MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. PHYSICS

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

	Sub. No:	Subject status	Subject Title	Contact Hrs/week	L Hrs/week	T Hrs/week	P Hrs/week	Credits
Part I	1	Language	Tamil/Other Languages	6	6	0	0	4
Part II	2	Language	English	6	6	0	0	4
Part III	3	Core-1	Mechanics and relativity	4	4	0	0	4
	4	Core-2	Properties of matter and acoustics	4	4	0	0	4
	5.	Major .Practical-I	Practical-I	2	0	0	2	2
	6	Allied Paper-1	Allied Physics Paper-1	4	4	0	0	4
	7	Allied.Practical-1	AlliedPractical-1	2	0	0	2	2
Part IV	8	Common	Environmental Studies	2	2	0	0	2
			Total	**30**				**26**
Part I	9	Language	Tamil/Other Languages	6	6	0	0	4
Part II	10	Language	English	6	6	0	0	4
Part III	11	Core-3	Thermal physics and statistical mechanics	4	4	0	0	4
	12	Core-4	Optics	4	4	0	0	4
	13	Major .Practical-II	Practical-II	2	0	0	2	2
	14	Allied Paper-2	Allied Physics Paper-2	4	4	0	0	4
	15	Allied.Practical-2	Practical-2	2	0	0	2	2
Part IV	16	Common	Value Based education	2	2	0	0	2
			Total	**30**				**26**

MECHANICS AND RELATIVITY

UNIT-I: VECTORS

Vector analysis - components of a vector - gradient of a scalar point function-divergence and curl of vector point function- angular momentum as a vector-product of two vectors - work as a scalar product of two vectors - line, surface and volume integrals - Gauss divergence, Stoke's and Green's theorems

UNIT-II: CONSERVATION LAWS

Laws of conservation of energy, linear momentum and angular momentum - work energy theorem - work done by gravitational force - work done by spring force - potential energy - conservative and non conservative forces - potential energy curve - centre of mass - Two body problem and reduced mass - central field motion - motion of planets in elliptical orbits - proof of Kepler's second and third laws - Rocket motion - systems of varying mass - multistage rocket.

UNIT-III: 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 -Newton's second law for rotation – torque,work, rotational kinetic energy and expression for power during rotation - Kinetic energy of rolling - Acceleration of a uniform body, rolling down an inclined plane. Precessional motion - Gyrostat .

UNIT-IV: HYDROSTATICS AND HYDRODYNAMICS

Pressure and thrust - Thrust on a plane surface immersed in a liquid - centre of pressure - centre of pressure on a rectangular lamina, a triangular lamina. Laws of floation - determination of meta centric height of a ship - steady and streamline flow - equation of continuity - energy of a fluid - Bernoulli's theorem – proof - pitot's tube and venturimeter.

UNIT-V: **RELATIVITY**

Introduction - Reference frames-inertial frames - the ether hypothesis - Michelson morley experiment - Postulates of special theory of relativity - Lorentz transformation equations - Lorentz Fitzgerald contraction - time dilation - relativistic addition of velocities - velocity addition theorem - simultaneity - relativistic mass - relativistic momentum - mass energy equivalence. Relation between total energy, rest mass energy and momentum. Accelerated frames and gravity - general theory of relativity (basics) - gravity waves.

Books for study

1. Mechanics - D.S. Mathur - S Chand & Co

2. Mechanics and mathematical physics - R.Murugeshan -S Chand & Co. Pvt. Ltd., New Delhi.

Books for Reference

1. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker. Wiley NY 2001.

2. Mechanics - Berkely physics course: Charles Kittel-Tata Mc Graw Hill Publication

3. Mathematical physics - Satya Prakakash- S Chand & Co. Pvt. Ltd.,

4. Mechanics - Narayanamoorthy

PROPERTIES OF MATTER AND ACOUSTICS

UNIT-I: **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 constants - experimental determination of poisson's ratio of rubber - Twisting couple on a cylinder -Work done in twisting a wire - Torsional pendulum- Determination of Rigidity modulus and moment of inertia - **q,** *n* and **σ** by Searles method -I - section griders

UNIT-II: **BENDING OF BEAMS**

Bending of beams - Expression for bending moment - Cantilever - Expression for cantilever depression and oscillations - theory and experiments. Uniform bending and Non-uniform bending - theory and experiments .

UNIT-III: **FLUIDS**

Surface Tension - Synclastic and anticlastic surfaces - Excess of pressure - application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature - Jaegar's method. Capillary rise - Experimental determination of surface tension by capillary rise - angle of contact of mercury-Quincke's method. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity by capillary flow - Variations of viscosity of a liquid with temperature- lubricants.

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 notes - musical scale.

