Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

B. Sc Physics

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
I	Main Core	Mechanics	3	3	50	50
	Main Core	Properties of matter	3	3	50	50
	Main Core Practicals	Physics Main Practicals – I	4	4	50	50
	Allied	Allied Mathematics – I	6	5	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
		Communicative English	-	1	50	50
	Life Education	Personal Skills	2	1	50	50
		Christian Religion–1 / Value Education-1	2	1	50	50
TOTAL			30	24		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
II	Main Core	Heat and Thermodynamics	3	3	50	50
	Main Core	Waves and Oscillations	3	3	50	50
	Main Core Practicals	Physics Main Practicals – I	4	4	50	50
	Allied	Allied Mathematics – II	6	5	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
		Communicative English		1	50	50
	Life Education	Social Skills	2	1	50	50
		Christian Religion-2/Value Education-2	2	1	50	50
TOTAL			30	24		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
III	Main Core	Electricity and Magnetism	3	3	50	50
	Main Core	Optics	3	3	50	50
	Main Core Practicals	Physics Main Practicals – II	4	4	50	50
	Allied	Allied Chemistry –I	4	3	50	50
	Alied	Allied Chemistry Lab work	2	1	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
	Life Education	Employability Skills –1	2	1	50	50
		Environmental Science	2	1	50	50
	Extra credit Course	1.Special Project- I 2.NPTEL online courses	-	2#	100	
TOTAL			30	22+2#		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
IV	Main Core	Modern Physics	3	3	50	50
	Main Core	Electromagnetism	3	3	50	50
	Main Core Practicals	Physics Main Practicals – II	4	4	50	50
	Allied	Allied Chemistry –II	4	3	50	50
	Alied	Allied Chemistry Lab work	2	1	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
	Life Education	Employability Skills –2	2	1	50	50
		Human Rights	2	1	50	50
	Extra Credit Course	1. Special Project II (Repair and Maintenance of Lab Equipments) 2. Internship	-	2#	100	
	Extension	Outreach program	-	2		
		SHELTERS	-	2		
TOTAL			30	26+2#		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
V	Main Core	Classical mechanics and Statistical Physics	4	4	50	50
	Main Core	Semiconductor devices and their Applications	4	4	50	50

	Main Core	Solid State Physics	4	4	50	50
	Main Core	Mathematical Physics	4	4	50	50
	Main Core	Physics Main Practicals – III(General experiments)	3	3	50	50
	Main Core	Physics Main Practicals – IV(Electronic experiments)	3	3	50	50
	Subject Elective	1. Nanomaterials and their applications 2. Electronic communication systems 3. Renewable Energy and Energy Harvesting	3	2	50	50
	Subject Elective	1. Programming in C 2. 8085 Microprocessor and its applications 3. Medical Physics	3	2	50	50
	Self-Study Paper	1. 1. Astrophysics 2. 2. Laser Physics and Fiber Optics	–	1*	100	
	Non-Major Elective	Offered by other departments	2	1	100	
TOTAL			30	27+1*		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
VI	Main Core	Applied Electronics	5	5	50	50
	Main Core	Nuclear and Particle Physics	5	5	50	50
	Main Core	Quantum Mechanics and Relativity	4	4	50	50
	Main Core	Physics Main Practical – III (General experiments)	2	2	50	50
	Main Core	Physics Main Practicals – IV (Electronic experiments)	2	2	50	50
	Subject skill	Electrical circuits and Networks	5	4	50	50
	Subject skill	Basic Instrumentation	5	4	50	50
	Self-Study Paper	Physics Revisited	–	1*	100	
	Non-Major Elective	Offered by other departments	2	1	100	
Total			30	27+1*		

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: B.SC. Physics

S. No	Course Code	Course Name
1.	P113	Mechanics
2.	P114	Properties of matter
3.	P212	Heat and Thermodynamics
4.	P213	Waves and Oscillations
5.	AP105A	Allied Mathematics – I
6.	AP205A	Allied Mathematics – II

SYLLABUS

Mechanics

Semester: I **Hours / week: 3**
Course Code: P113 **Credits: 3**

Objectives

- To impart knowledge on concepts of Centre of gravity, Projectiles, Circular motion, Impact and Dynamics of rigid bodies.
- To learn the method of determining the centre of gravity of objects.
- To understand the projectile motion up and down an inclined plane.
- To learn the concept of Moment of inertia and the method of determining the Moment of Inertia of compound pendulum.
- To make the students to understand the basic concepts of Hydrostatics and Hydrodynamics.

