Unit-IV

Challenges in Promoting Rational Thinking: Barriers to rational thinking, role of education and media in promoting or hindering rationality, scientific temper, and constitutional duty: relevance in Indian context (Article 51A(h)), case studies: superstition and blind beliefs (e.g., astrology, miracle claims), science communication: importance of clear communication of science to the public

References:

1. Mythakon Se Vigyan Tak by Gauhar Raza, Penguin Random House India
2. The Scientific Attitude: Defending Science from Denial, Fraud, and Pseudoscience by Lee McIntyre, The MIT Press, Cambridge
3. In Search of Superstitions by Narendra Nayak, Mythri Books

240/PHY?/SE101-A

Skill Enhancement Course

Course ID - 240 [illegible]

BASICS OF INSTRUMENTATION SKILLS

Marks (Theory): 35 | **Credits:2 (30 lectures)**
Marks (Internal Assessment): 15 | **Time: 3 Hrs**

Note: The paper setter is to set nine questions in all. Question no. 1 (compulsory based on the entire syllabus) will consist of seven short answer type questions. The rest of the eight questions are to be set uniformly, with two questions from each unit selected. A student is required to attempt five questions, selecting one from each unit along with compulsory question no 1. The question paper shall contain 20% numerical problems in the relevant papers.

Course Objective: The course imparts practical knowledge about commonly used electronic instruments, including a multimeter, cathode ray oscilloscope, and LCR circuit, to undergraduate physics students.	**Course Outcome:** After completing this course, students will be able to understand the basic equipment used in a physics laboratory.

UNIT-I

Basic of Measurement: Instruments accuracy, precision, sensitivity, Resolution range, etc. Errors in measurements and loading effects, Random and systematic errors, Error propagation Multimeter: Principles of measurement of DC voltage and DC current, AC voltage, AC current and resistance. Specifications of a multimeter and their significance.

UNIT-II

Electronic Voltmeter and their Advantage for voltage measurement w.r.t. input impedance and sensitivity, Principles of current & voltage measurement, Electronic Voltmeter/Multimeter and their significance

UNIT-III

Oscilloscope: Block diagram of basic CRO, CRT, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence, Time base operation, synchronization, Front panel controls, Specifications of CRO and their significance, Use for the measurement of voltage (dc and ac), frequency and time period.

UNIT-IV

Impedance Bridges and Q-meters: Block diagram of bridge, Working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge, Block diagram and working principles of a Q- Meter.

Digital Instruments: Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles and block diagram of digital voltmeter.

References:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co. Performance and design of AC machines - M G Say ELBS Edn.
2. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill. Logic circuit design, Shimon P. Vingron, 2012, Springer.
3. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
4. Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

BASICS OF INSTRUMENTATION SKILLS LAB

Marks (External): 20 **Credits: 1 (30 Hrs)**
Marks (Internal Assessment): 05 **Time: 3 Hrs**

1. Each student should perform at-least five (any) experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. To observe sine wave, square wave, triangular wave and ramp waveforms on the C.R.O. and to measure amplitude and frequency of the waveforms.
5. Measurement of time period, frequency, average period using universal counter/ frequency counter.
6. Measurement of rise, fall and delay times using an Oscilloscope.
7. Measurement of R, L and C using a LCR bridge/ universal bridge.

8. To study the variation in current and voltage in a series LCR circuit and hence determine the resonant frequency of the circuit
9. To study the variation in current and voltage in a parallel LCR circuit and hence determine the resonant frequency of the circuit
10. To study the effect of voltmeter resistance on voltage measurement.

References:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co. Performance and design of AC machines - M G Say ELBS Edn.
2. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill. Logic circuit design, Shimon P. Vingron, 2012, Springer.
3. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
4. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.

SEMESTER-II

Minor Courses

Course ID - 240/PHYP/MI201

Modern Physics

Max. Marks: 35 **Credit 2 (30 Hrs)**

Internal Assessment: 15 **Time: 3 hrs**

*Note: The paper setter is to set **Nine** questions. Question no. 1 (compulsory based on the entire syllabus) will consist of short answer type questions. The rest of the **eight** questions will be set uniformly, with two questions from each unit selected. A student is required to attempt **five** questions, selecting one from each unit along with compulsory question no 1. The question paper shall contain 20 % numerical problems in the relevant papers.*

Course Objective: This course aims to introduce students to the foundational concepts of quantum mechanics. It covers the quantum theory of light, wave-particle duality, the Heisenberg uncertainty principle, and the Schrödinger equation. Students will gain an understanding of particles' behaviour at the quantum level and learn to apply quantum mechanical principles to solve problems.	**Course Outcome:** Upon successfully completing this course, students will be able to understand the quantum theory of light, describe wave-particle duality and the Heisenberg uncertainty principle, solve the Schrödinger equation for simple systems and interpret wave functions in terms of probabilities and normalization.

Unit-I

Blackbody Radiation (observations and models), Plank's proposition and quantum theory of light, Photoelectric effect, X-rays, X-ray production, Compton scattering, Pair Production, De Broglie Waves, Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and the relation between them. Two-Slit experiment with electrons, Probability, Wave amplitude and wave functions, Rutherford Model, Hydrogen spectra and Bohr model of atom.

Unit-II

Position measurement- gamma-ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables,