Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

(Autonomous)

Four Year B.Sc. Degree Program in Physics

(Faculty of Science & Technology)

CBCS Syllabus

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

For Department of Physics

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

Title of the Programme: F.Y.B.Sc. (Physics)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Statistics and related subjects, the Board of Studies in Statistics at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc. Statistics, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023. Physics is concerned with the study of the universe from the smallest to the largest scale: it is about unraveling 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.

• Programme Specific Outcomes (PSOs)

PSO1: Understand basic mechanics and properties of matter.

PSO2: Illustrate the principles of electricity, magnetism, thermodynamics, optics and spectroscopy.

PSO3: Identify, formulate and analyze complex problems using basic principles of mathematics, physics and statistics.

PSO4: Design, construct and analyze basic electronic and digital circuits.

PSO5: Understand the basics of programming language and apply it to various numerical problems

PSO6: Develop effective communication skills

PSO7: Develop experimental skills and independent work culture through a series of experiments that compliment theories and projects.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Physics

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	Prof. (Dr.) P. C. Pingale	Chainman BoS
2.	Prof. (Dr.) S. S. Veer	Member, Expert from SPPU, Pune
3.	Prof. (Dr.) K. Y. Rajpure	Member, Expert from Shivaji University, Kolhapur
4.	Prof. (Dr.) K.R. Priolkar	Member, Expert from Goa University
5.	Mr. Subhash Zambare	Representative From Industry, Gaser Metacoat, Pune
6.	Mr. Swapnil Nardekar	Alumni and Research Scholar Jeju National University, South Korea
7.	Prof. (Dr.) A. E. Kalange	Member, Vice Principal
8.	Dr. R. D. Mane	Member
9.	Dr. R. T. Sapkal	Member, Vice Principal
10.	Dr. S. B. Kulkarni	Member
11.	Mr. S. B. Kakade	Member
12.	Dr. V. S. Mohite	Member
13.	Dr. S. J. Rajoba	Member
14.	Ms S E Bhosale	Member
15.	Mr. S. S. Mhaske	Member
16.	Dhanshree Hole, TYBSc	Student Representative

17.	Aditya Sorte, TYBSc	Student Representative
18.	Saurabh Malve, MSc II	Student Representative
19.	Asmita Ghadge, MSc II	Student Representative

Credit Distribution Structure for F.Y.B.Sc.-2023-2024 (Physics)

Level	Semester	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	PHY-101-MJM: Mechanics & Properties of Matter PHY-102-MJM: Electromagnetics PHY-103-MJM: Physics Practical-I Credits-2+2+2	--	--	PHY-116-OE: Astronomy-I [आकाशाशी जडले नाते - भाग १] PHY-117-OE: Astronomy-I [आकाशाशी जडले नाते - भाग १] Practical Credit- 2+2	PHY-121-VSC : Physics Workshop Skills-I PHY-126-SEC: Applications of Internet of Things-I Credit- 2+2	ENG-131-AEC: Functional English-I PHY-135-VEC: Environmental Science PHY-137-IKS: Knowledge System of Bharata Credit- 2+2+2	CC1: To be selected from the Basket Credit- 2	22	UG Certificate 44
	II	PHY-151-MJM: Heat & Thermodynamics PHY-152-MJM - Physics Principles & its Application PHY-153-MJM: Physics Practical-II Credits-2+2+2	--	PHY-161-MN: Basic Physics Credits-2	PHY-166-OE: Astronomy-II [आकाशाशी जडले नाते - भाग २] PHY-167OE: Astronomy-II [आकाशाशी जडले नाते - भाग २] Practical Credit- 2+2	PHY-171-VSC: - Physics Workshop Skills-II PHY-176-SEC : Applications of Internet of Things-II Credit- 2+2	ENG-181-AEC : Functional English-II PHY-185-VEC : Value Education & Physics Credit- 2+2	**CC2:** To be selected from the Basket Credit- 2	22	
	Cum Cr.	12	--	2	8	8	10	4	44	

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	PHY-101-MJM	Mechanics & Properties of Matter	Theory	2
	Major Mandatory	PHY-102-MJM	Electromagnetics	Theory	2
	Major Mandatory	PHY-103-MJM	Physics Practical-I	Practical	2
	Open Elective (OE)	PHY-116-OE	Astronomy-I [आकाशाशी जडले नाते - भाग १]	Theory	2
	Open Elective (OE)	PHY-117-OE	Astronomy-I [आकाशाशी जडले नाते - भाग १] Practical	Practical	2
	Vocational Skill Course (VSC)	PHY-121-VSC	Physics Workshop Skills-I	Theory	2
	Skill Enhancement Course (SEC)	PHY-126-SEC	Applications of Internet of Things-I	Practical	2
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English-I	Theory	2
	Value Education Course (VEC)	PHY-135-VEC	Environmental Science	Theory	2
	Indian Knowledge System (IKS)	PHY-137-IKS	Knowledge System of Bharata	Theory	2
	Co-curricular Course (CC)	-	To be Selected from the Basket	Theory	2
				Total Credits Semester-I	**22**
II	Major Mandatory	PHY-151-MJM	Heat & Thermodynamics	Theory	2
	Major Mandatory	PHY-152-MJM	Physics Principles & its Application	Theory	2
	Major Mandatory	PHY-153-MJM	Physics Practical-II	Practical	2
	Minor	PHY-161-MN	Basic Physics	Theory	2
	Open Elective (OE)	PHY-166-OE	Astronomy-II [आकाशाशी जडले नाते - भाग २]	Theory	2
	Open Elective (OE)	PHY-167-OE	Astronomy-II [आकाशाशी जडले नाते - भाग २] Practical	Practical	2
	Vocational Skill Course (VSC)	PHY-171-VSC	Physics Workshop Skills-II	Practical	2
	Skill Enhancement Course (SEC)	PHY-176-SEC	Applications of Internet of Things-II	Practical	2
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	2
	Value Education Course (VEC)	PHY-185-VEC	Value Education & Physics	Theory	2
	Co-curricular Course (CC)	-	To be Selected from the Basket	Theory	2
				Total Credits Semester-II	**22**
				Cumulative Credits Semester I + Semester II	**44**

