F.Y.B.Sc. (Physics)

Semester-I

&

Semester-II

Syllabus

2022 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 2022-Pattern

Semester	Paper Code	Title of Paper	No. of Credits
I	USPH111	Mechanics & Properties of Matter	2
	USPH112	Electromagnetics	2
	USPH113	Practical-I	2
II	USPH121	Heat and Thermodynamics	2
	USPH122	Physics Principles and Applications	2
	USPH123	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

SYLLABUS (CBCS) FOR F.Y.B.Sc. PHYSICS (W.E.F. June 2022)
Academic Year 2022-2023
F.Y.B.Sc. PHYSICS (Semester- I)
USPH111: Mechanics & Properties of Matter

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 concepts of energy, work, power, conservation of energy and be able to perform calculations using them.

CO2: Understand the concepts of elasticity and be able to perform calculations using them.

CO3: Understand the concepts of surface tension and viscosity and be able to perform calculations using them.

CO4: Use of Bernoulli's Principle in real life examples.

CO5: Demonstrate quantitative problem-solving skills in all the topics covered.

CO6: Apply the knowledge in construction of beams, bridges etc,

CO7: Apply knowledge in understanding the flow of liquid and surface tension applied on the surface of liquid.

TOPICS/CONTENTS:

UNIT 1: Motion
(6L)

1.1 Introduction (motion, displacement, velocity, acceleration, forces)

1.2 Various types of forces in nature

1.3 Newton's laws & its applications.

1.4 Limitation of Newton's laws of motion

1.5 Newton's law of gravitation.

1.6 Frame of reference: Inertial and non- inertial

1.7 Introduction to classical relativity

1.8 **Problem Solving**

UNIT 2: Work and Energy
(8L)

2.1 Introduction (work, energy, power)

2.2 Work and Work-Energy theorem

2.3 Calculation of work done with constant force and variable force

2.4 Conservative and non-conservative forces

2.5 Potential energy and conservation of mechanical energy

2.6 Change in potential energy in rigid body motion

2.7 Mass-energy equivalence

2.8 **Problem Solving**

UNIT 3: Properties of Matter
(14L)

1.1 Introduction: **(**surface tension, angle of contact)

1.2 Rise of liquid in a conical capillary tube

1.3 Jaeger's method for determination of surface tension

1.4 Factors affecting surface tension

1.5 Applications of surface tension (washing of cloths with detergents, surfactants, capillary action)

1.6 Work done during longitudinal strain, volume strain, shearing strain and Poisson's ratio.

1.7 Determination of Y of thin rectangular bar loaded at the center

1.8 Torsional oscillations

1.9 **Problem solving**

Unit 4: Fluid Mechanics
(8L)

4.1 Introduction**: (**Concept of viscous force and viscosity, Pressure in a fluid, buoyancy, Pascal's law, and Archimedes Principle)

4.2 Atmospheric Pressure and Barometer

4.3 Pressure difference in liquid accelerating vertically upward with an acceleration a_0

4.4 Steady and turbulent flow, Reynolds's number

4.5 Equation of continuity

4.6 Poiseuille's equation

4.7 Bernoulli's Principle and its application (Venturi meter, Aspirator Pump)

4.8 **Problem Solving**

References:

1) University Physics: Sears and Zeemansky, XIth edition, Pearson education
2) Concepts of Physics: H.C. Varma, Bharati Bhavan Publishers
3) Problems in Physics: P.K. Srivastava, Wiley Eastern Ltd.
4) Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir, VI Edition,
5) Pearson Education/Prentice Hall International, New Delhi
6) Properties of Matter: D. S. Mathur, Shamlal Chritable Trust New Delhi
7) Mechanics: D.S Mathur, S Chand and Company New Delhi-5.

	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	3	1	2	2		1		3
CO 2	3	3	1	2	2		1		3
CO 3	3	3	1	2	2		1		3
CO 4	3	3	1	2	2		1		3
CO 5	3	3	1	2	2		1		3
CO 6	2	3	1	2	2	3	1	2	3
CO7	3	3	1	2	2		1		3

Justification

PO1: Disciplinary Knowledge

CO1: Understand the concepts of energy, work, power, conservation of energy and be able to perform calculations using them.Weightage: 3

Disciplinary knowledge (PO1) is directly related to understanding and applying the concepts of energy, work, power, and conservation of energy (CO1).

