F.Y.B.Sc. (Physics)
Semester-I
&
<u>Semester-II</u>
Syllabus

2019 Pattern

Anekant Education Society's

Tuljaram Chaturchand College

of Arts, Science and Commerce, Baramati

(Autonomous Status)

(Affiliated to Savitribai Phule Pune University, Pune)

Course Structure for F.Y.B.Sc. Physics 2019 pattern

Semester	Paper Code	Title of Paper	No. of Credits
I	PHY1101	Mechanics & Properties of Matter	2
	PHY1102	Electromagnetics	2
	PHY1103	Practical-I	2
II	PHY1201	Heat and Thermodynamics	2
	PHY1202	Waves and Optics	2
	PHY1203	Practical-II	2

Program Outcomes

PO1: Disciplinary Knowledge

PO2: Critical Thinking and Problem solving

PO3: Social competence

PO4: Research-related skills and Scientific temper

PO5: Trans-disciplinary knowledge

PO6: Personal and professional competence

PO7: Effective Citizenship and Ethics

PO8: Environment and Sustainability

PO9: Self-directed and Life-long learning

Class : F.Y. B. Sc. (Semester- II)
Paper Code: PHY1201
Paper : I Title of Paper: Heat and Thermodynamics
Credit : 2 No. of lectures: 36

A) Learning Outcome:

After successfully completing this course, the student will be able to:

CO1: Describe the thermodynamic properties of a material.

CO2: Understand the ideal gas equation and its limitations.

CO3: Understand the real gas equation.

CO4: Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.

CO5: Understand principle of heat engines and calculate thermal efficiency.

CO6: Understand the principle of the refrigerators to calculate coefficient of performance

CO7: Understand phenomenon of 'entropy'

CO8: Understand the types of thermometers and their uses

TOPICS/CONTENTS:

UNIT 1: Equation of state (6L)

1.1 Introduction: (Equation of state, ideal and real gas).
1.2. Andrew's Experiment and Amagat's Experiment
1.3. Van der Waals 'equation of state, critical constants and reduced equation of state
1.4. Joule-Thomson porous plug experiment (Throttling process)
Problem Solving

UNIT 2: Concepts of Thermodynamics (8L)

2.1 Introduction**:** (Thermodynamic state of a system, Zeroth law of thermodynamics, Thermodynamic equilibrium, reversible and irreversible processes)
2.2 Thermodynamic Processes: isothermal, adiabatic, isochoric and isobaric
2.3 Work done during isothermal change
2.4 Adiabatic relations for perfect gas
2.5 Work done during adiabatic change
2.6 First law of thermodynamics and its applications
Problem Solving

UNIT 3: Applied Thermodynamics (8L)

3.1 Introduction (Joules law of heating)
3.2 Heat and work
3.3 Carnot's cycle and Carnot's heat engine and its efficiency
3.4 Second law of thermodynamics
3.5 Concept of entropy, Enthalpy, Free energy
3.6 Maxwell's relations in thermodynamics
3.7 T-dS Equation
3.8 Clausius-Clapeyron Latent heat equations (I and II)
Problem Solving

UNIT 4: Heat Transfer Mechanisms (6L)

4.1 Introduction (Kinematics of heat)
4.2 Heat Engines: Otto cycle and its efficiency and Diesel cycle and its efficiency
4.3 Refrigerators: Principle and coefficient of performance of refrigerator
4.4 Air conditioning: Principle and its applications
Problem Solving

Unit 5: Thermometry (8L)

5.1 Introduction: (Temperature Scales: Celsius, Fahrenheit and Kelvin scale)
5.2 Principle, construction and working of thermometers
5.2.1 Liquid thermometers
5.2.2 Gas thermometers
5.2.3 Resistive type thermometer
5.2.4 Thermocouple as thermometer
5.2.5 Pyre-heliometers
Problem Solving

References:

1. Physics: 4th Edition, Volume I, Resnick/Halliday/Krane JOHN WILEY & SON (SEA) PTE LTD
2. Concept of Physics: H.C. Verma, Bharati Bhavan Publishers
3. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi
4. Heat and Thermodynamics: Mark. W. Zemansky, Richard H. Dittman, Seventh Edition, McGraw-Hill International Editions
5. Thermodynamics and Statistical Physics: J.K. Sharma, K.K. Sarkar, Him

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3			2					2
CO 2	3		2						
CO 3	3								
CO 4	3	3						2	
CO 5		3				2			
CO 6		3							
CO7	3			2			2		
CO8	2				2				

Justification

PO1: Disciplinary Knowledge

CO1: Describe the thermodynamic properties of a material. Weightage: 3

Describing thermodynamic properties is a direct application of disciplinary knowledge in thermodynamics.