• Programme Outcomes (POs)

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

Course Structure for F.Y.B.SC. Physics (2023 Pattern)

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics (2023 Pattern)

Name of the Programme : B.Sc. Physics
Programme Code : USPH
Class : F.Y.B.Sc.
Semester : I
Course Type : Major Mandatory (Theory)
Course Code : PHY-101-MJM
Course Title : Mechanics & Properties of Matter
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

The student will learn:

1. Basic definitions (stress, strain, Hooke's law, and Poisson's ratio) of elasticity
2. Definition of Cantilever and expression for depression and elevation
3. Bending of beams and expression for bending moment
4. To carry out experiments to understand the laws and concepts of Physics.
5. To apply the theories learnt and the skills acquired to solve real time problems.
6. Torsional Pendulum - determination of rigidity modulus and time period.
7. Stress – Strain Diagram

Course Outcomes:

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 equation of motion to one or two dimensions of the system in order to understand kinematics of the body under the various conditions of applied force

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

Topics and Learning Points

UNIT 1: Motion (5L)

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 (6L)

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 (12L)

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 (7L)

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 a0

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

The understanding and application of energy concepts are fundamental to disciplinary knowledge in physics.

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

Elasticity is a key concept in physics, and understanding it is crucial for disciplinary knowledge.

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

Justification: Surface tension and viscosity are essential concepts within the discipline of physics.

PO2: Critical Thinking and Problem Solving

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

The application of Bernoulli's Principle involves critical thinking and problem-solving skills.

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

Quantitative problem-solving is a central aspect of critical thinking in physics.

PO3: Social Competence

All COs: CO1 to CO7Weightage: 1

The technical nature of the content in CO1 to CO7 is not directly related to social competence (PO3).

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 CO1 to CO7.

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 equation of motion to one or two dimensions of the system in order to understand kinematics of the body under the various conditions of applied force.Weightage: 3

The application of the equation of motion (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

CO7. Apply knowledge in understanding the flow of liquid and surface tension applied on the surface of liquid.Weightage: 2

The application of knowledge in understanding the flow of liquids (CO7) has some relevance to environmental and sustainability considerations (PO8).

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7Weightage: 3

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

(2023 Pattern)

Name of the Programme : B.Sc. Physics

Programme Code : USPH

Class : F.Y.B.Sc.

Semester : I

Course Type : Major Mandatory (Theory)

Course Code : PHY-102-MJM

Course Title : Electromagnetics

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
3. To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.
5. To impart knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.
6. To introduce various co-ordinate system and review of Maxwell’s equations.
7. To identify, formulate and solve fields and electromagnetic waves propagation problem

Course Outcomes:

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. Understand the basic mathematical concepts related to electromagnetic vector fields.

CO8. Problem solving ability

Topics and Learning Points

UNIT 1: Electrostatics (8L)

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 (7L)

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 (9L)

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 (6L)

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

Justification

PO1: Disciplinary Knowledge

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

Understanding electric force, field, and potential is fundamental to disciplinary knowledge in electromagnetism.

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

The ability to calculate electrostatic field and potential using Coulomb's law and Gauss's law is a crucial component of disciplinary knowledge.

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

Understanding dielectrics and their impact on electric fields is essential in the discipline of electromagnetism.

PO2: Critical Thinking and Problem Solving

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

Application of Biot-Savart's and Ampere's law involves critical thinking and problem-solving skills in the context of magnetic fields.

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

Quantitative problem-solving is a central aspect of critical thinking in electromagnetism.

PO3: Social Competence

All COs: CO1 to CO7Weightage: 1

The technical nature of the content in CO1 to CO7 is not directly related to social competence (PO3).

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 CO1 to CO7.

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

CO7. Understand the basic mathematical concepts related to electromagnetic vector fields.Weightage: 3

Understanding mathematical concepts related to electromagnetic vector fields 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

All COs: CO1 to CO7Weightage: 1

The direct connection to environment and sustainability (PO8) is weak in the technical content areas covered.

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7Weightage: 3

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

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics (2023 Pattern)

Name of the Programme : B.Sc. Physics

Programme Code : USPH

Class : F.Y.B.Sc.

