# PG & RESEARCH DEPARTMENT OF PHYSICS B.Sc. PHYSICS SYLLABUS

(For the Candidates to be admitted from the academic year 2023-2024 onwards)



## **POOMPUHAR COLLEGE (AUTONOMOUS)**

(of the Tamil Nadu H.R. & C.E Admn. Dept) (Affiliated to Annamalai Univesity)

> MELAIYUR - 609 107 2023- 24

## POOMPUHAR COLLEGE (AUTONMOUS)

## **B.Sc. PHYSICS**

Programme Structure and Scheme of Examination (under CBCS) (Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Dout	Course Code	Study Commonweak & Common Title	Cuadit	<b>TT</b>	Maximum Marks		
Part	Course Code	Study Components & Course The	Creat	Hours	CIA	ESE	Total
		SEMESTER – I					
Ι		Language-I: பொதுதமிழ்– I	3	6	25	75	100
II		General English – I	3	6	25	75	100
		Core – I: Properties of Matter and Acoustics	5	5	25	75	100
		Core –II: Practical –I: Physics Practical –I	4	4	25	75	100
III		Elective – I (Generic / Discipline Specific): Chemistry for Physical Sciences–I	2	3	25	75	100
		Chemistry for Physical Sciences Practical –I	2	2	25	75	100
IV		Skill Enhancement Course – 1 (NME-I): Zoology	2	2	25	75	100
1 V		Foundation Course: Introductory Physics	2	2	25	75	100
		Total	23	30			800
		SEMESTER – II					
Ι		Language-II பொதுதமிழ்– II	3	6	25	75	100
II		General English – II	3	6	25	75	100
		Core – III: Heat, Thermodynamics and Statistical Mechanics	5	5	25	75	100
		Core –IV: Practical II: Physics Practical –II	4	4	25	75	100
III		Elective - II (Generic / Discipline Specific) Chemistry for Physical Sciences-II	2	3	25	75	100
		Chemistry for Physical Sciences Practical –II	2	2	25	75	100
		Skill Enhancement Course – 2 (NME-II): Zoology	2	2	25	75	100
IV		Skill Enhancement Course – 3: Internet and its Applications (Common Paper)	2	2	25	75	100
		Total	23	30			800

#### Non-major (NME) Electives offered to other Departments

W	23UPHYN16	Physics for Everyday Life	2	2	25	75	100
IV	23UPHYN26	Astrophysics	2	2	25	75	100

CREDIT: 5 HOURS:5

#### **COURSE OBJECTIVES:**

To expound the fundamentals of elastic properties of solids, surface properties of liquids, the viscous properties of liquids and gases, on the SHM, resonance phenomena and loudness and the ultrasonic generation method and acoustics of buildings.

#### **UNIT-I ELASTICITY:**

Hooke's law – stress-strain diagram – elastic constants –Poisson's ratio – relation between elastic constants and Poisson's ratio – work done in stretching and twisting a wire – twisting couple on a cylinder – rigidity modulus by static torsion– torsional pendulum.

#### **UNIT-II BENDING OF BEAMS:**

cantilever– expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – non-uniform bending– experiment to determine Young's modulus by Koenig's method – uniform bending – experiment to determine Young's modulus using pin & microscope

#### **UNIT-III FLUID DYNAMICS:**

Surface tension: definition – molecular forces– excess pressure over curved surface – determination of surface tension by Jaegar's method–variation of surface tension with temperature .

Viscosity:Definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille's formula – terminal velocity and Stoke's formula.

#### UNIT-IV WAVES AND OSCILLATIONS:

Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM – composition of two SHM in a straight line and at right angles – Lissajous's figures- free, damped, forced vibrations –resonance.

Laws of transverse vibration in strings –sonometer – determination of frequency using Melde's string apparatus

## UNIT-V ACOUSTICS OF BUILDINGS AND ULTRASONICS:

Intensity of sound – decibel – loudness of sound –reverberation – Sabine's reverberation formula – acoustic intensity – factors affecting the acoustics of buildings. Ultrasonic waves: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction method – application of ultrasonic waves

## **TEXT BOOKS:**

- 1. D.S.Mathur, 2010, Elements of Properties of Matter, S. Chand & Co.
- 2. Brijlal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co
- 3. D.R.Khanna & R.S.Bedi, 1969, Textbook of Sound, Atma Ram & sons
- 4. Brijlal and N. Subrahmanyam, 1995, A Text Book of Sound, Second revised edition, Vikas Publishing House.
- 5. R.Murugesan, 2012, Properties of Matter, S. Chand & Co.

#### **REFERENCE BOOKS:**

- 1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers
- 2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, R. Chand & Co.
- 3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.

