Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune - 5

First Year of B.Sc.
(2023 Course under NEP 2020)

Course Code: 23ScPhyU1101 Course Name: Mechanics and Properties of Matter

Teaching Scheme: 4 Hours/Week **Credit: 04**

Examination Scheme: CIA : 40 Marks **End-Sem : 60 Marks**

Prerequisite Courses:

- Familiarity with 10+2 level physics syllabus
- Familiarity with basic concepts of Motion, work and Energy, Fluid Mechanics, Properties of Matter

Course Objectives:

- To Study and. Demonstrate an understanding of Newton's laws and applying them in calculations of the motion of simple systems.
- Use the free body diagrams to analyze the forces on the object.
- Understand the concepts of energy, work, power, the concepts of conservation of energy and be able to perform calculations using them.
- Understand the concepts of elasticity and be able to perform calculations using them.
- To learn/Understand the concepts of
    1. Surface tension and viscosity and be able to perform calculations using them.
    2. Use of Bernoulli's theorem in real life problems.
    3. Demonstrate quantitative problem-solving skills in all the topics covered.

Course Outcomes:

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Define Newton's laws and apply them in calculations of the motion of simple systems.	1
CO 2	Summarize the Applications of Mechanics and Fluid Dynamics	2
CO 3	Apply Newton's Law and Basics Fluid dynamics in real life problems.	3
CO 4	Explain the free body diagrams to analyze the forces on the object.	4
CO 5	Evaluate different dynamics and static physical quantities for a given situation	5
CO 6	Solve the problems related to concepts of energy, work, power, the concepts of conservation of energy and being able to perform calculations using them.	6

Course Contents

Unit 1	Units, Physical Quantities, and Vectors	4
	• Standards and Units • Consistency and Conversions • Uncertainty and Significant Figures • Estimates and Orders of Magnitude • Vectors and Vector Addition • Components of Vectors • Unit Vectors • Products of Vectors	
Unit 2	Motion Along a Straight Line	4
	• Displacement, Time, and Average Velocity • Instantaneous Velocity • Average and Instantaneous Acceleration • Motion with Constant Acceleration • Freely Falling Bodies • Velocity and Position by Integration	
Unit 3	Motion in Two and Three Dimensions	5
	• Position and Velocity Vectors • The Acceleration Vector • Projectile Motion • Motion in a Circle • Relative Velocity	
Unit 4	Newton's Laws of Motion	4
	• Force and Interactions • Newton's First Law • Newton's Second Law • Mass and Weight • Newton's Third Law • Free-Body Diagrams	
Unit 5	Applying Newton's Laws	5
	• Newton's First Law: Particles in Equilibrium • Using Newton's Second Law: Dynamics of Particles • Frictional Forces • Dynamics of Circular Motion • The Fundamental Forces of Nature	
Unit 6	Work and Kinetic Energy	5
	• Work • Kinetic Energy and the Work–Energy Theorem • Work and Energy with Varying Forces • Power	

Unit 7	Potential Energy and Energy Conservation	5
	• Gravitational Potential Energy • Elastic Potential Energy • Conservative and Nonconservative Forces • Force and Potential Energy • Energy Diagrams	
Unit 8	Momentum, Impulse, and Collisions	5
	• Momentum and Impulse • Conservation of Momentum • Momentum Conservation and Collisions • Elastic Collisions • Center of Mass • Rocket Propulsion	
Unit 9	Rotation of Rigid Bodies	5
	• Angular Velocity and Acceleration • Rotation with Constant Angular Acceleration • Relating Linear and Angular Kinematics • Energy in Rotational Motion • Parallel-Axis Theorem • Moment-of-Inertia Calculations	
Unit 10	Dynamics of Rotational Motion	5
	• Torque • Torque and Angular Acceleration for a Rigid Body • Rigid-Body Rotation About a Moving Axis • Work and Power in Rotational Motion • Angular Momentum • Conservation of Angular Momentum • Gyroscopes and Precession	
Unit 11	Equilibrium and Elasticity	5
	• Conditions for Equilibrium • Center of Gravity • Solving Rigid-Body Equilibrium Problems 3 • Stress, Strain, and Elastic Moduli • Elasticity and Plasticity	
Unit 12	Fluid Mechanics	4
	• Density • Pressure in a Fluid • Buoyancy • Fluid Flow • Bernoulli's Equation • Viscosity and Turbulence	