Semester : I

Course Type : Major Mandatory (Practical)

Course Code : **PHY-103-MJM**

Course Title : Physics Practical-I

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

1. To help develop habit of practice in the experimental skill developments.
2. To develop experimental skills in due course of time.
3. To introduce students to different apparatus & instruments, and demonstrate the skill based experiments.
4. To explain association between theoretical ideas and experimental skills.
5. To emphasize the need of practice in the skill developments.
6. To develop experimental skills in due course of time.
7. To help grow confidence while performing the practical individually.

Course 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. To correlate their physics theory concepts through practical.

CO7. To understand and practice the skills while doing physics practical with Problem solving ability & Critical Analysis

List of Practicals

1. Mechanics

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

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	3				2	2	2		3
CO 2	3			3	2	2	2		3
CO 3	3				2	2	2	2	3
CO 4		3			2	2	2		3
CO 5			3		2	2	2		3
CO 6					2	2	2		3
CO7		7			2	2	2		3

Justification

PO1: Disciplinary Knowledge

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

Acquiring technical and manipulative skills in the laboratory is directly related to gaining disciplinary knowledge (PO1).

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

The ability to collect and interpret data through observation and experimentation is crucial for developing disciplinary knowledge (PO1).

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

Weightage: 3

Understanding laboratory procedures, safety, and scientific methods directly contributes to disciplinary knowledge (PO1).

PO2: 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 in the laboratory setting involves critical thinking and contributes to problem-solving skills (PO2).

CO7. To understand and practice the skills while doing physics practical with Problem-solving ability & Critical Analysis.Weightage: 3

Understanding and practicing physics skills in the laboratory setting with problem-solving ability and critical analysis directly align with critical thinking and problem-solving (PO2).

PO3: Social Competence

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

Weightage: 3

Collaborative learning and teamwork in the laboratory contribute to social competence (PO3).

PO4: Research-related Skills and Scientific Temper

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

Weightage: 3 (Strong or direct relation)

Collecting data through observation and experimentation is a fundamental aspect of research-related skills and scientific temper (PO4).

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO7

Weightage: 2 (Moderate or partial relation)

The laboratory activities involve aspects that may contribute to trans-disciplinary knowledge (PO5).

PO6: Personal and Professional Competence

All COs: CO1 to CO7

Weightage: 2 (Moderate or partial relation)

The skills acquired in the laboratory contribute to personal and professional competence (PO6).

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO7

Weightage: 2 (Moderate or partial relation)

Adhering to laboratory procedures, safety, and ethical considerations contributes to effective citizenship and ethics (PO7).

PO8: Environment and Sustainability

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

Weightage: 2 (Moderate or partial relation)

Understanding laboratory procedures, safety, and scientific methods can have implications for environment and sustainability (PO8).

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7Weightage: 3 (Strong or direct relation)

The continuous learning aspect is inherent in laboratory activities, contributing to self-directed and life-long learning (PO9).

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics
(2023 Pattern)

Name of the Programme	**:** B.Sc. Physics
Programme Code	**:** USPH
Class	**:** F.Y.B.Sc.
Semester	**:** I
Course Type	**:** OE Theory
Course Code	**:** PHY-116-OE
Course Title	**:** Astronomy-I [आकाशाशी जडले नाते - भाग १]
No. of Credits	**:** 02
No. of Teaching Hours	**:** 30

Course Objectives:

A) अभ्यासक्रमाची उद्दिष्टे

१. विद्यार्थी पृथ्वी, चंद्र आणि सूर्य यांच्यातील परस्परसंबंधांचे अन्वेषण आणि वर्णन करतील.

२.. विद्यार्थी सूर्यमालेतील ग्रहांची तुलना करतील.

३. विद्यार्थी प्रकाश, सूर्य आणि इतर तारे यांच्यातील संबंध ओळखतील.

४. विद्यार्थी ताऱ्याचे जीवनचक्र समजावून सांगतील.

५. विद्यार्थी विश्वाची रचना आणि इतिहासाचे विश्लेषण करतील.

६. विद्यार्थी प्रमुख नक्षत्र ओळखतील आणि ते आकाशात का फिरताना दिसतात ते स्पष्ट करतील

७. विद्यार्थी सूर्यमालेची उत्पत्ती शास्त्रीय भाषेत सांगतील

Course Outcomes:

B) अभ्यासक्रमाची फलिते

CO1. खगोलशास्त्र म्हणजे काय? याचा अभ्यास कसा केला जातो? खगोलशास्त्राचा अभ्यास करण्याचे परिणाम काय आहेत आशा सर्व प्रश्नाची उत्तरे विद्यार्थी स्वत शोधू शकतील.

CO2. खगोलशास्त्रातील घटकांची माहिती सांगता येईल

CO3. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न

करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणाऱ्या ताऱ्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट ताऱ्यांचे नाव सांगु शकतील.

CO4. ताऱ्यांचा रंग पाहून, त्याची दीप्ती (Magnitude) किती आहे हे सांगु शकतील

CO5. ताऱ्यांचे वर्गीकरण करता येईल

CO6. सौर मंडळात तसेच दूरच्या ताराभोवती भ्रमण करणार्या जगात (ग्रह, चंद्र, रिंग, लघुग्रह आणि धूमकेतू) याबद्दल माहिती सांगता येईल.

CO7. तारे व आकाशगंगा यांच्या दृष्टीकोनातून हे सांगता येईल की आपल्या विश्वाचे अस्तित्व कसे आले आणि कसे कार्य करते.