CO2: Understand the ideal gas equation and its limitations. Weightage: 3

Understanding the ideal gas equation involves core concepts in thermodynamics, indicating a strong relation.

CO3: Understand the real gas equation. Weightage: 3

Understanding the real gas equation is a fundamental aspect of disciplinary knowledge in thermodynamics.

CO4: Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process. Weightage: 3

Applying the laws of thermodynamics requires a deep understanding of disciplinary knowledge in the field.

CO7: Understand the phenomenon of 'entropy'. Weightage: 3

Understanding entropy is a core concept in thermodynamics, indicating a strong relationship.

CO8: Understand the types of thermometers and their uses. Weightage: 2

While the types of thermometers are related to thermodynamics, the direct link may not be as strong as with other outcomes.

PO2: Critical Thinking and Problem Solving

CO4: Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process. Weightage: 3

Critical thinking is required to apply the laws of thermodynamics to analyze processes.

CO5: Understand the principle of heat engines and calculate thermal efficiency. Weightage: 3

Calculating thermal efficiency involves critical thinking and problem-solving skills in the context of heat engines.

CO6: Understand the principle of refrigerators to calculate the coefficient of performance. Weightage: 3

Calculating the coefficient of performance for refrigerators requires critical thinking and problem-solving skills.

PO3: Social Competence

CO2: Understand the ideal gas equation and its limitations. Weightage: 2

Understanding the ideal gas equation has social applications, but the direct link may not be as strong.

PO4: Research-related Skills and Scientific Temper

CO1: Describe the thermodynamic properties of a material. Weightage: 2

Describing thermodynamic properties can be part of research-related skills, but the link may not be as direct.

CO7: Understand the phenomenon of 'entropy'. Weightage: 2

Understanding entropy involves a scientific temper, contributing to research-related skills, but the link may not be as strong.

PO5: Trans-disciplinary Knowledge

CO8: Understand the types of thermometers and their uses. Weightage: 2

Understanding types of thermometers has applications in various fields, but the direct trans-disciplinary link may not be as strong.

PO6: Personal and Professional Competence

CO5: Understand the principle of heat engines and calculate thermal efficiency. Weightage: 2

Understanding heat engines and calculating thermal efficiency contributes to personal and professional competence, though the link may not be as direct.

PO7: Effective Citizenship and Ethics

CO7: Understand the phenomenon of 'entropy'. Weightage: 2

Understanding entropy may have ethical implications, contributing to effective citizenship, though the link may not be as strong.

PO8: Environment and Sustainability

CO4: Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process. Weightage: 2

Applying thermodynamic laws can indirectly contribute to considerations of environment and sustainability.

PO9: Self-directed and Life-long Learning

CO1: Describe the thermodynamic properties of a material. Weightage: 2

Describing thermodynamic properties can be part of self-directed and life-long learning, but the link may not be as direct.

Class : F.Y. B. Sc. (Semester- II)
Paper Code: PHY1202
Paper : II Title of Paper: Waves and Optics
Credit : 2 No. of lectures: 36

Learning Outcome:
On successful completion of this course students will be able to do the following:
CO1:Understand the mathematical description of travelling and standing waves.

CO2:Recognize the one-dimensional classical wave equation and its solutions.

CO3:Calculate the phase velocity of a travelling wave.

CO4:Understand the concept of Doppler Effect.

CO5:Explain in qualitative terms how frequency, amplitude, and wave shape affect the pitch, intensity, and quality of tones produced by musical instruments.

CO6:Understand the phenomena like reflection, refraction, diffraction, dispersion.

CO7:Understand construction and working principle of optical instruments

TOPICS/CONTENTS:

UNIT 1: Wave Motion (7L)

1.1 Introduction (Electromagnetic wave, Frequency, Amplitude, Period, Wavelength and wave equation)
1.2. Concept of wave motion
1.3. Transverse waves on a string
1.4 Travelling and standing waves on a string
1.5. Normal Modes of a string
1.6. Group velocity, Phase velocity
1.7. Plane waves, Spherical Waves, Wave intensity
Problem Solving

UNIT 2: Sound (9L)

2.1 Introduction (Longitudinal wave, Sound velocity, Intensity, amplitude, frequency, Acoustic parameters)
2.2 Simple harmonic motion
2.3 Forced vibrations and resonance
2.4 Application to saw tooth wave and square wave
2.5 Intensity and loudness of sound
2.6 Decibel, Intensity level, musical notes, musical scale
2.7 Reverberation, time of reverberation and its measurement, Absorption coefficient
2.8 Sabine’s formula
2.9 Acoustic aspects of auditorium.
Problem Solving

UNIT 3: Geometrical Optics (8L)