CO2: Understand the concepts of elasticity and be able to perform calculations using them.Weightage: 3

Disciplinary knowledge (PO1) is directly linked to understanding and applying the concepts of elasticity (CO2).

CO3: Understand the concepts of surface tension and viscosity and be able to perform calculations using them.Weightage: 3

Disciplinary knowledge (PO1) is directly connected to understanding and applying the concepts of surface tension and viscosity (CO3).

CO4: Use of Bernoulli’s Principle in real-life examples.Weightage: 3

Disciplinary knowledge (PO1) is directly applicable to the understanding and application of Bernoulli's Principle in real-life situations (CO4).

CO5: Demonstrate quantitative problem-solving skills in all the topics covered.Weightage: 3

Disciplinary knowledge (PO1) is directly associated with the ability to demonstrate quantitative problem-solving skills in topics like energy, elasticity, surface tension, and viscosity (CO5).

CO6: Apply the knowledge in the construction of beams, bridges, etc.Weightage: 2

While there is a connection between disciplinary knowledge (PO1) and the application of knowledge in construction (CO6), the relationship is not as direct as in other cases.

CO7: Apply knowledge in understanding the flow of liquid and surface tension applied on the surface of the liquid.Weightage: 3

Disciplinary knowledge (PO1) is directly applicable to the application of knowledge in understanding the flow of liquid and surface tension (CO7).

PO2: Critical Thinking and Problem Solving

All COs: CO1 to CO7Weightage: 3

Critical thinking and problem-solving (PO2) are inherent in understanding and applying the concepts in all the specified content areas (CO1 to CO7).

PO3: Social Competence

All COs: CO1 to CO7Weightage: 1

The connection with social competence (PO3) is weak, as the technical content of energy, elasticity, surface tension, etc., may not directly involve social aspects.

PO4: Research-related Skills and Scientific Temper

All COs: CO1 to CO7Weightage: 2

There is a moderate connection as the application of scientific principles (PO4) is involved in understanding and solving problems related to energy, elasticity, surface tension, etc.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO7Weightage: 2

There is a moderate connection as the application of disciplinary knowledge (PO1) involves aspects that may span multiple disciplines.

PO6: Personal and Professional Competence

CO6: Apply the knowledge in the construction of beams, bridges, etc.Weightage: 3

The ability to apply knowledge in construction (CO6) directly contributes to personal and professional competence (PO6).

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO7Weightage: 1

The direct connection to effective citizenship and ethics (PO7) is weak in the technical content areas covered.

PO8: Environment and Sustainability

CO6: Apply the knowledge in the construction of beams, bridges, etc.Weightage: 2

The application of knowledge in construction (CO6) has some relevance to environmental and sustainability considerations (PO8).

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7 Weightage: 3

The continuous learning aspect (PO9) is inherent in understanding and applying the principles in all the specified content areas (CO1 to CO7).

F.Y. B. Sc. PHYSICS (Semester- I)

USPH 112: Electromagnetics

Credit: 2 **No. of lectures: 36**

Learning Outcome:

On successful completion of this course students will be able to do the following:

CO1: Demonstrate and understand the electric force, field, potential and related concepts for stationary charges.

CO2: Calculate electrostatic field and potential of simple charge distributions using Coulomb's law and Gauss's law.

CO3: Demonstrate and understand the dielectrics and effect of dielectric on electric field.

CO4: Demonstrate and understand the magnetic field for steady currents using Biot-Savart's and Ampere's law.

CO5: Understand the concept of magnetization of materials.

CO6: Demonstrate quantitative problem-solving skills in all the topics covered.

CO7: Apply knowledge in understanding the electromagnetism fundamentals in daily life.

