Abeda Inamdar Senior College
Of Arts, Science and Commerce, Camp, Pune-1
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Structure of F.Y.B.Sc. Physics

(CBCS – Autonomy 2021 Pattern)

Semester	**Course Code**	**Title of the** Course	**Number of Credits**
I	21SBPH111	Mechanics and Properties of Matter	2
I	21SBPH112	Physics Principles and Applications	2
I	21SBPH113	Physics Laboratory based on courses 21SBPH111 and 21SBPH112	1.5
II	21SBPH121	Heat and Thermodynamics	2
II	21SBPH122	Electricity and Magnetism	2
II	21SBPH123	Physics Laboratory based on courses 21SBPH111 and 21SBPH112	1.5

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Syllabus for

First Year Batchelor of Science (F.Y.B.Sc.) Physics

(CBCS – Autonomy 2021 Pattern)

Course/ Paper Title	Mechanics and Properties of Matter
Course Code	21SBPH111
Semester	I
No. of Credits	2 (36 lectures of 50 Minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To understand the basic terms like displacement, velocity, acceleration etc. associated with motion.
2.	To demonstrate an understanding of Newtons laws and applying them in calculations of t he motion of simple systems
3.	To understand the concept of energy, work, power and conservation of energy and perform calculations.
4.	To understand the concept of viscosity and Bernoulli's theorem and its real-life applications
5.	To understand the concept of surface tension and elasticity and its applications
6.	To demonstrate quantitative problem-solving skills in all the topics covered.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the basic terms like displacement, velocity, acceleration etc. associated with motion.
2.	Students willapply Newtons laws in calculations of the motion of simple systems
3.	Students willunderstand the concept of energy, work, power and conservation of energy and perform calculations.
4.	Students will understand the concept of viscosity and Bernoulli's theorem and its real-life applications
5.	Students will understand the concept of surface tension and elasticity and its applications
6.	Students will acquire quantitative problem-solving skills in all the topics covered.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Motion:**	**9**
	1. Introduction to motion	2
	i. Types of motion	
	ii. Displacement	
	iii. Velocity	
	iv. Acceleration	
	v. Inertia	
	2.Newton's laws of motion with their explanations	2
	i. Various types of forces in nature	
	ii. Frames of reference (Inertial and Non inertial)	
	iii. Laws of motion and its real-life applications	3
	3.Problems	2
Unit II	**Work and Energy**	**7**

	1. Kinetic energy i. Work Energy Theorem ii. Work done with constant force iii. Work done with varying force (spring force) **2. Conservative and non-conservative forces** i. Potential energy ii. Law of energy conservation iii. Gravitational potential energy **3. Problems**	2 3 2
Unit III	**Fluid Mechanics**	**8**
	1. Concept of viscous force and viscosity i. Coefficient of viscosity ii. Steady and Turbulent flow iii. Reynolds number **2. Bernoulli's Theorem** i. Equation of continuity ii. Bernoulli's Principle iii. Application of Bernoulli's Venturi meter, Pitot tube iv. Applications of viscous fluids **3. Problems**	2 2 2 2
Unit IV	**Surface Tension and Elasticity**	**12**
	1. Surface tension i. Angle of contact ii. Factors affecting surface tension **2. Jaeger's method for determination of surface tension** i. Applications of surface tension **3. Concept of elasticity** i. Stress and Strain ii. Young's modulus iii. Bulk modulus	2 2 2

	iv. Modulus of rigidity v. Hooke's law **4. Work done during longitudinal strain** i. Volume strain ii. Shearing strain iii. Poisson's ratio **5. Relation between three elastic moduli, (Y, η, K)** i. Applications of elasticity **6. Problems**	2 2 2

References:

1. Resnick, Halliday & Walker,Physics Wiley.
2. Sears and Zemanski, University Physics, PearsonEducation.
3. D. S. Mathur, Mechanics, S. Chandand Company, NewDelhi.
4. D. S. Mathur, Elements of Properties of Matter, S. Chand, NewDelhi.
5. H. C. Verma, Concepts of Physics, Bharati Bhavan Publisher.
6. P. K. Srivastava ,Problems in Physics , Wiley EasternLtd.
7. Mott Robert Applied Fluid Mechanics, Pearson Education/Prentice Hall International, New Delhi.
8. J C Upadhyaya, Fundamentals of Mechanics, Himalaya PublishingHouse.
9. D. S. Mathur, Revised by P. S. Hemne, Mechanics ,S. Chand and Company, NewDelhi.
10. D H Bergey; John G Holt, Bergey's manual of determinative Bacteriology, 9th Edition. ,Baltimore: Williams & Wilkins, 1994.

