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 -II

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 second semester of F.Y.B.Sc. Physics, 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 unravelling its complexities to discover the way it is and how it works. Discoveries in physics have formed the foundation of countless technological advances and play an important role in many scientific areas. Many techniques used in medical imaging, nanotechnology and quantum computing are derived from physics instrumentation. Even the World Wide Web was a

spin-off from the information processing and communications requirements of high-energy particle physics. The contributions of physics to solving global problems such as energy production, environmental protection, global warming and public health are essential and have an enormous impact on our society.

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

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Physics

From 2023-24 to 2025-26

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.	Dr. Swapnil Nardekar	Alumni and Research Scholar Jeju National University, South Korea
7.	Prof. (Dr.) A. E. Kalange	Member, Vice Principal
8.	Dr. R. D. Kale	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.	Ms S E Bhosale	Member
14.	Mr. S. S. Mhaske	Member
15.	Mr. S. M. Thorat	Member
16.	Dhanshree Hole, M.Sc.	Student Representative

17.	Aditya Sorte, M.Sc.	Student Representative
18.	Saurabh Malve, M.Sc.	Student Representative
19.	Asmita Ghadge, M.Sc.	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	

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

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

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 : II

Course Type : Major Mandatory (Theory)

Course Code : PHY-151-MJM

Course Title : Heat and Thermodynamics

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

The student will learn:

1. To describe the thermodynamic properties of a material.
2. To understand the ideal gas equation and its limitations.
3. To understand the real gas equation.
4. To apply the laws of thermodynamics to formulate the relations necessary to analyse a thermodynamic process.
5. To understand principle of heat engines and calculate thermal efficiency.
6. To understand the principle of the refrigerators to calculate coefficient of performance.
7. To understand phenomenon of 'entropy'.
8. To understand the types of thermometers and their uses.

Course Outcomes:

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

CO1. Describe the thermodynamic properties of a material.

CO2. Understand the ideal gas equation and its limitations.

CO3. Understand the real gas equation.

CO4. Apply the laws of thermodynamics to formulate the relations necessary to analyse a thermodynamic process.

CO5. Understand principle of heat engines and calculate thermal efficiency.

CO6. Understand the principle of the refrigerators to calculate coefficient of performance.

CO7. Understand phenomenon of 'entropy'.

CO8. Understand the types of thermometers and their uses.

Topics and Learning Points

UNIT 1: Equation of state (7L)

1.1 Introduction (Equation of state, ideal and real gas).

1.2 Andrew's Experiment and Amagat's Experiment

1.3 Van der Waals 'equation of state, critical constants and reduced equation of state

1.4 Joule-Thomson porous plug experiment (Throttling process)

1.5 **Problem Solving**

UNIT 2: Concepts of Thermodynamics (8L)

2.1 Introduction (Thermodynamic state of a system, Zeroth law of thermodynamics, Thermodynamic equilibrium, reversible and irreversible processes)

2.2 Thermodynamic Processes: isothermal, adiabatic, isochoric, and isobaric

2.3 Work done during isothermal change.

2.4 Adiabatic relations for perfect gas

2.5 Work done during adiabatic change.

2.6 First law of thermodynamics and its applications

2.7 **Problem Solving**

UNIT 3: Applied Thermodynamics (9L)

3.1 Introduction (Joules law of heating)

3.2 Heat and work

3.3 Carnot's cycle and Carnot's heat engine and its efficiency

3.4 Second law of thermodynamics

3.5 Concept of entropy, Enthalpy, Free energy

3.6 Maxwell's relations in thermodynamics

3.7 T-dS Equation

3.8 Clausius-Clapeyron Latent heat equations (I and II)

3.9 **Problem solving**

Unit 4: Heat Transfer Mechanisms (6L)

4.1 Introduction (Kinematics of heat)

4.2 Heat Engines: Otto cycle and its efficiency and Diesel cycle and its efficiency

4.3 Refrigerators: Principle and coefficient of performance of refrigerator

4.4 Air conditioning: Principle and its applications

4.5 **Problem Solving**

References:

1. Physics: 4th Edition, Volume I, Resnick/Halliday/Krane JOHN WILEY & SON (SEA) Pvt. Ltd.
2. Concept of Physics: H.C. Verma, Bharati Bhavan Publishers
3. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi
4. Heat and Thermodynamics: Mark. W. Zemansky, Richard H. Dittman, Seventh Edition, McGraw-Hill International Editions
5. Thermodynamics and Statistical Physics: J.K. Sharma, K.K. Sarkar, Him

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3	3	1	2	2	3	1	1	2
CO 2	3	3	1	2	2	3	1	1	2
CO 3	3	3	1	2	2	3	1	1	2
CO 4	3	3	1	2	2	3	1	1	2
CO 5	3	3	1	2	2	3	1	1	2
CO 6	3	3	1	2	2	3	1	1	2
CO7	3	3	1	2	2	3	1	1	2
CO8	3	3	1	2	2	3	1	1	2

Justification

PO1: Disciplinary Knowledge

CO1. Describe the thermodynamic properties of a material.
Weightage: 3 (Strong or direct relation)
Justification: Describing thermodynamic properties is fundamental to disciplinary knowledge in thermodynamics.
CO2. Understand the ideal gas equation and its limitations.
Weightage: 3 (Strong or direct relation)
Justification: Understanding the ideal gas equation is a key concept in thermodynamics, contributing directly to disciplinary knowledge.
CO3. Understand the real gas equation.
Weightage: 3 (Strong or direct relation)

