

NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
M. Tech. in Electronics and Communication Engineering (Embedded System)
M.Tech. Semester - II
Department Elective I

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Course Code	6EC263ME22
Course Title	Industrial Automation and Control

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -

1. Comprehend industrial automation systems architecture, sensors and measurement systems for process control.
2. Evaluate the need of electric drive for given industrial control requirement and select the drive for it.
3. Propose industrial automation and control system using networking of sensors, actuators, drives and controllers for given specifications.

Syllabus:

Teaching Hours:45

UNIT I: Introduction: Sensors and Measurement Systems	08
Architecture of industrial automation systems, measurement techniques of temperature, pressure, force, displacement, speed, flow, level, humidity, pH etc., Signal conditioning and processing, Estimation of errors and calibration	
UNIT II: Process Control and Structures	11
P-I-D control, Controller tuning, Implementation of PID controllers, Feed forward and Ratio control, Predictive control, Control systems with Inverse response, Cascade control, Overriding control, Selective control, Split range control	
UNIT III: Sequence Control Mechanism	08
PLCs, Relay ladder logic, Scan cycle, RLL Syntax, Structured design approach, Advanced RLL programming, Hardware environment, Production control systems, Pneumatic control systems	
UNIT IV: Control of Machine Tools	04
Introduction to CNC machines, Analysis of a control loop	
UNIT V: Introduction to Actuators, Networking of Sensors	08
Flow control valves, hydraulic actuator systems, Principles, Components and symbols, Pumps and Motors, Proportional, Servo valves, Fieldbus communication protocol	
UNIT VI: Electric Drives	06
Introduction, Energy saving with adjustable speed step motors, DC Motor Drives, DC-DC converters, Induction motor drives, Synchronous motor drives, Servo drives	

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

1. Jon Stenerson, Industrial Automation and Process Control, Prentice Hall
2. Peng Zhang, Advanced Industrial Control Technology, Elsevier
3. Kok Kiong Tan, Andi Sudjana Putra, Drives and Control for Industrial Automation, Springer
4. Tyson Macaulay, Industrial Automation and Process Control Security: SCADA, DCS, PLC, HMI, CRC Press
5. Karl-Heinz John, Michael Tiegelkamp, Programming Industrial Automation Systems: Concepts and Programming Languages, Requirements for Programming Systems, Decision Making Aids, Springer