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Course/ Paper Title	Physics Principles and Applications
Course Code	21SBPH112
Semester	I
No. of Credits	2 (36 lectures of 50 Minutes)

Aims and Objectives of the Course

Sr. No.	Objectives
1.	To understand the general structure of atom, spectrum of hydrogen atom.
2.	To understand the atomic excitation and LASER principles.
3.	To understand the bonding mechanism and its different types.
4.	To demonstrate an understanding of electromagnetic waves and its spectrum.
5.	Understand the types and sources of electromagnetic waves and applications.
6.	To demonstrate quantitative problem-solving skills in all the topics covered.

Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the general structure of atom and spectrum of hydrogen atom.

2.	Students atomic will understand the excitation and LASER principles.
3.	Students will understand the bonding mechanism and its differenttypes.
4.	Students will develop an understanding of electromagnetic waves and its spectrum.
5.	Students will understand the types and sources of electromagnetic waves and applications.
6.	Students will develop problem-solving skills in all the topics covered.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**PhysicsofAtoms**	**8**
	1. Introduction toAtom	2
	i. Atomic Model	
	ii. Thomson's Atomic Model	
	iii. Rutherford's Atomic Model	
	iv. Bohr's Atomic Model	
	2. Atomic Spectra	2
	i. Emission line Spectrum	
	ii. Absorption line spectrum	
	iii. Uses of Atomic Spectra	
	3. Classical planetary model of HydrogenAtom	2
	i. The Bohr Theory of the HydrogenAtom	
	ii. The HydrogenSpectrum	
	iii. Frank-Hertz experiment	
	4. Problems	2
Unit II	**Physics of Molecules**	**8**

	1. Introduction to Bonding Mechanisms i. Forces betweenAtoms **1. Types of Bonding** i. Ionic Bonds ii. Covalent Bonds iii. Van der Waal'sBonds iv. Hydrogen Bond v. Metallic Bond **3. Rotation energy levels of a diatomic molecule** i. Vibration energy levels of a diatomic molecule **4. Problems**	2 2 2 2
Unit III	**LASERS andItsApplications**	**7**
	2. Introduction to LASERS i. Basic Principle of Lasers: Three Processes ii. Characteristics of Lasers: brief explanation iii. Boltzmann DistributionLaw iv. Population Inversion and Optical Pumping **2. Types of Lasers** i. He-Ne Laser ii. Ruby Laser iii. Applications of Lasers **3. Problems**	3 2 2
Unit IV	**Electromagnetic Waves**	**6**
	1. Introduction to Electromagnetic Waves:Historical Perspective i. General properties of Electromagnetic radiations **2. Electromagnetic spectrums and its sources** i. Production of electromagnetic waves: Hertz experiment **3. Plank's hypothesis of Photons** i. Applications of various waves in electromagnetic spectrum	2 2 2

Unit V	Applications of Electromagnetic Waves	7
	1. RADAR, microwave oven	1
	2. Pyroelectric thermometer	1
	3. X-ray radiography	1
	4. CT-scan	1
	5. Solar cell	1
	i. Types of solar cell	1
	6. Problems	1

References:

1. A. Beiser ,Concepts of Modern Physics
2. Raymond A. Serway, Clement J. Moses, Curt A.Moyer , Modern Physics
3. H.D. Young R. A. Freedman, Sandin Sears and Zemanski's University Physics,
4. Pearson Education.
5. Electricity and Magnetism , ICFAI University Press.
6. M. N. Avdhanulu ,LASERS ,S. ChandPublications.

