

**Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Microprocessor Programming and
Interfacing Using 8085
Course No: INS-301 (Effect from: June, 2004)
3 hrs 80 Marks**

Unit-1:

Microprocessor as programming device, Organization of microprocessor based system, Machine language & Computer languages, Microprocessor architecture: Address bus, Data bus, Control bus, Register, Accumulator, Flag, Program Counter, Stack pointer, Memory: its types, Flip-flop, Latch as a storage element, Memory mapped I/O and I/O mapped I/O, logic devices for interfacing: buffers, decoders, encoders, latches, 8085 microprocessor: pin-out diagram, functional block diagram, bus timing, de-multiplexing of address bus, control signals, ALU, flags.

Unit-2:

Machine cycles: op-code fetch, memory read, memory write, Memory interfacing, I/O interfacing, I/O instructions, device selection, data transfer, Absolute/Linear decoding input interfacing, interfacing I/O, devices using decoders, interfacing output displays, interfacing input devices. 8085 programming model, instruction classification, instruction format, op-code format, Data transfer instructions.

Unit-3:

Arithmetic operations logic operations, branch operations, 8085 interrupts and restart instructions. Arithmetic operations related to memory, Programming techniques: looping, counting and indexing.

Unit-4:

16-bit data transfer and arithmetic instructions, logic operations: rotate, compare: counter or time delay generation using single register or register pair, loop, counter design with time delay, Hexadecimal, decade counter, pulse generation. Stack: concept, instructions: CALL, RET, conditional call and return instructions, multiple subroutine or nesting.

Unit-5:

Code conversion: BCD to BINARY, BINARY to BCD, BCD to 7-SEGMENTS, BINARY to ASCII, ASCII to BINARY, BCD arithmetic: addition, subtraction, multiplication,

Unit-6:

ADC, DAC interface, General purpose programmable peripheral device: 8255 a programmable peripheral interface, interface with key board and seven segment display.

Text books: 1. Microprocessor Architecture Programming and Application by R.S. Gaonkar

Reference:

1. Microprocessor Theory and Application by Rafiquazzaman
2. Microprocessor (8085) by B.Ram

**Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Process Instrumentation
Course No: INS-302 (Effect from: June, 2004)
3 hrs 80 Marks**

Unit-1: Temperature Measurement:

Definition & Scales, Liquid in glass thermometer, Bimetallic thermometer, Filled System thermometer, Liquid filled, gas filled, Vapour Pressure thermometer, RTD: Laws, materials, types, Thermocouple Laws, materials, types, Pyrometer: Total radiation pyrometer, optical pyrometer.

Unit-2: Pressure measurement:

Terminology: Absolute pressure, Atmospheric pressure, Gauge pressure, Static pressure, Vacuum, Total pressure and their units, Manometers: U-tube, inclined manometer, Ring balance manometer, Mechanical Gauges: Bourdon Tube, Diaphragm, Bellows, Low pressure gauges: Mcleod gauge, Pirani gauge, ionization gauge, Dead weight Tester.

Unit-3: Level, Density & Specific gravity Measurement:

Direct methods: Sight glass, Float & Tape, Float & Shaft, Float & Spring: Electrical methods: Capacitance level indicator, Ultrasonic method, Radioactive method; Air and liquid purge method of level measurement.

Specific gravity bottle method, Hydrometer, Weight method, Pressure method, Viscosity measurement, moisture measurement.

Unit-4: Flow Measurement:

Flow of fluid in pipes & Bernoulli's equation, nature of flow, Head flow meters: Orifice plate, Venturimeter, Venturi nozzle, Pitot tube, Multiplying pitot tube, Variable Head flow meter: Rotameter. Quantity meters: Piston type, Nutating disk meter, Rotary vane type, Sealed drum, Lobbed impeller meter type.

Unit-5: Flow Measurement:

Open Channel meters: Rectangular weir, V-notch weir, Trapezoidal weir, Electrical type flow meters: Turbine type, Electromagnetic flow meter, Hot wire anemometer, Ultrasonic method, Mass Flow measurement, Basic block of smart series transmitters.

Unit-6: Force, Torque and Speed Measurement:

Force: Hydraulic force meter, Pneumatic force meter, Proving ring, Strain gauge load cell, Pressductors load cell. Torque: Inline rotating torque meter, inline stationary torque meter, Proximity sensors, Speed: Revolution Counter, Tacho-scope, Slipping clutch tachometer, Centrifugal force tachometer, Drag cup, Contact less electrical tachometers, Tacho-generators.

Text Books:

1. Process instrumentation by D.P. Eckman
2. Mechanical measurement and control by D.S. Kumar
3. Principles of industrial instruments by Patranabis

Reference:

1. Instrumentation measurement and analysis by Nakara and Chaudhary
2. Principles of measurement and instrumentation by A.S. Morris

Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Introduction to Control System
Course No: INS-303 (Effect from: June, 2004)
3 hrs 80 Marks

Unit-1: Fundamentals of Process Control:

Introduction to process control, open loop and closed loop control systems, Process parameters: Process equation, process load, Process lag, Self regulation, Control system parameters: Error, control lag. Controller modes: Two position, Multi-position, Floating control mode, Proportional, Integral, Derivative, PI, PD, and PID.

Unit-2: Discrete control system:

Definition, Characteristics, Discrete state variable, Continuous control, Discrete control, composite control, Process specifications, Hardware, Event sequence description, Cascade control, Feed-forward Control, Ratio control.

Unit-3: Laplace transform: step function, Ramp function, Sinusoidal function, inverse laplace transform, Solving differential equation using laplace transform, Transfer function, open loop transfer function, closed loop transfer function, Block diagram reduction.

Unit-4: Control Valve:

Valve capacity, valve rangeability, Body design : Single and double port valve, three way, split body, ball valve, Butterfly, Diaphragm. Flow characteristics, Quick opening, Linear, Equal percentage, trim design, plug, seat, Bonnet assembly: extension bonnet, finned bonnet. Actuators: Spring and Diaphragm, Cylindrical: Single cylinder type, Double acting cylinder type, Rotary cylinder type, positioner

Unit-5: Instrument Air System:

Requirement/Characteristics, Sizing, Air supply Source, Compressor system, Compressor Cooling, Compressor control, Oil removal, Dryer, Desiccant type, refrigeration type Distribution system.

Unit-6: Boiler control: objectives, purpose of instrumentation in boilers basic boiler, feed water control system, objective, measurement and indication of drum level, single element control, two element control, three element control, forced draft control, furnace draft control, steam pressure/fuel control, combustion control.

Text Books:

1. Process Control Instrumentation Technology by C.D. Johnson
2. Industrial Electronic by Petruzella
3. Automatic Control By S.N. Verma
4. Control System by Nagrath and Gopal

Reference:

1. Instrumentation Handbook by William Andrew
2. Computer-Based Industrial Control by Krishna Kant

**Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Advance Control System
Course No: INS-304 (Effect from: June,
2004) 3 hrs 80 Marks**

Unit-1: Programmable logic controllers:

Programmable logic controllers, History, Characteristics of the PLC, Parts of PLC: its Architecture, Memory module, CPU, power supply unit, Principal of operation of PLC, Modifying the operation, PLC Versus Computers, PLC Versus DCS, PLC Size and Applications, PLC Versus Relay

Unit-2: PLC Hardware Components:

The I/O Section, Discrete I/O Modules, Analog I/O module, Intelligent I/O modules, Digital I/O modules and their interfacing circuits, Memory types, Program memory and Data memory, Fundamentals and Logic: Review of Digital logics, Hard-wired logic versus programmed logic

Unit-3: Basics of PLC Programming:

Processor memory organization, Scan Cycle: Self Scan, Input Scan, Output Scan, Program Scan, PLC Programming Languages. Ladder diagram and Boolean language, instruction addressing, Branch Instructions, Internal Relay Instruction.

Unit-4: Programming Timers and Counters:

Time Instructions: ON DELAY Timer, OFF-DELAY Timer, Retentive Timer, Cascading Timers, Counter Instructions: Up-Counter, Down-Counter, Cascading Counters.

Unit-5: Relay and Contactors:

Electromechanical relay, solid-state relay, timing relay, latching relay, relay logic, specifications and rating, Contactors: Size, rating.

Input devices: temperature switch, proximity switch, pressure switch.

Unit-6: Distributed Control System:

Introduction, history, functional requirements of process control system, system architecture, Distributed control systems.

Text Book:

1. Automatic manufacturing system using PLCs by Jack Hugh
2. Industrial electronics by Petruzella
3. Computer bases industrial control by Krishna Kant

Reference:

1. Programmable Logic Controller by Petruzella
2. Introduction to programmable logic controller by Thomas Hughes

**Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Industrial Electronics
Course No: INS-305 (Effect from: June, 2004)
3 hrs 80 Marks**

Unit-1: Transformer:

Working principle, construction, core type transformer, shell type transformer, theory of ideal transformer, EMF equation of transformer, voltage transformation ratio, transformer with losses but no magnetic leakage, transformer with winding resistance but without magnetic leakage, equivalent resistance, magnetic leakage, transformer with resistance and leakage reactance, equivalent circuit.

Unit-2: D.C. Generator:

Principle, construction, working, total losses in D.C. Generator. D.C. Motors: principles, comparison of Generator and Motor action, voltage equation of a motor, condition of maximum power, torque, armature torque of a motor, shaft torque, speed regulation, torque and speed of a motor, motor characteristics, characteristics of series motor, shunt motor.

Unit-3: Induction motor: classification of A.C. motors, general principle, construction, revolving magnetic field (two and three phase), why does the rotor rotate? Slip, frequency of rotor current, torque speed characteristics and curve, relation between torque and slip, current speed curve, types of single phase induction motors.

Unit-4: Stepper motor: Types: variable reluctance, permanent magnet, hybrid stepper motors. Synchronous motor: Three phase synchronous motor, generation of three phase voltage system, synchronous motor, synchronous motor applications.