Justification: Understanding the real gas equation is crucial to disciplinary knowledge, providing a more accurate representation of gases.
CO4. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
Weightage: 3 (Strong or direct relation)
Justification: Applying the laws of thermodynamics is a core aspect of disciplinary knowledge in thermodynamics.
CO5. Understand the principle of heat engines and calculate thermal efficiency.
Weightage: 3 (Strong or direct relation)
Justification: Understanding heat engines and calculating thermal efficiency directly contributes to disciplinary knowledge in thermodynamics.
CO6. Understand the principle of refrigerators to calculate the coefficient of performance.
Weightage: 3 (Strong or direct relation)
Justification: Understanding refrigerators and calculating the coefficient of performance is integral to disciplinary knowledge in thermodynamics.
CO7. Understand the phenomenon of 'entropy'.
Weightage: 3 (Strong or direct relation)
Justification: Understanding entropy is a fundamental concept in thermodynamics and contributes directly to disciplinary knowledge.
CO8. Understand the types of thermometers and their uses.
Weightage: 3 (Strong or direct relation)
Justification: Understanding thermometers and their uses is a key aspect of disciplinary knowledge in thermodynamics.

PO2: Critical Thinking and Problem Solving

All COs: CO1 to CO8
Weightage: 3 (Strong or direct relation)
Justification: Each competency involves critical thinking and problem-solving skills in the context of thermodynamics.

PO3: Social Competence

All COs: CO1 to CO8
Weightage: 1 (Weak or low relation)
Justification: While thermodynamics has societal applications, 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 (Moderate or partial relation)
Justification: Understanding and applying thermodynamic principles contribute to research-related skills and scientific temper to some extent.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO8
Weightage: 2 (Moderate or partial relation)
Justification: While thermodynamics itself is a specific discipline, some aspects may have trans-disciplinary applications, contributing to trans-disciplinary knowledge to some extent.

PO6: Personal and Professional Competence

All COs: CO1 to CO8
Weightage: 3 (Strong or direct relation)
Justification: The entire course contributes significantly to personal and professional competence by imparting knowledge and skills in thermodynamics.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO8
Weightage: 1 (Weak or low relation)
Justification: 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 (Weak or low relation)
Justification: 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 (Moderate or partial relation)
Justification: The course contributes moderately to self-directed and life-long learning by providing knowledge and skills applicable beyond the classroom in the field of thermodynamics.

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 : II

Course Type : Major Mandatory (Theory)

Course Code : PHY-152-MJM

Course Title : Physics Principles & Applications

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

The student will learn:

1. Atomic structures though Thomson, Rutherford and Bohr atomic models.
2. Quantum energy levels of atomic electrons through hydrogen atom.
3. Problem solving, energy estimation through various series of hydrogen spectrum
4. Proof of quantum energy of atoms through Frank-Hertz experiment
5. Various types of bonding mechanism between atoms to form molecule.
6. Expression of Rotation and Vibrational energy levels of a diatomic molecule for problem solving.
7. Basic mechanism of LASER, Types and Applications.
8. Sources of Electromagnetic Waves, Electromagnetic spectrums and their applications.

Course Outcomes:

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

CO1. Distinguish and identify various series in the hydrogen atom emission spectrum.

CO2. Calculate energy of electron in various orbits/levels.

CO3. Check the properties of LASER and use them for various applications and experimental purpose.

CO4. Demonstrate and Explain importance of monochromatic source and their use in opticalexperiments for better results.Demonstrate quantitative problem-solving skills in all the topics covered.

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

CO6. Apply knowledge of LASER applications, for project work.

CO7. Enable to search and understand use of various EM Sources applications in day today's

life.

Topics and Learning Points

UNIT 1: Physics of Atoms (9L)

1.1 Introduction to Atom (Atomic Models: Thomson, Rutherford, Bohr)

1.2 Atomic Spectrum

1.3 The Bohr Theory of the Hydrogen Atom

1.4 Energy levels of Hydrogen Spectrum

1.5 Frank-Hertz experiment

1.6 **Problem Solving**

UNIT 2: Physics of Molecules (11L)

2.1 Introduction to Bonding Mechanisms

2.2 Forces between Atoms

2.3 Types of Bonding: Ionic Bonds, Covalent Bonds, Van der Waals Bonds, Hydrogen Bond, Metallic Bond

2.4 Rotational energy levels of a diatomic molecule

2.5 Vibrational energy levels of a diatomic molecule

2.6 **Problem Solving**

UNIT 3: LASERS and its Applications (7L)

3.1 Introduction to LASERS

3.2 Basic Principle of Lasers: Three Processes

3.3 Characteristics of Lasers: brief explanation

3.4 Population Inversion and Pumping

3.5 Types of Lasers & Applications of Lasers

3.6 **Problem Solving**

UNIT 4: Sources of Electromagnetic Waves (13L)

4.1 Introduction to Electromagnetic Waves: Historical Perspective

4.2 General properties of Electromagnetic radiations

4.3 Electromagnetic spectrums and its sources

4.4 Production of electromagnetic waves: Hertz experiment

4.5 Plank's hypothesis of Photons (Concept only)

4.6 Sources of Electromagnetic Waves

4.7 Applications of Electromagnetic Waves: Microwave, Solar Cell etc

4.8 **Problem Solving**

References:

1. Concepts of Modern Physics: A Beiser (6th ed., McGraw Hill, 2003)
2. Modern Physics: Raymond A. Serway, Clement J. Moses, Curt A. Moyer
3. Sears and Zemansky's University Physics: H.D. Young R. A. Freedman, Sandin (11th Ed. Pearson Education)
4. University Physics: F. Sears and M. Zeemansky, XIth/XIIth Edition, Pearson Education
5. An Introduction to LASERS- Theory and Applications: M.N. Avdhanulu, S. Chand Publications
6. LASERS: M. N. Avdhanulu, S. Chand Publications.
7. Fundamental of molecular Spectroscopy: by C.N. Banwell (3rd Edition) McGRAW-HILL Book company Europe

Mapping of PHY-152-MJM : Physics Principles & Applications

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

Justification

PO1: Disciplinary Knowledge

CO1. Distinguish and identify various series in the hydrogen atom emission spectrum.

