

B.Tech IV Year I Semester**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA****19AEE74c- INSTRUMENTATION****(Professional Elective-III)**

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Course Objectives: The objectives of the course are to make the students learn about

- Measuring system, Common errors, Objectives of Measuring systems
- Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems
- Measuring various meters and analyzers
- Basic transducers and their usage in various measurements
- Provides an introduction to the field of instrumentation and covers process variables and the various instruments used to sense, measure, transmit and control these variables.

UNIT – I: Instrument Errors**10 Hrs**

Measuring Systems, Objectives of Measuring Instruments, definition of terms-Span & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of generalized measurement system. **L1**
- Know about the static and dynamic characteristics. **L2**

UNIT – II: Data Transmission and Telemetry**10 Hrs**

Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of different modulations and compare different types of modulations in telemetry system. **L1**
- Know about the various telemetry systems and basic operation of Data acquisition systems **L2**

UNIT – III: Signal Analyzers**10 Hrs**

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the principles of Wave Analyzers. **L1**
- Demonstrate the applications of Wave Analyzers. **L2**

UNIT – IV: Transducers**10 Hrs**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the working principle, characteristics of various transducers **L1**
- Understand about applications of various transducers **L2**

UNIT – V: Measurement of Non-Electrical Quantities**10 Hrs**

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn about measurement the various non-electrical quantities such as pressure, temperature, displacement, velocity **L1**
- Understand the concepts of measuring of various non-electrical quantities **L2**

Text Books:

1. D.V.S Murthy, “Transducers and Instrumentation Prentice Hall of India”, 2004.
2. A.K. Sawhney, “A course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai & Co., 2012.

Reference Books:

1. H.S.Kalsi “Electronic Instrumentation”, Tata MCGraw-Hill Edition, 3rd edition. 2010.
2. A.D Helfrick and W.D.Cooper, Modern “Electronic Instrumentation and Measurement techniques” Pearson/Prentice Hall of India., 1990.
3. T. R. Padmanabhan, “Industrial Instrumentation – Principles and Design Springer”, 3rd re print, 2009.

Course Outcomes:

At the end of this Course the student will be able to

- Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques **L1**
- Various telemetry systems and basic operation of Data acquisition systems **L2**
- Various measuring meters and signal analyzers **L3**
- Transducers and their measurement of electrical and non-electrical quantities **L4**
- The application of the above as a prerequisite topics to SCADA in power systems, state estimation theory, etc. **L5**