Unit-5: SCR: mode of operation, dynamic characteristics, SCR gate characteristics, methods of turning On, principle features of firing circuits, simple R and RC triggering circuits, UJT pulse triggering circuit, UJT characteristics, triggering circuits suitable for single phase converters, triggering circuits suitable for single phase inverters, digital firing schemes, series and parallel connections of SCR.

Triac: characteristics, triggering mechanism, phase control using triac.

Unit-6: Phase controlled rectifier and inverters: thyristor circuits and their control, single phase converter, three-phase converter. dc-dc switch mode converters: control, step down converter, step up converter.

Text Book:

1. A text book of Electrical Technology by B.L. Theraja
2. Electrical Engineering Fundamentals by Del Toro
3. An introduction to Thyristor and their application by M Ramamoorthy
4. Power Electronics by Mohan and Robbins

Reference:

1. Electronics in Industry by G.M. Chute and R.D. Chute
2. Power Electronics by P.C. Sen

Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Analytical and Bio-medical
Course No: INS-306 (Effect from: June, 2004)
3 hrs 80 Marks

Unit-1: pH: introduction, principle of pH measurement, buffer solutions, pH electrodes: glass, calomel, combined, hydrogen, pH meters: null detector, chopper amplifier type, direct reading, zero corrected DC amplifier type. Conductivity: introduction, cell constant, conductivity cell, measurement, null balance type conductivity meter. Gas analyzers: O₂: Magnetic wind type. Dumbbell type, CO₂, CO: IR type, gas chromatography type H₂: thermal conductivity type.

Unit-2: GAS chromatography: basic parts of chromatograph, carrier gas supply system, sample injection system, chromatographic column, thermal compartment, Detection system: Flame Ionization Detector (FID), Electron Capture Detector (ECD), Thermal Conductivity Detector, Cross-sectional area Ionization Detectors (CID), Recording instruments.

Liquid Chromatography: high pressure pump system, gradient elution, sample injection system, column, Detection system: fluorescence detector, UV-Visible-IR absorption, electric conductivity, refractive index.

Unit-3: UV/Visible spectroscopy:

Electromagnetic radiation, wavelength spectra, Beer Lambert's Law, and deviation from the law, Absorption instruments: radiation source, optical filters, monochromators (prism and grating), Detectors: photovoltaic, photo emissive, silicon diode detector, Single and double beam photometers, visible colorimeter, flame photometer.

Unit-4: IR Spectroscopy:

Basic components: radiation sources, monochromators, slits, and mirrors, Detectors: Photoconductive cells, solid state photo detectors, thermal detectors, thermocouple bolometer, pneumatic detector, pyro-electric detector. Optical null method, ratio recording method Sample holders, gas, liquid

Unit-5: Mass Spectrometer: Basic mass spectrometer, types, components, resolution, applications.

NMR Spectroscopy: Principle, construction.

Unit-6: Bio-potential, resting and action potential, propagation of action potential, electrode theory, bio-potential electrodes.

Electrocardiography: ECG amplifier, electrodes and leads, recorder principle,

Electroencephalography: recorder principle and block diagram. Blood pressure measurement.

Text Books:

1. Handbook of analytical instrumentation by R.S. Khandpur
2. Handbook of Bio-medical instrumentation by R.S. Khandpur

Reference:

1. Bio-medical instrumentation and measurement by Cromwell, Weibell and Pfeiffer

**Sardar Patel University,
T.Y.B.Sc. (Instrumentation)
Subject: Practicals
Course No: INS-307 (Effect from: June, 2004)
3 hrs 80 Marks**

- | Sr. | Title |
|------------|---------------------------------------|
| 01. | Data transfer operations |
| 02. | Arithmetic operations-I |
| 03. | Arithmetic operations-II |
| 04. | Logic operations |
| 05. | Delay programming |
| 06. | Subroutine programming |
| 07. | Code conversion programming |
| 08. | Analog to Digital conversion |
| 09. | Digital to Analog conversion |
| 10. | And other experiments based on theory |

T.Y.B.Sc. (Instruments) Course No. INS:308

- | Sr. | Title |
|------------|------------------------------------------|
| 01. | Study of LVDT characteristics |
| 02. | Study of Thermocouple characteristics |
| 03. | Study of RTD characteristics |
| 04. | Study of Strain gauge characteristics |
| 05. | Study of UJT characteristics |
| 06. | Proportional controller study |
| 07. | Frequency modulation and demodulation |
| 08. | TRIAC for phase control |
| 09. | SCR for half and full wave phase control |
| 10. | Study of Dead Weight Tester |
| 11. | Study of Hall effect |
| 12. | Eg measurement using for probe method |
| 13. | Voltage to frequency converter |
| 14. | Pulse modulation and demodulation |
| 15. | And other experiments based on theory |

T.Y.B.Sc. (Instrumentation) Course No. INS:309

PROJECT WORK BASED ON THEORY PAPERS