JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANICOLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program: B.Sc. Physics

Course: Mechanics and Thermodynamics- I

Semester I

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-22

F.Y. B.Sc Physics Syllabus

Semester I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SPHY101	Mechanics and Thermodynamics- I	2	3

Semester I – Theory

Course: SPHY101	Mechanics and Thermodynamics- I	Credits: 2 Lecture/Week:3
	Objectives: • To understand the fundamentals of Mechanics and Thermodynamics. **Outcomes:** • To state the applications of Newton's laws to classical systems. • To explain the concepts of elasticity and viscosity • To apply the laws of thermodynamics to formulate the relations necessary to analyze a thermo dynamic process.	
Unit I	**Mechanics:** **1. Newton's laws of motion** **1.1.** Newton's first and second law and their explanation **1.2.** Working with Newton's first and second law **1.3.** Newton's third law and its explanation. **2. Applying Newton's laws** **2.1.** Using Newton's first law: Particles in equilibrium, **2.2.** Using Newton's second law: Dynamics of particles, Frictional forces, Dynamics of circular motion, typical examples such as a block on table/ incline, Pulley, Lift etc. **3. Rotation of rigid bodies** **3.1.** Angular velocity and acceleration, **3.2.** Rotation with constant angular acceleration **3.3.** Relating linear and angular kinematics **3.4.** Energy in rotational motion, moment of inertia calculations, Problems	**15L**
Unit II	**Mechanics:** **1. Elasticity** **1.1.** Review of Elastic constants Y, K, η and σ; **1.2.** Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder. **Fluid Dynamics** **2.1.** Equation of continuity **2.2.** Bernoulli's equation, applications of Bernoulli's equation **2.3.** Streamline and turbulent flow, lines of flow in airfoil **2.4.** Poiseuille's equation, Stoke's law, Toricelli's theorem, **2.5.** Millikan's oil drop experiment, applications to biological sciences	**15L**
Unit III	**Thermodynamics:** **1.** Andrew's experiment, Behaviour of real gases and real gas equation, Boyle's law, Van der Waal equation. **2.** Thermodynamic Systems, Zeroeth law of thermodynamics, Concept of Heat, the First Law, Non Adiabatic process and Heat as a path function, Internal energy, Heat Capacity and specific heat, Applications of first law to simple processes,	**15L**

	general relations from the first law, Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems. Temperature variation with height.	
ICA (Internal Continuous Assessment)	**Class test, Seminars, Assignments, Class performance**	

References:

1. B. K. Guha, (2007), *Degree Physics for Science and Engineering*, Asian Books private limited.

2. Halliday, Resnick and Walker, (9th Edition 2010), *Fundamental of Physics (extended)*, John Wiley and Sons.

3. H.S. Hans and S.P. Puri, *Mechanics*, (2nd Edition 2008), Tata Mcgraw Hill.

4. A. B. Gupta, H. Roy, (2009), *Thermal Physics*, Tata Mc Graw Hill.

5. H. C. Verma, (2002), *Concepts of Physics(Part I)*, Bharati Bhavan Publishers.

6. Brijlal, Sub ramanyam and Hemne, (Multi-coloured, 2007), *Heat Thermodynamics and Statistical Physics*, S. Chand publications.

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Program: B.Sc. Physics

Course: Vector Calculus-I and Modern Physics

Semester I

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-22

F.Y. B.Sc Physics Syllabus

Semester I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SPHY102	Vector Calculus-I and Modern Physics	2	3

Course Code: SPHY102	Vector Calculus – I and Modern Physics	Credits: 2 Lectures/Week:3
	Objectives: • To study the basics of Mathematical Physics and to introduce concepts of modern physics • To develop quantitative problem-solving skills in all the topics covered **Outcomes:** • To apply the basic mathematical concepts and their applications in physical situations. • .To define the properties of the nucleus. • To explain the basic concepts of quantum physics.	
Unit I	**Vector Algebra and Calculus** **1. Vector Algebra:** **1.1.** Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra. **1.2.** Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). **1.3.** Problems and applications based on Dot, Cross and Triple products. **2. Vector Calculus:** **2.1.** Gradient, divergence and curl: The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl. **2.2.** Distributive Laws for Gradient, Divergence and Curl (Omit proofs) **2.3.** Problems based on Gradient, Divergence and Curl	**15L**