CO	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Differentiate between centre of mass and centre of gravity of objects and will be able to determine the Center of gravity of spheres and cones.	K2, K3
CO2	Apply the knowledge of circular motion to explain the concept of banking of curves.	K3, K4
CO3	State the laws of impact and Assess the loss of K.E. due to direct and oblique impact of two smooth spheres.	K1, K5

CO4	Determine the M.I. of solid sphere and spherical shell about a diameter and the M.I. of a compound pendulum about an axis through its centre of gravity.	K3
CO5	Derive Euler's equation and elucidate Bernoulli's theorem.	K6, K2
CO6	Solve simple problems related to circular motion, projectiles, Impact and Rotational motion of rigid bodies.	K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	2	3	2	2	2	3	2	3	2	2	2.4
CO	3	3	3	3	2	3	2	3	3	2	2	2	2.6
CO	2	2	3	2	3	2	2	3	2	2	2	2	2.3
CO	3	3	3	2	2	2	3	3	2	3	3	2	2.6
CO	2	2	2	3	2	2	2	3	2	3	3	3	2.4
CO	3	2	2	3	2	2	2	3	2	2	2	3	2.3
Mean Overall Score													**2.4**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	10	10	20
Understand	10	10	30
Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I: Centre of gravity

Centre of mass –centre of gravity – distinction between centre of mass and centre of gravity –centre of gravity of solid cone, solid hemisphere, hollow hemisphere, solid tetrahedron.

Unit – II: Projectiles and Circular Motion

Projectiles: Projectile –range of projectile up an inclined plane – range of projectile down an inclined plane.

Circular Motion: Relation between linear velocity and angular velocity–Normal acceleration-banking of curve–motion of a carriage along a banked curved track.

Unit – III: Impulse and Impact

Impulse –impulsive force –impact – laws of impact – coefficient of restitution – impact of a smooth sphere on a smooth fixed horizontal plane –direct impact of two smooth elastic spheres – loss of kinetic energy due to direct impact–oblique impact of two smooth elastic spheres – loss of kinetic energy due to oblique impact.

Unit – IV: Dynamics of Rigid bodies

Moment of inertia –radius of gyration–Theorems of moment of inertia–moment of inertia of sphere about a diameter –moment of inertia of a spherical shell about a diameter.

Kinetic energy of rotation of a body–Compound pendulum – theory of compound pendulum – equivalent simple pendulum – reversibility of centre of oscillation and centre of suspension – determination of 'g' and M.I of a compound pendulum about an axis through its centre of gravity

Unit – V: Hydrostatics and Hydrodynamics

Hydrostatics: Laws of flotation-Pressure and thrust– center of pressure – centre of pressure of a rectangular lamina with one side in the surface of the liquid.

Hydrodynamics: Equation of continuity–Euler's equation for unidirectional flow –Bernoulli's theorem (no proof) – Applications: Torricelli's theorem.

Books for study

1. M.Narayanamurti and Nagarajan, Dynamics, National Publishing Company, 8th Edition, 2002.
2. R. Murugeshan, Mechanics and Mathematical Physics, S. Chand and company Pvt.Ltd., 2015.
3. M.Narayanamurti, Statics, Hydrostatics and Hydrodynamics, National Publishing Company, 1994.

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1. P.Duraipandian, LaxmiDuraipandian, MuthamizhJayapragasam, Mechanics, 6th edition, S. Chand and Company Ltd., 2005.
2. D.S.Mathur, Mechanics, 3th Edition, S. Chand and Company Ltd., 1981.
3. M. Ray and G. C. Sharma, A Text Book on Dynamics, 13th Edition, S. Chand and company, New Delhi, 2005.
4. S.G. Venkatachalapathy, Mechanics, Margham Publication, 2012.
5. C. L. Arora, Refresher course in Physics for B. Sc. Classes (Vol-I), S. Chand Publishing, New Delhi, 1981.
6. Halliday, Resnick, Walker, Fundamentals of Physics, 8th Edition, John Wiley & Sons, New Delhi, 2009.
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Properties of Matter

Semester : I **Hours/week : 3**
Course Code: P114 **Credits : 3**

Objectives

- To impart knowledge on Elasticity, Moduli of elasticity, relation between elastic constants and the methods of determining rigidity modulus of material of objects.
- To learn, understand and determine the Young's modulus of material of objects.
- To learn about the concept of Viscosity and understand the Poiseuille's method and Searle's method of determining the viscosity of liquids.
- To comprehend the concept of Surface tension and evaluate the surface tension and interfacial surface tension of liquids by drop weight method.
- To learn and understand the concepts of osmosis and diffusion and their applications.

