DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING
BASAVESHWAR ENGINEERING COLLEGE, BAGALKOT

V SEMESTER OPEN ELECTIVE OFFERED FOR THE STUDENTS OF OTHER DEPARTMENT

UEI531N: ELECTRICAL SENSORS AND TRANSDUCERS

3 Credits (3-0-0)

About the course:

Sensors and transducers are essentially required to interface real-time process to computers and virtual world. This syllabus gives working principle and some constructional details of most of electrical sensors and transducers

UNIT-I

Introduction to Sensor: Meaning of sensors and transducers, classification of transducers (Mechanical/electrical, Active/passive, Absolute/Modulated output type), Sensor based measurement system, Static characteristics (Accuracy, precision, sensitivity, error, linearity, resolution, hysteresis), Dynamic characteristics (Order and step response of I, II order system) **Resistive Sensors:** Potentiometers, Strain gages, Resistive temperature detectors (RTD), Thermistors, Magnetoresistors, Light-dependent resistors (LDR), Resistive hygrometer, Resistive gas sensor, Liquid conductivity sensors. **10 Hrs.**

UNIT-II

Self-Generating Sensors: Thermoelectric sensors: Thermocouples, Piezoelectric sensors, Hall effect sensors, Pyroelectric sensors, Photo voltaic sensors, Electrochemical sensors. **Capacitive Sensors:** Variable capacitors: Differential arrangement, Different applications. Differential capacitor: Principle based on variable are, distance and dielectric property, applications. **10 Hrs.**

UNIT-III

Inductive Sensors: Variable reluctance type, Eddy current type, LVDT, LVDT applications, Variable transformers: Synchros, Resolvers, Inductosyns. Magnetoelastic and magnetostrictive sensors, Super Quantum Interference Devices (SQUIDS). **Electromagnetic Sensors:** Sensors based on Faraday's law, Linear velocity sensor, Search coil magnetometer, Electromagnetic flow meter. **10 Hrs.**

UNIT-IV

Digital and Intelligent Sensors: Position encoders, Resonant sensors, Intelligent sensors. **Miscellaneous Sensors:** Sensors based on semiconductor junctions, sensors based on MOSFET transistors, Fiber optic sensors, Ultrasonic based sensors, Biosensors. **10 Hrs.**

Total Hrs.: 40 Hrs.

TEXT BOOK:

1. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning," 2nd Edition, Wiley India Private Ltd.

REFERENCE BOOKS:

1. Ian R. Sinclair, "Sensors and Transducers," 3rd Edition, Newnes Publication.
2. D. Patranabis, "Sensors and Transducers," 2nd Edition, PHI.
3. Allan S. Morris, "Measurement and Instrumentation Principles," 3rd Edition, Butterworth and Heinmann Publication.
4. John P. Bentley, "Principles of Measurement Systems," 3rd Edition, 2004, Pearson Publication.

Course Outcomes:

Student will be able to:

CO1: Describe the characteristics of various sensors/transducers
CO2: Interpret the construction and working of various sensors/transducers
CO3: Select an appropriate sensor for real time measurement application
CO4: Use an appropriate sensor for designing an engineering solution for real time measurement of process parameter

UEI631N: INSTRUMENTAL METHODS OF ANALYSIS

3 Credits (3-0-0)

VI SEMESTER OPEN ELECTIVE OFFERED FOR THE STUDENTS OF OTHER DEPARTMENT

About the Course:

Instrumental methods of analysis refers to the application of instruments for analysis of given sample. These are modern methods used for the analysis of liquid/solid/gaseous samples. This course is intended to give an overview of most of the analytical instruments and their working principle.

UNIT-I

Introduction: Analytical methods, **Electromagnetic Spectrum**: Properties of electromagnetic radiation and interaction with matter. **Molecular Spectroscopy**: Measurement of transmittance and absorbance, Beer Lambert's law and its limitations, Components of analytical instruments: Sources of radiation, Wavelength selectors, Sample containers, Detectors. **UV-Visible Absorption Spectrometry**: Single and double beam absorption instruments, Application for qualitative and quantitative analysis.

10 Hrs.

UNIT-II

IR Absorption Spectrometry: Basic components of IR instruments, Non-dispersive spectrometers: Filter photometers, Photometers without filters, Filter correlation analyzers. **Mass Spectrometry**: Features of mass spectroscopy, Components of spectrometers: Sample inlet systems, Electron impact ion source, Mass analyzers- Single focus and double focus magnetic sector analyzer, Quadrupole analyzer and time of flight (TOF) analyzer, Applications.