Unit 13	Gravitation	4
	• Newton's Law of Gravitation • Weight • Gravitational Potential Energy • The Motion of Satellites • Kepler's Laws and the Motion of Planets • Spherical Mass Distributions • Apparent Weight and the Earth's Rotation	

References:

1. Sear's and Zimansky's University Physics with Modern Physics, Young and Freedman
2. Fundamentals of Physics, Resnick and Halliday
3. Classical Mechanics, J.C. Upadhyaya, Himalaya publishing Houses, 2nd Edition of 2005.
4. Introduction to Classical Mechanics, R. G. Takawale, P. S. Puranik, Tata McGraw Hill publishing Company Ltd., New Delhi.

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code: 23ScPhyU1102 Course Name : Experiments on Mechanics and Properties of Matter

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Familiarity with 10+2 level physics syllabus
- Familiarity with basic Science Instruments /Apparatus

Course Objectives:

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical and optical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Course Outcomes:

On completion of the course, student should be able to–

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Define Newton's laws and apply them in calculations of the motion of simple systems.	1
CO 2	Use the different measuring devices and meters to record the data with precision	2
CO 3	Apply the various procedures and techniques for the experiments. Apply the mathematical concepts/equations to obtain quantitative results	3
CO 4	Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.	4
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the result	5
CO 6	Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.	6

Course Contents

	1. Measurements using Vernier calipers. 2. Measurements using Micrometer screw gauge. 3. Measurements using Travelling Microscope. 4. Measurements using Spectrometer. 5. M. I. of flywheel. 6. Flat spiral spring 7. M. I. of Disc by Torsional Oscillations 8. Modulus of rigidity of Disc by Torsional Oscillations 9. Surface Tension by Capillary Rise Method 10. Coefficient of Viscosity by Stokes' Method 11. Study of law of Parallel axis for moment of inertia 12. Calculate g by using simple pendulum 13. Activity, Study Tour Report 14. Assignments, Demonstration 15. Virtual Lab etc.	

References:

1. An Advanced course in Practical Physics, D. Chattopadhyay and P. C. Rakshit
2. B. Sc. Practical Physics, C.L.Arora
3. B. Sc. Practical Physics, Harnam Singh
4. University Physics with Modern Physics, Sears and Zemansky
5. Fundamental of Physics, Halliday and Resnick
6. Fundamental of Optics, Francis Jenkins, Harvey White

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU1401 Course Name : Renewable Energy: Global Scenario

Teaching Scheme: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Course Prerequisites:

- Familiarization of basic knowledge of Renewable Energy
- Familiarity with basic Science Instruments /Apparatus

Course Objectives:

1. To create awareness among the students about the different types of non-conventional energy resources and emphasize its importance
2. Apply the concept and use of knowledge of the renewable energy sources course to real-life problems.

Course Outcomes:

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Understand different types of storage technologies	1
CO 2	Design a thermal storage system	2
CO 3	Identify the basic principles of electricity generation from wind energy systems and photovoltaic systems.	3
CO 4	Differentiate between generation of electricity from fossil fuels and renewable resources	4
CO 5	Review the present energy scenario and the need for energy storage	5
CO 6	Solve problems related to wind energy systems and	6

	PV systems.	

Course Contents

Unit 1	Introduction to Energy	15
	Introduction to Energy: Definition and units of energy, Forms of energy, Conservation of energy, Conventional energy sources, Role of energy in economic development and social transformation. Global Energy Scenario: Energy consumption in various sectors, projected energy consumption for the next century, exponential increase in energy consumption, impact of exponential rise in energy usage on global economy.	
Unit 2	Indian Energy Scenario	15
	Indian Energy Scenario: Energy resources available in India, urban and rural energy consumption, Final Energy Consumption, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features, National Green Tribunal (NGT) act, NGT activities.	

References:

1. Non -Conventional Energy Resources, third edition by B. H. Khan, Mc Graw Hil Education Pvt. Ltd
2. Silicon solar cells: advanced principles and practice. Sydney, M. Green, Bridge Printery, 1995.
3. Third Generation Photovoltaics. Berlin, Germany, M. Green, Springer-Verlag, 2003.
4. Crystalline silicon solar cells: advanced surface passivation and analysis, Aberle A. G.,

Sydney, Centre for Photovoltaic Engineering, UNSW, 1999.

