LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Mechanical Engineering (710)

Bachelor of Engineering (B.E.) – Semester – I

Course Code:	017101192
Course Name:	Physics
Category of Course:	Basic Science Course (BSC)
Prerequisite Course:	---

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
3	0	2	4	30

Syllabus				
Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Basic Physics**			**2 (7%)**
	1.1 Units and dimensions	---	Scalar and Vector Quantities (017102291-Unit-1.2) System of Units(017102291-Unit-1.3) Dimension reasoning and dimensional homogeneity (017103491-Unit-7.1) Significance and use of dimensionless number (017103491-Unit-8.1)	
	1.2 Centre of mass	---	---	
	1.3 Laws of motion (force and inertia)	---	Introduction of Force, Effect of force and Characteristics of force, Types of force, Type of force systems (017102291-Unit-2.1) Resolution of a single force, Resolution method for coplanar concurrent force system (017102291-Unit-2.3) Buoyancy, Metacenter and Metacentric Height (017103491-Unit-4.1) Momentum and fluid flow (017103491-Unit-5.1)	
	1.4 Work, energy, power	---	Basic terms (force, pressure, energy, work, power, internal energy, enthalpy, pure substance) (017103301-Unit-1.1) Heat and work (heat, temperature, sensible heat, latent heat, specific heat, work transfer and its types) (017103301-Unit-1.2)	
	1.5 Friction and torque	---	Friction and its applications, Types of friction(017102291-Unit-7.1)	
02	**Properties of Materials**			**4 (13%)**
	2.1 Concept of load, stress, strain	---	Stress and types of stress, Strain and types of strain (017103391-Unit-1.2)	
	2.2 Hooke's law and stress-strain diagram	Concept of Load, stress, strain (017101192-Unit-2.1)	Hooke's law, Stress strain Characteristics (017103391-Unit-1.3)	
	2.3 Types of elasticity	---	Fluid Properties (Fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus) (017103491-Unit-1.4)	
	2.4 Poisson's ratio and factor of safety	Concept of Load, stress, strain (017101192-Unit-2.1)	---	
	2.5 Mechanical properties	---	---	
	2.6 Factors affecting elasticity	---	---	
03	**Waves and Motion**			**4 (13%)**
	3.1 Types of waves	---	Electromagnetic waves and its spectrum (017103591-Unit-7.1) Radiation properties (Emission properties absorption and reflection of radiant energy, emission, black and non-black bodies) (017103591-Unit-7.3)	
	3.2 Simple harmonic motion	---	Simple harmonic motion (Terminology and basic Concepts) (017103601-Unit-3.2)	
	3.3 Damped harmonic motion	Simple harmonic motion (017101192-Unit-3.2)	Equivalents of springs and dampers (Spring force and damping force) (017103601-Unit-3.4)	
	3.4 Free and forced resonance	---	---	
	3.5 Types of damping	Damped harmonic motion(017101192-Unit-3.3)	Dampers and methods of damping (017103601-Unit-5.1)	

