SEMESTER - I					
Core I Properties of Matter					
Code: 18UPHC11 Hrs/Week: 4 Hrs/Semester: 60 Credits: 4					

- Vision: To enhance the knowledge of the students about the properties of matter and their relevance to day to day applications
- Mission: To provide a clear insight about gravitational force, elasticity, surface tension and viscous nature of matter

<b>CO.</b>	CO. Upon completion of this course students will be able to		CL
No.	Upon completion of this course, students will be able to	addressed	
CO-1	calculate the acceleration due to gravity at a place.	1	An
CO-2	define stress, strain, Hooke's law and Poisson's ratio	1	Re
CO-3	describe the fundamental concepts of stress and strain and the relationship between both through the stress-strain equations in order to solve the problems for simple tridimensional elastic modes	1	Un
CO-4	calculate the elastic constant values of materials which is necessary for beam construction.	1, 6	An
CO-5	sketch the uses of I-form girders	1	Ар
CO-6	describe the properties of fluids such as viscosity, surface tension and capillary rise.	1	Un
CO-7	evaluate the properties and utility of lubricants	1, 6	Ev
CO-8	calculate the surface tension of a liquid	1, 6	Ap

SEMESTER - I				
Core I Properties of Matter				
Code: 18UPHC11Hrs / Week: 4Hrs/Semester: 60Credits: 4				

#### **Unit I: Gravitation**

Newton's law of gravitation – Kepler's law of planetary motion – Determination of gravitational constant: Boy's Method – Gravitational field and gravitational potential – Potential and field due to a spherical shell and a solid sphere – Variation of 'g' with altitude, latitude anddepth.

#### **Unit II: Elasticity**

Stress – Strain – Hooke's law – Poisson's ratio – Relation between the elastic moduli – Determination of Poisson's ratio for rubber – Twisting couple on a cylindrical wire – Expression for couple per unit twist – Work done in twisting – Torsional oscillation of a body – Torsion pendulum – Theory – Experimental determination of rigidity modulus and moment of inertia: Dynamic method.

## Unit III: Bending of beams

Bending of beams – Expression for bending moment – Uniform bending: Expression for elevation – Experiment to find Young's Modulus using pin and microscope – Non-uniform bending – Cantilever: Expression for depression – Experiment to find Young's Modulus using pin and microscope – Non-uniform bending: Expression for depression – Experiment to determine Young's Modulus using scale and telescope – I section of girders.

# Unit IV: Viscosity

Newton's law of viscous flow – Streamlined and turbulent motion – Reynold's number – Poiseuille's formula for the flow of liquid through a horizontal capillary tube – Analogy between current and liquid flow – Experimental determination of co-efficient of viscosity of a liquid by Poiseuille's method – Ostwald's viscometer – Terminal velocity and Stokes' formula – Experimental determination of viscosity of a liquid by Stoke's method – Viscosity of gases – Meyer's formula – Rankine's method – Variation of viscosity with temperature and pressure –Lubrication.

### **Unit V: Surface Tension**

Definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – Work done on increasing the area of a surface – Angle of contact – Neumann's triangle – Excess pressure inside a liquid drop and soap bubble – Excess pressure inside a curved liquid surface – Experimental determination of surface tension: Jaegar's method, Drop-weight method and capillary rise method – Variation of surface tension with temperature.

## **Text Books:**

- 1. R. Murugeshan, Properties of matter, S. Chand & Company Ltd., revised edition 2008.
- 2. A. Ubald Raj and G. Jose Robin, Properties of matter and optics, Indira publication, Marthandam, First edition 2003.
- 3. A. Ubald Raj and G. Jose Robin, Allied Physics, Indira publication, Marthandam, First edition 2008.
- 4. D. S. Mathur, Elements of Properties of matter, Shyam Lal Charitable Trust, New Delhi, Reprint 2013.

# **Book for Reference:**

David Halliday, Robert Resnik and Jearl Walker, Fundamentals of Physics, John Wiley & Sons Inc.

SEMESTER – I				
Core II Mechanics, Wave Oscillations and Acoustics				
Code: 18UPHC12Hrs/Week: 4Hrs / Semester: 60Credits: 4				

- Vision: To impart knowledge in the mechanics of objects, wave oscillations and acoustics of buildings
- **Mission:** To enhance the understanding of students in the mechanics of objects, wave oscillations and acoustics through a detailed study of projectile motion, translational and rotational motion, centre of gravity of objects and the nature of sound.

