GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: ALL

Subject Code : BE01R00021

Subject Name : Physics

w. e. f. Academic Year:	2024-25
Semester:	Ist 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 apply basic principles, properties, and various methods of production techniques in Optics to solve real-world problems.	Apply
04	The student will apply fundamental 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
						Theory		Tutorial / Practical			
L	T	P	TW/SL	TH		ESE (E)	PA (M)	PA/ (I)	TW/ SL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

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**

	• Ultrasonic waves - Properties - Generation – Piezoelectric method – Detection- Kundt's tube • Application of Ultrasonics in industries – NDT.		
3.	**OPTICS** • Huygens' Principle: Fundamental principle for wave propagation. • Superposition of Waves: Basic principle for understanding interference and diffraction. • Explanation of constructive and destructive interference. • Applications in thin film interference, such as soap bubbles and oil films. • Young's double slit experiment. • Newton's rings, • Michelson Interferometer • Anti-reflection coating. • Fresnel and Fraunhofer diffraction– diffraction due to 'n' slits- plane transmission grating. • Rayleigh criterion for limit of resolution - resolving power of grating.	**8**	**18**
4.	**QUANTUM PHYSICS** • Black body Radiation-Planck's law • Energy distribution function, • Wave-particle duality-de Broglie matter waves • Concept of the wave function and its physical significance – Heisenberg's Uncertainty Principle • Schrodinger's wave equation – Time-independent and Time-dependent equations – • Particle in a one-dimensional rigid box – tunneling (Qualitative) – Scanning Tunnelling Microscope.	**8**	**18**
5.	**LASERS** • Properties of Laser, Einstein's theory of matter radiation: A and B coefficients, • Amplification of light by population inversion,	**8**	**18**

	• 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.		
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)

References/Suggested Learning Resources:

(a) Books:

1. Engineering Physics by Dattu R Joshi, McGraw hill Publications
2. Engineering Physics by Shatendra Sharma & Jyotsan Sharma, Pearson Publication
3. Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi
4. Optics by R.Agarwal, S. Chand
5. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi,
6. Concepts of Modern Physics by Arthur Beisser, McGraw Hill
7. Modern Physics by R Murugeshan, Kiruthiga, Sivaprasath S Chand
8. Quantum Mechanics by V. Devanathan, Narosa, Chennai
9. Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut
10. Engineering Physics by M.N.Avadhanulu, S.Chand & Company
11. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications
12. Engineering Physics I & II – G. Senthilkumar, VRB publications
13. Applied Engineering Physics – Rajendran & Marikani (Tata McGraw Hill)
14. Applied Physics for Engineers – K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech)
15. Principles of Electronics by V.K.Mehta, (S.Chand)
16. Basic Electronics by B.L.Theraja, S.Chand
17. Mechanics of Materials, Barry J. Goodno, James M. Gere, Published
18. Fundamentals of Physics, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.

(b) Open source software and website:

1. https://nptel.ac.in/
2. https://www.vlab.co.in/

Suggested Course Practical List: If any

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. To determine the frequency of a given laser source.
6. Frequency of AC Supply-Sonometer method
7. Wavelength of Light -Diffraction Grating using LASER
8. Acoustic grating method set up for measurement of the velocity of ultrasonic waves in liquid
9. Melde's experiment Resonator
10. Study of Damped Simple Harmonic Motion
11. Newton's rings, Determination of using sodium light.
12. Calibration of Spectrometer & determination of unknown wavelength
13. Dispersive curve of a prism
14. Study of Fabry-Perot Etalon
15. Study of Lloyd's Mirror
16. Study of Double Refraction in Calcite Prism
17. Virtual Heat & Thermodynamics Lab
18. Virtual Advanced Mechanics Lab
19. Virtual Laser Optics Lab
20. Virtual Harmonic Motion & Waves Lab
21. Virtual Optics Lab
22. Virtual Modern Physics Lab
23. Virtual Lab on oscillations
24. Virtual Physical Sciences Lab

- **Activities suggested under self-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-learningthrough 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.	power point 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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