4/4 B.Tech. EIGHTH SEMESTER
ELECTIVE – IV

EM8T3D INTELLIGENT INSTRUMENTATION Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives

The purpose of this course is to introduce the students

- To the basics of intelligent instrumentation
- To understand the operation of smart sensors
- To inculcate the concepts of signal processing

Learning outcomes

The student will be able to

- Know the fundamentals of intelligent instrumentation
- Apply signal processing and manipulation concepts
- Get the Knowledge on smart sensors.

UNIT I

Introduction: Intelligence, features characterizing intelligence, intelligent instrumentation system; features of intelligent instrumentation; components of intelligent instrumentation system. Block diagram of an intelligent instrumentation system.

UNIT II

Signal Processing and Manipulation –I: Signal amplification & attenuation (OP-AMP based), Instrumentation Amplifier (circuit diagram, highCMRR& other features), Signal Linearization (different types such as Diode resistor combination.

UNIT III

Signal Processing and Manipulation –II: OP-AMP based, etc.(; Bias Removal, Signal filtering (outputs from ideal filters, outputs form constant-k filters, matching of filter sections, active analog filters), OP-AMP based Voltage-to-current converter, Current-to-voltage converter, Signal integration, Voltage follower (pre amplifier), voltage comparator, Phase – Locked loop.

UNIT IV

Signal Processing and Manipulation –III: Signal addition, Signal multiplication, Signal Transmission (Signal amplification, Shielding, Current loop transmission, Voltage-to-frequency conversion, Fiber optic transmission Description of Spike Filter (software based).

UNITV

Smart Sensors: Primary sensors, Excitation, Compensation (Nonlinearity: look up table method, polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation & regression, Noise & interference.

UNIT VI

Response time: Drift; Cross-sensitivity), information coding, Processing, Data Communication, Standards for smart sensor interface.

UNIT VII

Interfacing Instruments & Computers Address decoding, Data transfer control, A/D converter,D/A converter, Sample & hold circuit, others interface considerations.

UNIT VIII

Recent Trends In Sensor Technologies: Introduction, Film sensors (Thick film sensors, this film sensor) Semiconductor IC Technology- Standard method, Micro electro- mechanical systems (Micro-machining, some application examples), Nano-Sensors.

Text Book

1. Barney, G.C., Intelligent instruments. Hemel Hempsteao: Prentice Hall, 1985.
2. ALAN S. Morris, Principles of Measurement s Instrumentation. New. Delhi: PHI Pvt. Ltd. 1999.

Reference Book:

1. D.Patranabis, Sensors s Transducers. New .Delhi: PHI, 2003.
2. Roman Kuc, Introduction to Digital Signal Processing. New York: McGraw-Hill Pub. Co.