CO.	CO. Upon completion of this course, students will be able to		CL
No.	Opon completion of this course, students will be able to	addressed	
CO-1	discuss impulse and linear momentum, calculate the change in momentum of an object for the net force acting on the object	1	Un
СО-2	analyze the motion of the projectile that is projected with an initial velocity	1	An
CO-3	calculate the torque and angular momentum for a moving particle	1,6	An, Ev
CO-4	locate the center of gravity, the line of gravity and the center of pressure of the objects	1,6	Un, Ev
CO-5	understand the factors affecting atmospheric pressure , variation of atmospheric pressure with temperature, principle of barometer and working of different kinds of barometer	1	Un
CO-6	define simple harmonic motion and discuss the principle of simple harmonic motion and their types	1	Re, Un
CO-7	understand how sound is transmitted through building components	1	Un
CO-8	identity, discuss and resolve acoustical problems related to architectural acoustics and acoustic comfort	1, 6	Un, An

SEMESTER – I				
Core II Mechanics, Wave Oscillations and Acoustics				
Code: 18UPHC12Hrs / Week: 4Hrs / Semester: 60Credits: 4				

#### Unit I: Projectile, Impulse and Impact

Projectile – Expression for time of flight on a horizontal range of a projectile – Path of a projectile is a parabola – Range of a projectile on plane inclined to the horizontal – Impulse of a force – Fundamental principles of impact – Oblique impact of a smooth sphere on a smooth fixed horizontal plane – Direct impact of two smooth spheres – Loss of KE due to direct impact – Oblique impact of two smooth spheres – Loss of KE due to oblique impact.

#### Unit II: Dynamics of rigid bodies

Translational and rotational motion – Angular momentum and angular impulse – moment of inertia and radius of gyration – Moment of inertia of a thin circular ring, solid sphere, solid cylinder – Parallel axis and perpendicular axis theorem – Compound pendulum – theory – Equivalent simple pendulum – Reversibility of centres of oscillation and suspension – Determination of g and k.

#### Unit III: Centre of gravity, Centre of Pressure, Floating bodies, Atmospheric pressure

Centre of gravity of a body – C.G. of a solid hemisphere – C.G. of a solid tetrahedron – C.G. of a solid cone – Centre of pressure – Rectangular lamina – Triangular lamina – Laws of floatation – Stability of floating bodies – Metacentre – Experimental determination of a metacentric height of a ship – The barometer – Fortin's barometer – Correction for a barometer – Faulty barometer – Variation of atmospheric pressure with altitude.

#### **Unit IV: Sound**

Sound – Simple harmonic motion – free, damped, forced vibrations and resonance – Helmholtz resonator – laws of transverse vibration of strings – Sonometer – Determination of AC frequency using sonometer – Determination of frequency using Melde's apparatus. Decibels – Intensity levels – Musical sound and noise – Musical scale.

#### **Unit V: Acoustics**

Reverberation – Sabine's reverberation formula – Factors affecting the acoustics of buildings – Sound distribution in an auditorium – Requisites for good acoustics.

Ultrasonics: Production (Magenetostriction oscillator) and detection – Applications of ultrasonic waves.

# **Text Books:**

- 1. M. Narayanamurthi and N. Nagarathinam, Statics, Hydrostatics and Hydrodynamics, The National Publishing Company, Chennai, 2005.
- 2. D.S. Mathur, Mechanics, S. Chand & Co., Reprint, 2013.
- 3. R. Murugeshan, Mechanics and Mathematical Physics, S. Chand & Co. Pvt. Ltd., New Delhi.
- 4. Brij Lal & Subramaniam, Text book of sound, N. Vikas Publishing House, New Delhi, 1982.
- 5. R. Murugeshan, Properties of matter, S. Chand & Company Ltd., revised edition 2008.
- 6. A. Ubald Raj and G. Jose Robin, Mechanics and Thermal Physics, Indira Publications, Marthandam, First Edition, 2003

## **Books for Reference:**

- 1. M. Narayanamurthi and N. Nagarathinam, Dynamics, The National Publishing Company, Chennai, 2005.
- 2. R. Murugesan, Mechanics and Mathematical Physics, S. Chand & Company Ltd., New Delhi, 2008.
- 3. N. Subrahmanyam and Brij Lal, Waves & Oscillations, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
- 4. D. R. Khanna and R. S. Bedi, A Textbook of Sound, Atma Ram & Sons, New Delhi 1985.
- 5. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, Wiley NY. 6<sup>th</sup> Edition, 2001.