Learning outcomes

CO	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Have an understanding of basic concepts of Elasticity and will be able to determine the rigidity modulus of materials in the form of wire or rod.	K1, K6

CO2	Evaluate the work done in stretching and twisting a wire and determine the rigidity modulus of materials in the form of wire and rod.	K5, K3
CO3	Determine the viscosity of liquids by Poiseuille's method and Searle's method and explain the theory behind the method.	K3
CO4	Evaluate the surface tension and interfacial surface tension of liquids by drop weight method.	K2, K1, K4
CO5	Distinguish between osmosis and diffusion and explain the methods of determining osmotic pressure and rate of diffusion of fluids.	K2, K4

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	2	2	3	2	2	3	3	2	2	2	2.4
CO	3	3	2	3	2	2	2	3	3	3	2	2	2.5
CO	3	3	2	3	2	2	2	3	3	2	2	2	2.4
CO	3	3	2	2	2	2	2	3	3	3	2	2	2.4
CO	3	3	2	2	3	2	2	3	3	3	2	2	2.5
Mean Overall Score													**2.44**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Elasticity–I

Moduli of elasticity– relation between elastic constants – Poisson's Ratio – expression for Poisson's ratio in terms of elastic constants –Elastic energy - Factors affecting elastic modulus and tensile strength- work done in stretching and work done in twisting a wire – twisting couple on a cylinder – determination of Rigidity modulus by static torsion – Torsional pendulum – Rigidity modulus determination-

Unit - II: Elasticity–II

Bending of beams – expression for bending moment – cantilever – expression for depression at the loaded end – determination of Young's modulus by cantilever depression experiment (mirror and telescope) – non–uniform and uniform bending theory and experiment to determine Young's modulus (pin and microscope).

Unit - III: Viscosity

Viscosity – Streamline and turbulent flow – rate flow of liquid in a capillary tube – Poiseuille's formula – determination of coefficient of viscosity of a liquid by variable pressure head method — viscosity of a highly viscous liquid – Searle's viscometer -variations of viscosity of a liquid with temperature – lubrication.

Unit - IV: Surface Tension

Synclastic and anticlastic surface – surface tension- Relation between surface tension and surface energy - surface tension and interfacial surface tension – drop weight method(Theory and experiment) – variation of surface tension with temperature – Jaegar's method

Unit - V: Osmosis and Diffusion

Osmosis-Reverse osmosis-Laws of osmosis-osmotic pressure-Experimental determination of osmotic pressure by Berkley Hartley's method-Osmotic and vapour pressure of a solution-biological significance of osmosis. Diffusion-Rate of diffusion –Explanation based on kinetic theory of matter-diffusion through the Cell Membrane -Pressures of Gases Dissolved in Water and Tissues

Books for study

1. R. Murugeshan, Er. KiruthigaSivaprasath, Properties of Matter and Acoustics, S. Chand company, New Delhi, 2012.
2. BrijLal, N. Subramaniam, Properties of Matter, S. Chand company, New Delhi, 2012.
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1. S. Mathur, Elements of Properties of Matter,revised edition, Shymlal Charitable Trust, New Delhi, 2010.
2. Richard Wormell, An Elementary Course of Hydrostatics and Sound, Kessinger Publishing, 2009.
3. D. Halliday, R.Resnick and J. Walker "Fundamentals of physics", 6th Edition, Wiley plus , NY, 2013
4. Chatterjee and Sen Gupta, "A treatise on general properties of matter", New central Books agency (p) Ltd, Kolkata, 2001

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Heat and Thermodynamics

Semester : II **Hours / Week: 3**
Course code: P212 **Credits: 3**

Objectives:

- To learn basic concepts of calorimetry, C_P and C_V of a gas, Vanderwaal's equation of state and derive expressions for critical constants in terms of Vanderwaal's constants.
- To define coefficient of thermal conductivity of a material and describe experimental methods for determining thermal conductivity of a good and a bad conductor.
- To learn about Planck's quantum theory of radiation and interpret energy distribution in the spectrum of a black body radiation.
- To study Boltzmann's Law of equipartition of energy and apply it to find the specific heat capacity of mono atomic and diatomic gases.
- To learn and understand Joule Thomson effect, explain the different methods of producing low temperature and liquefaction of Hydrogen and Helium.
- To learn laws of thermodynamics, explain the working of Otto engine, define thermodynamic potentials, derive Maxwell's relations and deduce Clausius-Clapeyron Equation.

Learning outcomes

CO	Course outcomes	

	On successful completion of the course, the students will be able to	**Knowledge level**
CO1	Distinguish between thermal capacity and specific heat capacity, C_P and C_V of a gas. They will be able to develop Vanderwaal's equation of state and derive expressions for critical constants in terms of Vanderwaal's constants.	K2, K6
CO2	Define coefficient of thermal conductivity of a material and describe experimental methods for determining thermal conductivity of a good and a bad conductor.	K1
CO3	Explain Planck's quantum theory of radiation and interpret energy distribution in the spectrum of a black body radiation.	K4, K2
CO4	Explain Boltzmann's Law of equipartition of energy and apply it to find the specific heat capacity of mono atomic and diatomic gases.	K4, K3, K5
CO5	Describe Joule Thomson effect, explain the different methods of producing low temperature and liquefaction of Hydrogen and Helium.	K1, K4
CO6	State the laws of thermodynamics, explain the working of Otto engine, define thermodynamic potentials, derive Maxwell's relations and deduce Clausius-Clapeyron Equation.	K1, K4, K6

Mapping of CO with PO and PSO

CO	**Programme Outcomes (PO)**							**Programme Specific Outcomes (PSO)**					**Mean Scores of Cos**
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	
CO	3	3	3	2	2	2	3	3	2	3	2	2	2.5
CO	3	3	3	2	2	2	2	3	2	3	2	2	2.4
CO	3	2	2	2	2	2	2	3	2	3	2	2	2.3
CO	3	3	3	3	2	2	2	3	2	3	3	2	2.6
CO	3	3	2	2	2	2	3	3	2	3	2	2	2.4
CO	3	3	3	2	2	2	2	3	2	3	2	2	2.4
Mean Overall Score													**2.4**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)	Term End Exam (100)

	I CA (50)	II CA (50)	Marks Allotment
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit–I: Calorimetry

Specific heat capacity and thermal capacity– specific heat capacity of a liquid by cooling method (Spherical calorimeter) – specific heat capacity of a liquid by Joule's Calorimeter - specific heat capacity of gases – C_p and C_v– Meyer's relation – Joly's method to find C_V – Vanderwall's equation of state – critical constants – deduction of critical constants.

Unit–II: Transmission of Heat

Conduction

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe's method – thermal conductivity of a poor conductor – Lee's disc method

Black body Radiation

Blackbody radiation – Stefan – Boltzmann law – Planck's law-Planck's quantum theory of radiation-distribution of energy in the spectrum of a black body – Wien's displacement law and Rayleigh Jeans Law-

Unit–III: Kinetic Theory of Gases

Postulates – derivation of Maxwell's law of distribution of velocities – mean free path – transport phenomena: viscosity, conduction and diffusion – Boltzmann's Law of equipartition of energy and its applications to specific heat of gases; mono – atomic and diatomic gases.

Unit-IV Low temperature Physics

Joule-Thomson effect –Porus plug-theory and experiment-Liquefaction of hydrogen Liquefaction of Helium by K.Onnes method-Properties of Helium I and Helium II-Adiabatic demagnetization –-superconductivity-Type I and type II-Meissner effect –Applications of superconductors

Unit-V Thermodynamics

Thermodynamic equilibrium -I, II and III law of thermodynamics-Otto engine – working and efficiency-Fundamentals of thermodynamic potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions – Maxwell's relations & applications:Clausius-Clapeyron Equation – TdS equations-Entropy changes in reversible & irreversible processes, Entropy –temperature diagrams.