#### **WEBLINKS:**

- 1. <u>https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work</u>
- 2. <u>http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html</u>
- 3. <u>https://www.youtube.com/watch?v=gT8Nth9NWPM</u>
- 4. <u>https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s</u>
- 5. <u>https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work</u>
- 6. <u>https://learningtechnologyofficial.com/category/fluid-mechanics-lab/</u>
- 7. http://www.sound-physics.com/
- 8. http://nptel.ac.in/courses/112104026/

## **COURSE OUTCOMES:**

After attending the course, the student will be able to:

		-
	CO1	Relate elastic behavior in terms of three moduli of elasticity and
		working of torsion pendulum.
	CO2	appreciate concept of bending of beams and analyze the expression,
		quantify, and understand nature of materials.
ES	CO3	Explain the surface tension and viscosity of fluid and support the
M		interesting phenomena associated with liquid surface, soap films
CO		provide an analogue solution to many engineering problems.
)T(	<b>CO4</b>	Analyze simple harmonic motions mathematically and apply them.
10		Understand the concept of resonance and use it to evaluate the
SE		frequency of vibration. Set up experiment to evaluate frequency of ac
ß		mains
10	CO5	Understand the concept of acoustics, importance of constructing
C		buildings with good acoustics.
		apply their knowledge of ultrasonics in real life, especially in medical
		field and assimilate different methods of production of ultrasonic
		waves

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the 3-points cale of STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	<b>PO8</b>	PO9	PO10
CO1	S	S	Μ	Μ	S	М	М	S	Μ	S
CO2	М	S	S	S	М	М	S	М	S	S
CO3	S	Μ	S	Μ	S	S	Μ	S	S	S
CO4	S	S	S	S	S	М	S	М	Μ	Μ
CO5	Μ	Μ	S	S	Μ	S	S	S	S	М

SEMESTER: I PART: III Core : II	PRACTICAL - I	Credit:4 Hours: 4

**COURSE OBJECTIVES:** Apply various physics concepts to understand Properties of Matter viz., elasticity, surface tension, viscosity, moment of inertia, acceleration due to gravity and sound waves in solids. Set up experimentation to verify theories, quantify and analyze.

## LIST OF EXPERIMENTS (Any Eight Experiments only)

- 1. Compound Pendulum Determination of 'g' and 'k'.
- 2. Determination of moment of inertia of an irregular body.
- 3. Verification of parallel axes theorem on moment of inertia.
- 4. Verification of perpendicular axes theorem on moment of inertia.
- 5. Determination of Young's modulus by stretching of wire with known masses.
- 6. Young's modulus Non-uniform bending -Pin and microscope.
- 7. Young's modulus Uniform bending -Pin and microscope.
- 8. Rigidity modulus Torsional Pendulum without masses.
- 9. Rigidity modulus -Static torsion -Mirror, Scale and telescope.
- 10. Surface tension and Interfacial surface tension drop weight method.
- 11. Determination of coefficient of viscosity Stoke's method
- 12. Coefficient of viscosity of liquid Poiseuille's mehod
- 13. Determination of Poisson's ratio of rubber tube.
- 14. Sonometer verification of laws of transverse vibrations of stretched strings.
- 15. Sonometer Frequency of Tuning fork.
- 16. Detrmination of frequency Melde's string.

## **TEXT BOOKS:**

- C.C. Ouseph, U.J. Rao, V. Vijayendran (2018), *Practical Physics and Electronics*, S. Viswanathan, Printers & Publishers Private Ltd, Chennai
- 2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan (2015) *A Text Book of Practical Physics*, Sultan Chand & Sons, New Delhi

## **REFERENCE BOOKS:**

- 1. Samir Kumar Ghosh (2000) A Textbook of Advanced Practical Physics, NCBA
- 2. Kolkatta
- 3. D. Chattopadyay, P.C.Rakshit(2011), *An Advanced Course in Practical Physics*, NCBA, Kolkatta,
- 4. C.L.Arora, B.Sc., *Practical Physics*, S. Chand and Company., New Delhi.
- 5. D.P.Khandelwal, *A Laboratory Manual of Physics for Undergraduate Classes*, VaniPublications.
- 6. B.Saraf et al, *Physics through Experiments*, Vikas Publications.
- 7. Harnaam Singh., B.Sc., Practical Physics, S. Chand and Company, New Delhi.
- 8. D C Tayal, University Practical Physics, Himalaya Publishing House.
- 9. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut

## **COURSE OUTCOMES:**

A the end of the course, the student will be able to:

ES	CO1	Understand and determine accurately the length, radius by using screw gauge and vernier calipers.
COM	CO2	Grasp and find the Young's modulus, rigidity modulus of solid materials
OUTO	CO3	Recognize and estimate the surface tension and interfacial properties two immiscible liquids.
URSE	CO4	Appreciate and measure the internal friction between the layers of the liquid.
C0	CO5	perform experiments in sonometer and verification of laws of transverse vibrations.

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the3-pointscale STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	М	S	М
CO2	М	S	S	S	Μ	S	S	Μ	Μ	Μ
CO3	S	S	S	М	S	S	S	М	S	М
CO4	S	S	S	S	S	S	S	Μ	Μ	Μ
CO5	S	М	S	S	S	S	S	Μ	Μ	S

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CREDIT: 2 HOURS: 2

**COURSE OBJECTIVES:** To help students get an overview of Physics before learning their core courses. To serve as a bridge between the school curriculum and the degree programme.

#### UNIT-I:

Vectors, scalars –examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants.

#### **UNIT-II:**

Different types of forces-gravitational, electrostatic, magnetic, electromagnetic, nuclear -mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces.

#### **UNIT-III:**

Different forms of energy– conservation laws of momentum, energy – types of collisions –angular momentum– alternate energy sources–real life examples.