5. The physics of solar cells, J. Nelson, Imperial college press, 2006.

5. G. D.Rai,-"Non Conventional Energy Sources", Khanna publisher, New Delhi

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU1501 Course Name: Lab Course on Energy Studies I

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Familiarity with Renewable and Non-Renewable Energy Sources

Course Objectives:

- To study the basic concepts regarding fundamentals of renewable energy
- To impart knowledge about importance of renewable energy and its practical applications

Course Outcomes:

On completion of the course, student should be able to–

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Operational experience on solar cooker	1
CO 2	Measurement of I-V characteristic of Mono-Crystalline and Poly-Crystalline PV module	2
CO 3	Measurement of illumination using Lux meter	3
CO 4	Learn the functioning of box-type solar cooker, hybrid solar cooker	4

CO 5	Covers the modern knowledge and on-field practices of solar PV systems.	5
CO 6	Characterize the biomass qualitatively and quantitatively	6

Course Contents

Unit 1		15
	1. Global Energy Scenario (Survey) 2. Solar Radiation and its measurements 3. Study of Photovoltaic Characteristics of Solar Cell (Variation of Intensity, Distance between Source and Solar Cell, and load) 4. Study of power versus load characteristics of Solar Power Photovoltaic Systems and 5. Study of Series and Parallel Combination of Solar Photovoltaic panels. 6. Study of Flat Plate Collector 7. Study of Evacuated Tube Collector 8. Study of optical properties of selective coatings. 9. Study of Solar Dryer (Hot Air Collector) 10. Study of Solar Still. 11. Study of solar concentrators 12. Study of Wind Energy and Technology 13. Estimation of energy content in the wind 14. Demonstration (Lab Safety) 15. Visit to solar energy farm (Solar PV plant/Wind energy/ Thermal energy/ Hydroelectric/Co generation plant).	

References:

1. Sukhatme S P, Solar Energy: principles of Thermal Collection and Storage, TataMcGrawHill.
2. Duffie J A, Beckman W A, Solar Engineering of Thermal Processes, Johnn Wiley.

3. Goswami D Y, Frank Kreith and Kreider J F, Principles of Solar Engineering, Taylor and Francis, USA.
4. Garg H P, Prakash S, Solar Energy: Fundamental and Application, Tata McGrowHill, New Delhi.
5. Kreith F, Kreider J F, Principles of Solar Engineering, McGrawHill.
6. Kreider J F, Kreith F, Solar Energy Handbook, McGrawHill.
7. Bent Sorensen, Renewable Energy, Academic press, New York.
8. Tiwari, G N, Solar Energy, Fundamentals Design, Modeling and Applications, Narosa, New Delhi

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU1601 Course Name: Basic Instrumentation Skills

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Familiarity with courses in first year B.Sc.
- Familiarity with topics learned in 23ScPhyU1101

Course Objectives:

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of optical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Course Outcomes:

On completion of the course, student should be able to–

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Find the various procedures and techniques for the experiments related to topics in 23ScPhyU3102.	1
CO 2	Generalize the mathematical concepts/equations to obtain quantitative results.	2
CO 3	Integrate the basic communication skills through working in groups in performing the laboratory experiments and by interpreting the result.	3
CO 4	Correlate the technical and evaluative skills using laboratory equipment, tools, and materials.	4
CO 5	Test practical knowledge by applying the experimental	5

	methods to correlate with the Physics theory.	
CO 6	Adapt the knowledge of mechanical, electrical and optical systems for various measurements.	6

Course Contents

Unit 1		15
	1. Units and Dimensions in physics experiments. 2. Measurements and Error analysis in Physics 3. Study of Digital Multimeter 4. Study of CRO 5. Study of Signal Generator 6. Study of Potential divider circuit 7. Study of Voltmeter. 8. Study of Ammeter. 9. Study of Bread Board 10. Study of DSO 11. Study of Transformer 12. Study of lenses 13. Study of Power Supply 14. Study of different types of sensors 15. Study of Telescope	

References:

1. An Advanced course in Practical Physics, D. Chattopadhyay and P. C. Rakshit
2. B. Sc. Practical Physics, C.L.Arora
3. B. Sc. Practical Physics, Harnam Singh
4. University Physics with Modern Physics, Sears and Zemansky
5. Fundamental of Physics, Halliday and Resnick
6. Fundamental of Optics, Francis Jenkins, Harvey White

Semester II Syllabus

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code: 23ScPhyU2101 Course Name : Electricity and Magnetism

Teaching Scheme: 4 Hours/Week **Credit: 04**

Examination Scheme: CIA : 40 Marks **End-Sem : 60 Marks**

Prerequisite Courses:

- Familiarity with 10+2 level physics syllabus
- Familiarity with basic concepts of calculus

Course Objectives:

- To Study Basics of Electrostatics and Magnetostatics in Vacuum and in Dielectric Media
- To enrich knowledge of Electricity and Magnetism through problem solving

Course Outcomes:

On completion of the course, student will be able to–

- Apply Classical Theory of Electromagnetics to simple systems

Course Contents

Unit 1	Electric Charge and Electric Field	5
	• Electric Charge • Conductors, Insulators, and Induced Charges • Coulomb's Law • Electric Field and Electric Forces • Electric-Field Calculations • Electric Field Lines • Electric Dipoles	
Unit 2	Gauss's Law	6
	• Charge and Electric Flux • Calculating Electric Flux • Gauss's Law • Applications of Gauss's Law • Charges on Conductors	
Unit 3	Electric Potentials	5
	• Electric Potential Energy • Electric Potential • Calculating Electric Potential • Equipotential Surfaces • Potential Gradient	

Unit 4	Capacitance and Dielectrics	6
	• Capacitors and Capacitance • Capacitors in Series and Parallel • Energy Storage in Capacitors and Electric-Field Energy • Dielectrics • Molecular Model of Induced Charge • Gauss's Law in Dielectrics	
Unit 5	Current, Resistance, and Electromotive Force	5
	• Current • Resistivity • Resistance • Electromotive Force and Circuits • Energy and Power in Electric Circuits • Theory of Metallic Conduction	
Unit 6	Direct-Current Circuits	5
	• Resistors in Series and Parallel • Kirchhoff's Rules • Electrical Measuring Instruments • R-C Circuits • Power Distribution Systems	
Unit 7	Magnetic Field and Magnetic Forces	5
	• Magnetism • Magnetic Field • Magnetic Field Lines and Magnetic Flux • Motion of Charged Particles in a Magnetic Field • Applications of Motion of Charged Particles • Magnetic Force on a Current-Carrying Conductor • Force and Torque on a Current Loop • The Direct-Current Motor • The Hall Effect	
Unit 8	Sources of Magnetic Field	5
	• Magnetic Field of a Moving Charge • Magnetic Field of a Current Element • Magnetic Field of a Straight Current-Carrying Conductor • Force Between Parallel Conductors • Magnetic Field of a Circular Current Loop	

	• Ampere's Law • Applications of Ampere's Law • Magnetic Materials	
Unit 9	Electromagnetic Induction	6
	• Induction Experiments • Faraday's Law • Lenz's Law • Motional Electromotive Force • Induced Electric Fields • Eddy Currents • Displacement Current and Maxwell's Equations • Superconductivity	
Unit 10	Inductance	6
	• Mutual Inductance • Self-Inductance and Inductors • Magnetic-Field Energy • The R-L Circuit • The L-C Circuit • The L-R-C Series Circuit	
Unit 11	Alternating Current	6
	• Phasors and Alternating Currents • Resistance and Reactance • The L-R-C Series Circuit • Power in Alternating-Current Circuits • Resonance in Alternating-Current Circuits • Transformers	

References:

1. Sear's and Zimansky's University Physics with Modern Physics, Young and Freedman
2. Fundamentals of Physics, Resnick and Halliday

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU2102 Course Name : Experiments based on Electricity and Magnetism

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Familiarity with 10+2 level physics syllabus
- Familiarity with basic Science Instruments /Apparatus

Course Objectives:

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical and optical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Course Outcomes:

On completion of the course, student should be able to–

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Find the various procedures and techniques for the experiments related to topics in 23ScPhyU3102.	1
CO 2	Generalize the mathematical concepts/equations to obtain quantitative results.	2
CO 3	Integrate the basic communication skills through working in groups in performing the laboratory experiments and by interpreting the result.	3
CO 4	Correlate the technical and evaluative skills using laboratory equipment, tools, and materials.	4

CO 5	Test practical knowledge by applying the experimental methods to correlate with the Physics theory.	5
CO 6	Adapt the knowledge of mechanical, electrical and optical systems for various measurements.	6

Course Contents

Unit 1		
	1. Verification of Kirchhoff's Current Law 2. Verification of Kirchhoff's Voltage Law 3. Vector diagrams of L - R circuit 4. Charging and discharging of Capacitor. 5. Self-inductance using Maxwell's Bridge. 6. Wheatstone's Bridge 7. Study of B-H curve 8. Study of Solenoid 9. Equivalent resistance in series and parallel 10. Equivalent capacitance in series and parallel 11. Dielectric constant 12. u1/u2 by Suspension Method 13. Activity, Study Tour Report 14. Assignments, Demonstration 15. Virtual Lab etc.	

References:

1. An Advanced course in Practical Physics, D. Chattopadhyay and P. C. Rakshit
2. B. Sc. Practical Physics, C.L.Arora
3. B. Sc. Practical Physics, Harnam Singh
4. University Physics with Modern Physics, Sears and Zemansky
5. Fundamental of Physics, Halliday and Resnick
6. Fundamental of Optics, Francis Jenkins, Harvey White

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code: 23ScPhyU2301 Course Name : Physics Minor Lab I

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Familiarity with courses in first year B.Sc.
- Familiarity with topics learned in 23ScPhyU3102

Course Objectives:

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of optical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Course Outcomes:

On completion of the course, student should be able to–

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Find the various procedures and techniques for the experiments related to topics in 23ScPhyU3102.	1
CO 2	Generalize the mathematical concepts/equations to obtain quantitative results.	2
CO 3	Integrate the basic communication skills through working in groups in performing the laboratory experiments and by interpreting the result.	3
CO 4	Correlate the technical and evaluative skills using laboratory equipment, tools, and materials.	4

CO 5	Test practical knowledge by applying the experimental methods to correlate with the Physics theory.	5
CO 6	Adapt the knowledge of mechanical, electrical and optical systems for various measurements.	6

Course Contents

Unit 1		
	1. Units and Dimensions in physics experiments. 2. Measurements and Error analysis in Physics 3. Measurements using Vernier caliper. 4. Measurements using Micrometer screw gauge. 5. Measurements using Travelling Microscope. 6. Measurements using Spectrometer. 7. Study of Digital Multimeter 8. Study of CRO 9. Study of Signal Generator 10. Study of Potential divider circuit 11. Study of Voltmeter. 12. Study of Ammeter. 13. Study of Bread Board 14. Activity, Study Tour Report 15. Assignments, Demonstration, Virtual Lab etc.	

References:

1. An Advanced course in Practical Physics, D. Chattopadhyay and P. C. Rakshit
2. B. Sc. Practical Physics, C.L.Arora
3. B. Sc. Practical Physics, Harnam Singh
4. University Physics with Modern Physics, Sears and Zemansky
5. Fundamental of Physics, Halliday and Resnick
6. Fundamental of Optics, Francis Jenkins, Harvey White

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU2401 Course Name: Conventional and Non-conventional energy sources

Teaching Scheme: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Course Prerequisites:

- Familiarization of basic knowledge of Non-conventional Energy Sources

Course Objectives:

1. To create awareness among the students about the different types of non-conventional energy resources and emphasize its importance
2. Apply the concept and use of knowledge of the renewable energy sources course to real-life problems.

