GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Instrumentation and Control Engineering

(Applied Instrumentation)

Subject Name: Mechatronics (Institute Level Elective -1)

Sr.No	Course content
1.	**Mechatronics:** What is mechatronics?, Systems, Measurement system, control system, Microprocessor-based controllers, Response of systems, The mechatronics approach, Problems
2.	**Sensors and transducers :** Sensors and transducers, Performance terminology, Displacement, position and motion, Force, fluid pressure, liquid flow, liquid level Temperature, Light sensors, Selection of sensors Inputting data by switches, problems.
3.	**Signal conditioning:** Signal conditioning, the operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal Processing, Pulse modulation, Problems.
4.	**Data Presentation System:** Displays, Data Presentation elements, Magnetic recording, Displays, Data acquisition systems, Measurements systems, Testing and calibration , Problems
5.	**Pneumatic and hydraulic actuation systems:** Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Cylinders, Process control valves, Rotary actuators, Problems.
6.	**Mechanical actuation systems:** Mechanical systems, types of motion, Kinematic chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection
7.	**Electrical actuation systems:** Electrical systems, Mechanical switches, solid-state switches, Solenoids, D.C. motors, A.C. motors Stepper motors, Problems
8.	**Basic system models:** Mathematical models, Mechanical system building blocks, electrical system buildings blocks, Fluid system building blocks, Thermal systems building blocks, Problems
9.	**System models:-** Engineering systems, Rotational- translational systems, Electomechanical systems,Hydraulic- mechanical systems, Problems

10.	**Dynamic responses of systems:-** Modelling dynamic systems, First- order systems, second-order systems, Performance measures for second-order systems, systems identification, Problems
11.	**System transfer functions:** The transfer function, First-order systems, Second-order systems, system in series, Systems with feedback loops, Effect of pole location on transient response, MATLAB and SIMULINK , Problems
12.	**Frequency response:** Sinusoidal input, Phases, Frequency response, Bode Plots, Performance specifications, stability, problems
13.	**Closed-loop controllers:** Continuous and discrete processes, control modes, Two-step mode, Derivative control, Integral control, PID Controller, Digital Controllers, Control system performance, Controller Tuning, Velocity Control, Adaptive Control
14.	**Digital Logic:** Digital Logic, Number Systems, Logic Gates, Boolean Algebra, Karnaugh maps, Applications of logic gates, Sequential logic, problems.
15.	**Microprocessors:** Control, Microprocessor Systems, Microcontrollers, Applications, Programming, Problems
16.	**Assembly Language:** Languages, Instruction Set, Assembly language Programme, Subroutines, Look-up Table, problems
17.	**C Language:** Why C?, Program Structure, Branches and loops, Arrays, Pointers, Program Development, Examples of programs
18.	**Input/Output Systems:** Interfacing, Input/Output Addressing, Interface Requirements, Peripheral Interface Adapters, Serial Communications interface, Examples of interfacing, problems.
19.	**Fault Finding:** Fault-Detection Technique, Watchdog Timer, Parity and error coding checks, Common hardware faults, Microprocessor Systems, Emulation and Simulation, PLC Systems, problems
20.	**Mechatronics systems:** Traditional and Mechatronics Design, Possible mechatronics design solutions, Case studies of mechatronics systems, problems and assignments

Reference Books:

1. Mechatronics , Electronics Control systems in Mechanical and Electrical Engineering – W. Bolton (third edition)