Weightage: 3 (Strong or direct relation)

Justification: Distinguishing and identifying series in the hydrogen atom emission spectrum is a fundamental aspect of disciplinary knowledge in atomic physics.

CO2. Calculate energy of electron in various orbits/levels.

Weightage: 3 (Strong or direct relation)

Justification: Calculating the energy of electrons in different orbits is a key component of disciplinary knowledge in atomic physics.
CO3. Check the properties of LASER and use them for various applications and experimental purpose.
Weightage: 3 (Strong or direct relation)
Justification: Understanding the properties of LASER and its applications directly contributes to disciplinary knowledge in optics and photonics.

PO2: Critical Thinking and Problem Solving

CO4. Demonstrate and explain the importance of monochromatic sources and their use in optical experiments for better results.
Weightage: 3 (Strong or direct relation)
Justification: Demonstrating the importance of monochromatic sources involves critical thinking in optimizing experimental conditions for better results.
CO5. Demonstrate quantitative problem-solving skills in all the topics covered.

Weightage: 3 (Strong or direct relation)
Justification: Demonstrating quantitative problem-solving skills is a direct application of critical thinking in the field of optics and photonics.
CO6. Apply knowledge of LASER applications for project work.
Weightage: 3 (Strong or direct relation)
Justification: Applying knowledge of LASER applications involves critical thinking and problem-solving skills in a practical project context.

PO3: Social Competence

All COs: CO1 to CO6
Weightage: 1 (Weak or low relation)
Justification: The direct connection to social competence is weak in the technical content areas covered.

PO4: Research-related Skills and Scientific Temper

CO7. Enable to search and understand the use of various EM Sources applications in day-to-day life.
Weightage: 3 (Strong or direct relation)
Justification: Searching and understanding the applications of electromagnetic sources in daily life contributes to research-related skills and scientific temper.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO7
Weightage: 2 (Moderate or partial relation)
Justification: While the primary focus is on the discipline of atomic physics and optics, there is a moderate relation to trans-disciplinary knowledge through applications in daily life.

PO6: Personal and Professional Competence

All COs: CO1 to CO7
Weightage: 3 (Strong or direct relation)
Justification: The entire course contributes significantly to personal and professional competence by imparting knowledge and skills in atomic physics and optics.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: The direct connection to effective citizenship and ethics is weak in the technical content areas covered.

PO8: Environment and Sustainability

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: 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 (Moderate or partial relation)

Justification: The course contributes moderately to self-directed and life-long learning by providing knowledge and skills applicable beyond the classroom in the field of atomic physics and optics

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 : II

Course Type : Major Mandatory (Practical)

Course Code : PHY-153-MJM

Course Title : Physics Practical-II

No. of Credits : 02

No. of Teaching Hours : 30

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. Problem solving ability

CO7. Critical Analysis

List of Practicals

1. Heat and Thermodynamics (Any Four)

1 Interpretation of isothermal and adiabatic curves on PV diagrams (Theoretical). Theoretical study of Carnot's cycle by drawing graphs of isothermal and adiabatic curves.
2 Temperature coefficient of resistance
3 Determination of inversion temperature of a thermocouple
4 Thermal conductivity by Lee's method
5 Specific heat of graphite
6 Calibration of silicon diode/ Copper-constantan thermocouple as temperature sensor.
7 Study of Peltier effect

2. Physics Principals & Application (Any Four)

1. Study of spectrometer and determination of angle of prism
2. Total internal reflection using LASER.
3. Polarization of light by reflection
4. Determination of wavelength of LASER light by plane diffraction grating
5. To determine the angular magnifying power of telescope by slit method.
6. To determine linear magnifying power of telescope.
7. Determination of frequency of AC mains using sonometer.

3. Additional Activities

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

i. Biprism
ii. LASER
iii. Goniometer
iv. Center of Mass and Center of gravity

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

i. Carnot engine, diesel engine
ii. Graphs and their slopes, and Kinematics graphs (using computer simulations)
iii. Mini projects/Hands on activities

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

Mapping of PHY-153-MJM: Physics Practical-II

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

Justification

PO1: Disciplinary Knowledge

CO1. Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.
Weightage: 3 (Strong or direct relation)
Justification: Acquiring technical and manipulative skills is a fundamental aspect of disciplinary knowledge in any scientific field, particularly in a laboratory setting.
CO2. Demonstrate an ability to collect data through observation and/or experimentation and interpreting data.
Weightage: 3 (Strong or direct relation)
Justification: Data collection and interpretation are core components of disciplinary knowledge, and this directly aligns with the skill set required in a laboratory setting.
CO3. Demonstrate an understanding of laboratory procedures, including safety and scientific methods.
Weightage: 3 (Strong or direct relation)
Justification: Understanding laboratory procedures, safety measures, and scientific methods is integral to disciplinary knowledge in any scientific discipline.