UNIT-V: **ULTRASONICS**

Ultrasonics - production - piezoelectric method-magnetostriction method- detection - properties – applications. Acoustics - Intensity level and loudness

Acoustics of buildings: Reverberation - reverberation time - derivation of Sabine's formula - determination of absorption coefficient - optimum reverberation time-factors affecting acoustics of buildings-sources of noises and its control-sound level meter.

Books for study

1. Properties of matter - Murugeshan R, S Chand & Co. Pvt. Ltd., New Delhi
2. Text book of sound - Brij Lal & Subramaniam, N Vikas Publishing House, New Delhi, 1982

Books for Reference

1. Elements of Properties of Matter - Mathur D S, Shyamlal Charitable Trust, New Delhi, 1993

2. Fundamentals of General Properties of Matter - Gulati H R, R Chand & Co. New Delhi, 1982

3. Waves & Oscillations - Subrahmanyam N & Brij Lal, Vikas Publishing House Pvt. Ltd., New Delhi, 1994

4. A Textbook of Sound - Khanna D R & Bedi R S, Atma Ram & Sons, New Delhi 1985

5. Fundamentals of Physics, - D Halliday, R Resnick and J Walker, Wiley NY 2001. 6th Edition

6. The Feynman Lectures on Physics, , - R P Feynman, RB Leighton and M Sands, Narosa, New Delhi, 1998. Vols. I, II and III

PRACTICAL-1
(8 experiments compulsory)

1. Youngs modulus - non uniform bending - pin and microscope

2. Youngs modulus - uniform bending - optic lever and telescope

3. Youngs modulus - cantilever – depression

4. Torsional pendulum -Rigidity modulus and moment of inertia (with & without masses)

6. Co-efficient of viscosity-Stoke's method

6. Surface tension – Capillary rise.

7. Sonometer – Verification of laws

8. Sonometer- determination of AC frequency

9. Compound pendulum - **g** and **I**

10. Melde's string – determination of frequency- transverse and longitudinal modes

ALLIED PHYSICS – I

Unit I : Elasticity and bending moment

Hooke's law – Elastic moduli – Relation between elastic constants – Work done in stretching a wire – Expression for bending moment - uniform bending- Experiment to determine Young's modulus using pin and microscope-Twisting couple of a wire – Expression for couple per unit twist – Work done in twisting – Experimental determination of rigidity modulus of a wire using Torsion pendulum with theory

Unit II: Surface tension and Viscosity

Surface tension – Definition – Examples – Molecular interpretation – Expression for excess of pressure inside a synclastic and anticlastic surface-Application to spherical and cylindrical drops and bubbles

Viscosity: Coefficient of viscosity – Rate of flow of liquid in a capillary tube (Poisueuille's formula) – Analogy between liquid flow and current flow – Stokes' formula for highly viscous liquids (Dimension method) – Experimental determination of viscosity of highly viscous liquid (stokes' method)

Unit III: Sound

Simple harmonic motion – Free, damped ,forced vibrations and resonance – Composition of two SHMs along a straight line and in perpendicular direction – Melde's string experiment – Determination of frequency of tuning fork(both longitudinal and transverse mode)

Unit IV : Thermal physics : Mean free path- Expression for mean free path (Zero order approximation) – Transport phenomena – Expression for viscosity and thermal conductivity – Conduction in solids – coefficient of thermal conductivity – Lee's disc method to determine thermal conductivity of a bad conductor – Wiedmann – Franz's law – Convection : Newton's

law of cooling – Experimental verification – Radiation : Black body radiation – Distribution of energy in black body spectrum – Important features.

Unit V: Optics

Interference: Condition for interference-Air wedge-determination of thickness of a thin wire by air wedge

Diffraction: Fresnel & Fraunhofer diffraction-Plane diffraction grating- theory and experiment to determine wavelength (normal incidence)

Polarization: Double refraction- half wave and quarter wave plate – Production and detection of plane, elliptically and circularly polarized light.

Books for study

1. Optics – Brijlal & Subramanian

2. Properties of matter – R.Murugesan

3. Heat & Thermodynamics – D.S.Mathur

Reference Books

1.Heat and thermodynamics - Brijlal & Subramanian, S Chand & Co., New Delhi

2.Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi, 1976.

3. Elements of Properties of Matter by Mathur D S, Shyamlal Charitable Trust, New Delhi, 1993

PRACTICAL-1

(8 experiments compulsory)

1. Youngs modulus - non uniform bending - pin and microscope

2. Youngs modulus - uniform bending - optic lever and telescope

3. Torsional pendulum -Rigidity modulus

4. Co-efficient of viscosity-Stoke's method

5. Co-efficient of viscosity-variable pressure head

6. Thermal conductivity of a bad conductor - Lee's disc method.

7. Spectrometer –dispersive power

8. Spectrometer - grating - -normal incidence method.

9. Air wedge - thickness of a wire

10,Melde's string-frequency of tuning fork

THERMAL PHYSICS AND STATISTICAL MECHANICS

UNIT-I: **LOW TEMPERATURE PHYSICS**

Joule - Kelvin effect - liquefaction of hydrogen - liquefaction of helium-Kammerling - Onne's method - Helium I and II - Lambda point - production of low temperatures - adiabatic demagnetization - practical applications of low temperature - refrigerators and air-conditioning machines - super fluidity - application of super fluidity.

