



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA–533003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

| III Year – II SEMESTER | | L | T | P | C |
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| ELECTRICAL MEASUREMENTS AND INSTRUMENTATION | | | | | |

Preamble:

This course gives an outset on principles of operation and construction of various basic instruments for measurement of different electrical quantities. Familiarization of modern digital measurement systems were also included here.

Course Objectives:

- To understand and analyze the factors that effect the various measuring units.
- To choose the appropriate meters for measuring of voltage, current, power, power factor and energy qualities & understand the concept of standardization.
- Describe the operating principle of AC & DC bridges for measurement of resistance, inductance and capacitance.
- To understand the concept of the transducer and their effectiveness in converting from one form to the other form for the ease of calculating and measuring purposes.
- To understand the operating principles of basic building blocks of digital systems, record and display units.

UNIT - I

Analog Ammeter and Voltmeters

Classification – deflecting - control and damping torques - – PMMC - moving iron type and electrostatic instruments - Construction - Torque equation - Range extension - Errors and compensations - advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer-construction - theory - errors-Numerical Problems.

UNIT - II

Analog Wattmeters and Power Factor Meters

Electrodynamometer type wattmeter (LPF and UPF) - Power factor meters: Dynamometer and M.I type (Single phase and Three phase) - Construction - theory - torque equation - advantages and disadvantages.

Potentiometers: Introduction to DC and AC Potentiometers – Construction-working – Applications - Numerical Problems.

UNIT - III

Measurements of Electrical parameters

DC Bridges: Method of measuring low - medium and high resistance - sensitivity of Wheat stone's bridge - Kelvin's double bridge for measuring low resistance - Loss of charge method for measurement of high resistance - Megger – measurement of earth resistance - Numerical Problems.

AC Bridges: Measurement of inductance and quality factor - - Maxwell's bridge - - Hay's bridge - - Anderson's bridge. Measurement of capacitance and loss angle - - Desauty's bridge - Schering Bridge - Wien's bridge - Wagner's earthing device - - Numerical Problems.

UNIT - IV

Transducers

Definition - Classification - Resistive - Inductive and Capacitive Transducer - LVDT - Strain Gauge - Thermistors - Thermocouples - Piezo electric and Photo Diode Transducers - Hall effect sensors-Numerical Problems.



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UNIT - V

Digital meters

Digital Voltmeters – Successive approximation DVM - Ramp type DVM and Integrating type DVM – Digital frequency meter - Digital multimeter - Digital tachometer - Digital Energy Meter - Q meter - Power Analyzer. CRO- measurement of phase difference & Frequency using lissajious patterns - Numerical Problems.

Course Outcomes:

After the completion of the course the student should be able to:

- Know the construction and working of various types of analog instruments.
- Describe the construction and working of wattmeter and power factor meters
- Know the construction and working various bridges for the measurement resistance - inductance and capacitance
- Know the operational concepts of various transducers
- Know the construction and operation digital meters

Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.

Reference Books:

2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications - 19th revised edition - 2011.
3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rd edition.
3. Electrical Measurements by Buckingham and Price - Prentice – Hall
4. Electrical Measurements by Forest K. Harris. John Wiley and Sons