PO2: Critical Thinking and Problem Solving

CO6. Problem-solving ability
Weightage: 3 (Strong or direct relation)

Justification: Problem-solving ability is a key element of critical thinking, and it is directly related to the development of critical thinking skills in a laboratory environment.
CO7. Critical Analysis

Weightage: 3 (Strong or direct relation)
Justification: Critical analysis involves evaluating information and making judgments, which is a crucial aspect of critical thinking in laboratory settings.

PO3: Social Competence

CO5. Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.
Weightage: 3 (Strong or direct relation)
Justification: Collaborative learning and teamwork contribute to social competence, fostering effective communication and collaboration in a laboratory environment.

PO4: Research-related Skills and Scientific Temper

All COs: CO1 to CO7
Weightage: 2 (Moderate or partial relation)
Justification: While the primary focus is on developing practical skills, there is a moderate relation to research-related skills and scientific temper, especially in the context of experimental design and data interpretation.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: The direct connection to trans-disciplinary knowledge is weak, as the focus is primarily on laboratory skills within a specific scientific discipline.

PO6: Personal and Professional Competence

All COs: CO1 to CO7
Weightage: 3 (Strong or direct relation)
Justification: The acquisition of laboratory skills and the development of critical thinking contribute significantly to personal and professional competence.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO7
Weightage: 2 (Moderate or partial relation)
Justification: While laboratory skills contribute to effective citizenship and ethics to some extent, the direct connection is moderate.

PO8: Environment and Sustainability

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: 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 (Moderate or partial relation)
Justification: While laboratory skills contribute to self-directed learning, the direct connection to life-long learning is moderate.

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 : II
Course Type : Minor (Theory)
Course Code : PHY-161-MN
Course Title : Basic Physics
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.

CO8. Problem solving ability.

Topics and Learning Points

UNIT 1: Motion (5L)

1.1 Introduction
1.2 Various types of forces in nature
1.3 Newton's laws & its applications
1.4 Newton's law of gravitation
1.5 Frame of reference: Inertial and non- inertial
1.6 **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 **Problem Solving**

UNIT 3: Properties of Matter (12L)

3.1 Introduction
3.2 Rise of liquid in a capillary tube
3.3 Jaeger's method for determination of surface tension
3.4 Work done during longitudinal strain, volume strain, shearing strain and Poisson's ratio.
3.5 Determination of Y of thin rectangular bar loaded at the centre.
3.6 Torsional oscillations
3.7 Problem solving

UNIT 4: Fluid Mechanics (7L)

4.1 Introduction
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

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.

2. Mapping of PHY-161-MN Basic Physics (Mechanics & Properties of Matter)

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

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 (Strong or direct relation)

Justification: Understanding energy concepts is fundamental to disciplinary knowledge in physics.

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

Weightage: 3 (Strong or direct relation)

Justification: 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 (Strong or direct relation)

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 (Strong or direct relation)

Justification: Applying Bernoulli's Principle involves critical thinking and problem-solving skills.
CO5. Demonstrate quantitative problem-solving skills in all the topics covered.

Weightage: 3 (Strong or direct relation)
Justification: Quantitative problem-solving is a central aspect of critical thinking in physics.

PO3: Social Competence

CO6. Apply the equation of motion to one or two dimensions of the system in order to understand kinematics of the body under various conditions of applied force.
Weightage: 1 (Weak or low relation)
Justification: While this skill is important for understanding physical concepts, its direct connection to social competence is weak.
CO7. Apply knowledge in understanding the flow of liquid and surface tension applied on the surface of liquid.
Weightage: 1 (Weak or low relation)
Justification: The direct link to social competence is weak, as these concepts are more focused on physical phenomena.

PO4: Research-related Skills and Scientific Temper

All COs: CO1 to CO7
Weightage: 2 (Moderate or partial relation)
Justification: The course content involves skills that contribute moderately to research-related skills and scientific temper, especially in the context of experimentation.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: The course content is primarily focused on physics and lacks a strong connection to trans-disciplinary knowledge.

PO6: Personal and Professional Competence

All COs: CO1 to CO7
Weightage: 2 (Moderate or partial relation)
Justification: While the course contributes to personal and professional competence, the direct link is moderate.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: The course content does not explicitly emphasize effective citizenship and ethics.

PO8: Environment and Sustainability

All COs: CO1 to CO7
Weightage: 1 (Weak or low relation)
Justification: The course content does not explicitly address environmental and sustainability considerations.

PO9: Self-directed and Life-long Learning

All COs: CO1 to CO7
Weightage: 2 (Moderate or partial relation)
Justification: The course content contributes moderately to self-directed learning, but the direct connection to life-long learning is moderate.

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 : II

Course Type : OE Theory

Course Code : PHY-166-OE

Course Title : Astronomy-II [आकाशाशी जडले नाते - भाग २]

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

A) अभ्यासक्रमाची उद्दिष्टे

१. विद्यार्थी ताऱ्यांच्या जीवन गाथेचे व सुर्य का प्रकाशतो याचे वर्णन करतील.

२.. विद्यार्थी आकाशगंगेची व्याप्ती समजून घेतील .

३. विद्यार्थी रेडिओ लहरी व त्यांचे स्त्रोत तसेच क्वेसार याची माहिती घेतील .

४. विद्यार्थी ताऱ्याचे जीवनचक्र समजून घेतील .

५. विद्यार्थी विश्वाची रचना आणि इतिहासाचे विश्लेषण करतील.

६. विद्यार्थी नवे ग्रह, ग्रहमाला, गुरूत्वीय लहरी याबददल माहिती घेण्यास सुरूवात करतील .

