

SARDAR PATEL UNIVERSITY
Programme & Subject: B.Sc (Instrumentation – Vocational)
Semester: V
Syllabus with Effect from: June-2020

Paper Code: US05CINV21	Total Credit: 4
Title Of Paper: Process Measurement Technique – I	

Unit	Description in detail
I	Temperature Measurement – I Introduction, Definition, Scales used for Temperature measurements, Liquid in glass thermometer, Filled System Thermometer: Liquid filled, Gas filled and Vapour pressure and Dual filled thermometer, Bimetallic strip Thermometer.
II	Temperature Measurement – II Seebeck experiment of thermo electricity, Paltier effect, Thompson’s effects, Thermo couples: Laws, Materials, Types, Thermocouple Instrumentation, Resistance type Temperature Detectors (RTD), Thermistor, and semiconductor temperature sensor, Pyrometer: Total Radiation pyrometer, Optical pyrometer.
III	Pressure Measurement – I Introduction, Definition, Terminology: Absolute, Atmospheric, Gauge, Vacuum, Static and Dynamic pressure. Manometers: Single column, U- tube, Expanded bulb U-tube, Inclined U-tube Inverted U-tube, Ring balance Manometer.
IV	Pressure Measurement – II Mechanical Gauges: Bourdon tubes, Diaphragm, Bellows. Low pressure gauges: McLeod Gauge, Thermal conductivity, Ionization Gauges. Dead Weight tester.

Basic Text & Reference Books:-

- Mechanical Measurement and Control (Metropolitan Books) by D.S.Kumar
- Industrial Instrumentation (Wiley Eastern Limited) by D.P.Eckman.
- Mechanical and Industrial Measurements (Khanna Publishers) by R.K.Jain
- Instrumentation by Krik and Rimboi.
- Process Instrumentation and Control (Nirali Publications) by Kulkarni.
- Industrial Measurements and Control by S.K. Singh.
- Instrumentation Devices and Systems by Rangan, Sharma and Mani.

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Paper Code: US05CINV22	Total Credit: 4
Title Of Paper: Control System components and Technique – I	

Unit	Description in detail
I	Controller Principles Introduction, Process Characteristics: Process Equation, Process Load, Transient, Process Lag, Self Regulation; Control System Parameters: Error, Variable Range, Control Parameter Range, control Lag, Dead Time, Cycling, Controller Modes; Discontinuous Controller Modes (with Electronic Design): Two - Position Mode, Multiposition Mode, Floating - Control Mode, Continuous Controller Modes (with Electronic Design): Proportional (P) Control Mode, Integral (I) Control Mode, Derivative (D) Control Mode; Composite Control Modes (with Electronic Design): PI, PD, PID
II	Instrument Air System (IAS) Introduction , Characteristics of Air, Various Factors for Designing IAS: Sizing Criteria, Pressure Level, Air Supply Source (Small Scale Requirement, Typical IAS); Compressor System: Positive Displacement Type, Dynamic; Compressor Cooling, Compressor Control, Oil Removal, Dryer (Desiccant Type, Refrigeration Type), Necessity for Dryers, Distribution System
III	Relays: Electromechanical Control Relays, Solid State Relays, Timing Relays, Latching Relays, Relay Logic, Contactors: Magnetic Contactor, Arc Suppression, Contactor size and ratings, Magnetic Motor Starter, Solid State Contactor; Introduction of control valves, Bonnet Assembly, selection of control valve; Globe Valves, Butterfly Valves, diaphragm valves, cage guided valve bodies, valve plug guiding
IV	Stepper motor: Introduction and Construction ; Servos: Introduction and categories of control system, servo components and circuits, Synchro: Introduction and classification, Electrical Actuators, Pneumatic Actuators, Piston actuators, Rotary air motor actuator and Hydraulic actuators. Comparison between different actuators.

Basic Text & Reference Books:-

- Process Control Instrumentation Technology By Curtis Johnson
- Handbook of Instrumentation By W. G. Andrew
- Computer - Based Industrial Control By Krishna Kant
- Process Control (Concepts, Dynamics and Applications) By S. K. Singh
- Control System By Nagrath and Gopal
- Industrial Electronics By Petruzella
- Control Systems By K. Padmanabhan

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Paper Code: US05CINV23	Total Credit: 04
Title Of Paper: 8-Bit Microprocessor Programming & Applications – I	

Unit	Description in detail
I	The 8085 Microprocessor unit, Bus timing, De-multiplexing the bus, Generating control signal, A detailed look at the 8085 Microprocessor and its architecture, Examples of 8085 based microcomputer.
II	Instruction classification, Instruction Format, Method of wiring and executing a simple program, Instruction timing and operation status, Addressing modes. Data transfer Instruction set, Arithmetic instruction set, Logical instruction set, program related to Arithmetic and logical instruction.
III	Branch operations and their related programs, writing assembly language programs, Debugging a program, programming techniques: Looping, Counting and Indexing and their related flow charts, Additional Data transfer and 16 bit Arithmetic instruction and related program.
IV	Arithmetic operations related to memory, Logical operations: Rotate and compare and related programs, Dynamic Debugging.