TOPICS/CONTENTS:

UNIT 1: Electrostatics (10L)

1.1 Introduction (Electric charge, Coulombs law, potential, electric field, electric flux)
1.2 Gauss's theorem of electrostatics.
1.3 Applications of Gauss theorem (Spherical, Planar, Cylindrical symmetry)
  i. Electric field due to point charge
  ii. Infinite line of charge
1.4 Electric potential as line integral of electric field
1.5 Electric Potential due to a point charge
1.6 Electric dipole
1.7 Calculation of electric field from potential
1.8 **Problem Solving**

UNIT 2: Dielectrics (10L)

2.1 Introduction (Dielectric constant, Polar & non-polar molecule)
2.2 Polarization
2.3 Polar and non-polar dielectrics
2.4 Capacitance due to parallel plate capacitor
2.5 Displacement vector.
2.6 Gauss's theorem in dielectrics.
2.7 **Problem Solving**

UNIT 3: Magnetism **(10L)**

3.1 Introduction (Lines of forces, Magnetization, Magnetic field)
3.2 Magnetostatics
3.3 Biot-Savart's law & its applications
  3.3.1 Straight conductor
  3.3.2 Circular coil
3.4 Ampere's circuital law and its applications
3.5 Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability,
Susceptibility, hysteresis
3.6 Magnetization of materials
3.7 Types of magnetic materials: dia, para, ferro, antiferro, and ferri magnetic
3.8 **Problem Solving**

UNIT 4: Electromagnetic Induction
(10L)

4.1 Introduction
4.2 Faraday's laws of electromagnetic induction
4.3 Lenz's law
4.4 Self and mutual inductance
4.5 Self-inductance of single coil
4.6 Mutual inductance between two coils
4.7 Maxwell's equations and their significance
4.8 **Problem Solving**

References:

1. Electricity and Magnetism, D. C. Tayal, 1988, Himalaya Publishing House.
2. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
3. Fundamentals of Physics: 8th Edition, Halliday Resnik and Walker

	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								
CO 4	3								
CO 5	3								
CO 6	2	3		2		2			2
CO7	2		2						

Justification

PO1: Disciplinary Knowledge

CO1: Demonstrate and understand the electric force, field, potential and related concepts for stationary charges.Weightage: 3

This course outcome directly aligns with the disciplinary knowledge objective as it focuses on fundamental concepts of electric force, field, and potential for stationary charges.

CO2: Calculate electrostatic field and potential of simple charge distributions using Coulomb's law and Gauss's law.Weightage: 3

This outcome involves the application of disciplinary knowledge in calculating electrostatic field and potential, emphasizing a strong connection with understanding the principles of Coulomb's law and Gauss's law.

CO3: Demonstrate and understand the dielectrics and effect of dielectric on electric field.Weightage: 3

This outcome is directly related to disciplinary knowledge, focusing on dielectrics and their impact on electric fields, which is a crucial aspect of the study of electromagnetism.

CO4: Demonstrate and understand the magnetic field for steady currents using Biot-Savart’s and Ampere's law.Weightage: 3

This outcome involves understanding and demonstrating knowledge of magnetic fields for steady currents, directly linking to the disciplinary knowledge related to electromagnetism.

CO5: Understand the concept of magnetization of materials.Weightage: 3

This outcome is aligned with disciplinary knowledge, focusing on the concept of magnetization, an essential aspect of understanding electromagnetic properties of materials.

CO6: Demonstrate quantitative problem-solving skills in all the topics covered.Weightage: 2

While this outcome is related to disciplinary knowledge, it also involves critical thinking and problem-solving skills. Hence, the relation is moderate, covering both disciplinary and critical thinking aspects.

CO7: Apply knowledge in understanding the electromagnetism fundamentals in daily life.Weightage: 2

This outcome requires the application of disciplinary knowledge to real-life situations, indicating a moderate relation between disciplinary knowledge and its practical application.

PO2: Critical Thinking and Problem Solving

CO6: Demonstrate quantitative problem-solving skills in all the topics covered.Weightage: 3

This course outcome is strongly related to critical thinking and problem-solving skills, as it explicitly mentions the demonstration of quantitative problem-solving skills in the covered topics.

PO3: Social Competence

CO7: Apply knowledge in understanding the electromagnetism fundamentals in daily life.Weightage: 2

While the application of electromagnetism fundamentals in daily life may not directly relate to social competence, there is a partial connection as understanding these concepts can contribute to informed societal interactions.

PO4: Research-related Skills and Scientific Temper

CO6: Demonstrate quantitative problem-solving skills in all the topics covered.Weightage: 2

Problem-solving skills are essential for research, and while this CO is not explicitly focused on research, it contributes to the development of skills needed for scientific inquiry.