७. विद्यार्थी पृथ्वी पलीकडील जीवसृष्टी तसेच खगोलशास्त्र आणि फलज्योतिष याची माहिती घेण्यास सुरूवात करतील . **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 : ताऱ्यांची जीवनगाथा (०७ तास)

१.१ ताऱ्यांच्या जगात
१.२ ताऱ्यांचे गुणधर्म
१.३ ताऱ्यांचा जन्म
१.४ सूर्य का प्रकाशतो □
१.५ राक्षस तारे
१.६ मूलद्रव्यांची निर्मिती
१.७ श्वेतबटूंचे विश्व
१.८ जेव्हा ताऱ्यांचा स्फोट होतो
१.९ विनाशातून नवनिर्मितीकडे
१.१० पल्सार □□□ स्पंदक) अंतराळातली घडयाळे
१.११ कृष्णविवर
१.१२ तारायुगुलांचे नृत्य

प्रकरण दुसरे :आकाशागंगेच्या आत आणि बाहेर **(०८ तास)**

२.१. आकाशगंगेची व्याप्ती

२.२ तारकाविश्वाच्या जगात

२.३ रेडिओ लहरीचे प्रचंड स्त्रोत

२.४ क्वेसार

२.५ विश्वातले मोठे घटक

२.६ गुरूत्वाकर्षणाचे भिंग

२.७ प्रारणाची पार्श्वभूमी

प्रकरण तिसरे : विश्वरचनाशास्त्र **(०७ तास)**

३.१ प्रसरणशील विश्व

३.२ विश्वातील मोजमापे

३.३ विश्वाचा आदिकाळ □पर्व२

३.४ विश्वाचा आदिकाळ □पर्व१

३.५ स्थिर स्थितीच्या विश्वाचा सिध्दांत

प्रकरण चौथे : पुढची आव्हाने **(०८ तास)**

४.१ नवे ग्रह □सव्या ग्रहमाला

४.२ गुरूत्वीय लहरीचा शोध

४.३ क्वेसार किती दूर आहेत □

४.४ माखचा सिध्दांत

४.५ अंतराळातले रोगजंतू

४.६ पृथ्वीपलीकडे जीवसृष्टी असेल का□

४.७ खगोलशास्त्र आणि फलज्योतिष

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

Mapping of PHY-166-OE: Astronomy-II Theory

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3			3	1	2	1		
CO 2	3			3	1	2	1		
CO 3	3			3	1	2	1		
CO 4		3		3	1	2	1		
CO 5		3		3	1	2	1		
CO 6			2	3	1	2	1		
CO7			1	3	1	2	1		
CO8				3	1	2	1		
CO9				3	1	2	1		
CO10				3	1	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 (Strong or direct relation)
Justification: The question emphasizes understanding the essence of astronomy, directly contributing to disciplinary knowledge.

CO2. खगोलशास्त्रातील घटकांची माहिती सांगता येईल

Weightage: 3 (Strong or direct relation)
Justification: Understanding the components of astronomy is crucial for disciplinary knowledge.

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 (Strong or direct relation)
Justification: The use of telescopes is directly related to observational skills in astronomy, contributing to disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

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

Weightage: 3 (Strong or direct relation)
Justification: Analyzing the color and magnitude of stars involves critical thinking in astronomy.

CO5. ताऱ्यांचे वर्गीकरण करता येईल

Weightage: 3 (Strong or direct relation)
Justification: Performing classification tasks involves critical analysis and problem-solving skills in astronomy.

PO3: Social Competence

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

Weightage: 2 (Moderate or partial relation)
Justification: Sharing knowledge about solar system exploration has a moderate social relevance.

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

Weightage: 1 (Weak or low relation)
Justification: While understanding the universe is important, the direct link to social competence is weak.

PO4: Research-related Skills and Scientific Temper

All COs: CO1 to CO9
Weightage: 3 (Strong or direct relation)
Justification: The entire set of learning outcomes contributes significantly to research-related skills and scientific temper.

PO5: Trans-disciplinary Knowledge

All COs: CO1 to CO9
Weightage: 1 (Weak or low relation)
Justification: The content is primarily focused on astronomy, and the link to trans-disciplinary knowledge is weak.

PO6: Personal and Professional Competence

All COs: CO1 to CO9
Weightage: 2 (Moderate or partial relation)
Justification: While contributing to personal competence, the direct link to professional competence is moderate.

PO7: Effective Citizenship and Ethics

All COs: CO1 to CO9
Weightage: 1 (Weak or low relation)
Justification: The course content does not explicitly emphasize effective citizenship and ethics.

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 : II
Course Type : OE Practical
Course Code : PHY-167-OE
Course Title : Astronomy-II [आकाशाशी जडले नाते - भाग 2] Practical
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

A) अभ्यासक्रमाची उद्दिष्टे

१. विद्यार्थी ता□यांच्या जीवन गाथेचे व सुर्य का प्रकाशतो याचे वर्णन करतील.

२.. विद्यार्थी आकाशगंगेची व्याप्ती समजून घेतील .

३. विद्यार्थी रेडिओ लहरी व त्यांचे स्त्रोत तसेच क्वेसार याची माहिती घेतील .

४. विद्यार्थी ताऱ्याचे जीवनचक्र समजून घेतील .

५. विद्यार्थी विश्वाची रचना आणि इतिहासाचे विश्लेषण करतील.

६. विद्यार्थी नवे ग्रह, ग्रहमाला, गुरूत्वीय लहरी याबददल माहिती घेण्यास सुरूवात करतील .

७. विद्यार्थी पृथ्वी पलीकडील जीवसृष्टी तसेच खगोलशास्त्र आणि फलज्योतिष याची माहिती घेण्यास सुरूवात करतील .

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

तार्‌यांचे नाव सांगु शकतील.

