COURSE-WISE SYLLABUS

Semester I

Mechanics and Properties of Matter

Year	I	**Course Code: 21BSC1C1PHY1L**	**Credits**	**04**
Sem.	1	**Course Title: Mechanics and Properties of Matter**	**Hours**	52
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 2 hrs.	

Unit No.	**Course Content**	**Hours**
Unit I	**Conservation Laws:** Law of conservation of linear momentum. Centre of mass and expression for position vector, velocity, acceleration and force of centre of mass. Distinction between laboratory frame of reference and centre of mass frame of reference. Concept of elastic collision and inelastic collisions. Derivation of final velocities in case of elastic collision in (i) laboratory frame of reference (ii) centre of mass frame of reference. Derivation of final velocities in case of inelastic collision in (i) laboratory frame of reference (ii) centre of mass frame of reference. Conservation of linear momentum in case of variable mash. Principle of rocket and derivation for equation of motion for single stage rocket. Necessity of multi stage rocket. Basics of angular momentum and torque, relation between angular momentum and torque. Law of conservation of angular momentum with examples. Concept of work and power. Law of conservation of energy with examples. Work energy theorem. Simple harmonic oscillations of light spiral spring. Problems	13
Activity/ Self Study	1 Students can try and find every day examples of conservation of energy. For example: i) What happens in solar panels ii) pushing an object on the table it moves iii) moving car hits a parked car causes parked car to move. In these cases, energy is conserved. How? Understand and verify if possible.	
Unit II	**Gravitation:** Newton's law of Gravitation (statement). Expressions for escape velocity and orbital velocity. Kepler's laws of planetary motion. Derivation for Kepler's 2nd and 3rd law. Concept of Satellite, derivation for binding energy of satellite. Artificial Satellite: Geostationary satellite and polar orbit satellite with different types of orbits (qualitative). Concept of weightlessness. Basic ideas of G.P.S. and NAVIC. Problems **Rigid Body Dynamics**: Moment of Inertia. Radius of Gyration. Statements of theorem of parallel axis and theorem of perpendicular axis. Derivation of expressions for moment of inertia for (i) rectangular lamina (ii) thin uniform rod and (iii) circular disc. Theory of compound pendulum and bar pendulum. Theory of flywheel and its applications. Problems	13
Activity/ Self Study	1. Moment of inertia is an abstract concept. It simply gives a measure of rotational inertia of a rigid body. It is proportional to the product of the square of radius, r of the body and its mass, m. Students by referring to websites, can construct and perform simple experiments to verify that MI α mr^2.	

	2. Performing experiments on gravity and Kepler's laws are somewhat difficult. However, students can prepare suitable charts, understand and give seminar talks in the class. Websites can help in this regard.	
Unit III	**Elasticity:**Definition of Stress-strain, Hooke's law. Types of elastic constants. modulus of elasticity and derivation of expression for relation between elastic constants, Poisson's ratio, expression for Poisson's ratio in terms of elastic constants. Work done in stretching and twisting wire. Theory of torsional pendulum, determination of rigidity modulus and time period. Bending moments. Theory of cantilever. Determination of Youngs modulus by bending of beam supported at its ends and loaded at middle. Problems	13
Activity/ Self Study	1.Verification of Hook's law Arrange a steel spring with its top fixed with a rigid support on a wall and a meter scale alongside. Add 100 g load at a time on the bottom of the hanger in steps. This means that while putting each 100g load, we are increasing the stretching force by 1N. Measure the extension for loads up to 500g. Plot a graph of extension versus load. Shape of the graph should be a straight line indicating that the ratio of load to extension is constant. Go for higher loads and find out elastic limit of the material. 2. Repeat the above experiment with rubber and other materials and find out what happens after exceeding elastic limit.	
Unit IV	**Surface tension :** Definition of surface tension, Angle of contact, Surface energy, relation between surface tension and surface energy, pressure difference across curved surface. Excess of pressure inside spherical liquid drop, Capillary rise, derivation of expression for rise of liquid in a capillary tube. Determination of surface tension by Quinke's method. Effect of temperature, impurity on surface tension. Problems **Viscosity :** Streamline flow, turbulent flow, equation of continuity, determination of coefficient of Viscosity by Poisulle's method, Stoke's law with derivation and expression for terminal velocity. Effect of temperature on viscosity. Problems	13
Activity/ Self study	1. Measure surface tension of water and other common liquids and compare and learn i) Why water has high ST? Give reasons. ii) Check whether ST is a function of temperature? You can do it by heating the water to different temperatures and measure ST. iii) Plot ST. versus T and learn how it behaves. iv) Mix some quantity of kerosene or any oil to water and measure ST. Check whether ST for the mixture is more or less than pure water. Give reasons. 2**.** Collect a set of different liquids and measure their viscosity. i) Find out whether sticky or non-sticky liquids are most viscous. Think of reasons. ii) Mix non-sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out whether viscosity is increasing or decreasing with increase of non- sticky liquid concentration. iii) Do the above experiment by mixing sticky liquid to the non-sticky liquid. Find out change in viscosity with increase of concentration of sticky liquid. iv) Think why one should know viscosity of the liquid.	