#### **UNIT-IV:**

Types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – streamline and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations.

#### **UNIT-V:**

Surface tension – shape of liquid drop – angle of contact – viscosity –lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use- conductors, insulators (thermal and electric).

#### **TEXT BOOKS:**

- 1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chand & Co
- 2. Brijlal & N. Subrahmanyam, 2003, Properties of Matter, S.Chand & Co.

#### **REFERENCE BOOKS:**

1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S.Chand & Co

#### **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

ES	CO1	Apply concept of vectors to understand concepts of Physics and solve problems
COM	CO2	Appreciate different forces present in Nature while learning about phenomena related to these different forces.
OLIO	CO3	Quantify energy in different process and relate momentum, velocity, and energy
URSE	CO4	Differentiate different types of motions they would understand the various courses and their basis
CO	CO5	Relate various properties of matter with their behaviour and connect them with different physical parameters involved.

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the3-pointscale STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	Μ
CO2	М	S	S	S	М	S	S	М	М	М
CO3	S	S	S	М	S	S	S	M	S	М
CO4	S	S	S	S	S	S	S	M	М	М
CO5	S	М	S	S	S	S	S	Μ	Μ	S

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# HEAT, THERMODYNAMICS AND STATISTICAL MECHANICS

CREDIT:5 HOURS: 5

#### **COURSE OBJECTIVES:**

To understand the laws, knowledge on specific heat capacity of matter and method to determine, different modes of heat transmission, knowledge on low temperature and its applications and the concept and various laws involved in thermodynamics and basics of statistical mechanics.

#### **UNIT-I CALORIMETRY & LOWTEMPERATUREPHYSICS:**

Calorimetry: specific heat capacity – specific heat capacity of gases  $C_P \& C_{V^-}$ Mayer's relation – Joly's method for determination of  $C_V$  – Regnault's method for determination of  $C_P$ 

Low temperature physics: Joule-Kelvin effect – porous plug experiment – Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process.

## **UNIT-II THERMODYNAMICS-I:**

zeroth law and first law of thermodynamics – P-V diagram – heat engine – efficiency of heat engine – Carnot's engine - construction, working and efficiency of petrol engine and diesel engines.

#### **UNIT-III THERMODYNAMICS-II:**

second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermodynamical scale of temperature – Maxwell's thermodynamical relations –Clausius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics.

#### **UNIT-IV HEATTRANSFER:**

Conduction, convection, and radiation. Thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad conductor by Lee's disc method. Radiation: black body radiation – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law – Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.

#### **UNIT-V STATISTICALMECHANICS:**

Definition of phase-space – micro and macro states – ensembles –different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics – expression for distribution function – three statistics.

#### **TEXT BOOKS:**

- 1. Brijlal & N. Subramaniam, 2000, Heat and Thermodynamics, S. Chand & Co.
- 2. Narayanamoorthy & KrishnaRao, 1969, Heat, Triveni Publishers, Chennai.
- 3. R. Murugeshan & Kiruthiga Sivaprasath, Thermal Physics, S. Chand & Co.

## **REFERENCE BOOKS:**

- J.B.Rajam & C.L.Arora, 1976, Heat and Thermodynamics, 8th edition, S.Chand& Co. Ltd.
- 2. D.S.Mathur, Heat and Thermodynamics, Sultan Chand & Sons.
- 3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand & Co.
- 4. Resnick, Halliday&Walker, 2010, Fundamentals of Physics, 6th Edition.
- 5. Sears, Zemansky, Hugh D. Young, Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson.

## WEBLINKS:

- 1. <u>https://youtu.be/M\_5KYncYNyc</u>
- 2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

## **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

	CO1	Acquires knowledge on how to distinguish between temperature and							
		heat Introduce him then to the field of theme emotion and explain most icel							
		neat. Introduce nim/ner to the field of thermometry and explain practical							
		measurements of high temperature as well as low temperature physics.							
		Student identifies the relationship between heat capacity and specific							
		heat capacity. The study of Low temperature Physics sets the basis for							
S.		the students to understand cryogenics, superconductivity, superfluidity							
W		and Condensed Matter Physics							
Õ	CO2	Derive the efficiency of Carnot's engine. Discuss the implications of the							
<b>DT</b>		laws of Thermodynamics in diesel and petrol engines							
	CO3	analyze performance of thermodynamic systems viz efficiency by							
E		problems. Gets an insight into thermodynamic properties like enthalpy.							
RS		entropy							
nc	CO4	Study the process of thermal conductivity and apply it to good and bad							
ŭ		conductors. Quantify different parameters related to heat, relate them							
		with various physical parameters and analyse them							
	CO5	Interpret classical statistics concepts such as phase space, ensemble,							
		Maxwell-Boltzmann distribution law. Develop the statistical							
		interpretation of Bose-Einstein and Fermi-Dirac. Apply to quantum							
		narticles such as photon and electron							
	l	particles such as photon and electron							

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the 3-points cale of STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	М	S	М
CO2	М	S	S	S	М	S	S	Μ	Μ	Μ
CO3	S	S	S	Μ	S	S	S	Μ	S	Μ
CO4	S	S	S	S	S	S	S	Μ	Μ	Μ
CO5	S	S	Μ	S	S	S	Μ	Μ	S	Μ

SEMESTER: II PART: III CORE:IV	PRACTICAL – II	CREDIT:5 HOURS: 4
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**COURSE OBJECTIVES:** Apply various physics concepts to understand Properties of Matter viz., elastic properties, thermal properties, acceleration due to gravity and sound waves in solids. Set up experimentation to verify theories, quantify and analyze.