CO3. तार्‌यांचा 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 तार्‌यांना 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

प्रात्यक्षिकांची यादी

प्रात्यक्षिक/ प्रयोगांची यादी

1. पृथ्वीवरील गुरूत्वाकर्षण मोजणे .
2. मुलद्रव्याची ओळख करून घेणे .
3. दोन ताऱ्यामधील अंतर मोजणे.
4. रेडिओ लहरींचा अभ्यास करणे .
5. विश्वाच्या मोजमापामधील संबंध ओळखणे .
6. ता□यांच्या गुणधर्माचा अभ्यास करणे .
7. कृष्णविवरांच्या गुणधर्माचा अभ्यास करणे .
8. गुरूत्वीय लहरींचा अभ्यास करणे .

Mapping of PHY-167-OE: Astronomy-II Practical

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

Justification

PO1: Disciplinary Knowledge

CO1: खगोलशास्त्रातील घटकांची माहिती सांगता येईल

Weightage: 3 (Strong or direct relation)
Justification: Imparts knowledge about the components and elements within astronomy, directly contributing to disciplinary knowledge.

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 (Strong or direct relation)
Justification: Engaging students in telescope observation and identification of specific stars directly involves applying disciplinary knowledge.

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

Weightage: 3 (Strong or direct relation)
Justification: Understanding the color and magnitude of stars is a fundamental aspect of disciplinary knowledge in astronomy.

CO4: ताऱ्यांचे वर्गीकरण करता येईल

Weightage: 3 (Strong or direct relation)
Justification: Classification of stars is a direct application of disciplinary knowledge.

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

Weightage: 3 (Strong or direct relation)
Justification: Providing information about celestial bodies in the solar system contributes directly to disciplinary knowledge.

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

Weightage: 3 (Strong or direct relation)
Justification: Understanding the perspectives of stars and galaxies directly contributes to disciplinary knowledge.

CO7: अवकाश निरीक्षण करताना अवकाश नकाशाद्वारे तार्यांना लगेच ओळखू शकतील.

Weightage: 3 (Strong or direct relation)
Justification: Utilizing star maps for observations involves the practical application of disciplinary knowledge.

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

Weightage: 2 (Moderate or partial relation)
Justification: While internet research can supplement knowledge, the direct link to disciplinary knowledge is moderate.

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

Weightage: 2 (Moderate or partial relation)
Justification: Using various software for astronomy practice is a moderate application of disciplinary knowledge.

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 : II
Course Type : VSC Practical
Course Code : PHY-171-VSC
Course Title : Physics Workshop Skills-II
No. of Credits : 02
No. of Teaching Hours : 30

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 Outcomes:

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

Topics and Learning Points

List of experiments:

1. To measure the least count of various measuring instruments: Digital/Analog (Vernier caliper, micrometer screw gauge, travelling microscope, spectrometer etc.)
2. To measure the diameter of a given wire and thickness of a given sheet using screw gauge.
3. To measure diameter of a small spherical/cylindrical body and to measure depth of a given beaker/cylinder using vernier callipers and find its volume.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine g by Bar Pendulum.
6. To study variation of time period of simple pendulum of a given length by taking bobs of different masses and interpret the result.
7. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
8. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CR0
9. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
10. To determine g by Kater's Pendulum.
11. To determine the Height of a Building using a Sextant.
12. Study and use of multimeter.

References:

1. 1 Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, AsiaPublishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. A Textbook of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Mapping of PHY-171-VSC Practical (Physics Workshop Skills-II)

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3								2
CO 2		3							
CO 3					2		2	1	
CO 4		3							
CO 5					3				
CO 6		3							
CO7					2	2			

Justification

PO1: Disciplinary Knowledge

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

Developing technical and manipulative skills in the laboratory directly contributes to gaining disciplinary knowledge in the field of physics.

PO2: Critical Thinking and Problem Solving

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

Critical thinking and problem-solving are essential in the process of collecting, interpreting, and analyzing data during experiments.

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

Visualizing abstract concepts through hands-on experience enhances critical thinking and deepens understanding.

CO6: To correlate their physics theory concepts through practical. Weightage: 3

Correlating theoretical concepts with practical applications fosters critical thinking and problem-solving skills.

PO5: Trans-disciplinary Knowledge

CO3: Demonstrate an understanding of laboratory procedures including safety and scientific methods.
Weightage: 2

While laboratory procedures are crucial for disciplinary knowledge, they also have relevance in a broader scientific context.

CO5: Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.
Weightage: 3

Collaborative learning and teamwork in the laboratory contribute to both disciplinary knowledge and trans-disciplinary skills.

CO7: To understand and practice the skills while doing physics practical.
Weightage: 2

Understanding and practicing skills during physics practical exercises are moderately related to trans-disciplinary knowledge.

PO6: Personal and Professional Competence

CO7: To understand and practice the skills while doing physics practical.
Weightage: 2

Understanding and practicing skills during physics practical exercises are moderately related to personal and professional competence.

PO7: Effective Citizenship and Ethics

CO3: Demonstrate an understanding of laboratory procedures including safety and scientific methods.
Weightage: 2

Understanding laboratory procedures, including safety and ethical considerations, has a moderate relationship with effective citizenship and ethics.

PO8: Environment and Sustainability

CO3: Demonstrate an understanding of laboratory procedures including safety and scientific methods.
Weightage: 1

While safety is important for sustainability, the direct link to environmental aspects is weak.