Course Outcomes:

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Evaluation of the environmental effects of energy production and the relationship between energy generation and environment will be achieved	1
CO 2	Various types of environmental pollution and their effects will be explained	2
CO 3	Identify the basic principles of electricity generation from wind energy systems and photovoltaic systems.	3
CO 4	Differentiate between generation of electricity from fossil fuels and renewable resources	4
CO 5	Review the present energy scenario and the need for energy storage	5

CO 6	Solve problems related to wind energy systems and PV systems.	6

Course Contents

Unit 1		15
	Classification of Energy Sources, Primary Energy Sources, Secondary Energy Sources,Statistical Review of Primary Energy Sources, Energy Consumption Pattern in India, Impact of Excessive Use of Fossil Fuels on Environment	
Unit 2		15
	Features of Non-Conventional/Renewable Energy Sources, Statistical Review of Renewable Energy Sources, Benefits of Energy Conservation to a Nation, Energy Audit, Energy Management, Energy Strategy, Green energy, Clean energy, Green footprint, Carbon footprint etc.	

References:

1. Sukhatme S P, Solar Energy: principles of Thermal Collection and Storage, TataMcGrawHill.
2. Duffie J A, Beckman W A, Solar Engineering of Thermal Processes, Johnn Wiley.
3. Goswami D Y, Frank Kreith and Kreider J F, Principles of Solar Engineering, Taylor and Francis, USA.
4. Garg H P, Prakash S, Solar Energy: Fundamental and Application, Tata McGrowHill, New Delhi.
5. Kreith F, Kreider J F, Principles of Solar Engineering, McGrawHill.
6. Kreider J F, Kreith F, Solar Energy Handbook, McGrawHill.
7. Bent Sorensen, Renewable Energy, Academic press, New York.
8. Tiwari, G N, Solar Energy, Fundamentals Design, Modeling and Applications, Narosa, New Delhi

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU2501 Course Name: Energy Studies II

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Familiarity with Renewable and Non-Renewable Energy Sources

Course Objectives:

- To study the basic concepts regarding fundamentals of renewable energy
- To impart knowledge about importance of renewable energy and its practical applications

Course Outcomes:

On completion of the course, student should be able to–

CO No	Course Outcomes (COs)	Bloom's Cognitive level
CO 1	Operational experience on solar cooker	1
CO 2	Measurement of I-V characteristic of Mono-Crystalline and Poly-Crystalline PV module	2
CO 3	Measurement of illumination using Lux meter	3
CO 4	Learn the functioning of box-type solar cooker, hybrid solar cooker	4

CO 5	Covers the modern knowledge and on-field practices of solar PV systems.	5
CO 6	Characterize the biomass qualitatively and quantitatively	6

Course Contents

Unit 1		15
	1. Determination of Calorific value of Wood 2. Determination of Calorific value of Cow dung 3. Determination of heat Loss Coefficient in Flat Plate Collector. 4. Performance Evaluation of Box Type Solar Cooker 5. Performance Evaluation of Concentrating Type Solar Cooker 6. Solar radiation measurements by Sun meter 7. Determine efficiency of solar still 8. Inverter Bulb 9. Solar chimney 10. Study of Energy Storage Systems 11. Biomass energy 12. Study of Biogas plant 13. Estimation of Solar constant 14. Charging and discharing of Electric Vehicle Battery 15. Visit to solar energy farm (Solar PV plant/Wind energy/ Thermal energy/ Hydroelectric Co generation plant).	

References:

1. Sukhatme S P, Solar Energy: principles of Thermal Collection and Storage, TataMcGrawHill.
2. Duffie J A, Beckman W A, Solar Engineering of Thermal Processes, Johnn Wiley.
3. Goswami D Y, Frank Kreith and Kreider J F, Principles of Solar Engineering, Taylor and Francis, USA.
4. Garg H P, Prakash S, Solar Energy: Fundamental and Application, Tata McGrowHill, New Delhi.
5. Kreith F, Kreider J F, Principles of Solar Engineering, McGrawHill.
6. Kreider J F, Kreith F, Solar Energy Handbook, McGrawHill.

7. Bent Sorensen, Renewable Energy, Academic press, New York.
8. Tiwari, G N, Solar Energy, Fundamentals Design, Modeling and Applications, Narosa, New Delhi

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.