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Syllabus for

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Course/ Paper Title	Physics Laboratory based on courses 21SBPH111 and 21SBPH112
Course Code	21SBPH113
Semester	I
No. of Credits	1.5 (46.8 lectures of 50 Minutes)

Aims and Objectives of the Course

Sr. No.	Objectives
1.	To understand the concept of least count and usage of different measuring devices.
2.	Acquire technical and manipulative skills in using laboratory equipment, tools and materials.
3.	To develop an ability to collect and interpret data through observation and experimentation.
4.	To understand the laboratory procedure including scientific and safety methods
5.	To acquire the complimentary skills of collaborative Learning and team work.

Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the concept of least count and usage of different measuring devices.
2.	Students will acquire technical and manipulative skills in using

	laboratory equipment, tools and materials.
3.	Students willdevelop an ability to collect and interpret data through observation and experimentation.
4.	Students will understand the laboratory procedure including scientific and safety methods
5.	Students will acquire the complimentary skills of collaborative Learning and team work.

Syllabus

Sr. No	Title of the experiment
	Section I
1	Study and use of various measuring Instruments. 1. Meter scale 2. Vernier caliper 3. Micrometer screw gauge 4. Travelling Microscope 5. Spectrometer
2	Determination of Modulus of Rigidity of wire using Torsional Oscillations
3	Determination of coefficient of Viscosity by Poiseuille's method
4	Determination of "Y" and "η" by flat spiral spring
5	Determination of "Y" by bending method.
6	Study of surface tension by Jaeger's method
7	Study of Poisson's ratio of rubber using rubber tube /rubber chord
	Section II
8	Study of Spectrometer and determination of angle of prism
9	Study of Spectrometer calibration and determination of refractive indices of different colors
10	Study of divergence of LASER beam
11	Study of total internal reflection using LASER
12	Determination of wavelength of LASER light by plane diffraction grating
13	Study of I-V characteristics of solar cell
14	Demonstration of venturi tube/pitot tube experiment.

Note: Any eight experiments (at least four from each section) to be conducted during the semester and one additional activity/demonstration (AutoCAD software), equivalent to two experiments should be done. Total Laboratory work with additional activities should be equivalent to ten experiments.

Additional Activities:

1. Collect the information of at least four Physicists with their work and report that in journal.
2. Carry out mini-project up to the satisfaction of professor in-charge of practical.
3. Display any two computer aided demonstrations using computer simulations or animations
4. Present hands on activity up to the satisfaction of professor in-charge of practical

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(CBCS – Autonomy 2021 Pattern)

Course/ Paper Title	Heat and Thermodynamics
Course Code	21SBPH121
Semester	II
No. of Credits	2 (36 lectures of 50 Minutes)

Aims and Objectives of the Course

Sr. No.	Objectives
1.	To describe the properties and relationship between different variable of a pure substance
2.	To describe the ideal gas equation and its limitations
3.	To understand the concept of real gas equation.
4.	To apply the laws of thermodynamics and to formulate the relations necessary to analyze a thermodynamic process.
5.	To study the heat engines and calculate the thermal efficiency.
6.	To understand the concept of refrigerators and calculate the coefficient of performance.
7.	To understand the concept of entropy
8.	To study different types of thermometers and their usage.

Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will be able to describe the properties and relationship between different variable of a pure substance

2.	Students can describe the ideal gas equation and its limitations
3.	Students will understand the concept of real gas equation.
4.	Students will be able toapply the laws of thermodynamics and to formulate the relations necessary to analyze a thermodynamic process.
5.	Students will calculate the thermal efficiency of heat engines.
6.	Students will understand the concept of refrigerators and calculate the coefficient of performance.
7.	Students will understand the concept of entropy
8.	Students will be able to use different types of thermometers