PO9: Self-directed and Life-long Learning

CO1: Acquire technical and manipulative skills in using laboratory equipment, tools, and materials.
Weightage: 2

Acquiring technical skills in the laboratory contributes moderately to fostering 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 : II
Course Type : SEC Practical
Course Code : PHY-176-SEC
Course Title : Applications of Internet of Things-II
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To learn and understand the basics of Embedded systems.
2. To be acquainted with interfacing of sensors and actuators with microprocessor.
3. To design embedded systems applications.
4. To understand Internet of Things and its usefulness for society.
5. To understand the fundamentals and functionality of various embedded board platforms.
6. To design and implement interconnection and integration of sensors to embedded board platform
7. To design and implement application of IoT using various sensors.
8. The knowledge and understanding of Internet of Things
9. Provide a strong foundation of fundamentals of Internet of Things and need of IoT Security
10. Get acquainted with various communication protocols of Internet of Things
11. Detailed understanding of present scope of Internet of Things with case studies

Course Outcomes:

Student will be able to

CO1. Identify and understand the unique characteristics and components of embedded systems
CO2. Compare various development boards Arduino, Raspberry pi, Beagle bone
CO3. Implement interfacing of various sensors, actuators to the development boards
CO4. Design, implement and test an embedded system application
CO5. Configure U-Boot, Understand IoT building blocks
CO6. Compare various IoT communication technologies and Design various IoT applications

CO7. Apply the knowledge to interface various sensors with IoT development board

CO8. Design and implement IoT system for real time applications

CO9. Model Internet of Things using various protocols of standard communication layers

CO10. Represent and Analyze various communication models, carry out the comparative analysis in terms of specified parameters

CO11. Choose an appropriate communication model for given design criteria

CO12. Understand essentials of IoT Security

CO13. Provide most optimum model of connectivity solution to various things in different application areas.

Topics and Learning Points

Unit-1: Introduction to ES System Software [10L]

Embedded Systems: Architecture & Characteristics of ES, Types of Embedded systems, Examples of Embedded Systems. Embedded System On Chip (SOC).

Components of ES: Hardware and software

Hardware components of ES: Power supply: types, characteristics, selection criteria, Processing Unit, Input devices, Output Devices

Unit-2: Sensors, Actuators and Interfacing [10L]

Sensors: Roles of Sensors & Actuators, Types of sensors, Active and passive, analog and digital, Contact and no-contact, Absolute and relative

Working of Sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.

Development boards: Types of boards - Arduino, Raspberry pi, Beagle bone, ESP8266, selection criteria. Interfacing of sensors with development boards

Unit-3: Communication under IoT [5L]

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

Unit 4: IoT Case Studies

Smart Cities, Agriculture, Health and Lifestyle, Industry, Home Automation, Telecom/5G **[5L]**

List of Practicals:

Sr. No.	Title Of Experiment	No. Of Experiment
1.	Embedded Systems of Object Detection	1
2.	Embedded Systems of Traffic Signal,	1
3.	Embedded Systems of Digital Clock	1
4.	Embedded Systems of Robotics Arm Movement	1
5.	Embedded Systems of Fire Alarm	1
6.	Embedded Systems of Automated Disinfection Tent	1
7.	Embedded Systems of Tyre Pressure Monitoring System	1
8.	Embedded Systems of Smart energy home management	1
9.	Communication Technologies for Smart Homes	1
10.	Smart Irrigation System using Arduino uno	1
11.	Crop Water Management System using Arduino uno	1
12.	Transport And Traffic Management System using Arduino uno	1
13.	Interface IR sensor to Arduino. Write a program to detect obstacle using IR sensor and notify it using led.	1
14.	Interface stepper motor and seven segment display with Arduino and write a program to control the motion of motor and display number of rotation made by motor on 7 segment display.	1
15.	Write an application using Arduino for streetlight control system. System consists of smart street lights that have external light sensing that automatically turns on at desired intensity based on amount of lighting needed.	1
16.	Write an application using Arduino for traffic signal monitoring and control system.	1
17.	Implement smart home automation system. The system automates home appliances and control them over internet from anywhere	1
18.	Develop a real time application like a smart home security. Description: when anyone comes at door the camera module automatically captures his image and sends a notification to the owner of the house on his mobile phone using gsm modem	1

References:

1. 1. Sriram V. Iyer, Pankaj Gupta, "Embedded Real-time Systems Programming", Tata McGraw-Hill, ISBN: 13: 9780070482845 .
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Raj Kamal, "Embedded Systems: Architecture, programming and Design", 2nd Edition, McGrawHill, ISBN: 13: 9780070151253
4. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345 3.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0
6. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
7. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally 3. HakimaChouchi, "The Internet of Things Connecting Objects to the Web", ISBN 078 -1- 84821-140-7,
8. Wiley Publications Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.
9. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
10. Data and Computer Communications; By: Stallings, William; Pearson Education Pte.Ltd., Delhi, 6th Edition

Mapping of PHY-176-SEC Applications of Internet of Things-II

	Programme Outcomes (POs)								
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	3								2
CO 2		3							
CO 3					2		2	1	
CO 4		3							
CO 5					3				
CO 6		3							
CO7					2	2			

Justification

PO1: Disciplinary Knowledge

CO1: Identify and understand the unique characteristics and components of embedded systems

Weightage: 3

Understanding the unique characteristics and components of embedded systems is fundamental to disciplinary knowledge in this field.

PO2: Critical Thinking and Problem Solving

CO2: Compare various development boards Arduino, Raspberry Pi, Beagle Bone Weightage: 3
Comparing development boards requires critical thinking to assess their features and choose the most suitable one for a given application.
CO4: Design, implement and test an embedded system application Weightage: 3
Designing and implementing embedded system applications involve critical thinking and problem-solving skills.