SEMESTER - II				
Core III Thermal Physics and Statistical Mechanics				
Code: 18UPHC21 Hrs / Week: 4 Hrs / Semester: 60 Credits: 4				

Vision: To impart knowledge in thermal physics and statistical mechanics

**Mission:** To provide a solid understanding of the fundamental laws of thermodynamics, kinetic theory and statistical physics

CON	Upon completion of this course, students will be able to	PSO	CL
CO.NO.	opon completion of this course, students will be able to	addressed	
CO-1	define temperature, pressure, closed system, reversible	1	Re
	and irreversible process		
CO-2	understand the basic concepts of thermodynamics such as	1	Un
	temperature, pressure, properties, closed system,		
	reversible and irreversible process		
CO-3	understand the transfer of energy	1	Un
CO-4	demonstrate the experiment regarding the measurement	1, 2	An
	of thermal conductivity and specific capacity		
CO-5	calculate the thermal conductivity of a bad conductor	1,6	An
CO-6	understand the low temperature physics, concerned with	1	Un
	the behavior of matter in the temperature regime where		
	quantum effects are dominated		
CO-7	create an interest in field of research in low temperature	1	Cr
	physics		
CO-8	employ Fermi-Dirac and Bose-Einstein statistics	1	An, Ev
	according to the spin of the particle and compare the three		
	statistics		

SEMESTER - II				
Core III Thermal Physics and Statistical Mechanics				
Code: 18UPHC21Hrs / Week: 4Hrs / Semester: 60Credits: 4				

## Unit I: Laws of thermodynamics

Zeroth law of Thermodynamics – First law of thermodynamics – Isothermal Change – Adiabatic Change – Heat engine – Expression for the efficiency of a Carnot's engine – Carnot's cycle as refrigerator – Carnot's theorem - Reversible and irreversible process – Second law of thermodynamics – Thermodynamic scale of temperature – Entropy – Change in entropy in reversible and irreversible process – Temperature-entropy diagram – Third law of thermodynamics.

## Unit II: Kinetic theory of gases

Ideal gas equation – Degrees of freedom – Equipartition of energy – Atomicity of gas – Mean free path of a molecule – Expression for the mean free path – Transport phenomena – Expression for the viscosity of a gas – Thermal conductivity of a gases – Expression for the coefficient of diffusion – Vander Waal's equation of the state: Real or imperfect gas Vander Waal's equation – Critical constant in terms of Vander Waal's constants – Demerits of Vander Waal's equation – Reduced equation of state .

#### Unit III: Transmission of heat

Transference of heat : Conduction, Convection and Radiation – Conduction: Coefficient of thermal conductivity – Thermal conductivity of good conductor: Forbe's method – Thermal conductivity of bad conductor: Lee's disc method – Widemann Franz law – Convection: Illustrative examples – Verification of Newton's law of cooling and determination of specific heat capacity of liquid – Convective equilibrium – Radiation : Black body – Stefan-Boltzman's law – Boltzman's proof – Distribution of energy in the spectrum of a black body – Wien's displacement law – Rayleigh-Jean's law – Planck's radiation law.

# **Unit IV: Low temperature Physics**

Joule-Thomson effect – Porous-plug experiment – Theory – Expression for the Joule – Thomson cooling produced in a Vander Waal's gas – Liquefaction of gases: Regenerative cooling – Liquefaction of air (Linde's process) – Liquefaction of Helium – Adiabatic demagnetisation – Expression for the fall in temperature due to adiabatic demagnetisation – Practical applications of low temperature – Refrigeration – Air conditioning – Air conditioner – Window air-conditioner – Central heating system – Effects of  $CF_2Cl_2$  on ozone layer.

# **Unit V: Statistical Mechanics**

Probability – Probability theorems – Phase space – Chemical potential – Quantum states – Microscopic and macroscopic systems – Microstates, macrostates and thermodynamic

probability – Fundamental postulates of statistical mechanics – Probability and disorder (Entropy) – Derivation of Boltzmann's relation – Maxwell-Boltzman distribution law (M.B statistics) – Quantum statistics – Fermi-Dirac statistics – Bose-Einstein statistics – Comparison of three statistics.

#### **Text Books:**

- 1. R. Murugeshan, Er. Kiruthiga Sivaprasath, Thermal Physics, S. Chand & Co. pvt. Ltd., New Delhi, Reprint 2014.
- 2. G. Jose Robin and A. Ubald Raj, Thermal Physics and Statistical Mechanics, Indira Publications, Marthandam, 2001.
- 3. J.B. Rajan and C.L. Arora, A textbook of Heat and thermodynamics, S. Chand & Co. Pvt. Ltd., New Delhi, Reprint 1983.

#### **Books for Reference:**

- 1. A.B. Gupta, H.P. Roy, Thermal physics, Books and Allied (P) Ltd., Kolkata, Reprinted 2011.
- 2. Halliday and Resnik, Fundamentals of Physics, John Wiley publication, 6<sup>th</sup> edition extended, 2006.
- 3. M.N. Bapat, D.S. Mathur's Heat and Thermodynamics, Sultan Chand & sons, Educational publishers, New Delhi, Reprint 2001.
- 4. Brijlal and N. Subrahmanyam, Heat and thermodynamics, S. Chand & Co, Ltd., 7<sup>th</sup> edition, 1981.