Recommended Leaning Resources	
Text Books	**Textbooks** 1. Mechanics by D.S.Mathur, New Edition 2000, S. Chand& Co. 2. Classical Mechanics by J. C.Upadhya,2019, Himalaya Publishers. 3. Mechanics and Relativity by Vidwan Singh Soni,3rd Edition, PHIL earning Pvt.Ltd. 4. Mechanics Berkeley PhysicsCourse,Vol.1: Charles Kittel, *et.al*.2007,Tata McGraw-Hill. 5. Engineering Mechanics, Basudeb Bhattacharya, 2ndEdn, 2015, Oxford University Press. 6. Elements of properties of matter by D.S.Mathur, 2010, S. Chand & Co. 7. Properties of Matter by Brijlal & Subramanyam.
Reference Books	1. Physics:Resnick,Halliday&Walter,9thEdn,2010,Wiley. 2. Physics by Halliday and Resnick,Vol1. 3. University Physics,Ronald Lane Reese,2003,Thamson Brooks/Cole.

Laboratory Experiments:

NOTE: Minimum of Eight experiments has to be performed

Year	I	**Course Code: 21BSC1C1PHY1P**	**Credits**	2
Sem.	1	**Course Title: Practical- I**	**Hours**	4 hrs/week

Formative Assessment Marks: 25	Summative Assessment Marks: 25	Duration of ESA: 4 hrs.

Sl. No	**Experiment**
1	Determination of g using bar pendulum (L versus T and L versus LT^2graphs)
2	Determination of moment of inertia of a Fly Wheel
3	Determination of moment of inertia of an irregular body
4	Determination of rigidity modulus using torsional pendulum
5	Verification of parallel axis theorem
6	Verification of perpendicular axis theorem
7	Determination of Young's Modulus of a bar by bending method
8	Verification of Hook's Law by Searle's method.
9	Young's modulus by cantilever–Load versus Depression graph
10	Young's modulus by Koenig's method
11	Young's modulus by stretching (Searle's apparatus).
12	Modulus of rigidity (twisting)
13	Viscosity by Stoke's method
14	Radius of capillary tube by mercury pellet method
15	Surface tension by drop weight method
16	Critical pressure for streamline flow

Recommended Leaning Resources

Text Books	1.Practical Physics-M.A. Hipparagi
Reference Books	1. Physics through experiments,by B. Saraf,2013,Vikas Publications. 2. A labmanual of Physics for undergraduate classes, 1st Edition, Vikas Publications. 3. BSc Practical Physics by CL Arora, Revised Edition 2007, S. Chand & Co. 4.Anadvanced course in practical physics, D. Chattopadhyay, PC Rakshit, B.Saha, Revised Edition 2002, New Central Book Agency Pvt Ltd.

OPEN-ELECTIVE SYLLABUS:

Year	I	**Course Code: 21BSC1O1PHY1**	**Credits**	03
Sem.	1	**Course Title: Energy Sources**	**Hours**	40
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	

Unit No.	**Course Content**	**Hours**
Unit I	**Introduction:** Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources.	**05**
	Renewable energy sources: Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	**05**
Unit II	**Conventional energy sources:** Fossil fuels & Nuclear energy-production & extraction, usage rate and limitations. Impact on environment and their issues& challenges. Overview of Indian & world energy scenario with latest statistics- consumption & necessity. Need of eco-friendly & green energy & their related technology.	**10**
Unit III	**Solar energy**: Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.	**10**
Unit IV	Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.	**08**
	Geothermal and hydro energy: Geothermal Resources, Geothermal	**02**

	Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources.	
	Activity 1. Demonstration of on Solar energy, wind energy, etc, using training modules at Labs. 2. Conversion of vibration to voltage using piezoelectric materials. 3. Conversion of thermal energy into voltage using thermoelectric (using thermocouples or heat sensors) modules. 4. Project report on Solar energy scenario in India 5. Project report on Hydro energy scenario in India 6. Project report on wind energy scenario in India 7. Field trip to nearby Hydroelectric stations. 8. Field trip to wind energy stations like Chitradurga, Hospet, Gadag, etc. 9. Field trip to solar energy parks like Yeramaras near Raichur. 10. Videos on solar energy, hydro energy and wind energy.	
	Reference Books: 1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi 2. Solar energy - M P Agarwal - S Chand and Co. Ltd. 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd. 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University. 5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009 6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). http://en.wikipedia.org/wiki/Renewable_energy	