10 Hrs.

UNIT-III

Atomic Spectroscopy: Principles of AAS, AES and AFS, Sample atomization techniques, Atomic absorption instrumentation, Applications. **X-ray Techniques:** Introduction, Principles, Sources, Detectors, Instrumentation, X-ray absorption method - Absorptiometer, X-ray fluorescence method-Energy dispersive type, X-ray diffraction-powder diffraction method and applications.

10 Hrs.

UNIT-IV

Chromatography: Introduction, Classification, Gas chromatography: Principle, GLC instrumentation, Liquid chromatography: Scope and HPLC instrumentation, Applications. **NMR Spectroscopy:** Principles of NMR spectroscopy, Different types of NMR instruments: FT – NMR, Carbon-13 NMR, Applications.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

CO1:	Describe the importance and basic concepts of qualitative and quantitative analysis.
CO2:	Identify components and analytical methods for qualitative and quantitative analysis.
CO3:	Describe various principles and techniques employed for instrumental analysis using UV, visible and other EM sources.
CO4:	List the applications and usage of analytical instruments.

TEXT BOOKS:

1. Douglas A. Skoog, James Holler, Stanley R.Crounch, "Instrumental Analysis", Cengage Learning Publication, 2007.
2. H.H. Willard, L.L.Merritt, J.A.Dean, F.A. Settle, "Instrumental Methods of Analysis", 7thEdition, CBS Publishing and Distribution, 1986.

REFERENCE BOOK:

1. R.S. Khandpur, "Hand Book of Analytical Instrumentation", TMH, 1989.

VII SEMESTER OPEN ELECTIVE (For other branch students)

UEI747N: INDUSTRIAL AUTOMATION
3 Credits (3-0-0)

Course Learning Objectives:

1. To convey the importance and benefits of industrial automation.
2. To develop PLC programming skills.
3. To discuss SCADA and DCS for process automation.

UNIT-I

Introduction: Expectations from automation, Basic functions, Historical development of control systems, Current trends in computer of process plants. **Introduction to Programmable Logic Controllers (PLC):** Introduction to PLC operation-The digital concept, Analog signals, The input status file, The output status file, Input and output status files, Sixteen point I/O modules, PLC memory, Input modules - Discrete type, Discrete AC and DC type. Output Modules - Discrete type, Solid-state type, Switching relay type.

10 Hrs.

UNIT-II

Introduction to Logic: The logic, Conventional ladder v/s LPLC ladder, Series and parallel function of OR, AND, NOT, XOR logic, Analysis of rung. **PLC Instructions:** The basic relay instructions normally open and normally closed instructions, Output latching instructions, Understanding relay instructions and the programmable controller input modules, Interfacing start stop pushbutton and motor to PLC, Developing ladder diagram with analytical problems.

10 Hrs.

UNIT-III

Timer and Counter Instructions: On delay and off delay and retentive timer instructions, PLC counter up and down instructions, Combining counters and timers, Developing ladder diagram with analytical problems. **Comparison and Data Handling Instructions:** Data handling instructions, Sequencer instructions - Programming sequence output instructions, Developing ladder diagram with analytical problems.

10 Hrs.

UNIT-IV

Supervisory Control And Data Acquisition (SCADA): Introduction. Channel scanning, Conversion to engineering units, Data processing, Distributed SCADA system. **Distributed Control System (DCS):** Introduction, Distributed Vs Centralized control, Advantages of Distributed Control System, Functional requirements of distributed control system, System architecture, Distributed Control Systems.

10 Hrs.

Total Hrs.: 40

Text Books:

1. Garry Dunning, "Introduction to Programmable Logic Controllers," 2nd Edition. Thomson Publishing, ISBN: 981-240-625-5.
2. Krishna Kant, "Computer based Industrial Control," 6th Edition, 2004, PHI, ISBN: 1-203-11237

Reference Books:

1. Curtis Johnson, "Process Control Instrumentation Technology", Prentice Hall of India.
2. Bela G. Liptak, "Instrumentation Engineers Hand Book – Process Control", Chilton Book Company, Pennsylvania.
3. W.Bolton, "Industrial Control and Instrumentation", Universities Press.

Course Outcomes (COs):

Students will:

CO1: a. Elucidate the role of automation in industry and comprehend the various controllers used in industries
b. Illustrate typical elements of PLC and its memory organization

CO2: a. Compare electrical relay logic and PLC ladder logic illustrate the working of PLC instructions
b. Develop program using basic PLC instructions

CO3: a. Illustrate the working of advanced PLC instructions
b. Develop program for PLC applications

CO4: a. Interpret the role of SCADA in process control
b. Analyze the role of Distributed Control System (DCS)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	--	--	--	--	--	1	--	1	3	2
CO2	2	3	3	1	2	--	--	--	--	1	--	1	2	3
CO3	3	3	3	3	2	--	--	--	--	1	--	1	2	3
CO4	2	2	2	1	--	--	--	--	--	1	2	1	3	2