SEMESTER – II				
Core IV Optics				
Code: 18UPHC22Hrs / Week: 4Hrs / Semester: 60Credits: 4				

- **Vision:** To appreciate the spectacular nature of light and harness it for constructive day to day applications.
- **Mission:** To deepen the conceptual knowledge in optical phenomena and apply it in real life situations through the systematic study of theory, validating experiments and relevant applications.

CON	No. Upon completion of this course, students will be able to		CL
CO.NO.	Opon completion of this course, students will be able to	addressed	
CO-1	understand the theory behind the important properties of	1	Un
	light such as reflection, refraction, dispersion,		
	interference, diffraction and polarisation.		
CO-2	calculate the focal length of lenses in contact and out of	1,6	An
	contact with each other		
CO-3	determine the refractive index and dispersive power of the	1, 2, 6	Ev
	material of the prism		
CO-4	define the different types of aberrations in lenses and	1	Re, Un
	discuss the methods to reduce them		
CO-5	describe the phenomenon of interference in reflected	1, 2, 6	Un, Ev
	systems and calculate the refractive index of liquids by		
	forming Newton's rings		
CO-6	calculate the thickness of a thin wire by forming	1, 2, 6	Ev
	interference fringes		
CO-7	evaluate the dispersive power and resolving power of a	1, 2, 6	Ev, An
	grating and demonstrate experiments with a grating and		
	find the wavelengths of the light used		
CO-8	acquire knowledge of the polarisation of light and its	1	Un
	changes upon reflection and transmission		

SEMESTER – II				
Core IV Optics				
Code: 18UPHC22Hrs / Week: 4Hrs / Semester: 60Credits: 4				

#### **Unit I: Refraction in lenses**

Introduction – Refractive index and optical path – Fermat's principle – Laws of reflection and refraction – Refraction through a thin lens (Lens maker's formula) – Deviation produced by thin lens – Equivalent focal length of two thin lenses in contact and separated by a distance – Definition of Cardinal points and respective planes.

## **Unit II: Dispersion and Aberrations**

Dispersion by a prism – Refraction through a prism – Angular dispersion – Dispersive power – Deviation without dispersion – Dispersion without deviation – Direct vision spectroscope – Constant deviation prism – Constant deviation spectroscope – Aberrations – Spherical aberration in lenses – Methods of minimizing spherical aberration – Coma – Aplanatic points – Chromatic aberration in lenses – Achromatic lenses – Condition for achromatism of two thin lenses in contact and separated by a finite distance.

## Unit III: Interference

Introduction – Conditions for interference – Interference due to reflected light – Production of colours in thin films – Air wedge – Determination of diameter of a thin wire by air wedge – Test for optical flatness-Newton's rings – Determination of wavelength of Sodium light by Newton's rings – Determination of refractive index of a liquid by Newton's rings – Michelson's interferometer – Determination of  $\lambda$  and  $d\lambda$ .

#### **Unit IV: Diffraction**

Introduction – Fresnel's explanation of rectilinear propagation of light – Half period zones – Zone plate – Multiple foci in a zone plate – Comparison of a zone plate with a convex lens – Fraunhofer diffraction at a single slit – Plane diffraction grating – Theory – Determination of wavelength of light using transmission grating (Normal incidence) – Grating at oblique incidence – Dispersive power of grating – Rayleigh's criterion for resolution – Resolving power of a plane transmission grating.

#### **Unit V: Polarisation**

Introduction – Polarisation by reflection – Pile of plates – Law of Malus – Double refraction – Nicol prism – Polarizer and Analyzer – Quarter wave plate and half wave plate – Production and detection of plane, circularly and elliptically polarized light – Optical activity – Fresnel's theory of optical rotation – Specific rotation – Laurent's half-shade polarimeter. **Text Books:** 

- 1. N. Subramanyam and Brijlal, A textbook of Optics, S. Chand & Co., Revised by M. N. Avadhanulu 23<sup>rd</sup> revised and enlarged edition, 2006.
- 2. R. Murughesan, Optics and Spectroscopy, S. Chand & Co, 6<sup>th</sup> revised edition 2006.

## **Books for Reference:**

- 1. David Halliday, Robert Resnik & Jearl Walker, Fundamentals of Physics, John Wiley & Sons Inc.
- 2. Ajay Ghatak, Optics, McGraw Hill Education (India) Private Limited, New Delhi, Fourth reprint 2014.