AGRI 322(ELECTIVE-V) ADVANCED AUTOMATION AND SENSOR TECHNOLOGY 3(2+1)

Objective(s)

To make applicability of knowledge of students in terms of sensor based automation technology and make them aware of interfacing of automated sensors.

Unit I

Basic Measuring System:

Functional elements of a basic measuring system; different types of measurands, Input-output configuration of a measuring system interfering and modifying inputs; Interfacing Sensors in Mechatronic System as – Temperature Switch Circuit, Float Systems, Applications in agricultural automation

Unit II

Digital Electronics:

Number Systems and Codes, Logic gates and Boolean Algebra, Binary / BCD adders and subtractors, Carry look ahead adder, Magnitude comparator, ALU. Combinational & Sequential Circuits A/D & D/A convertor circuit and its principles.

Unit III

Instruments:

Objective of studying the characteristics of the instruments, Static characteristics (accuracy precision, error, sensitivity, hysteresis, threshold, drift, span, static stiffness etc.), Dynamic characteristics (time domain and frequency domain characteristics terms input-output impedance's and meaning of impedance mismatching), Description of mathematical model for the generalized configuration of a measurement system, Order of the systems, response of zero, first and second order systems of step, ramp and sinusoidal inputs, Method to study the response of the system

Unit IV

Electrical Actuation Systems:

Switching Devices (Mechanical Switches – SPST, SPDT, DPDT), Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid, Various Motors and their Control (DC Motors, Permanent Magnet DC Motors, Control of DC Motors, Bush less Permanent Magnet DC Motors, AC Motors, Stepper Motors, Stepper Motor Controls, Servo Motors). Applications in agricultural automation

Unit V

Power Electronics

Thyristor:

Characteristics, turn-on methods, protection, Series and parallel operation, commutation; Characteristics of Diac and Triac; Power diode; Power transistor etc.

Phase controlled converters:

Principle of phase control, Single-phase half-wave circuit with different types of load, Single phase full-wave mid-point converter, Single-phase full-wave bridge converters, Single-phase semi converter, Three-phase thyristor converters, Single-phase and three-phase dual converters

DC transformers:

Principle of transformers operation and control strategies, Step-up and step-down transformers, Types of transformers circuits, Voltage-commutated transformers, Current-commutated transformers, Load-commutated transformers

Inverters:

Single-phase voltage source inverters, Modified McMurray half-bridge and full-bridge inverter, McMurray-Bedford half-bridge and full-bridge inverter, Pulse-width modulated inverters, Current source inverters, Series inverters, Parallel inverter.

Applications of industrial electronics:

Switched mode power supply (SMPS), Uninterruptible power supplies, Solid state relays.

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Reference Book(s):

1. Power Electronics: Circuits, Devices and Applications by Muhammad H. Rashid; Pearson / PHI
2. Power Electronics by Dr. P. S. Bimbhra; Khanna Publishers.
3. Measurement systems, Application and Design By Doeblin, McGraw Hill
4. Mechanical Measurement By Beckwith and Buck, Wesley
5. Instrumentation Devices and Systems By Rangan, Sharma, Tata McGraw Hill
6. Instrumentation Measurement and Analysis By Nekra & Chaudhry, Tata McGraw Hill

Practical(s):

1. Study of basic instruments used for measurement.
2. Step, ramp and sinusoidal input methods.
3. Study of Power semiconductor devices (Thyristor, Phase controlled converters, DC transformers, Inverters)
4. Study of Solid State Switches.
5. Various Motors and their Control.
6. Study of programmable control systems.
7. Study of motion detector sensor system.
8. Study of proximity sensor technology.
9. Farm security system.
10. Study of automated farm requirements.