Books for study

1. R. Murugeshan, Er. KiruthigaSivaprasath, Thermal Physics, S. Chand company, New Delhi, 2012.
2. D. S. Mathur, Heat and Thermodynamics, S. Chand, New Delhi, 2011.
3. BrijLal, N. Subrahmanyam, P. S. Hemne, Heat Thermodynamics and Statistical Physics, S. Chand Company, New Delhi, 2012.
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2. Moran, Shapiro, Fundamentals of Engineering Dynamics, 6th Edition, John Wiley & Sons, 2008.
3. Ronald Lane Reese, University Physics, Thomson Brooks/Cole, 2003,

4. A. Kumar , S.P. Taneja, Thermal Physics, S. Chand Publications, 2014.
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6. MeghnadSaha, B.N. Srivastava , A Treatise on Heat, Indian Press, 1969.
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https://www.elprocus.com/what-is-superconductor-types-materials-properties/
http://www.shmoop.com/thermodynamics/kinetic–theory–gases.html

Waves and Oscillations

Semester: II **Hours / week: 3**
Course Code: P213 **Credits: 3**

Objectives

- To introduce the concepts of waves,wave motion, interference of sound waves, Beats
- To introduce the concept of interference of sound waves and beats.
- To understand SHM, Lissajous figures and the concepts related to them.
- To comprehend the concepts of damped vibrations, forced vibrations and resonance
- To acquire knowledge on the production, detection and applications of ultrasonic waves.
- To provide a better understanding of factors affecting acoustics of buildings

Learning Outcomes

CO	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Explain the different types of waves and derive expressions for plane progressive waves and energy of progressive waves.	K2, K6
CO2	Distinguish between progressive and stationary waves, derive expressions for stationary waves and energy of stationary waves, explain the concept of beats and apply their knowledge on beats to estimate the frequency of sound waves.	K2, K6, K4, K5

CO3	Explain Simple Harmonic Motion, derive expression for the resultant motion of a particle subjected to two SHMs of equal periods acting at right angles to each other and predict the shape of the curve traced by the particle.	K2, K6
CO4	Define, differentiate and derive expressions for free, damped and forced vibrations and determine the frequency of a.c. using sonometer.	K1, K2, K6, K3
CO5	Define reverberation time, summarize the factors affecting acoustics of buildings and suggest ways to improve acoustics of buildings.	K1, K2
CO6	Enumerate the production, detection and applications of ultrasonic waves.	K2

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	2	2	2	2	2	2	3	2	2	2	2	2.2
CO	3	3	2	2	3	2	2	3	2	2	2	2	2.3
CO	2	2	2	2	2	2	2	3	3	3	2	3	2.3
CO	3	3	3	3	3	2	2	2	2	2	2	2	2.4
CO	3	2	2	2	2	2	3	3	2	2	2	2	2.3
CO	2	3	3	2	2	2	3	3	2	3	2	2	2.4
Mean Overall Score													**2.3**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Waves and Wave Motion

Waves: Types of waves–Mechanical waves –Electromagnetic waves – Matter waves – shock waves– types of mechanical waves: transverse and longitudinal waves.

Wave Motion: Relation between frequency, wave length and velocity–progressive waves – expression for plane progressive waves– differential equation of wave motion –particle velocity – wave velocity – relation between particle velocity and wave velocity –Analytical treatment: Energy of progressive waves.

Unit - II: Stationary waves, Interferenceof sound waves

Stationary waves: Principle of superposition –formation of stationary waves–analytical treatment of stationary waves – energy of a stationary wave –distinction between a progressive and a stationary waves.

Interference of sound waves: Condition for interference – Demonstration: Quincke's tube- Beats – applications.

Unit - III: Harmonic Oscillations and Lissajous' figures

Simple harmonic motion – differential equation of simple harmonic motion –total energy of a vibrating particle – simple harmonic oscillations of a mass between two strings– oscillations in LC circuit.
Lissajous' figures-composition of two simple harmonic vibrations of equal periods acting at right angles.

Unit - IV: Vibrations

Free, damped and forced vibrations –theory of forced vibrations-sharpness of resonance–application.
Laws of transverse vibration of strings – Determination of frequency of a.c. mains by Sonometer (using steel wire)–Frequency of a vibrator Melde's method: Transverse mode and longitudinal mode.