## LIST OF EXPERIMENTS (Any Eight Experiments only)

- 1. Young's modulus non-uniform bending Optic lever.
- 2. Young's modulus uniform bending Optic lever.
- 3. Young's modulus-Cantilever depression dynamic method-Mirror, Scale and Telescope.
- 4. Searle's double bar pendulum- Determination of Young's modulus, Rigidity modulus.
- 5. Determination of Young's modulus by Koenig's method.
- 6. Rigidity modulus and moment of inertia -Torsional Pendulum with identical masses.
- 7. Determination of moment of inertia and 'g' using bifilar pendulum.
- 8. Sonometer Relative density of a solid and liquid.
- 9. Sonometer Frequency of AC mains Steel and Brass wires.
- 10. Specific heat capacity of liquid -Newton's law of cooling.
- 11. Emissivity Spherical calorimeter
- 12. Determination of thermal conductivity of bad conductor by Lee's disc method.
- 13. Determination of specific heat of liquid by Joule's electrical heating method.
- 14. To verify the laws of transverse vibration using Melde's apparatus.
- 15. To compare the mass per unit length of two strings using Melde's apparatus.

## **TEXT BOOKS:**

- 1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics,
- S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2018.

2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

#### **REFERENCE BOOKS:**

1. Samir Kumar Ghosh, *A Textbook of Advanced Practical Physics*, NCBA, Kolkatta, 2000

2. D. Chattopadyay, P.C.Rakshit, An Advanced Course in Practical Physics, NCBA,

## **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

	CO1	Understand and determine accurately the elevation, depression of a
ES		loaded wooden bar using optic lever, scale and telescope.
N	CO2	Grasp and find the Young's modulus, rigidity modulus of some selected
S		solid materials
L	CO3	Recognize and estimate the linear density of wire and frequency of AC
10		supply using sonometer.
RSE	CO4	Appreciate and measure the thermal properties such as specific heat and thermal conductivity of solids
	005	
U U	CO5	perform experiments using Melde's apparatus.

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the 3-pointscale of STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	Μ
CO2	М	S	S	S	М	S	S	М	М	М
CO3	S	S	S	М	S	S	S	М	S	М
CO4	S	S	S	S	S	S	S	М	М	М
CO5	S	М	S	S	S	S	S	М	М	S

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#### **Course Objectives**

- 1. To understand the basics of measurements and mechanics.
- 2. To learn the principle of Pressure cooker, Refrigerator and Air-conditioner.
- 3. To know the construction and working of domestic electrical appliances.
- 4. To study the fundamentals of laser and its applications.
- 5. To understand the different biomedical instruments.

#### **UNIT- I: MEASUREMENTS & MECHANICS**

Fundamental quantities - System of Units - CGS - FPS - MKS and SI - Vernier caliper - Screw gauge and their utility-Newton's law of motion- Lever mechanism – Pulleys - Force (Weight) - Work - Energy - Power - Horsepower

#### **UNIT-II: THERMO AND HYDRODYNAMICS**

Variation of boiling point with pressure - Pressure cooker - First and Second law of thermodynamics - Refrigerator - Air Conditioner - Principle and construction.

#### **UNIT - III: ELECTRICAL APPLIANCES**

Electric iron Box - Electric Fan - Construction and Working of Ceiling fan - Water Heater - Types - Function - Wet Grinder - Principle and Design.

#### **UNIT-IV: LASER**

Laser - Spontaneous emission - Stimulated emission - Meta stable state -Population inversion - Pumping - Laser Characteristics- Ruby Laser - Applications of Laser-Laser cutting - Welding- Drilling - Lasers in Surgery - Lasers in ophthalmology.

#### **UNIT- V: MEDICAL INSTRUMENTS**

Digital thermometer - Digital BP apparatus - One touch Glucometer - pulse oximeter - pH meter - BMI calculator - function and recording of ECG - artificial pacemaker.

#### **Course Outcomes:**

After completion of the course, the student should be able to understand:

- 1. the basics of measurements and mechanics in daily life
- 2. the principle of Pressure cooker, Refrigerator and Air conditioner.
- 3. the construction and working of domestic electrical appliances.
- 4. the fundamentals of laser and its applications.
- 5. the different biomedical instruments used in clinics.

#### **Text Books:**

#### Unit 1& Unit 2

- 1. N. Subrahmanyam and BrijLal, Principles of Physics, S.Chand &Co., Ltd, Chennai.
- 2. Plus one Physics Book, TN state Board and NCERT Books.
- 3. D. Jayaraman, K. Ilangovan, Thermal Physics & Statistical Mechanics, S. Viswanathan, Printers & Publishers Private LPtd, Chennai, 2016.
- 4. BrijLal and N Subrahmanyam, Heat and Thermodynamics, S Chand & Company Pvt Ltd, New Delhi, 2016.