Unit II	**Nuclear Physics** **1. Structure of Nuclei:** **1.1.** Basic properties of nuclei, Composition, Charge, Size. **1.2.** Rutherford's expt. for estimation of nuclear size **1.3.** Density of nucleus, Mass defect and Binding energy, Packing fraction **1.4.** BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems. **Radioactivity:** **2.1.** Radioactive disintegration concept of natural and artificial radioactivity **2.2.** Properties of α, β, γ-rays. **2.3.** Laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes **2.4.** Carbon dating, age of earth, Numerical Problems	**15L**
Unit III	**Modern Physics:** **1. Introduction to Quantum theory:** **1.1.** Black body (definition), Black Body spectrum, Wien's displacement law. **1.2.** Matter waves, wave particle duality, Heisenberg's uncertainty Principle. **1.3.** Davisson- Germer experiment, G. P. Thompson experiment. **X-Rays:** **2.1.** Production and properties, Continuous and characteristic X-Ray spectra, **2.2.** X-Ray Diffraction, Bragg's Law **2.3.** Application of X-Rays **Interaction of photon with matter:** Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift.	**15L**
ICA (Internal Continuous Assessment)	**Class test, Seminars, Assignments, Class performance**	

References:

1. H.K.Dass,2018, *Mathematical Physics*, S Chand Publications
2. Dr. S. B. Patel, (Reprint 2009), *Nuclear physics*, New Age International Pvt Ltd Publishers.
3. A. Beiser,(2017), *Conepts of Modern Physics*, McGraw Hill Education.

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Program: B.Sc. Physics

Course: Practical-I

Semester I

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Semester I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SPHY1PR	Practical-I	2	6

Course Code: SPHY1PR	**Practical-I**	Credits:02Lect/ Week:06
	Objectives: • To correlate theory concepts with practical knowledge and skills **Outcomes:** • Develop basic experimental Skills through conduct of experiments.	
	Skills: **1.** Use of Vernier calliper, micrometer screw gauge **2.** Use of spectrometer **3.** Use of Travelling microscope **4.** Estimation of errors and graph plotting	
	Experiments (ANY 8): **1.** Torsional oscillations **2.** Bifilar pendulum **3.** Angle of prism **4.** Y by vibrations **5.** Surface tension by capillary rise **6.** Refractive index of material of prism using spectrometer **7.** CVAT **8.** Flywheel **9.** Flat spiral spring (Determination of Y) **10.** Refractive index of water using Laser light	

Students will come for two turns of two and half hours each per week for the laboratory session (Performing practical)

i) Skill experiments: All 4 skill experiments mentioned are compulsory. Students are required to acquire these skills and enter details in their journal.

ii) Regular Physics Experiments: A minimum of **08** experiments from the practical course are to be performed and reported in the journal.
The certified journal must contain all 4 skills and a minimum of **08** regular experiments

Evaluation Scheme

Theory

I. Continuous Assessment (C.A.) - 40 Marks

C.A.-I: Test (MCQ) – 20 Marks of 30 minutes duration

C.A.-II: Assignment of Problems/Seminars/Class Performance – 20 Marks

II. Semester End Examination (SEE) - 60 Marks

Practical

Total marks: 100						
Continuous Internal Assessment (CIA) **40%(40 Marks)**			**Semester End Examination (SEE)** **60% (60 Marks)**			**Total**
Rough Journal	**Journal**	**Viva-Voice**	**Expt -I**	**Expt- II**	**Total**	
20	**10**	**10**	**30**	**30**	**100**	