Unit - V: Acoustics of Buildings and Ultrasonics

Acoustics of Buildings: Reverberation – reverberation time – absorption coefficient – Sabine's formula– optimum reverberation time – factors affecting acoustics of buildings.
Ultrasonics: Production of ultrasonics by piezo electric oscillator – detection:piezo electric detector – properties– Applications: Non-Destructive testing – SONAR – ultrasonic scanning.
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2. N.K.Bajaj, The Physics of waves and Oscillations, Tata McGraw Hill, New Delhi, 2006.
3. M. Ghosh, A text book of Sound, 2nd Edition, S. Chand & Co., New Delhi, 1987.

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2. D.P. Khandelwal, Oscillations and Waves (Himalaya Pub. House, Bombay)
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10. C. L. Arora, Refresher course series, Volume II, S. Chand & co., 16th Edition, New Delhi, 2001.
11. Baldevraj, Science and Technology of Ultrasonics, Narosa Publications, 2004.
12. N. Subrahmanyam&Brij Lal, Waves & Oscillations, Vikas Publishing House Pvt. Ltd.,New Delhi, 1994.
13. Khanna D R &Bedi R S, A Textbook of Sound, Atma Ram & Sons, New Delhi, 1985.
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http://www.nextgurukul.in/wiki/concept/ICSE/X/Physics/Free,–Damped–and–Forced–Vibrations.htm
http://www.brainkart.com/article/Vertical-oscillations-of-a-spring---Linear-Simple-Harmonic-Oscillator-(LHO)_36305/
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Allied Physics for Mathematics–I

Semester: I **Hours/week: 4**
Course Code:AP105A **Credits: 3**

Objectives

- To develop an understanding of basic concepts of mechanics, elasticity, viscosity, surface tension, heat and optics.
- To study the elastic behavior of the solids and viscosity of the liquids
- To comprehend and learn the concepts of heat and heat transmission
- To understand the concepts of interference and polarization of light waves and their applications.

Learning outcomes

Sl. No.	Outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Distinguish between centre of mass and centre of gravity of objects, state the laws of impact and calculate the loss of kinetic energy due to direct impact of smooth spheres.	K2, K1, K3

CO 2	Determine the Young's modulus of materials in the form of rod and rigidity modulus of material in the form of wire and explain the theory behind the experiments.	K3, K4
CO 3	Define and measure the viscosity and the surface tension of liquids	K1, K5
CO 4	Distinguish between C_P and C_V of a gas, describe experiments to measure the value of Cp and C_V of gas, thermal conductivity of poor conductors and different methods of producing low temperature.	K2, K1
CO 5	Differentiate between Spherical aberration and chromatic aberration in lenses, suggest ways to minimize them.	K2, K5
CO 6	Explain interference and polarization of light and perform experiment to determine the thickness of a thin wire by forming air wedge.	K4, K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	1	3	2	2	3	3	2	2	2	3	2.2
CO2	3	3	1	3	2	2	2	2	3	3	2	3	2.5
CO3	3	2	1	3	2	2	2	2	3	3	2	3	2.4
CO4	2	2	1	3	2	2	3	2	2	2	2	3	2.1
CO5	2	2	1	3	2	2	2	3	3	3	2	2	2.3
Mean Overall Score													2.36

	Results	High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Mechanics

Centre of mass–centroid- centre of gravity –centre of gravity of a solid cone –centre of gravity ofa hollow hemisphere – impulse **–** impulsive forces – conservation of linear momentum – collision – elastic and inelastic collision – impact – laws of impact – co-efficient of restitution – impact of a sphere on a smooth fixed plane – velocityand loss of kinetic energy of sphere after impact – direct impact between two smooth spheres – velocities of spheres after direct impact – loss of kinetic energy due to direct impact.

Unit–II: Elasticity

Moduli of elasticity – beam – bending of beams – expression for bending moment–cantilever –depression at the loaded end of a cantilever–determination of Young's modulus by cantilever depression method (scale and telescope)– non uniform bending theory and experiment (pin and microscope) – torsional couple per unit twist– work done in twisting a wire– torsional pendulum– theory– rigidity modulus by torsional oscillations (without symmetrical masses).

Unit – III: Viscosity and Surface Tension

Viscosity: coefficient of viscosity and its dimensions – rate of flow of liquid in a capillary tube (Poiseuille's formula) – determination of co-efficient of viscosity of a low viscous liquid by variable pressure head – variation of viscosity of a liquid with temperature.