UNIT II: **KINETIC THEORY OF GASES**

Kinetic theory of gases-Expression for pressure-gas laws-Maxwell's law of distribution of molecular velocities - Transport phenomena - Diffusion , viscosity and thermal conductivity of gases - Vander walls equation of state - Determination of Vander walls constant - Relation between Vander Wall's constant and critical constants.

UNIT-III: **THERMODYNAMICS I**

Zeroth law, I and II law of thermodynamics - isothermal process-adiabatic process-gas equation during adiabatic process - work done during adiabatic and isothermal process - Carnot's theorem - significance - thermodynamic scale of temperature - perfect gas scale of temperature - Carnot's engine - Otto engine and Diesel engine - working and efficiency.

UNIT-IV: **THERMODYNAMICS II**

First latent heat equation (Clausius - Clapeyron equation) - effect of pressure on melting point and boiling point - second latent-heat equation - III law of thermodynamics - concept of entropy - temperature entropy diagram - entropy of perfect gas - Maxwell's thermo dynamical relations - derivation - applications - Clausius - Clapeyron equation and specific heat relation

UNIT-V: **STATISTICAL MECHANICS**

Concept of probability - stirlings formula - microstate - macrostate -thermodynamic probability - phase space - Maxwell-Boltzmann, Bose - Einstein and Fermi-Dirac Statistics distribution law - fermi energy level - bosons and fermions – comparison.

Books for Study

1. Heat and thermodynamics - Brijlal and Subramaniyam, S Chand & Co.

2.Thermal Physics - R Murugeshan and Kiruthiga Sivaprasad, S Chand & Co., New Delhi.

Books for Reference

1. Heat and thermodynamics - D S Mathur, S Chand & Co., New Delhi

2. Elements of Statistical mechanics - Gupta and Kumar, Pragati Prakashan,   Meerut

3. Statistical mechanics - Sathya Prakash and J P Agarwal, Kedar Nath & Ram   Nath & Co., Meerut

4. Introduction to Solid State Physics - C Kittel, Prentice Hall of India

5. Thermal Physics – S C Garg, R M Bansal and C K Ghosh, Tata McGraw-Hill

6.. Heat and thermodynamics - J B Rajam, S Chand & Co., New Delhi

OPTICS

UNIT-I: GEOMETRICAL OPTICS

Introduction - chromatic and spherical aberration in lenses and their removal - Dispersion of light - Refraction through a thin prism - Dispersive power of a prism - deviation without dispersion - dispersion without deviation - constant deviation spectroscope. Eyepieces - Huygen , Ramsden and Gauss eyepieces - Aplanatic points - oil immersion objective - prism binocular.

UNIT-II: INTERFERENCE

Analytical treatment of interference - theory of interference fringes - interference in thin films due to reflected light - Air wedge - experiment to find thickness of a wire - Testing the plainness of surfaces – newton's rings-theory and experiment- Michaelson's interferometer and applications.

UNIT-III: DIFFRACTION (Fresnel and Fraunhofer)

Diffraction by single slit and determination of intensity distribution by phasor method - Diffraction by circular aperture - plane transmission grating- diffraction at normal and oblique incidence - Limit of resolution and resolving power-Rayleigh Criterion for resolution - Resolving power of a plane diffraction grating and prism - Fresnel wavefront and theory of half period zones - zone plate-comparison with convex lens - comparison between Fresnel and fraunhofer diffraction

UNIT-IV: POLARIZATION AND FIBRE OPTICS

Double refraction - Nicol Prism as polarizer and analyser - production and detection of plane, elliptically and circularly polarized light - Quarter and half wave plates - optical activity-Fresnel's theory of optical activity - Dichroism.

Optical fibre and principles of fibre optics - acceptance angle - numerical aperture expression - step index optical fibre- single mode and multimode step index optical fibres-characteristics.

UNIT-V: **LASER AND ITS APPLICATIONS**

Principle of laser - spontaneous emission - stimulated emission - threshold condition (Schaw low and townes equations) - rate equation - optical excitation-three and four level lasers. Types of lasers - semicondutor diode lasers - dye laser-nitrogen and carbon - di- oxide lasers - Holography - simple applications.

