

Chapter 1 : Introduction to Mechatronics, Sensors and Actuators 1-1 to 1-44

Syllabus : Introduction to Mechatronics and its Applications, Measurement Characteristics (Static/Dynamic), **Sensors** : Types of sensors; Motion Sensors : Encoder (Absolute & incremental), Lidar, Eddy Current, Proximity (Optical, Inductive, Capacitive), MEMS Accelerometer; Temperature sensor –Pyrometer, Infrared Thermometer; Force / Pressure Sensors : Strain gauges, Piezoelectric sensor; Flow sensors – Electromagnetic, Ultrasonic, Hot-wire anemometer; Color sensor : RGB type; Biosensors : Enzyme, ECG, EMG, **Actuators** : Servo motor; Hydraulic and Pneumatic (must be restricted to classification and working of one type of linear and rotary actuator); linear electrical actuators, Selection of Sensor & Actuator.

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Chapter 2 : Data Acquisition & Signal Communication
2-1 to 2-28

Syllabus : Signal Communication : Serial, Parallel; Synchronous, Asynchronous Introduction to DAQ, Types, Components of a Data Acquisition System (Sensor, Signal conditioning, processing, controlling and storage/display/action)

Data Acquisition : Signal collection, Signal conditioning – Isolation & Filtering, Amplification, Sampling, Aliasing, Sample and hold circuit, Quantization, Analog-to-digital converters (4 bit Successive Approximation type ADC), Digital-to-Analog converters (4 bit R2R type DAC), Data storage Applications: DAQ in Household ,Digital Pressure Gauge, Digital Flow measurement, DVB Digital Video Broadcast, AM/FM.

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Chapter 3 : Control systems & Transfer Function Based Modelling 3-1 to 3-38

Syllabus : Introduction to control systems, need, Types- Open and Closed loop, Concept of Transfer Function, Block Diagram & Reduction principles and problems; Applications (Household, Automotive, Industrial shop floor)

Transfer Function based modeling of Mechanical, Thermal and Fluid system; Concept of Poles & Zeros; Pole zero plot, Stability Analysis using Routh Hurwitz Criterion (Numerical Approach)

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Chapter 4 : Time and Frequency Domain Analysis 4-1 to 4-16

Syllabus : Time Domain Analysis – Unit step Response analysis via Transient response specifications (Percentage overshoot, Rise time, Delay time, Steady state error etc.)Frequency Domain Analysis – Frequency Domain Parameters - Natural Frequency, Damping Frequency and Damping Factor; Mapping of Pole Zero plot with damping factor, natural frequency and unit step response ; Introduction to Bode Plot, Gain Margin, Phase Margin.

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Chapter 5 : Controllers 5-1 to 5-20

Syllabus : Introduction to controllers, Need for Control, Proportional (P), Integral (I) and Derivative (D) control actions; PI, PD and PID control systems in parallel form; (Numerical approach), Feed forward anticipatory control, Manual tuning of PID control, Ziegler-Nichols method, Applications : Electro-Hydraulic/Pneumatic Control, Automotive Control.

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Chapter 6 : Programmable Logic Controller (PLC) 6-1 to 6-28

Syllabus : Introduction to PLC; Architecture of PLC; Selection of PLC; Ladder Logic programming for different types of logic gates; Latching; Timers, Counters; PLC control of Hydraulics / Pneumatics / Mechatronics systems involving timing and counting operations.

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