4141 - ELECTRONIC INSTRUMENTATION

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
3	2	5	25	25	3 Hrs	100	-	150

Pre-requisite	Source
4132	EXN

Semester	Theory	Test	Total	TW	PR	Gr Total
	75	25	100	25	—	125

Rationale:

COURSE CONTENTS	Hrs	Mks.
1. TRANSDUCERS	14	30
Block diagram of an instrumentation system.		
Transducers–classification as primary and secondary, active and passive, analog and digital, electrical and mechanical, examples of each, Characteristics of a good transducer, advantages of electrical transducer.		
Resistive transducer – principle of operation, typical construction, materials used in potentiometers, strain gauge RTD, Thermistors.		
Inductive transducers – principles of operation based on variation in self inductance, mutual inductance, variable reluctance type, differential output type, LVDT.		
Capacitive transducers – principles of operation, types of Capacitive variation, advantages and disadvantages, applications.		
Piezo-electric transducers – principle, construction, application.		
Photoelectric transducers – Photomultiplier tube, LDR, photocells, photo voltaic cell, photo diode, phototransistor.		
Thermocouples – principle, materials used, limitation.		
Digital Transducers – Optical and electrical type. Shaft encoders.		
2. MEASUREMENT TECHNIQUES	14	30
Various techniques in brief, based on above transducers to measure following Parameters: Displacement – Linear, Angular.flow – Mechanical methods, turbine flow meter. Angular Speed – analog and digital methods Stroboscope.		
Temperature – Resistance thermometers, Vibration - Seismic transducers, accelerometers, LVDT type. Pressure – LVDT, photoelectric. Capacitate low pressure by Pirani gauge an thermocouple, vacuum gauge. Thickness. measurement techniques - electrical methods, ultrasonic, nuclear.Level Measurement techniques - resistive, Capacitive, mechanical, Photoelectric.		
Humidity measurement - Hygrometer.Sound measurement-using microphones.		

3. SIGNAL CONDITIONING Need for signal conditioning; Block diagram of signal conditioning system (AC/ DC) Openup as ideal instrumentation amplifier. Data Acquisition system – BD & Chs, Data Loggger – BD & Chs	10	20
4. PROCESS CONTROL Definition of process control, block diagram of process control loop, elements of process control Controller Principles: Definition of process parameters, control system parameters. Controller modes – discontinuous and continuous modes. 2 position, multiposition, floating (single speed, multiple speed). Continuous controller modes – Pulse and Composite (PI, PD, PID) (no detailed mathematical treatment). Block diagram of Computers supervisory control, direct digital control, features pf Direct Digital Control, practical considerations in DDC.Final control operation: Elements of final control operation, examples of each element, signal conversions involving electrical and pneumatic signals, actuators – electrical actuators, solenoid, DC and AC servo motors. Stepper motors, control elements – valves, control valve. Synchro systems – Synchro transmitter types, synchro receiver.	10	20
Total	48	100

LIST OF PRACTICALS (ANY 8)

1. Study of potentiometer as a displacement transducer.
2. Study of LVDT characteristics.
3. Study of inductive transducer.
4. Study of Capacitate transducer
5. Study of Strain gauge.
6. Study of LDR.
7. Study of Thermistor.
8. Study of RTD.
9. Study of Thermocouple.
10. Study of Peizo-electric transducer.
11. Study of Photo-diode as transducer.
12. Study of Phototransistor as transducer.
13. Study of Strip chart recorder.
14. Study of magnetic recorder.

TEXT /REFERENCE BOOKS:

1. Electronic instrumentation by H. S. Kalsi
2. A Course in Electrical & Electronic Instrumentation by A. K. Sawhney
3. Process Control Instrumentation Technology by Curtis Johnson.