Basic Text & Reference Books:-

- Microprocessor , Architecture, Programming and Applications with the 8085/8080 By : Ramesh S. Gaonkar

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Paper Code: US05CINV24	Total Credit: 4
Title Of Paper: Analytical Instrumentation	

Unit	Description in detail
I	pH Concept & Definition, Principle of pH measurement, Electrodes: Hydrogen, Glass, Calomel, Combined pH Electrode, Buffer solution, Handling of pH Electrodes, Types of pH meters: Null Detector, Direct Reading: Chopper Amplifier, Zero Corrected DC Amplifier,
II	Components of Gas Chromatography: Carrier Gas Supply, Sample Injection, Column, Stationary Phase, Thermal Compartment, Conductivity detector, Flame Ionization Detection, Electron Capture Detector.
III	Liquid Chromatography, Ion Exchange, Gel Permeation, Thin Layer, Paper Partition, High Performance Liquid Chromatography, High Pressure Pump, Gradient Elution, Sample Injection, Column.
IV	Detection Systems: Fluorescence Detector, UV Detector, Refractive Index Detector, Conductivity detector, Mass Detector, Laser based, Dual type, Performance Parameters, Calibration Methods.

Basic Text & Reference Books:-

- Handbook of Analytical Instruments, R. S. Khandpur, Tata McGraw-Hill.
- Instrumental Methods of Chemical Analysis, Gurdeep R. Chatwal & Sham Anand, Himalaya Publishing House.
- Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler & Timothy A. Nieman, Thomson- Brooks/Cole.
- Instrumental Methods of Analysis, Hobart H. Willard, Lynne L. Merritt Jr., John A. Dean & Frank A. Settle Jr., CBS Publishers & Distributors.

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Paper Code: US05CINV25	Total Credit: 6
Title Of Paper: Practical	

	List
1	Proportional controller
2	Proportional integral controller
3	Proportional derivative controller
4	Proportional integral derivative controller
5	Water level on-off controller
6	Temperature level on-off controller
7	Ring counter
8	Shift register
9	Ph measurement
10	Conductivity measurement
11	Thermocouple
12	To study control valves and sizing
13	Digital to analog converter (DAC, R-2R)
14	Digital to analog converter (DAC, weighted Register)
15	Analog to digital converter (ADC, successive approximation)
16	Analog to digital converter (ADC, counter type)
17	Analog to digital converter (ADC, dual slope)
18	Introduction to 8085 up
19	8 bit Arithmetic addition in 8085 up
20	8 bit arithmetic subtraction in 8085 up
21	8 bit logical operation in 8085 up-I
22	8 bit logical operation in 8085 up-II
23	8 bit data transfer in 8085 up
24	Branch operation in 8085 up

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Paper Code: US05DINV26	Total Credit: 2
Title Of Paper: Digital and Analog systems	

Unit	Description in detail
I	Wheatstone Bridge, Kelvin Bridge, AC Bridges and their applications, Maxwell Bridge, Hay Bridge, Schering Bridge, Wein Bridge. Introduction Programmable logic devices
II	The Shift Register, Shift Right Register, Shift Left Register, Ring Counter, Bidirectional Register, Controlled Buffer Register, Tri-state switch, Specification of D/A converters, Resolution, Linearity, Accuracy, Settling Time, Temp. Sensitivity Weighted Resistor converter, R-2R D/A converter.
III	Introduction to ADC, Types of A/D converters, Parallel Comparator type, Successive Approximation type, Counter type, Dual slope type, Voltage to Frequency & Voltage to time converter, A/D converter Specification, Introduction to ADC 0801.
IV	Introduction to Modem and Interfaces, Low-speed Modem operation, Modem Interfaces, Asynchronous and Synchronous Operation, The Bell 103-Type Modem, The Schmitt trigger as an Interface circuit and tri- state buses.

Basic Text & Reference Books:-

- Electronics Instrumentation and Measurement Techniques - By Cooper and Helfrick.(Unit 1)
- Digital Integrated Electronics (TMH) - By Herbert Taub and Donald Schilling (Unit 2,3)
- Radio Engineering (Unit 4,5 & 6) - By G.K. Mithal, (Khanna publisher Delhi)
- Basic Radio and Television – By S.P. Sharma
- Monochrome and Colour Television – By R.R. Gulati
- Digital Principles and Applications (TMH) – By Malvino and Leach.
- Electrical and Electronics Measurements and Instrumentation – By A.K. Shawny.
- Fundamental of Digital Circuits – By A. Anand Kumar