1.1 Introduction (Electromagnetic nature of light, Definition and properties of wavefront, Huygens Principle)
3.2 Reflection of light, Refraction of light
3.3 Lens formula
3.4 Lens maker's formula
3.5 Magnifying power of a lens
3.6 Equivalent lens
3.7 Combination of two thin lenses
Problem Solving

UNIT 4: Lens Aberrations (8L)

4.1 Introduction (Lenses, focal length)
4.2 Aberration and its types: Monochromatic and Chromatic
4.3 Types of Monochromatic Aberration: Spherical aberration, Coma, Curvature, Distortion, Astigmatism
4.4 Types of Chromatic Aberration: Axial and Transverse Chromatic aberration
4.5 Achromatism.
Problem Solving

Unit 5: Optical Instruments (4L)

5.1 Introduction
5.2 Simple microscope
5.3 Compound microscope
5.4 Ramsdens Eyepiece
5.5 Huygens Eyepiece
Problem Solving

References:

1. **1.**A Textbook of Optics : N. Subrahmanyam and Brij Lal: S. Chand Publication.
2. **2.**Waves and Oscillations : Stephenson
3. The physics of waves and oscillations, N. K. Bajaj, Tata McGraw- Hill, Publishing co.ltd
4. Fundamentals of vibration and waves, SPPuri,Tata McGraw-Hill Publishing co. ltd.
5. Waves and Oscillations, R.N. Chaudhari, New age international (p) ltd.
6. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
7. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
8. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, S. Chand publication
9. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986.Addison-Wesley

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3			2					2
CO 2	3								
CO 3		3							
CO 4		3							
CO 5			2		2				
CO 6	3						2	2	
CO7	3					2			

Justification

PO1: Disciplinary Knowledge

CO1: Understand the mathematical description of traveling and standing waves. Weightage: 3

Understanding the mathematical description of waves is a direct application of disciplinary knowledge in wave physics.

CO2: Recognize the one-dimensional classical wave equation and its solutions. Weightage: 3

Recognizing and understanding the wave equation is fundamental to disciplinary knowledge in wave physics.

CO6: Understand the phenomena like reflection, refraction, diffraction, dispersion. Weightage: 3

Understanding wave phenomena like reflection, refraction, diffraction, and dispersion is integral to disciplinary knowledge in wave physics.

CO7: Understand construction and working principle of optical instruments. Weightage: 3

Understanding the construction and working principle of optical instruments is directly linked to disciplinary knowledge in optics.

PO2: Critical Thinking and Problem Solving

CO3: Calculate the phase velocity of a traveling wave. Weightage: 3

Calculating the phase velocity involves critical thinking and problem-solving skills in the context of wave physics.

CO4: Understand the concept of Doppler Effect. Weightage: 3

Understanding the Doppler Effect requires critical thinking and problem-solving skills in the context of wave phenomena.

PO3: Social Competence

CO5: Explain in qualitative terms how frequency, amplitude, and wave shape affect the pitch, intensity, and quality of tones produced by musical instruments. Weightage: 2

Understanding the qualitative aspects of wave characteristics in music has social applications, but the direct link may not be as strong.

PO4: Research-related Skills and Scientific Temper

CO1: Understand the mathematical description of traveling and standing waves. Weightage: 2

Understanding the mathematical description of waves can be part of research-related skills, but the link may not be as direct.

PO5: Trans-disciplinary Knowledge

CO5: Explain in qualitative terms how frequency, amplitude, and wave shape affect the pitch, intensity, and quality of tones produced by musical instruments. Weightage: 2

Understanding wave characteristics in music has applications in various disciplines, but the direct trans-disciplinary link may not be as strong.

PO6: Personal and Professional Competence

CO7: Understand construction and working principle of optical instruments. Weightage: 2

Understanding optical instruments contributes to personal and professional competence, though the link may not be as direct.

PO7: Effective Citizenship and Ethics

CO6: Understand the phenomena like reflection, refraction, diffraction, dispersion. Weightage: 2

Understanding wave phenomena has ethical implications, contributing to effective citizenship, though the link may not be as strong.

PO8: Environment and Sustainability

CO6: Understand the phenomena like reflection, refraction, diffraction, dispersion. Weightage: 2

Understanding wave phenomena can indirectly contribute to considerations of environment and sustainability.

PO9: Self-directed and Life-long Learning

CO1: Understand the mathematical description of traveling and standing waves. Weightage: 2

Understanding the mathematical description of waves can be part of self-directed and life-long learning, but the link may not be as direct.

Class : F.Y. B. Sc. (Semester- II)
Paper Code: PHY1203
Paper : III Title of Paper: Practical-II
Credit : 2 No. of Practicals: 10

A) Learning Outcome:
After successfully completing this laboratory course, the students will be able to do the following:
CO1: Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.
CO2: Demonstrate an ability to collect data through observation and/or experimentation and interpreting data.
CO3: Demonstrate an understanding of laboratory procedures including safety and scientific methods.
CO4: Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.
CO5: Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.
CO6: Apply knowledge in understanding the experimental Principles in Project work for demonstration.
CO7: Experimental Models for easy understanding and explanation Physics concepts.