CO8. अवकाश निरीक्षण करताना अवकाश नकाशाद्वारे ताऱ्यांना लगेच ओळखू शकतील.

CO9. इंटरनेटद्वारे खगोलशास्त्रावरील माहिती मिळऊन नवीनच लागलेल्या शोधाबद्दल माहिती घेता येईल.

CO10. वेग वेगळ्या सॉफ्टवेअर्स चा वापर करून खगोलशास्त्राचा अभ्यास करू शकतील.

Topics and Learning Points

प्रकरणे

प्रकरण पहिले : धरतीमातेला सोडून जाताना (०७ तास)

१. जेव्हा सूर्य पश्चिमेकडे उगवला

२. काळ्याकुट्ट आकाशात तळपणारा सूर्य कुठे असेल ?

३. चंद्रावरून आकाशदर्शन

४. ग्रहमालीकेतील अद्भुत दृश्ये

प्रकरण दुसरे : ग्रहमालीकेच्या परिसरात (०८ तास)

१. ग्रहमालीकेची व्याप्ती

२. ग्रहांच्या गतीचे विज्ञान

३. काही ऐतिहासिक किस्से

४. सूर्यमालिकेची उत्पत्ती

५. ग्रहमालेतल्या टकरी

प्रकरण तिसरे : भौतिकशास्त्राचा पाया (०७ तास)

१. हे विश्वचि प्रयोगांचे घर

२. गुरुत्वाकर्षण

३. विद्युचुंबकीय शास्त्र

४. तीव्र आणि मंद क्रिया

प्रकरण चौथे : दुर्बिणीच्या जगात (०८ तास)

१. दुर्बिणीच्या पूर्वी

२. गॅलिलिओची दुर्बीण

३. हर्शल ते केक: दुर्बिणीचा वाढता आवाका

४ दृश्य प्रकाशाची छाननी करणारी साधने

५. रेडिओ दुर्बिणी

६. अंतराळातून विश्वाचे वेध

References

संदर्भ ग्रंथ/ पुस्तके :

१. आकाशाशी जडले नाते - जयंत नारळीकर

२. आकाश कसे पहावे -आनंद घैसास

३. आपली सूर्यमाला -आनंद घैसास

४. दुर्बिणी आणि वेधशाळा -आनंद घैसास

५. आकाशगंगा - शिरीष पै

६. आकाशगमती - हेमंत मोने

७. आकाश कवेत घेताना - मानसी कुलकर्णी

	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	1		
CO 2	3			3	2	2	1		
CO 3		3			2	2	1	2	
CO 4		3			2	2	1		
CO 5			1		2	2	1		
CO 6					2	2	1		
CO7					2	2	1		
CO8					2	2	1		
CO9					2	2	1		3
CO10					2	2	1		

Justification

PO1: Disciplinary Knowledge

CO1. खगोलशास्त्र म्हणजे काय? याचा अभ्यास कसा केला जातो? खगोलशास्त्राचा अभ्यास करण्याचे परिणाम काय आहेत आशा सर्व प्रश्नाची उत्तरे विद्यार्थी स्वत शोधू शकतील. Weightage: 3

This outcome directly assesses the student's understanding of what astronomy is and their ability to articulate the results and impact of studying astronomy.

CO2. खगोलशास्त्रातील घटकांची माहिती सांगता येईल Weightage: 3

This outcome assesses the knowledge of the components of astronomy, directly contributing to disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

CO3. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणार्या तार्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट तार्यांचे नाव सांगु शकतील. Weightage: 3

This outcome involves hands-on experience and problem-solving skills, contributing to critical thinking in astronomy.

CO4. तार्यांचा रंग पाहून, त्याची दीप्ती (Magnitude) किती आहे हे सांगु शकतील Weightage: 3

Analyzing the color and brightness of stars involves critical thinking and problem-solving skills in the context of observational data.

PO3: Social Competence

CO5. ताऱ्यांचे वर्गीकरण करता येईल Weightage: 1

The skill of classifying stars is not strongly related to social competence.

PO4: Research-related Skills and Scientific Temper

CO2. खगोलशास्त्रातील घटकांची माहिती सांगता येईल. Weightage: 3

Providing information about the components of astronomy contributes to research-related skills and scientific temper.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO10 Weightage: 2

The study of astronomy can have connections to various disciplines, contributing to trans-disciplinary knowledge.

PO6: Personal and Professional Competence

All COs: CO1 to CO10Weightage: 2

The skills acquired through the study of astronomy contribute to personal and professional competence.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO10 Weightage: 1

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

PO8: Environment and Sustainability

CO3. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणार्या तार्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट तार्यांचे नाव सांगु शकतील. Weightage: 2

The environmental aspect is considered when choosing not to use a telescope if not necessary.

PO9: Self-directed and Life-long Learning

CO9. इंटरनेटद्वारे खगोलशास्त्रावरील माहिती मिळऊन नवीनच लागलेल्या शोधाबद्दल माहिती घेता येईल. Weightage: 3

Seeking information on astronomy through the internet directly aligns with self-directed and life-long learning.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics (2023 Pattern)

Name of the Programme : B.Sc. Physics

Programme Code : USPH

Class : F.Y.B.Sc.

