

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 | 6EC263 |
| 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

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| 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