04	**Ultrasonics**			**3 (10%)**
	4.1 Definition and properties	Types of waves (017101192-Unit-3.1)	---	
	4.2 Generation methods (magnetostriction and piezoelectric)	---	---	
	4.3 Detection of ultrasonic waves	---	---	
	4.4 Applications- (welding, drilling/cutting, cleaning)	---	Ultrasonic machining process (017103503-Unit-1.4)	
05	**Non-Destructive Testing**			**3 (10%)**
	5.1 Definition and objectives of NDT	---	---	
	5.2 Destructive and non-destructive tests	---	---	
	5.3 Types of defects	---	---	
	5.4 Basic equipments in inspection methods	Generation methods (Magnetostriction and Piezoelectric) (017101192-Unit-4.2)	---	
	5.5 Flaw detection system and pulse echo system	Basic equipments in inspection methods (017101192-Unit-5.4)	Testing and inspection of material (017103404-Unit-8.6)	
06	**Laser**			**3 (10%)**
	6.1 Characteristics of Laser	---	---	
	6.2 Einstein's theory	---	---	
	6.3 Basic terms related to laser and three and four level laser	Einstein's theory (017101192-Unit-6.2)		
	6.4 Ruby laser and Nd-YAG laser	Basic terms related to laser and three and four level laser (017101192-Unit-6.3)	---	
	6.5 Applications (Material processing, heat treatment, drilling/cutting, welding)	---	Radiant welding, Laser Beam welding and Electron Beam welding (017103401-Unit-7.6)	
07	**Pressure Measurement**			**3 (10%)**
	7.1 Barometer	---	Junker gas calorimeter (017103301-Unit-10.4) Steam Calorimeters- Barrel, Separating, Throttling and Combined (Separating and Throttling) calorimeters (017103403-Unit-1.4)	
	7.2 Manometer	---	Types of pressure (017103491-Unit-2.1) Pressure measurements devices (Gauges, Transducers, Manometer) (017103491-Unit-2.5)	
	7.3 Pressure gauges and bourdon tube	---	Pressure measurements devices (Gauges, Transducers, Manometer) (017103491-Unit-2.5)	
	7.4 Vacuum gauges	---	---	
	7.5 Piezometer (pressure tube)	---	---	
08	**Temperature measurement**			**3 (10%)**
	8.1 Basics of temperature measurement	---	Junker gas calorimeter (017103301-Unit-10.4) Steam calorimeters – Barrel, Separating, Throttling and Combined (Separating and Throttling) calorimeters (017103403-Unit-1.4)	
	8.2 Thermistors	---	---	
	8.3 Thermocouples and RTD	---	Instruments for temperature measurements (Thermometer, thermal gun, industrial and RTD thermocouple and optical pyrometer) (017103591-Unit-1.3)	
	8.4 Pyrometers	---	---	
	8.5 Solarimeter (solar radiation measurement)	---	---	
09	**Magnetism**			**3 (10%)**
	9.1 Important terms of magnetism	---	---	
	9.2 Origin of magnetic moments	---	---	
	9.3 Classification of magnetic materials	---	---	
	9.4 General properties of diamagnetic, paramagnetic, ferromagnetic	Classification of magnetic materials (017101192-Unit-9.3)	---	
	9.5 Hysteresis and B-H curve	Important terms of magnetism (017101192-Unit-9.1)	---	
	9.6 Hard and soft magnetic materials	Hysteresis and B-H curve (017101192-Unit-9.5)	Types of furnaces, Cupola, Electric arc furnace, Induction furnace (017103401-Unit-4.6)	
10	**Classical Mechanics**			**2 (7%)**
	10.1 Kinetics and kinematics of particle	---	Concepts of kinematics (017103392-Unit-1.1)	

	10.2 Curvilinear coordinates	---	Overview of three-dimensional heat conduction equations in cylindrical and spherical coordinates(017103591-Unit-5.2)	
	10.3 Rigid body and inertia effects of rigid body	---	Concept of Moment of Inertia(017102291-Unit-9.1)	
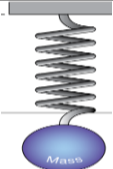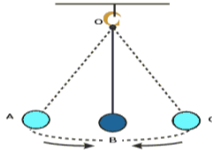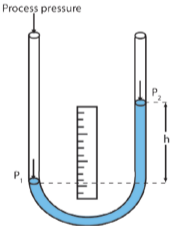
Sr No.	Practical Title	Link to Theory Syllabus
1	To Determine Young's Modulus of Elasticity of the Material of a Given Wire	Unit-2
2	To verify the laws of vibrating stretched string Melde's experiment.	Unit-3
3	To determine the unknown frequency of the tuning fork.	Unit-3
4	To find out the velocity & compressibility of liquid using Ultrasonic Interferometer.	Unit-4
5	To find out the wavelength of LASER source using Diffraction grating.	Unit-6
6	To study the variation in volume (V) with pressure (P) for a sample of air at constant temperature by plotting graphs between P and V, and between P and 1/V.	Unit-7
7	To measure temperature of an object with the help of thermistor.	Unit-8
8	To study B-H curve and to find out the values of coercivity, retentivity and saturation magnetization of experimental material. (commercial Nickel).	Unit-9