(2023 Course under NEP 2020)

Course Code: 23ScPhyU2601 Course Name: Computational Physics Skills I

Teaching Scheme: 4 Hours/Week **Credit: 02**

Examination Scheme: CIA: 20 Marks **End-Sem : 30 Marks**

Course Prerequisites:

- Completed first year course 23ScPhyU1101

Course Objectives:

- To understand basic programming in Python using Numpy and Matplotlib
- To get familiar with Jupyter notebook, Colab
- To understand solving simple problems using Python programming

Course Outcomes:

	Course Outcomes (COs)	**Bloom's Cognitive level**
CO 1	Explain various problems using algorithm	1
CO 2	Compare Jupyter Notebook Vs Colab	2
CO 3	Apply programming techniques to solve simple physics problems	3
CO 4	Analyze the errors in Python program	4
CO 5	Determine algorithm to solve simple physics problems using Numpy and Matplotlib for plotting	5
CO 6	Solve a given problem based on Mechanics using Python program	6

Course Content

Unit 1		15
	1. Introduction to Python script files 2. Introduction to Jupiter Notebook 3. Plotting one dimensional functions using Matplotlib 4. Displacement and velocity in motion with constant acceleration 5. Projectile Motion 6. Charging and Discharging of Capacitor 7. Motion of charged particle in external magnetic field 8. Ohm's law 9. Calculate Moment of Inertia of non-uniform disc	

	10. Random numbers generation using python 11. Plotting probability density function of random numbers generated using various methods 12. Plotting two dimensional functions using Matplotlib 13. Writing data files in Python 14. Study Tour Report 15. Assignments, Demonstration etc.	

References:

1. Scientific Computation in Python (2nd Edition), Abhikit Kar Gupta, Techno World Publication
2. Computational Physics: Problem Solving with Python, 4th Edition, Rubin H. Landau, Manuel J. Páez, Cristian C. Bordeianu, Wiley-VCH
3. Introduction to Methods of Numerical Analysis, (5th Edition), S. S. Sastry, Prentice Hall India
4. http://www.python.org
5. https://numpy.org/

Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune - 5

First Year of B.Sc.
(2023 Course under NEP 2020)
Course Code: 23ScPhyU1901 Course Name: Astronomy in India

Teaching Scheme: 2 Hours/Week **Credit: 02**

Examination Scheme: CIA : 20 Marks **End-Sem : 30 Marks**

Prerequisite Courses:

- Familiarity with 10+2 level physics syllabus

Course Objectives:

- To understand fundamental concepts of astronomy, including the structure of the Sun, Solar System, stars, galaxies, and cosmology.
- To study the principles of space and astrophysics, including general relativity and gravitation.
- To explore astronomical observatories and research facilities in India and their contributions to astrophysics.
- To analyze the role of observational and theoretical astronomy in understanding celestial phenomena.
- To develop problem-solving skills in astrophysical applications using mathematical and computational approaches.

Course Outcomes:

CO No.	**Course Outcomes (COs)**	**Bloom's Cognitive Level**
CO1	Recall fundamental concepts of astronomy, including the Sun, Solar System, stars, galaxies, and cosmology.	1
CO2	Explain key principles of space physics, general relativity, and gravitation. Interpret their significance in astrophysical phenomena.	2
CO3	Apply theoretical frameworks to analyze planetary motion, stellar evolution, and galaxy dynamics..	3
CO4	Analyze observational techniques used in Indian astronomical facilities and evaluate their contributions to astrophysical research.	4
CO5	Evaluate the role of radio, optical, and space-based observatories in advancing modern astronomy. Assess their impact on astrophysical discoveries.	5

CO6	Interpret astronomical data to understand celestial events and phenomena. Assess their significance in astrophysical contexts.	6

Course Contents

Unit 1	Chapter 1 Preliminaries	15
	1. The Sun 2. Solar System Studies 3. Stars and Galaxies 4. Galaxies and Cosmology 5. Space and Astrophysics 6. General Relativity and Gravitation	
Unit 2	Astronomical Facilities in India	15
	1. Vainu Bappu Observatories 2. Rangapur Observatory 3. Naital Observatory 4. Gurushikhar IR Observatory 5. Kodaikanal Observatory 6. Udaipur Solar Observatory 7. Radio Astronomy: NCRA, Raman Research Instritute, Bengaluru 8. PRL, Ahamdabad.	

References:

1) An Introduction to Astrophysics - Baidyanath Basu, Tanuka Chattopadhyay
2) Astronomy in India- Rajesh khochar and Jayanti Narlikar
3) Astrophysics and Cosmology- Roger Blandford, David Gross.
4) Astronomy and Astrophysics - Mohit Kumar Sharma