

NIRMA UNIVERSITY
INSTITUTE OF TECHNOLOGY, SCHOOL OF ENGINEERING
B Tech in Mechanical Engineering
Semester V

L	T	P	C
3	0	2	4

Course Code	2ME502
Course Title	Automation and Control

Course Outcomes(CO):

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

1. model and analyze the control system,
2. apply the concepts of traditional and advance automation systems,
3. select the appropriate sensors, actuator and controller for the automation systems,
4. make use of simulation software for automation applications.

Syllabus

Teaching Hours: 45

UNIT I	Control system modelling Classification of control systems, Transfer function, Nodal diagram, analogous systems, block diagram, signal flow graph, state space model	09 hours
UNIT II	Control system analysis Standard test signals, Response analysis of first order and second order system, transient response specification, steady state error constant, stability analysis using Hurwitz criteria, Routh criteria, Root locus, Bode plot and its interpretation. Waterfall plot for vibration analysis.	09 hours
UNIT III	Controllers Various control actions, pneumatic controllers, hydraulic controllers, introduction of Microcontrollers, introduction of PLC	09 hours
UNIT IV	Automation systems Dedicated automation systems: materials handling; analysis and control functions. Assembly: Part feed systems; orienting devices e.g. vibratory bowl feeder; tooling; Materials handling devices e.g. indexing devices; conveyors. Placement devices: Pick and place;	08 hours

General: Line balance of assembly systems; Reliability in automation; Cost justification of automation; Job analysis; Implementation of automated systems

UNIT V Sensors and Actuators 06 hours

Types of sensors, Position, distance, velocity, acceleration, vision, angle sensors, force torque sensors.

Hydraulic and Pneumatic cylinders, rotary actuators, air motors, hydraulic and pneumatic circuit design, control valves

Motors- DC motors, brushed and brushless motors, stepper motor, servo motor, motor selection, motor controllers

UNIT VI Advances in Automation Systems 04 hours

Industry 4.0, Artificial Intelligence, Machine learning, Neural network, Fuzzy logic control, advance microcontrollers, use of simulation software.

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.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments/exercise to be incorporated.

Suggested Readings:

1. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall
2. Groover, M. P. Automation, production systems, and computer-integrated manufacturing. Pearson Education India.
3. Kant, K. Computer-based Industrial Control. PHI.
4. Webb, J. W., & Reis, R. A. Programmable logic controllers: principles and applications. Prentice Hall.
5. Chang, T. C., & Wysk, R. A. An introduction to automated process planning systems. Prentice Hall.
6. Amber, G. H., & Amber, P. S. Anatomy of automation. Prentice-Hall.
7. Nagrath and Gopal, Control Systems engineering, New Age

L=Lecture T= Tutorial P=Practical, C=Credit

w.e.f. academic year 2020-21 and onwards