Books for Study

1. Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi, 1990

2. Laser and nonlinear optics by B.B.Laud 2nd edition Wiley Eastern Ltd., 1991

3.Optic fibre and fibre optic communication systems-Subir kumar sankar-. S Chand & Co. Pvt. Ltd., New Delhi,

Books for Reference

1. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGRaw Hill Inc., New Delhi, 1976.

2. Optical Physics by Lipson. S G, Lipson H and Tannhauser D S, Cambridge University Press (1995)

3. Fundamentals of Optics by Raj M G, Anmol Publications Pvt. Ltd., (1996), New Delhi

4. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker. Wiley NY 2001.

5.Optics and Spectroscopy by Murugeshan, S Chand & Co. Pvt. Ltd., New Delhi

PRACTICAL-1I

(8 experiments compulsory)

1. Specific heat capacity of liquid - Newtons law of cooling

2. Thermal conductivity of a bad conductor - Lee's disc method.

3. Callender and Barnes continous flow calorimeter- specific heat capacity of liquid

4. Spectrometer – dispersive power of prism

5. Spectrometer – refractive index of liquid

6. Spectrometer - grating - **N** and λ -normal incidence

7.Spectrometer - grating – **oblique** incidence - dispersive power

8. Air wedge - thickness of a wire and thickness of enamel coating.

9.Newtons rings-refractive index

10.Thermal conductivity -Searle,s apparatus

ALLIED PHYSICS - II

Unit I: Electricity

Current and current density – Expression for current density – Ohm's law – Resistors in series and in parallel – I-V characteristic of a resistor – Color coding – Conversion of a galvanometer into an ammeter and voltmeter – Kirchoff's laws – Application of Kirchoff's laws in Wheatstone network – sensitiveness of bridge.

Unit II: Electromagnetism

Magnetism: Definition of magnetic induction B, Magnetic field intensity H , Intensity of magnetization M – Relation connecting M, B and H – Magnetic permeability μ and magnetic susceptibility K – Relation between μ and K – Properties of Dia, Para and Ferro magnetic materials. Electromagnetism: Faraday's law of electromagnetic induction – Lenz's law – Expression for induced current and charge – Self inductance – Self inductance of a long solenoid – Determination of self inductance by Rayleigh's method –Mutual inductance – Coefficient of coupling – Determination of mutual inductance using BG.

Unit III: Electronics

Junction diodes-forward and reverse bias-diode charecteristics- Zener diode – VI characteristic of a Zener diode – Transistors-Charecteristics of a transistor(common emitter mode only). Digital Electronics: Decimal and binary numbers – binary to decimal and decimal to binary-Binary addition – Binary subtraction by 1's and 2's complement method – Basic logic gates OR, AND, NOT (Symbol, Boolean equation, truth table, circuit and working) – NAND, NOR, EX-OR(Symbol, Boolean equation , truth table only) – De Morgan's theorem.

Unit IV: Nuclear physics

Introduction – Classification of nuclei – General properties of nucleus – Nuclear size, Nuclear mass, Nuclear density, Nuclear charge, Nuclear spin & Nuclear magnetic dipole moments – Mass defect – Binding energy - Binding energy curve – Nuclear forces – Properties –

Fundamental laws of radioactivity – Soddy Fajan's displacement law – Law of radioactive disintegration – Half life period – The mean life.

Unit V: Mechanics and Relativity

Projectiles – Time of flight – Range on the horizontal plane – Greatest height attained by the projectile – Path of the projectile– Range on an inclined plane – Relativity: Frames of references – Postulates of special theory of relativity – Galilean & Lorentz transformation equations – Length contraction – Time dilation.

Books for study

1. Electricity and Magnetism – R.Murugesan

2. Modern physics – R. Murugesan

3. Principle of Electronics – V.K.Mehta

4. Digital principles and applications -   Albert Paul Malvino & Donald P.Leach

 5. Mechanics – D.S.Mathur

Reference Books

1.Modern Physics- Seghal Chopra & Seghal, Sultan chand 1998 Electricity and Magneti - **K**.K.Tiwari (S.Chand &Co.)

2.Electronic fundamentals and applications-John D.Ryder –Prentice Hall

3. Electronic principles-Malvino

4. Electricity and Magnetism – Vasudeva

PRACTICAL-1I

(8 experiments compulsory)

1.Potentiometre-calibration of volt meter(low range)

2. Potentiometre-calibration of ammeter

3.Series resonance circuit

4.Parallel resonance circuit

5.Basic logic gates using descrete components –AND,OR,NOT

6. Zener diode Diode charecteristics

7.Transistor charecteristics(CE mode)

8. Absolute determination of mutual inductance   -BG

9.Owen's bridge- Absolute determination of self inductance

10.Tangent galvanometer-Horizontal earth's magnetic induction