Programme/Class:	Year: **First**	Semester: **First/Second**
Subject: **Physics (Minor Elective Paper)**		
Course Code: **B010101T (M)**	Course Title: **Fundamentals of Physics-1**	

Course Outcomes (COs)

After going through the course, the student should be able to

1. Understand the role of vectors and coordinate systems in Physics.
2. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions
3. Explain the conservation of energy, momentum, angular momentum and apply them to basic problems.
4. Understand the analogy between translational and rotational dynamics, and application of both motions simultaneously in analyzing rolling with slipping.
5. Apply Kepler's law to describe the motion of planets and satellite in circular orbit.
6. Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.
7. Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward pull.
8. Describe special relativistic effects and their effects on the mass and energy of a moving object.

Credits: **4**	Core : Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	Fundamentals of physics-1	
I	**Vectors** Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter.	5
II	**Laws of Motion** Newton's Laws of motion, Frames of reference, Inertial and non-inertial frames of reference, Galilean Transformation, Dynamics of a system of particles. Centre of Mass.	10
III	**Momentum and Energy** Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.	8
IV	**Rotational Motion** Angular velocity and angular momentum, Torque, Conservation of angular momentum.	5
V	**Gravitation** Newton's Law of Gravitation, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only). Satellite in circular orbit and applications, Geosynchronous orbits, Basic idea of global positioning system (GPS), Weightlessness.	12

VI	**Oscillations** Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages	6
VII	**Elasticity** Hooke's law, Stress-strain diagram, Elastic moduli, Relation between elastic constants, Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constant, Work done in stretching and work done in twisting a wire, Twisting couple on a cylinder.	8
VIII	**Special Theory of Relativity** Constancy of speed of light, Postulates of Special Theory of Relativity, Length contraction, Time dilation, Relativistic addition of velocities.	6

Suggested Readings

1. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. AddisonWesley\
2. Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
3. Physics – Resnick, Halliday• & Walker 9/e, 2010, Wiley Engineering
4. Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

This course can be opted as an Elective by the students of following subjects

Open to all

Continuous Internal Evaluation (CIE) Methods

20 Marks for Test / Quiz / Assignment / Seminar

05 Marks for Class Interaction

Programme/Class:	Year: **Second**	Semester: **Third/fourth**
Subject: **Physics (Minor Elective Paper)**		
Course Code: **B010303T (M)**	Course Title: **Fundamentals of Physics-2**	

Course Outcomes (COs)

After going through the course, the student should be able to

1. Learn the basic concepts of thermodynamics, the first and the second law of Thermodynamics
2. Know the fundamentals of the kinetic theory of gases
3. Recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems.
4. Recognize the basic components of electronic devices.
5. Design simple electronic circuits.
6. Understand the applications of various electronic instruments.
7. Comprehend the wave-particle duality.
8. Develop an understanding of the foundational aspects of Quantum Mechanics.

Credits: **4**	Core : Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	Fundamentals of physics-2	
I	**Laws of Thermodynamics** Thermodynamic Description of system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Applications of First Law, Work Done during Isothermal and Adiabatic Processes, Second law and Entropy, Third law of Thermodynamics.	10
II	**Kinetic Theory of Gases** Maxwell's law of distribution of molecular Speed (No derivation), Mean speed, Root mean square speed and Most probable speed, Mean free path, Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases	7
III	**Waves Motion** Simple harmonic motion, Longitudinal and transverse wave, Transverse waves on a string. Travelling and standing waves on a string, Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.	7
IV	**Sound** Intensity and loudness of sound, Decibels, Intensity levels, musical notes, musical scale, Acoustics of buildings, Reverberation and time of reverberation, Absorption coefficient, Sabine's formula, Acoustic aspects of halls and auditoria.	6

V	**Semiconductor** Intrinsic and Extrinsic semiconductors, Semiconductor diode, Barrier Formation in PN Junction Diode, Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode, PN junction and its characteristics, Static and Dynamic Resistance, Principle and structure of (1) LEDs, (2) Photodiode, (3) Solar Cell.	8
VI	**Transistors** Bipolar Junction transistors, n-p-n and p-n-p Transistors, Characteristics of CB, CE and CC Configurations, Active, Cut off & Saturation regions, Current gains α and β, Relations between α and β.	6
VII	**Instrumentations** Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply, Half-wave Rectifiers, Full-wave Rectifiers, Ripple Factor and Rectification Efficiency.	10
VIII	**Introduction to Quantum Mechanics** Foundation of wave mechanics, Particle nature of photons and wave nature of particles, Principle of complimentarity, Principle of superposition, Matter Waves, Mathematical representation, Wavelength, Concept of Wave group.	6

Suggested Readings

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
4. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill
5. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa
6. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
7. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.
8. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
9. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
10. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
11. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. AddisonWesley
12. Electronic devices & circuits, S. Salivahanan & N.S. Kumar, 2012, Tata Mc-Graw Hill
13. Microelectronic Circuits, M.H. Rashid, 2nd Edn., 2011, Cengage Learning.
14. Modern Electronic Instrumentation and Measurement Tech., Helfrick and Cooper, 1990, PHI Learning
15. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw Hill
16. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford• University Press.

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05 Marks for Class Interaction