## Unit 3

- 1. Bali, S.P. 2005, Consumer Electronics, Pearson Education, New Delhi.
- 2. TN State Board, *Basic Electrical Engineering*, *Vocational Theory*, *Plus One Textbook*, TN Stat Board.

## Unit 4

1. Murugeshan, R.2016, Optics & Spectroscopy, S. Chand Co. Ltd, New Delhi.

## Unit 5

- 1. Arumugam M, 2011, *Biomedical Instrumentation*, Anuradha Publications, Kumbakonam.
- 2. Yuvaraj, V. 2020, Instrumentation Techniques, Sri Krishna Publications.

## **Reference Books**

- 1. Hallidy D. Rensick, R. and Walker, J. 2001, *Fundamentals of Physics*, 6<sup>th</sup> Edition, Wiley, NY.
- Brij Lal and N Subrahmanyam,2016, *Heat and Thermodynamics*, S Chand & Company Pvt Ltd, New Delhi.
  R. Murugeshan, 2016, *Optics & Spectroscopy*, S. Chand Co. Ltd, New Delhi.

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the3-pointscale of STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	М	S	М
CO2	М	S	S	S	М	S	S	М	Μ	М
CO3	S	S	S	Μ	S	S	S	Μ	S	М
CO4	S	S	S	S	S	S	S	М	Μ	М
CO5	S	М	S	S	S	S	S	М	М	S

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## ASTROPHYSICS

**Course Objective:** This course intends to introduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena and provide an understanding of the physical nature of celestial bodies along with the instrumentation and techniques used in astronomical research.

- 1. To understand the principle of telescopes and their operation and parameters, types of telescopes, detectors and image processing and advanced space telescopes.
- 2. To grasp the ideas behind Solar system, inter planetary distances, meteors, meteorites, comets, asteroids, belt, cloud, gravitational waves and recent advances in astrophysics.
- 3. To recognize the Physics behind Eclipses and types of eclipses, solar and lunar eclipse, structure of the Sun.
- 4. To appreciate the Stellar Evolution process, birth & death of star, pulsars, black holes, supernovae, Galaxies, dark matter, evolving universe.
- 5. To do any three of the activities mentioned in the Unit V

## **UNIT-I TELESCOPES:**

Optical telescopes – magnifying and resolving powers – types of reflecting and refracting telescopes – radio telescopes – Hubble space telescope.

## **UNIT-II SOLAR SYSTEM:**

Bode's law of planetary distances – meteors, meteorites, comets, asteroids – Kuiper belt – Oort cloud.

## **UNIT-III ECLIPSES:**

Types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse.

## UNIT IV THE SUN:

Physical and orbital data of Sun – solar atmosphere – photosphere – chromosphere – solar corona – sunspots – 11 year solar cycle – solar flares.

## **UNIT-V STELLAR EVOLUTION:**

H-R diagram – birth & death of low mass, intermediate mass and massive stars – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes. Galaxies: classification of galaxies – galaxy clusters - dark matter and super clusters.

## UNIT-VI ACTIVITIES IN ASTROPHYSICS:

(Any *three* activities to be done compulsorily)

- i. Basic construction of telescope
- ii. Develop models to demonstrate eclipses/planetary motion.
- iii. Night sky observation
- iv. Conduct case study pertaining to any topic in this paper.
- v. Visit to any one of the National Observatories

## **TEXT BOOKS:**

- 1. BaidyanathBasu, (2001). An introduction to Astrophysics, Second printing, Prentice Hall of India (P) Ltd, New Delhi
- 2. K.S.Krishnaswamy, (2002), Astrophysics a modern perspective, New Age International (P) Ltd, New Delhi.
- 3. Shylaja, B.S. & Madhusudan, H.R., (1999), Eclipse: A Celestial Shadow Play, Orient BlackSwan,

## **REFERENCE BOOKS:**

- 1. Niclolas. A. Pananides and Thomas Arny, (1979), *Introductory Astronomy*, Addison Wesley Publ. Co.
- 2. Mujiber Rahman, A. Concepts to Astrophysics, SciTech Publications, Chennai.
- 3. Abell, Morrison and Wolf, 1987, *Exploration of the Universe*, 5th ed., Saunders College Publ.
- 4. Carrol and Ostlie, 2007, *Introduction to Modern Astrophysics*, 2nd ed., Pearson International.
- 5. William J. Kaufmann, III, 1993, Universe Freeman & Company, W. H.
- 6. Abhyankar, K.D. 2001, Astrophysics: Stars and Galaxies Universities Press

## **COURSE OUTCOMES:**

Attheendofthecourse, the student will be able to:

	CO1	Understand the principle of telescopes and their operation and
		parameters, types of telescopes, detectors and image processing and
ES		advanced space telescopes.
N	CO2	Grasp the ideas behind Solar system, inter planetary distances, meteors,
2		meteorites, comets, asteroids, belt, cloud, gravitational waves and recent
L		advances in astrophysics.
0	CO3	Recognize the Physics behind Eclipses and types of eclipses, solar and
SE		lunar eclipse, structure of the Sun.
<b>R</b>	<b>CO4</b>	Appreciate the Stellar Evolution process, birth & death of star, pulsars,
10		black holes, supernovae, Galaxies, dark matter, evolving universe.
	CO5	perform any three of the activities related to the astrophysics.