Syllabus:

1. Heat and Thermodynamics (Any Four)
1. Interpretation of isothermal and adiabatic curves on PV diagrams (Theoretical). Theoretical study of Carnot's cycle by drawing graphs of isothermal and adiabatic curves.
2. Temperature coefficient of resistance
3. Determination of inversion temperature of a thermocouple
4. Thermal conductivity by Lee's method
5. Specific heat of graphite
6. Calibration of silicon diode/ Copper-constantan thermocouple as temperature sensor.
7. Study of Peltier effect

2. Waves & Optics (Any Four)
1. Study of spectrometer and determination of angle of prism
2. Total internal reflection using LASER
3. Polarization of light by reflection
4. Determination of wavelength of LASER light by plane diffraction grating
5. To determine the angular magnifying power of telescope by slit method.
6. To determine linear magnifying power of telescope.
7. Study of musical scales using a signal generator and musical instruments.
8. Determination of frequency of AC mains using sonometer.
9. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
10. Directional characteristics of Microphone.
11. To Study oscillations of rubber band and to draw potential energy curve for it.

3. Additional Activities
1. Demonstrations (Any two demonstrations equivalent to two experiments)
1. Biprism

2. LASER
3. Goniometer
4. Center of Mass and Center of gravity

2. Computer aided demonstrations using computer simulations or animations (Any one demonstrations equivalent to two experiments)
1. Carnot engine, diesel engine
2. Graphs and their slopes, and Kinematics graphs (using computer simulations)
3. Mini projects/Hands on activities

3. Student Involvement (Any one equivalent to two experiments)

1. Mini Projects
Group of 4 students should carry out mini project with the report.

Students have to perform at least two additional activities out of three activities in addition to sixteen experiments mentioned above. Total Laboratory work with additional activities should be equivalent to twenty experiments.

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3			2					
CO 2		3							
CO 3							3	2	
CO 4	3	3		2					
CO 5			3		2	2			
CO 6		2							2
CO7	3								

Justification

PO1: Disciplinary Knowledge

CO1: Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.Weightage: 3

Acquiring technical skills in a laboratory setting is fundamental to building disciplinary knowledge.

CO4: Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena. Weightage: 3

CO7: Experimental Models for easy understanding and explanation of Physics concepts. Weightage: 3

Creating experimental models for better understanding involves disciplinary knowledge and direct application, indicating a strong relationship.Weightage: 3

Visualizing and experiencing abstract concepts directly contribute to disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

CO2: Demonstrate an ability to collect data through observation and/or experimentation and interpreting data.Weightage: 3

Critical thinking is essential in collecting and interpreting data in a laboratory setting.

CO4: Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.Weightage: 3

Visualizing and experiencing abstract concepts require critical thinking skills.

CO6: Apply knowledge in understanding the experimental Principles in Project work for demonstration.Weightage: 2

Applying knowledge in project work involves problem-solving skills, but the link may not be as direct as in other cases.

PO3: Social Competence

CO5: Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.Weightage: 3

Collaborative learning and teamwork in a laboratory setting directly contribute to social competence.

PO4: Research-related Skills and Scientific Temper

CO1: Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.Weightage: 2

Acquiring technical skills can be part of research-related skills, but the link may not be as direct.

CO4: Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.Weightage: 2

Visualizing abstract concepts can be part of developing a scientific temper, but the link may not be as strong.

PO5: Trans-disciplinary Knowledge

CO5: Acquire the complementary skills of collaborative learning and teamwork in laboratory settings. Weightage: 2

Collaborative learning and teamwork contribute to trans-disciplinary knowledge, but the link may not be as strong.

PO6: Personal and Professional Competence

CO5: Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.Weightage: 2

Collaborative learning and teamwork contribute to personal and professional competence, though the link may not be as direct.

PO7: Effective Citizenship and Ethics

CO3: Demonstrate an understanding of laboratory procedures including safety and scientific methods.Weightage: 3

Understanding laboratory procedures, especially safety and scientific methods, directly contributes to effective citizenship and ethics.

PO8: Environment and Sustainability

CO3: Demonstrate an understanding of laboratory procedures including safety and scientific methods.Weightage: 2

Adhering to laboratory safety procedures can indirectly contribute to considerations of environment and sustainability.

PO9: Self-directed and Life-long Learning

CO6: Apply knowledge in understanding the experimental Principles in Project work for demonstration.Weightage: 2

Applying knowledge in project work is relevant to self-directed and life-long learning, though the link may not be as direct.