Semester : I

Course Type : OE Practical

Course Code : PHY-117-OE

Course Title : Astronomy-I [आकाशाशी जडले नाते - भाग १] Practical

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

A) अभ्यासक्रमाची उद्दिष्टे

१. विद्यार्थी पृथ्वी, चंद्र आणि सूर्य यांच्यातील परस्परसंबंधांचे अन्वेषण आणि वर्णन करतील.

२.. विद्यार्थी सूर्यमालेतील ग्रहांची तुलना करतील.

३. विद्यार्थी प्रकाश, सूर्य आणि इतर तारे यांच्यातील संबंध ओळखतील.

४. विद्यार्थी ताऱ्याचे जीवनचक्र समजावून सांगतील.

५. विद्यार्थी विश्वाची रचना आणि इतिहासाचे विश्लेषण करतील.

६. विद्यार्थी प्रमुख नक्षत्र ओळखतील आणि ते आकाशात का फिरताना दिसतात ते स्पष्ट करतील

७. विद्यार्थी सूर्यमालेची उत्पत्ती शास्त्रीय भाषेत सांगतील

Course Outcomes:

B) अभ्यासक्रमाची फलिते

CO1. खगोलशास्त्रातील घटकांची माहिती सांगता येईल

CO2. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणाऱ्या ताऱ्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट ताऱ्यांचे नाव सांगु शकतील.

CO3. ताऱ्यांचा रंग पाहून, त्याची दीप्ती (Magnitude) किती आहे हे सांगु शकतील

CO4. ताऱ्यांचे वर्गीकरण करता येईल

CO5. सौर मंडळात तसेच दूरच्या ताराभोवती भ्रमण करणार्या जगात (ग्रह, चंद्र, रिंग, लघुग्रह आणि धूमकेतू) याबद्दल माहिती सांगता येईल.

CO6. तारे व आकाशगंगा यांच्या दृष्टीकोनातून हे सांगता येईल की आपल्या विश्वाचे अस्तित्व कसे आले आणि कसे कार्य करते.

CO7. अवकाश निरीक्षण करताना अवकाश नकाशाद्वारे ताऱ्यांना लगेच ओळखू शकतील.

CO8. इंटरनेटद्वारे खगोलशास्त्रावरील माहिती मिळऊन नवीनच लागलेल्या शोधाबद्दल माहिती घेता येईल.

CO9. वेग वेगळ्या सॉफ्टवेअर्स चा वापर करून खगोलशास्त्राचा अभ्यास करू शकतील.

Topics and Learning Points

प्रात्यक्षिक/ प्रयोगांची यादी

1. आकाशाची ओळख (ग्रह, तारे, नक्षत्र)
2. आकाशाच्या नकाशाचा आभ्यास
3. दोन ताऱ्यामधील अंतर मोजणे
4. सप्तश्री किवा शार्मिष्ठा तारकासमूहावरून ध्रुवतारा ओळखणे
5. ध्रुवताऱ्यावरून दिशा ओळखणे
6. अक्षांश ओळखणे
7. तारकासमुह व नक्षत्रांच्या संकल्पनेचा आभ्यास करणे

	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	1		
CO 2		3	2	3		2	1		
CO 3		3	2			2	1		
CO 4			2			2	1		
CO 5			2	3	3	2	1		
CO 6			2			2	1		
CO7			2			2	1		
CO8			2			2	1	2	
CO9			2			2	1		

Justification

PO1: Disciplinary Knowledge

CO1. खगोलशास्त्रातील घटकांची माहिती सांगता येईल Weightage: 3

This outcome directly assesses the student's knowledge of the components of astronomy, contributing to disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

CO2. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणार्या तार्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट तार्यांचे नाव सांगु शकतील.Weightage: 3

This outcome involves practical application and identification of specific stars, requiring critical thinking and problem-solving skills.

CO3. तार्यांचा रंग पाहून, त्याची दीप्ती (Magnitude) किती आहे हे सांगु शकतील Weightage: 3

Analyzing the color and brightness of stars involves critical thinking and problem-solving skills.

PO3: Social Competence

All COs: CO1 to CO9Weightage: 2

Some aspects of astronomy, such as observing celestial events, can be shared socially, contributing to social competence.

PO4: Research-related Skills and Scientific Temper

CO2. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणार्या तार्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट तार्यांचे नाव सांगु शकतील. Weightage: 3

Research-related skills are involved in the practical use of telescopes and identification of specific stars.

CO5. सौर मंडळात तसेच दूरच्या ताराभोवती भ्रमण करणार्या जगात (ग्रह, चंद्र, रिंग, लघुग्रह आणि धूमकेतू) याबद्दल माहिती सांगता येईल.Weightage: 3

Knowledge about celestial bodies in the solar system requires research-related skills and contributes to scientific temper.

PO5: Trans-disciplinary Knowledge

CO5. सौर मंडळात तसेच दूरच्या ताराभोवती भ्रमण करणार्या जगात (ग्रह, चंद्र, रिंग, लघुग्रह आणि धूमकेतू) याबद्दल माहिती सांगता येईल. Weightage: 3

Understanding celestial bodies in the solar system involves knowledge from various disciplines, contributing to trans-disciplinary knowledge.

