

# UNDERGRADUATE PROGRAMME IN INSTRUMENTATION

**ELI -10**

**Measurement Science and Techniques**

**48 Periods**

## UNIT 1

**Basic Measurement Instruments**-DC Bridges and applications: Wheatstone, Kelvin, Murray and Varley loop tests. AC Bridges: General form of AC bridge balance, comparison bridges, Maxwell, Hay, Schering, Wien, Wagner ground condition.

DC measurement: DC voltmeter, ammeter, ohmmeter, multimeter, Single Phase wattmeter.

AC measurement: voltmeter, ammeter. Digital type voltmeters, digital multimeter, Digital LCR meter. Digital frequency meter: elements of frequency meter, universal counter and its different modes, measurement errors and extending the frequency range.

16 Periods

## UNIT 2

**Signal Generators**-Types of generators and their operation: Audio oscillator, Function generators, Pulse generators, RF generators, Random noise generators, Sweep generator. **Probes and Connectors**: Test leads, shielded cables, connectors, low capacitance probes, high voltage probes, RF demodulator probes, special probes for IC's, current probes.

10 Periods

## UNIT 3

**Electronic Displays**: Cathode Ray Oscilloscope (CRO) and applications: Block diagram of a General Purpose Oscilloscope and its basic operation, electrostatic focusing and deflection, screens for CRT and graticules, CRT Connections, CRO probes. Types of CRO's: dual trace oscilloscope, digital storage oscilloscope. Amplitude, Frequency, Phase measurements, Lissajous Figures.

12 Periods

## UNIT 4

**Frequency Spectrum, Distortion and wave measurement** - Spectrum analyzer, Harmonic distortion analyzer, intermodulation distortion analyzer, wave analyzer and distortion factor meter, wave meter, Different type of wave meters: Lumped and cavity wavemeters, Q-meter and its applications.

**Logic Analyzers**- Logic probes, timing analyzer, glitch detect, state analyzer

10 Periods

### Essential Books:

#### UNIT 1

Chapter 4, 5, 6, 10- Cooper H, Modern electronic Instrumentation and measurement techniques, , PHI Learning Private Limited

Chapter 7- Cooper H, Modern electronic Instrumentation and measurement techniques, PHI Learning Private Limited, 1994.

Chapter 4, 8- Bell D. A, Electronic Instrumentation & Measurements, , PHI Learning.

Chapter 4, 5, 6- Kalsi H. S, Electronic Instrumentation, Tata McGraw Hill.

Chapter 13- Cooper W.D, Electronic Instrumentation and Measurement Techniques, Prentice Hall, 1976.

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### **UNIT 2**

Chapter 11- Bell D. A, Electronic Instrumentation & Measurements, , PHI Learning.

Chapter 8- Cooper H., Modern electronic Instrumentation and measurement techniques, PHI Learning Private Limited, 2012.

Chapter 15- Carr J. J., Elements of electronic instrumentation and measurement, Joseph J, Pearson Education.

Chapter 8- Kalsi H. S., Electronic Instrumentation, Tata McGraw Hill.

### **UNIT 3**

Chapter 7- Cooper H, Modern Electronic Instrumentation and measurement techniques, PHI Learning Private Limited, 2012.

Chapter 9- Cooper W. D., Electronic Instrumentation and Measurement Techniques, Prentice Hall, 1976.

Chapter 9, 10- Bell D. A., Electronic Instrumentation & Measurements, PHI Learning.

### **UNIT 4**

Chapter 9, 16- Kalsi H.S., Electronic Instrumentation, Tata McGraw Hill.

Chapter 9, 6- Cooper H., Modern Electronic Instrumentation and Measurement Techniques, , PHI Learning Private Limited, 2012.

Chapter 4- Bakshi and Bakshi , Electronic Instrumentation, , Technical Publications.

### **Suggested Books:**

1. Wolf S. and Smith R.F.M , Student Reference Manual, Pearson Education.
2. Rangan, Sharma and Mani, Instrumentation devices and systems, Tata Mc-Graw Hill.
3. Witte R. A., Electronic test instruments: Analog and Digital measurements, Tata Mc-Graw Hill.
4. Witte R. A., Electronic Test Instruments, Pearson Education.

### **Practical (based on ELI -10 )**

1. Study and operation of Multimeters (Analog and Digital), Function Generator, Regulated Power Supplies, CRO.
2. Study the generation of Lissajous figures to find unknown frequency and phase shift.
3. Frequency measurement using Wein Bridge.
4. Study and application of Universal Counters.
5. Study of R,L,C and Q meter.
6. Study of DSO-Measurement of response time of relay using DSO.
7. Measurements of L, C, R using bridges.
8. To study bridge based loop tests.