Major Components/ Equipment

Sr. No.	Component/Equipment
1	Experimental set up, a spirit level, a meter scale, a screw gauge and a Vernier callipers.
2	Melde's apparatus, rubber hammer, thin string, pan, weight box, meter rule.
3	A Resonator, a set of tuning forks, graduated measuring cylinder.
4	Ultrasonic Interferometer, measuring cell, frequency generator, given liquid.
5	Optical bench, laser source, Optical screen, Double convex lens, Slit and Diffraction grating.
6	Boyle's law apparatus, Fortin's Barometer, Vernier Callipers, thermometer, set square and spirit level.
7	Thermistor, Digital multimeter, hot plate, mercury thermometer.
8	Set up for B-H curve, experimental material (commercial Nickel), CRO, connecting leads.

Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)

L :	**3**	**T:**	**0**	**P:**	**2**

Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory			MCQ	49%	65
Theory	**3**		Theory Descriptive	11%	15
Theory			Formulas and Derivation	4%	5
Theory			Numerical	11%	15
Expected Theory %	**75%**	**4**	**Calculated Theory %**	**75%**	**100**
Practical			Individual Project	0%	0
Practical			Group Project	9%	35
Practical	**1**		Internal Practical Evaluation (IPE)	16%	65
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**25%**		**Calculated Practical %**	**25%**	**100**
Overall %	**100%**			**100%**	**200**

Course Outcome

	Upon completion of the course students will be able to
1	Gain knowledge of theoretical and mathematical concepts associated with properties of matter.
2	Demonstrate understanding the basic principles, properties and applications of associated with Waves, and Motion.
3	Demonstrate the understanding of basic objectives, and its applications in NDT along with properties, type and application of Lasers. Also, ability to solve numerical problems related to pressure measurement using various devices.
4	Solve numerical problems related to temperature measurement using various devices, interpret and analyze BH curves understanding the relation between magnetic flux density and magnetic field strength, significance of various parameters in describing particle motion.

Suggested Reference Books

1	Engineering Physics by G Vijayakumari, Vikas Publication
2	Engineering Physics by V Rajendran, Mc Graw Hill Education
3	Engineering Physics by Dattu Joshi, Mc Graw Hill Education
4	Physics by Jim Breithaupt, Palgrave foundations
5	Industrial Instrumentation and control, S.K.Singh, Tata Mc Graw Hill
6	Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications
7	Engineering Mechanics by R S Khurmi, S Chand
8	Concept of Physics 1 by H C Verma, Bharati Bhawan Publishers

List of Open Source Software/Learning website

1	http://nptel.ac.in/

Practical Project/Hands on Project

Sr. No.	Project List	Linked with Unit
1	There is a well of depth 'd'. You have a bucket of mass 'm'. How much energy will be required to pull the bucket till the top of well? Assume required data.	Unit 01
2	Draw Stress-strain diagram for a basic set-up including elastic spring of any length and weight suspended from it. Assume suitable data.	Unit 02
3	Consider a pendulum that is making certain oscillations per minute. What will be its velocity and acceleration at the centre of oscillation?	Unit 03
4	Discuss how Non-destructive testing is used in quality control. Assume any real time application of your choice.	Unit 04, 05
5	Consider three different applications of laser and design parameters like a) Type of laser to be used b) Mode of laser beam to be used c) Power requirement for that application	Unit 06
6	Design a U-tube manometer to find out unknown pressure.	Unit 07
7	You have refrigerator of certain capacity 'x'. It is filled with water that is one fourth its capacity at a certain temperature. Calculate the time required to bring the temperature of water by 'y' ^{0}C.	Unit 08
8	Design an electric bell.	Unit 09
9	The airplane climbs at a constant speed 'v' and at a constant climb angle 'β'. The airplane is being tracked by a radar station at point 'A' on ground. Determine the radial velocity and angular velocity as a function of tracking angle 'θ'.	Unit 10