PO6: Personal and Professional Competence

All COs: CO1 to CO10 Weightage: 2

The skills acquired through the study of astronomy contribute to personal and professional competence.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO10Weightage: 1 (Weak or low relation)

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

PO8: Environment and Sustainability

CO3. खगोलशास्त्रामध्ये टेलेस्कोप (दुर्बीण) जरी महत्त्वाची वस्तू असली तरी दुर्बीणीचा वापर न करता विद्यार्थी सुरवातीला नुसत्या डोळ्यांनी दिसणार्या तार्यांचा अभ्यास करून तारका समूह ओळखणे, विशिष्ट तार्यांचे नाव सांगु शकतील. Weightage: 2 (Moderate or partial relation)

The environmental aspect is considered when choosing not to use a telescope if not necessary.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics (2023 Pattern)

Name of the Programme : B.Sc. Physics
Programme Code : USPH
Class : F.Y.B.Sc.
Semester : I
Course Type : VSC Theory
Course Code : PHY-121-VSC
Course Title : Physics Workshop Skills-I
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode
2. To understand the concepts and significance of the various physical phenomena.
3. To carry out experiments to understand the laws and concepts of Physics.
4. To apply the theories learnt and the skills acquired to solve real time problems.
5. To acquire a wide range of problem-solving skills, both analytical and computational and to apply them.
6. To endow the students with creative and analytical skills; this will equip them to become entrepreneurs.
7. To kindle the interest for research in students

Course Outcomes:

The students will acquire knowledge about ;

CO1. Aim of this course is to create awareness among the students about the mechanical, electrical and electronic tools through hands-on activities

CO2. This course introduces the students to the workshop skills like cutting, drilling, filing, different types of AC and DC generators, soldering- desoldering of electrical and electronics components, constructing regulated power supplies, etc.,

CO3. After completing this course students will gain skills of using various workshop tools and also to find faults and general troubleshoots and wiring faults.

CO4. Gain a wide spectrum of skills which will enable them to solve both theoretical and experimental problems

CO5. Secure jobs in banks, in the field of Education, and in industries which require Scientific and Engineering knowledge.

CO6. Acquire the skill to gauge the physical properties of materials.

CO7. Be able to make effective use of information technology.

Topics and Learning Points

Unit 1: Introduction **[7L]**

Measuring units, conversion of SI to CGS, familiarization with meter scale, Vernier calliper, screw gauge and their utility, measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, use of Sextant to measure height of buildings, mountains etc.

Unit 2: Mechanical Skill **[10L]**

Concept of workshop practice, overview of manufacturing methods: casting, foundry, machining, forming and welding, types of welding joints and welding defects, common materials used for manufacturing like steel, copper, iron, metal sheet, composites and alloy, wood, concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines, cutting tools, lubricating oils, cutting of a metal sheet using blade, Smoothening of cutting edge of sheet using file, drilling of holes of different diameter in metal sheet and wooden block.

Unit 3: Electrical and Electronic Skill **[6L]**

Use of multimeter, soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope, making regulated power supply, timer circuit, electronic switch using transistor and relay

Unit 4: Introduction to prime movers **[7L]**

Mechanism, gear system, wheel, fixing of gears with motor axel, lever mechanism, lifting of heavy weight using lever, braking systems, pulleys, working principle of power generation systems, demonstration of pulley experiment

References:

1. A text book in Electrical Technology- B. L. Theraja-S.Chand and Company
2. Performance and design of AC machines- M.G.Say, ELBS Edn
3.Mechanical workshop practice, K.C.John, 2010, PHI Learning PVT. Ltd
4.New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland

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

Justification

PO1: Disciplinary Knowledge

CO1. Aim of this course is to create awareness among the students about the mechanical, electrical and electronic tools through hands-on activities Weightage: 3

The course explicitly aims to create awareness about disciplinary tools through hands-on activities, aligning with disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

CO2. This course introduces the students to the workshop skills like cutting, drilling, filing, different types of AC and DC generators, soldering- desoldering of electrical and electronics components, constructing regulated power supplies, etc.,Weightage: 3

Introducing students to practical workshop skills involves critical thinking and problem-solving, essential components of the learning outcome.

CO4. Gain a wide spectrum of skills which will enable them to solve both theoretical and experimental problems Weightage: 3

Acquiring a wide spectrum of skills for theoretical and experimental problem-solving directly aligns with critical thinking and problem-solving.

PO3: Social Competence

CO5. Secure jobs in banks, in the field of Education, and in industries which require Scientific and Engineering knowledge.Weightage: 2

Justification: While gaining employment is related to social competence, it is a moderate relation as the focus is more on professional competence.

PO4: Research-related Skills and Scientific Temper

CO6. Acquire the skill to gauge the physical properties of materials.Weightage: 2

Gauging physical properties involves elements of research-related skills and developing a scientific temper.

PO5: Trans-disciplinary Knowledge

CO7. Be able to make effective use of information technology. Weightage: 1

While using information technology is a valuable skill, it has a weak relation to trans-disciplinary knowledge as it's more about technical competence.

PO6: Personal and Professional Competence

All COs: CO1 to CO7Weightage: 3

The entire course contributes significantly to personal and professional competence by imparting practical skills and knowledge.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO7Weightage: 1

While the course imparts valuable skills, the direct connection to effective citizenship and ethics is weak in the technical content areas covered.

PO8: Environment and Sustainability

All COs: CO1 to CO7Weightage: 1 (Weak or low relation)

The course content does not explicitly emphasize environmental considerations or sustainability.

