Applications.	7	15
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
30	40	30	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create
(as per Revised Bloom's Taxonomy)



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References/Suggested Learning Resources:

1. Engineering Physics by Dattu R Joshi, McGraw hill Publications
2. Engineering Physics by M. N. Avadhanulu, S.Chand & Company
3. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications
4. Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill)
5. Fundamentals of Physics, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.
6. Concepts of Modern Physics by Arthur Beisser, McGraw Hill
7. Modern Physics by R Murugesan, Kiruthiga, Sivaprasath S Chand
8. Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut
9. AICTE's Prescribed Textbook: Physics (Quantum Mechanics for Engineers)
10. Eisberg and Resnick, Introduction to Quantum Physics
11. D. J. Griffiths, Quantum mechanics
12. Quantum Mechanics by G. Aruldas

(b) Open source software and website:

1. <https://nptel.ac.in/>
2. <https://www.vlab.co.in/>
3. https://iitb.vlabs.co.in/discipline.html?discipline=Physical_Sciences

Suggested Course Practical List:

List of Experiments:

1. Diffraction and interference experiments (from ordinary light or laser pointers); measurement of the speed of light on a tabletop modulation; minimum deviation from a prism.
2. Measurement of the Distance using Ultrasonic Sensors.
3. Study of Object Detection using Ultrasonic Sensors.
4. Melde's Experiment Transverse and Longitudinal Modes
5. Rigidity Modulus of The Suspension Wire of A Torsion Pendulum
6. Young's Modulus-Uniform/ non-uniform Bending
7. To determine the frequency of a given laser source.
8. Wavelength of Light -Diffraction Grating using LASER
9. Laser beam divergence and spot size measurement
10. Acoustic grating method set up for measurement of the velocity of ultrasonic waves in liquid
11. Melde's experiment Resonator
12. Energy Band Gap of Semiconductor
13. Determination of Planck's Constant
14. Virtual Harmonic Motion & Waves Lab
15. Virtual Modern Physics Lab
16. Virtual Physical Sciences Lab



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• List of suggested activities for Problem Based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Multimedia based conceptual learning of topics related to Physics	Duration = 5h Report preparation = 3h Total = 8h	Report /presentation based on the learning outcomes.
2.	Assignment writing (Numericals based assignment is preferable)	6 assignments of 2h each. Total = 12h	Based on the assignment submitted.
3.	Self-learning through virtual lab experiments(2 Experiments)	Performance = 4 h Report preparation = 2 h Total = 6 h	Assessment based on report and viva
4.	Poster/chart preparation on technical topics	Total = 4 h	Based on poster/chart preparation
5.	Working model on technical topics and report writing	Idea = 2 h Execution = 6 h Report + Presentation = 4 h Total = 12 h	Based on inter department/external evaluation
6.	Assembly of Circuit on the bread board	Duration = 3 h Report preparation = 3 h Total = 6 h	Based on circuit and Clarity of components used
7.	powerpoint preparation on technical topics and presentation	Preparation = 4 h Presentation = 2 h Total = 6 h	Based on ppt prepared, presentation and viva
8.	Study of different physics principles involved in technical industrial equipment/ tools/ processes	Survey/ study = 4 h Report preparation = 4 h Total = 8 h	Based on report
9.	Study of units, conversion and use	Preparation = 4 h Quiz = 1 h Total = 5 h	Based on performance in quiz

Note:

1. All the suggested activity should be related to the subject.
2. The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
3. Rubrics for the evaluation can be prepared by the faculty.

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