Surface Tension: surface tension and its dimensions–synclastic and anticlastic surface–molecular theory – surface energy–excess pressure –application to spherical and cylindrical drops and bubbles – surface tension and interfacial surface tension – drop weight method.

Unit – IV: Heat

Heat – temperature – specific heat capacity and thermal capacity – specific heat capacity of a liquid by Joule's calorimeter–specific heat capacity of gases – C_p and C_v– Meyer's relation – Joly's method to find C_V – thermal conductivity – thermal conductivity of a poor conductor – Lee's disc method – Low temperature Physics: Joule – Kelvin effect – simple theory of Porous – Plug experiment – adiabatic demagnetization- refrigerating mechanism (ammonia gas plant)-superconductivity.

Unit – V: Optics

Aberration – spherical aberration in lenses – methods of minimizing Spherical aberration – chromatic aberration – achromatic combinations of two thin lenses in contact and at finite distance – dispersion of light – refraction through a prism of small angle –deviation – determination of refractive index of solid prism – interference – conditions for interference maxima and minima – air wedge – thickness of a thin wire –polarization – types of polarization –applications –polarizer and analyzer – double refraction– production and analysis by Nicol prism.

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1.R. Murugesan, Allied Physics paper I & II, S. Chand &Co. Ltd. New Delhi, 2010.
2.R. Murugesan, Mechanics and Mathematical Physics, S. Chand & Company Ltd, New Delhi, 2008.
3.R. Murugesan, Properties of matter, New Delhi, S. Chand & company Ltd, 2009.

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6. S. L. Kakani, K. C. Bhandari, Optics ,S. Chand& Sons, New Delhi, 1987.
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https://www.britannica.com/science/polarization-physics

Allied Physics for Mathematics–II

Semester: II **Hours/week: 4**
Course Code:AP205A **Credits: 3**

Objectives

- To understand the working principle of Lasers and their applications
- To study the different types of optical fibers and its applications
- To understand the properties of ultrasonics and its applications
- To study the critical potential and quantum numbers associated with the vector atom model.
- To study the process of artificial transmutation, radio isotopes and their applications, working of accelerators.
- To study the fundamentals of electrical and electronic devices and circuits.

Learning outcomes

Sl. No.	Outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Explain working principle of lasers and describe the applications of Lasers and Optical fibers.	K2, K1
CO2	Define SHM and derive expression for the resultant motion of a particle subjected to two SHMs acting at right angles.	K1, K2
CO3	State laws of transverse vibration of strings, determine the frequency of AC using a Sonometer and describe methods of production and detection of ultrasonics.	K1, K3
CO4	Specify and explain the Quantum numbers associated with the vector atom model, state the laws of Photoelectric effect and derive Einstein's photoelectric equation.	K1, K6
CO5	Determine the value of a resistor from its colour coding, explain the growth and decay of current in a circuit containing resistance and inductance and design an experiment to calibrate a low range voltmeter.	K4, K2, K6,
CO6	Construct two inputs AND, OR gates using diodes and NOT gate using Transistor, examine their operation and evaluate their performance,	K6, K4, K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	2	3	2	3	2	2	2	3	2.2
CO2	2	3	2	2	2	3	2	2	3	3	2	3	2.5
CO3	3	2	2	3	2	2	2	2	3	2	2	3	2.4
CO4	3	3	2	3	2	3	3	2	2	3	2	3	2.1
CO5	3	3	2	3	2	2	3	3	3	3	2	3	2.4
Mean Overall Score													2.52
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Laser and Fiber optics

Laser: Characteristics of laser –conditions to achieve laser action– population inversion – pumping process – types of laser –Nd:YAG Laser – CO_2 Laser– applications of lasers.

Fiber optics: Construction of fiber – total internal reflection – acceptance angle and numerical aperture – applications – optical fibers in a simple communication system – fiber optic displacement sensor

Unit – II: Sound

Simple harmonic motion (SHM) –composition of two simple harmonic vibrations of equal time periods (1:1) acting at right angles to each other – Lissajou's figures –applications of Lissajou's figures – laws of transverse vibrations- determination of frequency of AC by Sonometer (steel wire) - ultrasonics – properties – production of ultrasonic waves by Piezo-electric oscillator method – detection of ultrasonics by Piezo-electric method – applications of ultrasonics: Industrial applications – SONAR – non-destructive testing (NDT): pulse echo technique.

