| *DEPARTMENT OF PHYSICS* | | | | *CLASS: II B.Sc. Physics* | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Course Type** | **Course Code** | **Course Title** | **Credits** | **Contact Hours/week** | **CIA** | **Ext** | **Total** |
| IV | Skill based Elective-II | 20U4PSM2 | Basic Instrumentation Skill | 2 | 2 | 25 | 75 | 100 |

| **Nature of Course** | | | | |
|---|---|---|---|---|
| Knowledge and skill | | | Employability oriented | |
| Skill oriented | ✓ | | Entrepreneurship oriented | |

**Course Objectives:**

- To Learn errors in measurements and also to understand the construction of multi-meter. Acquire the skill in using multi-meter to measure various ranges of current, voltage and resistance
- To understand the construction of CRO. To acquire the skill in using CRO for various physical measurements.
- To understand the working of various generators the skill in using Q-meter
- To learn the bridge circuit and to acquire the skill in measuring R L C values.
- To understand the working of various types of recorders and acquire the skill of selecting a best recorder for particular system.

| Unit | Description | Hours | K-level | CLO |
|---|---|---|---|---|
| **I** | **Basics of Measurement:** Performance characteristics – Static Characteristics – Error in measurement – Types of Static error. Multimeter: DC Ammeter – multirange ammeters – DC voltmeter – Multirange voltmeter – Loading – AC voltmeter using rectifiers – multirange AC voltmeter – ohmmeter – Digital Voltmeter – Ramp technique Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance.<br>**Self Study/Audit :** Digital Voltmeter | 6 | **Up to K4** | **1** |
| **II** | **Cathode Ray Oscilloscope:** Introduction – Basic Principle- CRT features- Basic Principle of signal display - Block diagram of oscilloscope(Explanation only– no mathematical treatment),. Applications of Oscilloscope – Voltage measurements – Period and frequency measurements. | 6 | **Up to K3** | **2** |
| **III** | **Signal Generators and Analysis Instruments:** Signal generators – introduction- basic standard signal generators – function generator – square and pulse generators – basic wave analyser - - harmonic distortion analyser – resonance bridge – Q meter. | **6** | **Up to K3** | **3** |

| | | | | |
|---|---|---|---|---|
| **IV** | **Impedance Bridges:** Wheatstone's bridge – sensitivity-unbalanced bridge applications – AC brdiges – capacitance comparison bridge – Schering's bridge - inductance comparison bridge – Maxwell's bridge – precautions to be taken when using a bridge. | **6** | **Up to K2** | **4** |
| **V** | **Recorders:** Introduction – Graphic recorders – Strip Chart recorder - Galvanometer type recorders Potentiometric type recorders – Bridge type recorders magnetic recorders – Recorder Selections for particular applications – Recorder specifications - applications of strip chart recorders.<br>**Self Study/Audit :** Strip Chart Recorders. | **6** | **Up to K3** | **5** |

**Books for study:**

1. H.S. Kalsi, Electronic Instrumentation (Technical Education Serie) Fourth reprint (2002) Tata McGraw Hill New Delhi
   Unit-1 –1.2-1.5,3.2,3.3,4.2-4.4,4.6,4.12,4.15, 4.21, 5.1,5.2
   Unit -2 –7.1-7.4,7.30
   Unit -3 – 8.4, 8.5, 8.8, 8.9, 9.2, 9.5, 10.7
   Unit – 4 –11.2,11.2.1,11.2.4, 11.8-11.11, 11.13,11.18
   Unit – 5 – 12.1-12.4.2, 12.7, 12.11,12.12, 12.15

**Books for Reference:**


1. Electronic Devices and circuits, S. Salivahanan, N. S.Kumar, & A. Vallavaraja 11th reprint, 2010, Tata Mc-Graw Hill

2. A text book in Electrical Technology - B L Theraja - S Chand and Co.

3.Performance and design of AC machines - M G Say ELBS Edn.

4. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.

5.Logic circuit design, Shimon P. Vingron, 2012, Springer.

6. Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.


**Web Resources**

1. https://www.elprocus.com/what-are-errors-in-measurement-types-of-errors-with-calculation/
2. https://www.yourelectricalguide.com/2017/01/multimeter-construction-working.html
3. https://www.elprocus.com/cro-cathode-ray-oscilloscope-working-and-application/#:~:text=The%20CRO%20recruit%20the%20cathode,electron%20beam%20strikes%20with%20it
4. https://www.electricalengineeringinfo.com/2016/03/cathode-ray-oscilloscope-cro-construction-of-cathode-ray-oscilloscope-cro.html
5. https://www.electronics-notes.com/articles/test-methods/signal-generators/what-is-a-signal-generator.php#:~:text=A%20signal%20generator%20is%20piece,used%20with%20other%20 test%20instruments.
6. https://www.tutorialspoint.com/electronic_measuring_ instruments/electronic_measuring_instruments_signal_generators.htm

7. https://electronicscoach.com/ac-bridges.html, https://dkpandey.weebly.com/uploads/1/3/5/3/13534845/lecture6-8_dkp.pdf
8. http://www.darshan.ac.in/Upload/DIET/Documents/EE/EMMI_Ch%206_13092018_031526AM.pdf, https://instrumentationtools.com/recorders/

Note: 1. A maximum of Up to 10% (7.5 marks) of the questions may be asked from self study part of the syllabus in the summative examination.