## MAPPING WITH PROGRAM OUTCOMES:

 $Mapcourse outcomes ({\bf CO}) for each course with program outcomes ({\bf PO}) in the 3-points cale of STRONG (S), MEDIUM (M) and LOW (L).$ 

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	Μ
CO2	М	S	S	S	М	S	S	М	М	М
CO3	S	S	S	Μ	S	S	S	Μ	S	Μ
CO4	S	S	S	S	S	S	S	М	М	М
CO5	S	М	S	S	S	S	S	М	М	S

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## ELECTIVE: III (FOR CHEMISTRY & MATHS) PHYSICS – I

CREDIT:2 HOURS: 3

#### **COURSE OBJECTIVES:**

To impart basicprinciples of Physics that which would be helpful for students who have taken programmes other than Physics.

#### UNIT-I WAVES, OSCILLATIONS AND ULTRASONICS:

simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – ultrasound – production – piezoelectric method – application of ultrasonics: medical field –ultrasonography – ultrasonoimaging-– physiotheraphy.

#### **UNIT-II PROPERTIES OF MATTER:**

*Elasticity*: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending– determination of rigidity modulus by torsional pendulum

*Viscosity*: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula. *Surface tension*: definition – molecular theory – drop weight method – interfacial surface tension.

#### **UNIT-III HEAT AND THERMODYNAMICS:**

Thermal conductivity — determination of thermal conductivity of a bad conductor by Lee's disc method. Radiation: black body radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law. Theromodynamics: thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy.

#### **UNIT-IV ELECTRICITY AND MAGNETISM:**

potentiometer – principle – measurement of thermo emf using potentiometer – magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit.

#### **UNIT-V DIGITAL ELECTRONICS AND DIGITAL INDIA:**

logic gates, OR, AND, NOT, NAND, NOR, EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification - semiconductor laboratories under Dept. of Space – an introduction to Digital India.

## **TEXT BOOKS**

- 1. R.Murugesan (2001), AlliedPhysics, S.Chand&Co, NewDelhi.
- 2. BrijlalandN.Subramanyam (1994), WavesandOscillations,VikasPublishing House,NewDelhi.
- 3. BrijlalandN.Subramaniam (1994), PropertiesofMatter,S.Chand&Co.,NewDelhi.
- 4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8<sup>th</sup> edition), S.Chand&Co.,New Delhi.
- 5. R.Murugesan (2005), Optics and Spectroscopy, S.Chand&Co, NewDelhi.
- 6. A.Subramaniyam, Applied Electronics 2<sup>nd</sup> Edn., National Publishing Co., Chennai.

## **REFERENCE BOOKS**

- 1. Resnik halliday & Walker (2018).Fundamentals of Physics (11<sup>th</sup>edition),John Willey and Sons, Asia Pvt.Ltd., Singapore.
- 2. V.R.KhannaandR.S.Bedi (1998), TextbookofSound1<sup>st</sup>Edn. Kedharnaath Publish & Co, Meerut.
- 3. N.S.Khareand S.S.Srivastava (1983), Electricity and Magnetism10<sup>th</sup>Edn., AtmaRam & Sons, New Delhi.
- 4. D.R.Khanna and H.R. Gulati(1979). Optics, S. Chand & Co.Ltd., New Delhi.
- 5. V.K.Metha(2004).Principlesofelectronics6<sup>th</sup>Edn. S.Chandandcompany.

## WEBLINKS

- 1. <u>https://youtu.be/M\_5KYncYNyc</u>
- 2. <u>https://youtu.be/ljJLJgIvaHY</u>
- 3. <u>https://youtu.be/7mGqd9HQ\_AU</u>
- 4. <u>https://youtu.be/h5jOAw57OXM</u>
- 5. <u>https://learningtechnologyofficial.com/category/fluid-mechanics-lab/</u>
- 6. <u>http://hyperphysics.phy-</u>

astr.gsu.edu/hbase/permot2.htmlhttps://www.youtube.com/watch?v=gT8Nth9NWPMht tps://www.youtube.com/watch?v=9mXOMzUruMQ&t=1shttps://www.youtube.com/wa tch?v=m4u-SuaSu1s&t=3shttps://www.biolinscientific.com/blog/what-are-surfactantsand-how-do-they-work

## **METHOD OF EVALUATION:**

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	75	100	

## **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

	CO1	Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field.					
	<b>CO2</b> Explain their knowledge of understanding about mathematical their be haviors and apply it to various situations in and real life. Connect droplet theory with Corona tra						
COURSEO	CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of low temperature physics in the background of growth of this technology.					
UTCOMES	CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlate the connection between electricfield and magnetic field and analyze them mathematically verify circuits and apply the concepts to construct circuits and study them.					
	CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Infer operations using Boolean algebra and acquire elementary ideas of IC circuits.Acquire information about various Govt. programs/ institutions in this field.					

## MAPPING WITH PROGRAM OUT COMES:

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	Μ	S	S	S	М	S	S	S	S	М
CO3	Μ	S	S	S	S	М	S	S	S	S
CO4	S	S	S	S	S	S	S	М	S	S
CO5	Μ	S	S	S	S	S	S	S	S	S

Map course outcomes (CO) for each course with program outcomes (PO) in the 3-point scale of STRONG (S),MEDIUM (M) and LOW(L).