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**FundamentalsofThermodynamics**	**10**
	1. Concept of thermodynamic state	3
	i. Equation of state	
	ii. Van der Waal's equation of state	
	iii. Thermal equilibrium	
	iv. Zeroth law of thermodynamics	
	2. Thermodynamic processes	3
	i. Adiabatic, Isothermal	
	ii. Isobaric and Isochoric changes	
	iii. Indicator diagram	
	iv. Work done during isothermal change	
	3. Adiabatic relations	2
	i. Work done during adiabatic change	
	ii. Internal energy, Internal energy as state function	
	iii. First law of thermodynamics	
	iv. Reversible and Irreversible changes	
	4. Problems.	2

Unit II	**Applied Thermodynamics**	**9**
	1. Conversion of heat into work and it's converse i. Second law of thermodynamics **2. Concept of entropy** i. Temperature - entropy diagram ii. T-dS equations **3. Clausius - Clapeyron latent heat equation** **4. Problems**	3 2 2 2
Unit III	**Heat Transfer Mechanisms**	**9**
	1. Carnot's cycle and Carnot's heat engine and its efficiency i. Heat Engines: Otto cycle & its efficiency ii. Diesel cycle & its efficiency **2. Refrigerators** i. General principle and coefficient of performance of refrigerator ii. Simple structure of Vapour compression refrigerator **3. Air Conditioning** i. Principle of air conditioning and it's applications ii. **Problems**	3 2 2 2
Unit IV	**Thermometry**	**8**

	1. Concept of heat & temperature	2
	i. Principle of thermometry,	
	ii. Different temperature scales & inter- conversions,	
	2. Principle, Construction and Working	
	i. Liquid thermometers	4
	ii. Liquid filled thermometers	
	iii. Gas filled thermometers	
	iv. Bimetallic thermometers	
	v. Platinum resistance thermometer	
	vi. Thermocouple	
	3. Problems.	2

References:

1. H. C. Verma ,Concept of Physics, BharatiBhavanPublisher.
2. Brijlal, N. Subrahmanyam, Heat and Thermodynamics,S.Chand and CompanyLtd.
3. Mark W. Zemansky, Richard H. Dittman , Heat and Thermodynamics
4. J. K. Sharma, K. K. Sarkar ,Thermodynamics and Statistical Physics,Himalaya Publishing House.
5. A B. Gupta, H. P. Roy, Thermal Physics (Heat and Thermodynamics), S. Chand Publications.
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(CBCS – Autonomy 2021 Pattern)

Course/ Paper Title	Electricity and Magnetism
Course Code	21SBPH122
Semester	II
No. of Credits	2 (36 lectures of 50 Minutes)

Aims and Objectives of the Course

Sr. No.	Objectives
1.	To understand the concept of the electric force, electric field and electric potential for stationary charges.
2.	To be able to calculate electrostatic field and potential of charge distributions using Coulomb's law and Gauss'slaw.
3.	To understand the dielectric phenomenon and effect of electric field on dielectric.
4.	To Study magnetic field for steady currents using Biot-Savart and Ampere's Circuital laws.

5.	To study magnetic materials and its properties.
6.	Demonstrate quantitative problem-solving skills in all the topics covered.

Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the concept of the electric force, electric field and electric potential for stationary charges.
2.	Students will be able to calculate electrostatic field and potential of charge distributions using Coulomb's law and Gauss'slaw.
3.	Students will understand the dielectric phenomenon and effect of electric field on dielectric.
4.	Students will understand magnetic field for steady currents using Biot-Savart and Ampere's Circuital laws.
5.	Students will understand magnetic materials and its properties.
6.	Students will be able to demonstrate quantitative problem-solving skills in all the topics covered.

Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	**Electrostatics**	**8**
	1. Revision of Coulomb's law Equation of state i. Statement ii. Variation of forces withdistances	2
	2. Superposition principle i. Statement ii. Explanation withillustration	2
	3. Energy of system of charges **4. Concept of electric field** i. Due to pointcharge	2

