19BSP703					Basics of Instrumentation and Control					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	0	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To know about the principles of measurements and working mechanism of various sensors and devices.
- To make students aware about the basics of instrumentation and their applications in industrial, scientific and commercial realms.
- To learn about the type of system, dynamics of physical systems, classification of control system and its analysis.
- To develop skills to control schemes of various processes to get desired output.

UNIT 1 Introduction to Instrumentation **13 Hrs.**

Basic concepts and scope of Instrumentation, Functional elements of an instrument, Block diagram representation, Classification of Instruments, Measurement Systems:- Static characteristics (accuracy, precision, resolution, threshold, static sensitivity, linearity, range and span, hysteresis, dead band, backlash, drift), Input-output configuration of measuring instruments, Standards, Calibration.

UNIT 2 Data Analysis **17 Hrs.**

Definition of errors- systematic or cumulative errors, accidental or random errors, miscellaneous type of gross errors, types of uncertainties, propagation of uncertainties, Error analysis, Introduction to Statistical Distributions, Statistical analysis: Least square fit, P-test, Student's t-test, Chi-square test.

UNIT 3 Basic Sensors for Measurement and Control **15 Hrs.**

Definition, Types, Basic principle and applications of Resistive, Inductive, Capacitive, Piezoelectric and their Dynamic performance, Fiber optic sensors, Hall-Effect sensor, Photo-emissive cell, Photo Diode/ Photo Transistor, Photovoltaic, LVDT, Gravitational Sensors, Inclination detectors, Electromagnetic Sensors, Flow Sensors, Strain Gauge Digital transducers, Thermo-electric sensor: thermocouple, Bi-metallic strip, thermistors.

UNIT 4 Basic Instruments **15 Hrs.**

Basic principle and applications of X-Ray Diffraction, Raman spectrometer, Fourier Transform Infrared Spectroscopy (FTIR), Interpretation of Infrared (IR) spectra, various Mass spectrometer with their application, UV-Visible Spectrophotometer, Holography: Principle and applications, Michelson interferometer, Physical Vapor Deposition Sputtering, Gas Chromatograph, Bio-potentials, Bio-amplifiers and Bio-electrodes.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the function, utilization and limitations of various instruments.
CO2 – Analyze the usage of various devices along with their control processes to design circuits and solve real time problems.
CO3 –Evaluate to provide innovative ideas to control methodologies to core electronics, mechanical and industrial problems.
CO4 - Develop the skills to design appropriate instruments to measure given sets of parameters.
CO5 - Understand relationship between the measuring instruments and their role in the overall control loop process.
CO6-Apply appropriate techniques, research based methods/ideas, resources, design of experiments and interpretation of data to set up new improved techniques.

TEXT/REFERENCE BOOKS

1. Doeblin E. O., Measurement Systems, McGraw Hill, New York, 1992.
2. Nakra and Choudhary, Instrumentation Measurements and Analysis, Tata McGraw-Hill, 2nd edition.
3. Rangan, Sarma, and Mani, Instrumentation- Devices and Systems, Tata-McGraw Hill, 2nd edition.
4. Arun K. Ghosh, Introduction to Measurements and Instrumentation, PHI, 4th edition.
5. Dr R S Khandpur, Handbook of Analytical Instruments, McGraw-Hill Professional, 2006, 2nd edition.
6. Liptak B. G. - Process Measurement and Analysis, Third Edition, Chilton Book Company, Pennsylvania, 1995.
7. D. Patranabis, Principles of Industrial Instrumentation Tata McGraw Hill Publishing Co., New-Delhi, 1999.
8. R. S. Khandpur - Handbook of Biomedical Instrumentation, TMH.
9. Ian S. McLean: Electronic Imaging in Astronomy: Detectors and instrumentation, 2nd edition.
10. John F. Read, Industrial Applications of Lasers, Academic Press, 1978.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: <Details> <> Marks

Part B/Question: <Details> <> Marks