PO3: Social Competence

CO8: Design and implement IoT system for real-time applications
Weightage: 2 (Moderate relation)
Real-time IoT systems may have social implications, and designing them requires some consideration of social factors.
CO13: Provide the most optimum model of connectivity solution to various things in different application areas Weightage: 1
While connectivity solutions are important, the direct social impact may be less pronounced in this context.

PO4: Research-related Skills and Scientific Temper

CO9: Model Internet of Things using various protocols of standard communication layers Weightage: 3
Modeling IoT using standard communication protocols involves research-related skills and a scientific temper.
CO10: Represent and analyze various communication models, carry out the comparative analysis in terms of specified parameters Weightage: 3
Analyzing communication models requires research-related skills and a scientific approach.

PO5: Trans-disciplinary Knowledge

CO6: Compare various IoT communication technologies and design various IoT applications
Weightage: 2
Considering various IoT communication technologies involves elements from different disciplines.

PO6: Personal and Professional Competence

CO12: Understand essentials of IoT Security Weightage: 3
Understanding IoT security is crucial for personal and professional competence in the field.

PO7: Effective Citizenship and Ethics

CO11: Choose an appropriate communication model for given design criteria Weightage: 1
While ethical considerations are important, directly choosing a communication model may have a weak connection with effective citizenship.

PO8: Environment and Sustainability

CO5: Configure U-Boot, Understand IoT building blocks Weightage: 1
U-Boot configuration and understanding IoT building blocks may have a weak connection to environmental and sustainability concerns.

PO9: Self-directed and Life-long Learning

CO3: Implement interfacing of various sensors, actuators to the development boards Weightage: 2
Implementing interfaces involves practical application and promotes self-directed learning.
CO7: Apply the knowledge to interface various sensors with IoT development board Weightage: 2
Applying knowledge to interface sensors fosters self-directed learning in practical scenarios.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc. Physics, F. Y. B. Sc. (Computer Science), F.Y. B.Com., FYBBA(CA), FYBBA Sem - II (2023 Pattern)

(w. e. f. A.Y. 2023-2024)

Name of the Programme	: F.Y. B.Sc., F. Y. B. Sc. (Computer Science), F.Y. B.Com., FYBBA(CA), FYBBA
Program Code	: USCOS
Class	: F. Y. B. Sc. (Computer Science)
Semester	: II
Course Type	: Value Education Course (VEC) (TH)
Course Name	: Digital and Technological Solutions
Course Code	: COS-185-VEC
No. of Lectures	: 30
No. of Credits	: 02

Course Objectives:

- To gain. /'familiarity with digital paradigms
- To sensitize about role & significance of digital technology.
- To provide know how of communications & networks
- To bring awareness about the e-governance and Digital India initiatives
- To provide a. flavour of emerging technologies - Cloud, Big Data, AI 3D printing

Course Outcome:

CO1. Knowledge about digital paradigm.

CO2. Realisation of importance of digital technology, digital financial tools, e-commerce.

CO3. Know-how of communication and networks.

CO4. Familiarity with the e-governance and Digital India initiatives

CO5. An understanding of use & applications of digital technology.

CO6. Basic knowledge of all machine learning and big data.

CO7. Knowledge about social networking.

Units	Couse Contents	No. of Lectures
Unit - I	**Introduction & Evolution of Digital Systems**: Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & it's working, Software and its types. **Operating Systems:** Types and Functions. Problem Solving: Algorithms and Flowcharts. Communication Systems: Principles, Model & Transmission Media.	8
Unit - II	**Computer Networks & internet:** Concepts & Applicators, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. **Computer Based information System:** Significance & Types. E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.	7
Unit –III	**Digital India & e-Governance:** initiatives, infrastructure, Services and Empowerment. **Digital Financial Tools:** Unified Payment interface, Aadhar Enabled Payment System, USSD, Credit/Debit Cards, e-Wallet's internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and pos.	8
Unit- IV	**Cyber Security:** Threats, Significance, Challenges, Precautions, Safety Measures, & Tools **Emerging Technologies & their applications:** Overview of Cloud Computing, Big Data, internet of Things, Virtual Reality, Blockchain, Robotics, Artificial intelligence, 3-D Printing. Future of Digital Technologies.	7

REFERENCE BOOKS:

1. Fundamentals of Computers by E Balagurusamy- Tata Mc GrawHill

2. Data Communications and Networking by Behrouz A. Forouzan - McGraw Hill

3. "Cloud Computing- Principals and Paradigms" by Buvya, Broberg, and Gosciniski- Wiley

4. "E commerce" by Laudon.

5. "Artificial lntelligence- A Modern Approach by Russel and Norving" - Pearson Education.

6. "lnternet of Things" by Samuel Greengard - MIT press

7. "lntroduction to Computers by Peter Norton" - Tata McGraw Hill

8. "E-Commerce Concepts, Models, Strategies"- C.S.V. Murthy

9. "Basics of Artificial lntelligence and Machine Learning" by Dheeraj Mehrotra - Notion press.

10. "Big Data for dummies" by Hurwith, Nugent,Halper, Kaufman, Wiley & Sons - Wile

Mapping of COS-185-VEC Digital and Technological Solutions

Programme Outcomes								
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	**1**	**1**		**1**		**1**		
CO2		**1**			**1**	**1**	**1**	
CO3	**1**					**1**	**1**	
CO4			**1**				**1**	**1**
CO5	**1**			**1**	**1**	**1**		
CO6	**1**	**1**		**1**				**1**
CO7			**1**	**1**	**1**			