	ii. Due to groupcharges **5. Concept of electric flux** **6. Gauss's law in electrostatics** **7. Problems**	2
Unit II	**Dielectrics**	**8**
	1. Introduction to dielectric materials **2. Electric Dipole** i. Electric dipole ii. Dipolemoment **3. Electric potential and intensity at any point due to dipole** i. Torque on a dipole placed in an electricfield **4. Polar and non-polarmolecules** i. Electric polarization of dielectric material ii. Gauss' law in dielectric **5. Electric vectors and its relation** **6. Problems**	2 2 2 2
Unit III	**Electrical Circuits**	**7**
	1. Concept of Current Density i. Resistance ii. Resistivity iii. Kirchhoff's laws **2. Oscilloscopes** i. Block diagram of Oscilloscopes ii. Working of Oscilloscopes **3. Problems**	3 2 2
Unit IV	**Magnetostatics**	**7**
	1. Introduction tomagnetization i. Magnetic Induction and Intensity of magnetization **2. Biot-Savart'slaw** i. Statement ii. Long straight conductor	3

	iii. Circular Coil **3. Ampere's circuitallaw** i. Statement ii. Field of Solenoid iii. Field of Toroid **4. Gauss' law for magnetism** **5. Problems**	2 2
Unit IV	**Magnetic Properties of Materials**	**6**
	1. Definition of magnetic parameters i. Magnetization(M) ii. Magnetic Intensity(H) iii. Magnetic Induction(B) iv. Magnetic Susceptibility v. Magnetic Permeability vi. Relation between B, H and M **2. Ferrite materials, Hysteresis applications** **3. Problems**	2 2 2

References:

1. Halliday Resnik and Walkar , Fundamentals of Physics
2. B. B.Laud, Electromagnetics
3. Reitz, Milford, Christey, Foundations of Electromagnetic theory
4. D.C.Tayal, Electricity and Electronics, Himalaya Publishing House, Mumbai.
5. D.G. Griffith., Introduction to Electrodynamics
6. BrijLal, Subramanian ,Electricity and Magnetism, Ratan Prakashan
7. Khare, Shrivastav ,Electricity and Magnetism

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(CBCS – Autonomy 2021 Pattern)

Course/ Paper Title	Physics Laboratory based on courses 21SBPH121 and 21SBPH122
Course Code	21SBPH123
Semester	II
No. of Credits	1.5 (46.8 lectures of 50 Minutes)

Aims and Objectives of the Course

Sr. No.	Objectives
1.	To understand the concept of least count and usage of different measuring devices.
2.	Acquire technical and manipulative skills in using laboratory equipment, tools and materials.
3.	To develop an ability to collect and interpret data through observation and experimentation.
4.	To understand the laboratory procedure including scientific and safety methods
5.	To acquire the complimentary skills of collaborative Learning and team work.

Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the concept of least count and usage of different measuring devices.
2.	Students will acquire technical and manipulative skills in using laboratory equipment, tools and materials.
3.	Students will develop an ability to collect and interpret data through observation and experimentation.
4.	Students will understand the laboratory procedure including scientific and safety methods.
5.	Students will acquire the complimentary skills of collaborativelearning and teamwork.

Syllabus

Sr No	Title of the experiment
	Section I
1	Interpretation of Isothermal and Adiabatic curve on P-V diagram and theoretical study of Carnot's cycle by drawing graphs of Isothermal and Adiabatic curves
2	Study of temperature coefficient of Thermistor.
3	Study of Thermocouple and determination of inversion temperature
4	Study of thermal conductivity by Lee's method
5	Study of specific heat of Graphite
6	Study of Solar constant
7	Determination of calorific values of different fuels
	Section II
8	Study of charging and discharging of capacitor
9	Study of LR circuit
10	Study of LCR circuit
11	Study of Kirchhoff's Laws
12	Study of Diode characteristics
13	Study of Voltmeter, Ammeter and Multimeter (AC, DC, ranges and least count)
14	Determination of frequency of AC mains

Note: Any eight experiments (four from each section) to be conducted during the semester and one additional activity/demonstration (AutoCAD software), equivalent to two experiments should be done. Total Laboratory work with additional activity should be equivalent to ten experiments.

Additional Activities:

1.Collect information of at least four Physicists with their work and report it in the journal.

2. Carry out mini-project upto the satisfaction of professor In-charge of practical.

3. Display any two computer aided demonstrations using computer simulations or animations

4. Present hands on activity upto the satisfaction of professor In-charge of practical