Shiksha Mandal's

Bajaj College of Science, Wardha

Department of Physics

Vocational Skill Enhancement Course-VSC-I (w.e.f 2023-24)

B.Sc. Sem I

Course Title: Laboratory Training in Physics

Course Overview: This course is designed to provide undergraduate students with the skills and knowledge necessary to work as laboratory facilitators in the field of physics. Students will learn how to perform experiments, collect data, and analyze results in a physics laboratory setting.

Course Credits: 2

Course Duration: 60 hours

Course Objectives:

Couse has the main objective to provide the skills and knowledge necessary to work as laboratory technicians in the field of physics, including academic research labs and industrial labs.

Course Learning Outcomes (CO):

Upon completion of this course, students will be able to:

CO1: Demonstrate knowledge of laboratory safety procedures specific to physics laboratory settings, including the proper handling and disposal of hazardous materials.

CO2: Use laboratory equipment and tools correctly and safely.

CO3: Perform basic laboratory procedures such as calibration, measurement, and error analysis with accuracy and precision.

CO4: Collect data using appropriate methods and techniques used in physics experiments, and analyze data using statistical software commonly used in physics research.

CO5: Present data using graphs and charts specific to physics experiments, and communicate findings effectively both orally and in writing.

CO6: Manage laboratory inventory and supplies specific to physics experiments, and maintain accurate records of laboratory activities.

Course Contents:

Unit I: Introduction to Physics Laboratory Techniques

- Overview of laboratory safety procedures and records specific to physics.
- Introduction to laboratory equipment and tools used in physics experiments.
- Basic laboratory calculations and measurements used in physics experiments.

(20 hours)

Unit II: Laboratory Skills and Techniques in Physics

- Laboratory equipment and its uses in physics experiments.
- Basic laboratory procedures, including calibration, measurement, and error analysis.
- Introduction to microscopy and spectroscopy techniques used in physics experiments.

(20 hours)

Unit III: Data Collection and Analysis in Physics

- Introduction to data collection methods and techniques used in physics experiments.
- Data analysis using open access software.
- Presentation of data using graphs and charts specific to physics experiments.

(20 hours)

Practicals/activities that can be conducted for the mentioned topics:

1. Safety Procedures Demonstration: Conduct a demonstration on laboratory safety procedures specific to physics experiments, including handling of equipment.

2. Equipment Familiarization: Provide hands-on experience with various laboratory equipment and tools used in physics experiments, such as oscilloscopes, multimeters, and vernier calipers.

3. Measurement Practice: Engage students in basic laboratory calculations and measurements, emphasizing the use of units, significant figures, and measurement uncertainties by using a physical pendulum.

5. Calibration and Error Analysis: Conduct practical exercises on equipment calibration, measurement techniques, and error analysis to familiarize students with the importance of precision in experimental work using simple pendulum experiment.

6. Microscopy and Spectroscopy: Introducing microscopy and spectroscopy techniques, allowing students to observe and analyze spectrum using microscopes and spectrometers.

7. Data Collection Methods: Engage students in hands-on data collection methods, including experiments involving motion, and demonstrate the use of mobile phone sensors and data loggers.

8. Data Analysis Software Tutorial: Provide training on open access software for data analysis, such as Excel, focusing on statistical analysis and visualization of experimental data.

9. Graphical Data Presentation: Task students with presenting experimental data using graphs and charts specific to physics experiments, emphasizing the selection of appropriate graph types for different data sets.

10. Experiment Design and Analysis: Encourage students to design and conduct their own physics experiments, collect data, analyze results, and present their findings, promoting independent inquiry and critical thinking skills through making of pin hole camera.

Reference Books:

1. Experimental Physics: A Manual for the Laboratory by A.K. Ghatak and S. Lokanathan.
2. Laboratory Techniques in Physics and Electronics by R. K. Shukla.
3. Laboratory Management: A Comprehensive Guide to Best Practices and Tools by Sunita Singh and Ramesh C. Gupta.
4. Personnel Management in the Laboratory by J.K. Sharma.
5. Introduction to Experimental Physics by Colin Cooke.

Note: Mode of evaluation:
End Semester Exam + Continuous Internal Assessment (Poster presentation / Project/ Presentation/ Assignment/ quiz)
Total Mark: 50

Shiksha Mandal's

Bajaj College of Science, Wardha (Autonomous)

Proposed Syllabus for Four Year Multidisciplinary UG Program with DSC as Major (e.g. Four Year B.Sc. Honors/Research Program)

Program: B.Sc.
(Academic Session 2023-24)
Syllabus

SKILL ENHANCEMENT COURSE (SEC)

Semester II courses in
Physics
Syllabus under Autonomy

Shiksha Mandal's

Bajaj College of Science, Wardha (Autonomous)

Syllabus for B. Sc. I (SEM-II) w.e.f. 2023-24

Skill Enhancement Course (SEC-I)

Course: ELECTRICAL CIRCUITS AND NETWORK SKILLS

(Only Practical Component)

(Credits: 02) (60 Hours)

Lab (Credit: 02) **60 Hrs**

Course description:

The course is designed for the students of science faculty who choose Physics as major in their B.Sc. Programme. The course comprises of basic electrical skills to be acquired by undergraduate students.

Course Objectives:

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode.

Course learning outcomes: Upon completion of this course students will

CO1: Learn to understand basics of electrical wiring and use of electrical protection devices.

CO2: Acquire necessary skills/hands on experience/working knowledge of electrical equipment like Generators, motors, multi meters, voltmeters, ammeters, electric circuit elements.

CO3: Understand various types of DC and AC circuits and making electrical drawings with symbols for various systems.

CO4: Get the knowledge of various components of electrical circuits and networks.

Syllabus

Unit-I

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources.

Unit-II

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyse DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Rules to analyse AC sourced electrical circuits. Power factor. Saving energy and money.

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating.

Unit-III

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Electrical Drawing and Symbols: Drawing symbols. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.

Practical (02 Credit)

1. Verification of Ohm's law.
2. Study of transformer.
3. Study of I-V character of diode.
4. Characteristics of Zener diode
5. Study of full wave and half wave rectifiers using CRO.
6. Measurement of current and voltage in electrical networks.
7. Estimation of power consumption and electric bill.
8. Time constant of RC circuit.
9. Capacitive reactance measurement.
10. Determination of inductance using LC circuit.
11. Measurement of average and RMS values of electrical signals.

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand & Co.
- A text book of Electrical Technology - A K Theraja - S Chand & Co.
- Principles of Electronics- V. K. Mehta, Rohit Mehta- S Chand & Co.
- Basics of electronics-Solid State, B. L. Thereja- S Chand & Co.

Note: Mode of evaluation:

- **Continuous Internal Assessment (No end semester examination)(Poster presentation / Project/ Presentation/ Assignment/ quiz)**
- **Total Mark: 50**