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## **COURSE OBJECTIVES:**

Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

## **ANY Seven only**

- 1. Young's modulus by non-uniform bending using pin and microscope
- 2. Young's modulus by non-uniform bending using optic lever, scale and telescope
- 3. Rigidity modulus by static torsion method.
- 4. Rigidity modulus by torsional oscillations without mass
- 5. Surface tension and interfacial Surface tension drop weight method
- 6. Comparison of viscosities of two liquids burette method
- 7. Specific heat capacity of a liquid Joule's calorimeter
- 8. Verification of laws of transverse vibrations using sonometer
- 9. Calibration of low range voltmeter using potentiometer
- 10. Determination of thermo emf using potentiometer
- 11. Verification of truth tables of basic logic gates using ICs
- 12. Verification of De Morgan's theorems using logic gate ICs.
- 13. Use of NAND as universal building block. *Note* : Use of digital balance permitted

## **METHOD OF EVALUATION:**

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	75	100	

## **TEXT BOOKS:**

- 1. C.C. Ouseph, U.J. Rao, V. Vijayendran (2018), *Practical Physics and Electronics*, S. Viswanathan, Printers & Publishers Private Ltd, Chennai
- 2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan (2015) *A Text Book of Practical Physics*, Sultan Chand & Sons, New Delhi

## **REFERENCE BOOKS:**

- 1. Samir Kumar Ghosh (2000) A Textbook of Advanced Practical Physics, NCBA
- 2. Kolkatta
- 3. D. Chattopadyay, P.C.Rakshit(2011), *An Advanced Course in Practical Physics*, NCBA, Kolkatta,
- 4. C.L.Arora, B.Sc., *Practical Physics*, S. Chand and Company., New Delhi.
- 5. D.P.Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, VaniPublications.
- 6. B.Saraf et al, *Physics through Experiments*, Vikas Publications.
- 7. Harnaam Singh., B.Sc., Practical Physics, S. Chand and Company, New Delhi.
- 8. D C Tayal, University Practical Physics, Himalaya Publishing House.

9. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut

## **COURSE OUTCOMES:**

A the end of the course, the student will be able to:

AES	CO1	Understand and determine accurately the length, radius by using screw gauge and vernier calipers. Grasp and find the Young's modulus, rigidity modulus of solid materials
rcon	CO2	Recognize and estimate the surface tension and interfacial properties two immiscible liquids.
EOU	CO3	Appreciate and measure the viscosity of the liquid.
DURS	CO4	perform experiments in sonometer and verification of laws of transverse vibrations.
Ũ	CO5	Study the operations of logic gates verify De Morgan's theorem.

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the 3-pointscale f STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	<b>PO8</b>	PO9	PO10
CO1	S	S	S	S	S	S	S	М	S	М
CO2	М	S	S	S	М	S	S	М	М	М
CO3	S	S	S	Μ	S	S	S	Μ	S	Μ
CO4	S	S	S	S	S	S	S	М	М	Μ
CO5	S	М	S	S	S	S	S	Μ	Μ	S

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## ELECTIVE: III (FOR CHEMISTRY & MATHS) PHYSICS – II

CREDIT:2 HOURS: 3

#### **COURSE OBJECTIVES:**

To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum Physics, semiconductor Physics and electronics.

#### **UNIT-I OPTICS:**

Interference – colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries.

#### **UNIT-II ATOMIC PHYSICS:**

Atom models – Bohr atom model – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – applications of photoelectric effect: solar cells.

#### **UNIT-III NUCLEAR PHYSICS:**

Nuclear models – liquid drop model– shell model – magic numbers – nuclear energy – mass defect – binding energy – chain reaction – nuclear fission – energy released in fission – nuclear reactor – breeder reactor – nuclear fusion – differences between fission and fusion.

#### UNIT-IV INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES:

Frame of reference –Galilean transformation – postulates of special theory of relativity equations – Lorentz transformation equations – derivation – length contraction – time dilation – mass-energy equivalence – introduction on gravitational waves, LIGO.

#### **UNIT-V SEMICONDUCTOR PHYSICS:**

p-n junction diode – forward and reverse biasing – characteristic of diode – Zener diode – characteristic of Zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations.

#### **TEXT BOOKS:**

- 1. R.Murugesan (2005), AlliedPhysics, S.Chand&Co, NewDelhi.
- 2. K.ThangarajandD.Jayaraman(2004), AlliedPhysics, PopularBookDepot, Chennai.
- 3. BrijlalandN.Subramanyam(2002), TextbookofOptics,S.Chand&Co,NewDelhi.
- 4. R.Murugesan (2005), ModernPhysics, S.Chand&Co, NewDelhi.
- 5. A.SubramaniyamAppliedElectronics, 2<sup>nd</sup>Edn., NationalPublishingCo.,Chennai.