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7Weightage: 2

The course contributes moderately to self-directed and life-long learning by providing practical skills that can be applied beyond the classroom.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics (2023 Pattern)

Name of the Programme : B.Sc. Physics
Programme Code : USPH
Class : F.Y.B.Sc.
Semester : I
Course Type : SEC Practical
Course Code : PHY-126-SEC
Course Title : Applications of Internet of Things-I
No. of Credits : 02
No. of Teaching Hours : 60

Course Objectives:

1. appreciate the role of big data, cloud computing and data analytics in a typical IoT system
2. understand where the IoT concept fits within the broader ICT industry and possible future trends
3. apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
4. differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
5. explain the definition and usage of the term “Internet of Things” in different contexts
6. understand the key components that make up an IoT system
7. Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

Course Outcomes:

Student will be able to

CO1. Able to understand the application areas of IOT
CO2. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO3. Able to understand building blocks of Internet of Things and characteristics
CO4. Understand the concepts of Internet of Things
CO5. Analyze basic protocols in wireless sensor network
CO6. Design IoT applications in different domain and be able to analyze their performance
CO7. Implement basic IoT applications on embedded platform
CO8. Problem solving ability

Topics and Learning Points

Unit-1: Introduction to Internet of Things [8L]

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols

Unit-2: IOT Concepts and introduction [8L]

Technologies that led to evolution of IOT, IOT and SCADA, IOT and M2M, IOT and Big Data Requirement of international standard (case study), IOT standards in practice, Operating platforms /systems

Unit-3: IOT Applications (case study) [6L]

Lighting as a service, Intelligent Traffic systems, Smart Parking, Smart water management, IOT in Indian Scenario

Unit 4: Security and Future of IoT ecosystem [8L]

Need of security in IoT - Why Security? Privacy for IoT enabled devices- IoT security for consumer devices Security levels, protecting IoT devices Future IoT eco system - Need of power full core for building secure algorithms, Examples for new trends - AI, ML penetration to IoT

List of Practicals:

Sr. No.	Title of Experiment	No. of Experiment
1.	Smart Agriculture System	1
2.	Weather Reporting System	1
3.	Home Automation System	1
4.	Smart Garage Door	1
5.	Air Pollution Monitoring System	1
6.	Smart Parking System	1
7.	Familiarization with Arduino Pi & Perform necessary software installation	1
8.	Internet of things enabled real time water quality monitoring system	1

9.	Implement smart home automation system. The system automates home appliances and control them over internet from anywhere	1
10.	Develop a Real time application like a smart home security	1
11.	Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.	1
12.	Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.	1

References:

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

3. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World Paperback – 26 March 2015 by Michael Miller.

	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		1	2	2	3	1	1	2
CO 2	3		1	2	2	3	1	1	2
CO 3	3		1	2	2	3	1	1	2
CO 4	3		1	2	2	3	1	1	2
CO 5			1	2	2	3	1	1	2
CO 6			1	2	2	3	1	1	2
CO7			1	2	2	3	1	1	2
CO8		3	1	2	2	3	1	1	2

Justification

PO1: Disciplinary Knowledge

CO1. Able to understand the application areas of IoT Weightage: 3

Understanding the application areas of IoT directly contributes to disciplinary knowledge in the field.

CO2. Able to realize the revolution of the Internet in Mobile Devices, Cloud & Sensor Networks

Weightage: 3

Realizing the revolution of the Internet in various technological aspects aligns directly with disciplinary knowledge.

CO3. Able to understand building blocks of the Internet of Things and characteristics

Weightage: 3

Understanding the building blocks and characteristics of IoT is fundamental to disciplinary knowledge in this field.

CO4. Understand the concepts of the Internet of Things

Weightage: 3

Grasping the concepts of IoT is a core element of disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

CO8. Problem-solving ability Weightage: 3

Problem-solving ability is a key aspect of critical thinking, and it is directly related to addressing challenges in IoT applications.

PO3: Social Competence

All COs: CO1 to CO8 Weightage: 1

While IoT has societal implications, the direct connection to social competence is weak in the technical content areas covered.

PO4: Research-related Skills and Scientific Temper

All COs: CO1 to CO8 Weightage: 2

The course content involves understanding and applying IoT concepts, contributing to research-related skills and scientific temper to some extent.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO8 Weightage: 2

IoT applications span various domains, contributing to trans-disciplinary knowledge to some extent.

PO6: Personal and Professional Competence

All COs: CO1 to CO8 Weightage: 3

The entire course contributes significantly to personal and professional competence by imparting knowledge and skills in IoT.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO8 Weightage: 1

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

PO8: Environment and Sustainability

All COs: CO1 to CO8 Weightage: 1

The course content does not explicitly emphasize environmental considerations or sustainability.

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO8 Weightage: 2

The course contributes moderately to self-directed and life-long learning by providing knowledge and skills applicable beyond the classroom.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics (2023 Pattern)

Name of the Programme : B.Sc. Physics

Programme Code : USPH

Class : F.Y.B.Sc.