PO5: Trans-disciplinary Knowledge

CO1: Demonstrate and understand the electric force, field, potential and related concepts for stationary charges.Weightage: 2

While the focus is on disciplinary knowledge, understanding the electric force and related concepts may have applications across various disciplines.

PO6: Personal and Professional Competence

CO6: Demonstrate quantitative problem-solving skills in all the topics covered.Weightage: 2

Problem-solving skills contribute to personal and professional competence, although this CO alone may not cover all aspects of personal and professional competence.

PO9: Self-directed and Life-long Learning

CO6: Demonstrate quantitative problem-solving skills in all the topics covered.Weightage: 2

Problem-solving skills are foundational for self-directed learning, as they empower individuals to tackle new challenges and acquire knowledge independently.

F.Y.B.Sc. PHYSICS (Semester- I)

USPH113: Practical-I

Credit: 2 No. of Practicals: 10

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.

List of Practical

1. Mechanics (Any Four)

1 Use of tools and instruments as a measuring device
(Vernier caliper, micrometer screw gauge, travelling microscope, spectrometer etc.)
2 Determination MI of disc using ring
3 MI of Flywheel
4 Determination of coefficient of Viscosity by Poiseuille's method
5 Determination of Y and n by flat spiral spring
6 Determination of Y by method of bending
7 Surface Tension by Jaeger's method.

2. Electricity and magnetism (Any Four)

1. Charging and discharging of a capacitor
2. Study of LR circuit
3. Study of LCR series circuit
4. Study of Kirchhoff's laws
5. Diode characteristics
6. Use of Multimeter to measure DC and AC current, voltage and resistance

3. Additional Activities

1. Demonstrations (Any two demonstrations equivalent to two experiments)

1. Magnet –magnet interaction
2. Collision by using balls
3. Use of CRO (measurement of AC voltage, frequency)
4. Measurement of sound pressure level

2. Computer aided demonstrations using computer simulations or animations (Any one demonstrations equivalent to two experiments) / Virtual lab

1. Coulomb's law
2. Visualization of vectors
3. Bohr's model

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 one additional activity out of three activities in addition to eight experiments mentioned above. Total Laboratory work with additional activities should be equivalent to ten experiments.

OR

2. Industrial Visit / Study Tour / Field Visit

	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									2
CO 2		3		2					
CO 3							2		
CO 4		3							
CO 5			2			2			
CO 6	3								
CO7					2				

Justification

PO1: Disciplinary Knowledge

CO6: Apply knowledge in understanding the experimental principles in Project work for demonstration.

Weightage: 3

This CO is directly related to applying disciplinary knowledge in a practical setting, specifically in project work.

PO2: Critical Thinking and Problem Solving

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

Collection and interpretation of data require critical thinking skills, aligning with the PO on critical thinking and problem-solving.

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

Experiencing and visualizing abstract concepts contribute directly to critical thinking and a deeper understanding, fulfilling this PO.

PO3: Social Competence

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

Weightage: 2

Collaborative learning and teamwork skills in laboratory settings may contribute to social competence, although the relation is not direct.

PO4: Research-related Skills and Scientific Temper

CO2: Demonstrate an ability to collect data through observation and/or experimentation and interpreting data.Weightage: 2

Collecting and interpreting data is a fundamental research-related skill, but it's only one aspect of research-related skills.

PO5: Trans-disciplinary Knowledge

CO7: Experimental Models for easy understanding and explanation of Physics concepts.Weightage: 2

The use of experimental models may contribute to trans-disciplinary knowledge by providing a tangible and practical understanding of physics concepts.

PO6: Personal and Professional Competence

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

Weightage: 2

Collaborative learning and teamwork skills in laboratory settings can contribute to personal and professional competence.

PO7: Effective Citizenship and Ethics

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

Weightage: 2

Understanding laboratory procedures, especially safety and scientific methods, is crucial for ethical conduct in scientific practices.

PO9: Self-directed and Life-long Learning

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

Weightage: 2

Acquiring technical skills in a laboratory setting can contribute to self-directed learning, especially in gaining hands-on experience with equipment and materials.