## **REFERENCEBOOKS:**

- 1. ResnickHallidayandWalker (2018), FundamentalsofPhysics, 11<sup>th</sup>Edn., JohnWilleyandSons, Asia Pvt.Ltd.,Singapore.
- 2. D.R.KhannaandH.R. Gulati (1979).Optics, S.Chand&Co.Ltd., New Delhi.
- 3. A.Beiser (1997), ConceptsofModernPhysics,TataMcGrawHillPublication,NewDelhi.
- 4. Thomas L. Floyd (2017), Digital Fundamentals, 11<sup>th</sup>Edn., Universal Book Stall, NewDelhi.
- 5. V.K.Metha(2004), Principlesofelectronics, 6<sup>th</sup>Edn., S.Chandand Company, New Delhi.

## **WEBLINKS:**

- 1. https://www.berkshire.com/learning-center/delta-p-facemask/
- 2. https://www.youtube.com/watch?v=QrhxU47gtj4
- 3. <u>https://www.youtube.com/watch?time\_continue=318&v=D38BjgUdL5U&feature=emb\_logo</u>
- 4. <u>https://www.youtube.com/watch?v=JrRrp5F-Qu4</u>
- 5. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
- 6. https://www.atoptics.co.uk/atoptics/blsky.htm -

## **METHOD OF EVALUATION:**

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	75	100	

## **COURSE OUTCOMES:**

At the end of the course the student twill be able to:

	CO1	Explain the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns.					
	CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate interdisciplinary nature of science and in solar energy related applications.					
COURSEO UTCOMES	CO3	Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt. agencies like DAE guiding the country in the nuclear field					
	CO4	Describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice-versa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.					
CO5 Summarize the working of semiconductor devices I junction diode, Zener diode, transistors and practica we daily use like USB chargers and EV charging st							

## MAPPING WITH PROGRAM OUT COMES:

Map course outcomes (CO) for each course with program outcomes (PO) in the 3-point scale f STRONG (S), MEDIUM (M) and LOW(L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	М	S	S	S	Μ	S	S	S	S	Μ
CO3	Μ	S	S	S	S	Μ	S	S	S	S
CO4	S	S	S	S	S	S	S	Μ	S	S
CO5	М	S	S	S	S	S	S	S	S	S

SEMESTER: IV PART: III ELECTIVE : III

## ELECTIVE: IV (FOR CHEMISTRY & MATHS) PHYSICS PRACTICALS – II

CREDIT:2 HOURS: 2

## **COURSE OBJECTIVES:**

Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

## Any Seven only

- 1. Radius of curvature of lens by forming Newton's rings
- 2. Thickness of a wire using air wedge
- 3. Wavelength of mercury lines using spectrometer and grating
- 4. Refractive index of material by minimum deviation
- 5. Refractive index of liquid using liquid prism
- 6. Determination of AC frequency using sonometer
- 7. Specific resistance of a wire using PO box
- 8. Thermal conductivity of poor conductor using Lee's disc
- 9. Determination of figure of merit table galvanometer
- 10. Determination of Earth's magnetic field using field along the axis of a coil
- 11. Characteristics of Zenerdiode
- 12. Construction of Zener / IC regulated power supply
- 13. Construction of AND, OR, NOT gates using diodes and transistor
- 14. NOR gate as a universal building block

## **METHOD OF EVALUATION:**

<b>Continuous Internal Assessment</b>	End Semester Examination	Total	Grade
25	75	100	

## **TEXT BOOKS:**

- C.C. Ouseph, U.J. Rao, V. Vijayendran (2018), *Practical Physics and Electronics*, S. Viswanathan, Printers & Publishers Private Ltd, Chennai
- 2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan (2015) *A Text Book of Practical Physics*, Sultan Chand & Sons, New Delhi

## **REFERENCE BOOKS:**

- 1. Samir Kumar Ghosh (2000) A Textbook of Advanced Practical Physics, NCBA
- 2. Kolkatta
- 3. D. Chattopadyay, P.C.Rakshit(2011), *An Advanced Course in Practical Physics*, NCBA, Kolkatta,
- 4. C.L.Arora, B.Sc., *Practical Physics*, S. Chand and Company., New Delhi.
- 5. D.P.Khandelwal, *A Laboratory Manual of Physics for Undergraduate Classes*, VaniPublications.
- 6. B.Saraf et al, *Physics through Experiments*, Vikas Publications.
- 7. Harnaam Singh., B.Sc., Practical Physics, S. Chand and Company, New Delhi.
- 8. D C Tayal, University Practical Physics, Himalaya Publishing House.
- 9. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut

## **COURSE OUTCOMES:**

A the end of the course, the student will be able to:

ES	C01	Understand and determine accurately the wavelength of using diffraction grating.
COM	CO2	Grasp and find the thickness wire using air wedge and refractive index by prism.
OUTO	CO3	Recognize and estimate the thermal conductivity of a bad conductor.
URSE	CO4	Appreciate and measure the figure of merit of a table galvanometer
CO	CO5	perform experiments in logic gates and verification of universality of NOR gate.

## MAPPING WITH PROGRAM OUTCOMES:

Map course out comes (CO) for each course with program outcomes (PO) in the3-pointscale STRONG (S), MEDIUM (M) and LOW (L).

	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	Μ	S	Μ
CO2	М	S	S	S	Μ	S	S	Μ	Μ	Μ
CO3	S	S	S	Μ	S	S	S	Μ	S	Μ
CO4	S	S	S	S	S	S	S	М	М	М
CO5	S	М	S	S	S	S	S	Μ	Μ	S

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