

Anekant Education Society's  
**TULJARAM CHATURCHAND COLLEGE OF ARTS,  
SCIENCE AND COMMERCE, BARAMATI**  
**(Autonomous Status)**  
(Affiliated to Savitribai Phule Pune University, Pune)

Faculty of Science

## **Department of Physics**

Revised Syllabus Submitted to

IQAC

For

**B.Sc. in Physics**

**From Academic Year 2022-2023**

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## **Preamble:**

Physics is concerned with the study of the universe from the smallest to the largest scale: it is about unravelling its complexities to discover the way it is and how it works. Discoveries in physics have formed the foundation of countless technological advances and play an important role in many scientific areas. Many techniques used in medical imaging, nanotechnology and quantum computing are derived from physics instrumentation. Even the World Wide Web was a spin-off from the information processing and communications requirements of high-energy particle physics. The contributions of physics to solving global problems such as energy production, environmental protection, global warming, and public health are essential and have an enormous impact on our society.

The systematic and planned curricula from first year to the third year shall motivate and encourage the students for pursuing higher studies in Physics and for becoming an entrepreneur.

## **Objectives:**

- To provide in depth knowledge of scientific and technological aspects of Physics
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hand on activities, study visits, projects etc.
- To train students in skills related to research, education, industry, and market.
- To create foundation for research and development in Physics
- To develop analytical abilities towards real world problems
- To help student's build-up a progressive and successful career in Physics

## **Eligibility:**

1. First Year B.Sc.: Higher Secondary School Certificate (10+2) Science stream or its equivalent Examination as per the University of Pune eligibility norms.
2. Second Year B.Sc.: Keeping terms of First Year of B.Sc. with Physics as one of the subjects. Other students if they fulfil the conditions approved by the equivalence Committee of Faculty of Science of the University of Pune are also eligible.
3. Third Year B.Sc.: Student shall pass all First Year B.Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Physics as one of the subjects.

Admissions will be given as per the selection procedure/policies adopted by the Tuljaram Chaturchand College, in accordance with conditions laid down by the Academic Council of Anekant Education Society's, Tuljaram Chaturchand College, Baramati, Reservation and relaxation will be as per the Government rules for minority institution.

Proposed Structure of B.Sc. degree in physics and syllabus for first year degree in Physics as follows:

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**F.Y., S.Y., T.Y.B.Sc. [Physics] Structure**  
**2022-2025**

Class	Semester	Paper-I	Paper-II	Paper-III
F.Y.B.Sc.	I	Mechanics & Properties of Matter	Electromagnetics	Practical-I
	II	Heat and Thermodynamics	Physics Principles and Applications	Practical-II
S.Y.B.Sc.	III	Mathematical Methods of Physics-I	Electronics-I/ Instrumentation	Practical-I
	IV	Oscillations, Waves, and Sound	Optics	Practical-II
T.Y.B.Sc.	<b>Sem-I</b>		<b>Sem-II</b>	
	1	Mathematical Methods of Physics-II	Electrodynamics	
	2	Solid State Physics	Quantum Mechanics	
	3	Classical Mechanics	Thermodynamics and Statistical Physics	
	4	Atomic and Molecular Physics	Nuclear Physics	
	5	Computational Physics with Python	Electronics II/ Advanced Electronics	
	6	Elective-I (Select anyone) i. Elements of Material Science ii. Renewable Energy Sources iii. Physics and Technology of sensors. iv. Biophysics	Elective-II (Select anyone) i) Physics of Nanomaterials ii) Astronomy and Astrophysics iii) Medical Electronics  iv) Microcontroller	
	7	Practical -I	Practical -IV	
	8	Practical -II	Practical -V	
	9	Practical -III	Project	

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**Course Structure for F.Y.B.Sc. Physics 2022-23**

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

**SYLLABUS (CBCS) FOR F.Y.B.Sc. PHYSICS  
(W.E.F. June 2022)**

Name of the Programme : B.Sc. PHYSICS  
Programme Code : USPH  
Class : F.Y.B.Sc.  
Semester : I  
Course Name : Mechanics & Properties of Matter  
Course Code : USPS111  
No. of lectures : 36

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**Course Outcome:**

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

1. Understand the concepts of energy, work, power, conservation of energy and be able to perform calculations using them.
2. Understand the concepts of elasticity and be able to perform calculations using them.
3. Understand the concepts of surface tension and viscosity and be able to perform calculations using them.
4. Use of Bernoulli's Principle in real life examples.
5. Demonstrate quantitative problem-solving skills in all the topics covered.

**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)**

- 3.1 Introduction: (surface tension, angle of contact)
- 3.2 Rise of liquid in a conical capillary tube
- 3.3 Jaeger's method for determination of surface tension
- 3.4 Factors affecting surface tension
- 3.5 Applications of surface tension (washing of cloths with detergents, surfactants, capillary action)
- 3.6 Work done during longitudinal strain, volume strain, shearing strain and Poisson's ratio.
- 3.7 Determination of  $Y$  of thin rectangular bar loaded at the center
- 3.8 Torsional oscillations
- 3.9 **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, ShamlalChritable Trust New Delhi
- 7) Mechanics: D.S Mathur, S Chand and Company New Delhi-5.

**SYLLABUS (CBCS) FOR F.Y.B.Sc. PHYSICS  
(W.E.F. June 2022)**

Name of the Programme : B.Sc. PHYSICS  
Programme Code : USPH  
Class : F.Y.B.Sc.  
Semester : I  
Course Name : Electromagnetics  
Course Code : USPS112  
No. of lectures : 36

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**Course Outcome:**

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

1. Demonstrate and understand the electric force, field, potential and related concepts for stationary charges.
2. Calculate electrostatic field and potential of simple charge distributions using Coulomb's law and Gauss's law.
3. Demonstrate and understand the dielectrics and effect of dielectric on electric field.
4. Demonstrate and understand the magnetic field for steady currents using Biot-Savart's and Ampere's law.
5. Understand the concept of magnetization of materials.
6. Demonstrate quantitative problem-solving skills in all the topics covered.

**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: 8<sup>th</sup> Edition, Halliday Resnik and Walker

**SYLLABUS (CBCS) FOR F.Y.B.Sc. PHYSICS  
(W.E.F. June 2022)**

Name of the Programme : B.Sc. PHYSICS

Programme Code : USPH

Class : F.Y.B.Sc.

Semester : I

Course Name : Practical-I

Course Code : USPS112

No. of Practicals : 10

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**Course Outcome:**

After successfully completing this laboratory course, the students will be able to do the following:

1. Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.
2. Demonstrate an ability to collect data through observation and/or experimentation and interpreting data.
3. Demonstrate an understanding of laboratory procedures including safety and scientific methods.
4. Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.
5. Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.

**List of Practicals**

**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**