2. The questions in the Audit part of the syllabus shall not be asked in the summative examination.

**Course Designer**

Dr. J. Suresh, Associate Prof & Principal

**Lecture Schedule**

| Unit | Topics | Hours | Mode |
|---|---|---|---|
| **Unit-I (6)** | Performance characteristics – Static Characteristics – Error in measurement – Types of Static error. | **2** | PPT, Chalk & Talk, Quiz, Assignment and Experiments |
| | Multimeter: DC Ammeter – multirange ammeters – DC voltmeter- Multirange voltmeter – Loading | **2** | |
| | AC voltmeter using rectifiers – multirange AC voltmeter – Digital Voltmeter – Ramp technique Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance | **2** | |
| **Unit-II (6)** | Introduction – Basic Principle- CRT features | **2** | PPT, Chalk & Talk, Quiz, Assignment and Experiments |
| | Basic Principle of signal display | **2** | |
| | Block diagram of oscilloscope-Applications of Oscilloscope – Voltage measurements – Period and frequency measurements. | **2** | |
| **Unit-III (6)** | Signal generators – introduction- basic standard signal generators – function generator | **2** | PPT, Chalk & Talk, Quiz, Assignment and Experiments |
| | square and pulse generators – basic wave analyser | **2** | |
| | harmonic distortion analyser – resonance bridge – Q meter | **2** | |
| **Unit-IV (6)** | Wheatstone's bridge – sensitivity-unbalanced bridge applications | **2** | PPT, Chalk & Talk, Quiz, Assignment and Experiments |
| | AC brdiges – capacitance comparison bridge – Schering's bridge - inductance comparison bridge | **2** | |
| | Maxwell's bridge – precautions to be taken when using a bridge. | **2** | |
| **Unit-V (6)** | Introduction – Graphic recorders – Strip Chart recorder - Galvanometer type recorders Potentiometric type recorders | **3** | PPT, Chalk & Talk, Quiz, Assignment |
| | Bridge type recorders magnetic recorders – Recorder Selections for particular applications – Recorder specifications - applications of strip chart recorders | **3** | |

**Pedagogy**

Chalk and talk, PPT, Quiz, Assisgnment, Seminar, Problem Solving, Learning by doing.

**Rationale for Nature of the course:**

The student will be able to use effectively Multimeter, CRO for electrical parameter measurements. Understand the working of bridges and use them for electrical component measurements. May design and manufacture simple multimeter of his own.

**Activities having direct bearing on Skill development / Employability / Entrepreneurship**

Students will perform experiments using devices like ammeter, voltmeter, CRO etc

**Course Learning Outcomes**

| CLOs | Course Learning Outcomes | Knowledge Level |
|---|---|---|
| **CLO-1** | Analyze construction and operational aspects of different measuring instruments along with their application domains. | Up to K4 |
| **CLO-2** | Apply the fundamental measurement method of resistance, capacitance, inductance, etc. by using various a.c bridges and other techniques. | Up to K3 |
| **CLO-3** | Apply the impact of electrical measurement methods and use modern sophisticated instruments/systems for human utilities and industrial application | Up to K3 |
| **CLO-4** | Understand the various devises for recording values | Up to K2 |
| **CLO-5** | Solve problems relating to ranging of level instruments | Up to K3 |

**Course Learning Outcomes**

**Mapping of CLOs with PSOs**

| # | PSO-1 | PSO-2 | PSO-3 | PSO-4 | PSO-5 | PSO-6 | PSO-7 |
|---|---|---|---|---|---|---|---|
| **CLO-1** | 3 | 3 | 3 | 2 | | | 1 |
| **CLO-2** | 3 | 3 | 2 | 2 | | | 1 |
| **CLO-3** | 3 | 2 | 2 | 2 | | | 1 |
| **CLO-4** | 3 | 3 | 2 | 1 | | | 1 |
| **CLO-5** | 3 | 2 | 2 | 1 | | | 1 |

**Mapping of CLOs with POs**

| # | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 |
|---|---|---|---|---|---|
| **CLO-1** | 3 | 2 | 2 | | 1 |
| **CLO-2** | 3 | 2 | 2 | | 1 |
| **CLO-3** | 3 | 1 | 1 | | |
| **CLO-4** | 3 | 2 | 3 | | |
| **CLO-5** | 3 | 2 | 1 | | 1 |

**Summative – Blue-Print-Model**
**(Mapping with CLOs)**

| Units | CLOs | K-Level | Section-A | | Section-B | | Sec-C | Sec-D |
|---|---|---|---|---|---|---|---|---|
| | | | MCQs. | | Short Answers | | (Either OR ) | Open Choice |
| | | | No. of Questions | K-Level | No. of Questions | K-Level | | |
| 1 | CLO1 | Up to K4 | 2 | K1&K2 | 1 | K2 | 2(K4&K4) | 1(K4) |
| 2 | CLO2 | Up to K3 | 2 | K1&K2 | 1 | K2 | 2(K3&K3) | 1(K3) |
| 3 | CLO3 | Up to K3 | 2 | K1&K2 | 1 | K2 | 2(K1&K1) | 1(K3) |
| 4 | CLO4 | Up to K2 | 2 | K1&K2 | 1 | K1 | 2(K2&K2) | 1(K2) |
| 5 | CLO5 | Up to K3 | 2 | K1&K2 | 1 | K1 | 2(K3&K3) | 1(K3) |

**Distribution of Section-wise Marks with K Levels**

| K Levels | Section A (No Choice) | Section B (No Choice) | Section C (Either/or) | Section D (Open Choice) | **Total Marks** | % of Marks without choice | Consolidated |
|---|---|---|---|---|---|---|---|
| K1 | 5 | 4 | 10 | -- | **19** | 15.83 | **42%** |
| K2 | 5 | 6 | 10 | 10 | **31** | 25.83 | |
| K3 | - | - | 20 | 30 | **50** | 41.67 | **42%** |
| K4 | - | - | 10 | 10 | **20** | 16.67 | **16%** |
| Total Marks | 10 | 10 | 50 | 50 | **120** | 100.00 | **100%** |