Semester : I

Course Type : IKS Theory

Course Code : PHY-137-IKS

Course Title : Knowledge System of Bharata

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. Creating awareness amongst the youths about the true history and rich culture of the Country
2. Understanding the scientific value of the tradition and culture of the Bhārata
3. Promoting the youths to do research in the various fields of Bhāratīya knowledge Tradition
4. Converting the Bhāratīya wisdom into the applied aspect of the modern scientific Paradigm
5. Adding career, professional and business opportunities to the youths.
6. Reasons of ideas occurrence in the ancient society, and connection with the concept of material world, and religious, social, and cultural beliefs.
7. The course is designed to provide a broad-spectrum of the Bhāratīya knowledge system

Course Outcomes:

At the end of this course, students will be able to

CO1. The knowledge system was developed during the Vedic period, the Saraswatī-Sindhu Civilization, the Middle ages and practiced knowingly or unknowingly till date

CO2. In Bhārata, a special attention was given to the reasons of ideas occurrence, and connection with the concept of material world, and religious, social, and cultural beliefs

CO3. Bhārata was quite advanced in arts, literature, music, dance, drama, and all other spheres of life including aeronautics, science, astronomy, mathematics, life science, medical science, and architecture.

CO4. Awareness amongst the youths about the true history and rich culture of the country

CO5. The youth will be an individual with a great sense of patriotism and nation-pride.

CO6. The youths will be self-motivated to do research in the various fields of Bhāratīya

knowledge tradition

CO7. The students would be able to convert Bhāratīya wisdom into the applied aspect of the modern scientific paradigm

Topics and Learning Points

Unit 1: Bhāratīya Civilization and Development of Bhartiya Knowledge System [8L]

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy (6+3), Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.

Unit 2:Arts, Literature, and Scholars in Ancient Bharat [8L]

Art, Music, and Dance, Naṭarāja– A Masterpiece of Bhāratīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghoṣā, Vālmīki, Patañjali, Vedavyāsa, Yājňavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaṇāda, Patañjali, Kauṭīlya, Pāṇini, Thiruvalluvar, Āryabhaṭa, Varāhamihira, ĀdiŚaṅkarācārya, Bhāskarācārya, Mādhavācārya.

Unit 3:Ancient Bhartiya Contribution towards Science & Mathematics [8L]

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, BhāratīyaKāla-gaṇanā, Kerala School for Mathematics and Astronomy, History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archaeostronomy; Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics.

Unit 4:Ancient Bhartiya Engineering, Technology & Architecture [6L]

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet– Dwārkā.

References:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan, Under Publication (2021).

2. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ram krishan Mission Institute of Culture, Kolkata (2014).

3. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ram krishan Mission Institute of Culture, Kolkata (2014).

4. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).

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

Justification

PO1: Disciplinary Knowledge

CO1. The knowledge system was developed during the Vedic period, the Saraswatī-Sindhu Civilization, the Middle ages and practiced knowingly or unknowingly till date. Weightage: 3

Understanding the development of knowledge systems over historical periods is directly aligned with disciplinary knowledge.

CO2. In Bhārata, special attention was given to the reasons of ideas occurrence, and connection with the concept of the material world, and religious, social, and cultural beliefs Weightage: 3

Analyzing the reasons behind the occurrence of ideas and their connection with various aspects of life contributes directly to disciplinary knowledge.

CO3. Bhārata was quite advanced in arts, literature, music, dance, drama, and all other spheres of life, including aeronautics, science, astronomy, mathematics, life science, medical science, and architecture.

Weightage: 3

Recognizing the advancements in various fields in Bhārata directly contributes to disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

All COs: CO1 to CO7. Weightage: 3

Analyzing historical and cultural aspects, converting wisdom into modern scientific paradigms, and fostering research all involve critical thinking and problem-solving skills.

PO3: Social Competence

CO4. Awareness amongst the youths about the true history and rich culture of the country Weightage: 3

Creating awareness about history and culture contributes directly to social competence.

CO5. The youth will be an individual with a great sense of patriotism and nation-pride. Weightage: 3

Fostering a sense of patriotism and nation-pride is a key element of social competence.

PO4: Research-related Skills and Scientific Temper

CO6. The youths will be self-motivated to do research in the various fields of Bhāratīya knowledge tradition Weightage: 3

Encouraging self-motivation for research directly aligns with research-related skills and scientific temper.

PO5: Trans-disciplinary Knowledge

CO7. The students would be able to convert Bhāratīya wisdom into the applied aspect of the modern scientific paradigm Weightage: 3

Converting traditional wisdom into the modern scientific paradigm involves trans-disciplinary knowledge.

PO6: Personal and Professional Competence

All COs: CO1 to CO7 Weightage: 3

The entire course contributes significantly to personal and professional competence by imparting knowledge and skills in various aspects of Bhāratīya knowledge tradition.

PO7: Effective Citizenship and Ethics

CO4. Awareness amongst the youths about the true history and rich culture of the country

Weightage: 3

Creating awareness about history and culture contributes to effective citizenship and ethics.

CO5. The youth will be an individual with a great sense of patriotism and nation-pride.Weightage: 3

Fostering a sense of patriotism and nation-pride is also linked to effective citizenship and ethics.

PO8: Environment and Sustainability

All COs: CO1 to CO7. Weightage: 1

The course content does not explicitly emphasize environmental considerations or sustainability.

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7 Weightage: 2

The course contributes moderately to self-directed and life-long learning by fostering research skills and critical thinking applicable beyond the classroom.