Unit – III: Atomic Physics and Nuclear Physics

Atomic Physics: Vector atom model – Spatial quantization – Spinning electron – Quantum numbers associated with the vector atom model – Excitation potential – Ionization Potential – Determination of critical potentials – Frank and Hertz method–Photoelectric effect – Laws of photo electric emission – Einstein's photoelectric equation–photo cell.

Nuclear Physics: Radioactivity – Artificial Transmutation – Rutherford's experiment – Radio isotopes – Applications – Radiation damage and effects – Radiation dose, dosimetry – short term and long term biological effects of radiation – Radiation safety.

Unit – IV: Electricity

Current – voltage –resistance – Ohms law –Resistors– types of resistors – color coding scheme – series and parallel connections of resistors –voltage division in series circuits – current division in parallel circuits – capacitor – types of capacitors – series and parallel connections of capacitors –Growth and decay of current in a circuit containing resistance and inductance–Potentiometer – principle – Calibration of low range voltmeter –Calibration of High range Ammeter.

Unit V: Electronics

Analog Electronics: Zener diode – zener diode characteristics – low range stabilized power supply – Integrated circuits – Advantages and disadvantages

Digital Electronics: Binary concept – logic gates : OR, AND, NOT, NOR, NAND and Ex-OR gates – construction of two inputs AND, OR gates using diodes and NOT gate using Transistor – De Morgan's theorems – NAND as Universal gate – Arithmetic circuits: Half adder – Full adder–Half subtractor– Full subtractor.

Books for study

1. R. Murugesan, Allied Physics paper I & II, S. Chand &Co. Ltd. New Delhi, 2010.

2. M.R. Shenoy, Sunil K. Khijwania, Ajoy Ghatak, Bishnu P. Pal, Introduction to fiber optics, Viva Books, 3rd edition, 2015
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Allied Physics Practicals for Mathematics

Any 12 Experiments

Semester– I& II **Hours/week: 2**
Course Code : PAP205A **Credits: 2**

Objectives

- To relate theoretical concepts to real world applications and experiments.
- To familiarize the students with elastic, optics, sound laboratory experiments and procedures.
- To observe reliable data and record the observations.
- To organize the measurements, estimate errors and write the laboratory record.
- To develop an understanding of basic concepts of electrical and electronic experiments

Learning outcomes

Sl. No.	Outcomes	Criteria/ Mapping
1	Understand and Explain the theoretical concepts behind the experiments	K2, K1
2	Analyze the observed data and infer logical conclusions	K4, K2
3	Define and determine the value of a physical quantity without error	K1, K3
4	Design simple electrical and electronic circuits and test their operation	K6, K5
5	Locate, detect and rectify faults in simple electrical and electronic circuits	K1, K5, K6
6	Apply their knowledge to choose proper optical, electrical and electronic measuring instruments and illustrate their effective usage	K3, K4

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	1	3	3	3	3	3	3	2	2.6
CO2	3	2	2	3	1	3	3	3	3	1	3	2	2.5
CO3	3	3	2	3	1	3	3	3	3	1	2	2	2.5
CO4	3	3	2	3	2	3	3	3	3	3	3	3	2.9
CO5	3	3	2	3	2	3	3	3	3	3	2	2	2.7
Mean Overall Score													2.65
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

List of experiments

1. Young's Modulus– Cantilever depression (Mirror & Telescope).
2. Young's Modulus-Non Uniform Bending(Pin and Microscope)

3. Rigidity Modulus by torsional oscillations (without symmetrical mass).
4. Co–efficient of viscosity of a liquid– graduated burette– Constant volume method.
5. Surface tension – Drop weight Method
6. Interfacial surface tension - Drop weight Method
7. Frequency of AC –Sonometer.
8. Air wedge–Determination of thickness of wire.
9. Verification of ohm's law.
10. Potentiometer– Calibration of low range voltmeter.
11. Logic gates using IC's (AND, OR, NOT) and Verification of De Morgan's theorems.
12. Zener diode Characteristics
13. Low range stabilized power supply using Zener diode
14. Construction of AND, OR logic gates using diodes and NOT gate using transistor.
15. NAND as Universal gate.
16. Half adder and half subtractor.

Books for reference

1. C.C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan Pvt. Ltd., Chennai, 2012.
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