AUTOMATION IN MANUFACTURING SYSTEMS
(Professional Elective -IV)

Course Code: 19ME2162

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Course Outcomes: At the end of the course, the student will be able to
CO1: Identify and correlate the concepts of automation in production systems.
CO2: Explain various models and petrinets used in automated manufacturing systems.
CO3: Identify various sensors and actuators used in industrial control systems.
CO4: Identify various components of hydraulic and pneumatic systems in industrial applications.
CO5: Demonstrate on various input and output models used in PLC processor.

UNIT-I   **(10-Lectures)**
Fundamentals of manufacturing: production system facilities, manufacturing support systems, different types of manufacturing systems, automation in production systems, automation principles & strategies, manufacturing operations and production relationships, Mathematical concepts & models: production concepts & mathematical models, costs of manufacturing operations, numerical problems.
Learning outcomes:
1. Describe different types of manufacturing systems. (L1)
2. Explain automation principles & strategies. (L2)
3. Discuss various   production concepts & costs of manufacturing operations. (L2)

UNIT-II   **(10-Lectures)**
Automation and modeling automated manufacturing systems: basic elements of automated system, advanced automation functions, levels of automation, performance modeling tools, Markov chain models, quenching models, petrinet models, types of petrinets, differences between simple petrinets and high level petrinets.
Learning outcomes:
1. Describe various levels of automation. (L1)
2. Compare Markov chain models, quenching models, petrinet models. (L5)
3. Explain differences between simple petrinets and high level petrinets. (L2)

UNIT-III   **(10-Lectures)**
Industrial control and process planning: industrial control systems, sensors, actuators & other control systems, discrete control using PLC & PLC network, manufacturing support systems, CAPP, advanced manufacturing, planning, lean production & agile manufacturing.
Learning outcomes:
1. Explain industrial control systems such as sensors, actuators & other control systems. (L2)
2. Explain manufacturing support systems, PLC and discrete controls using PLC. (L2)
3. Differentiate Lean production & Agile manufacturing. (L2)

UNIT-IV   **(10-Lectures)**
Power hydraulics & pneumatics: concepts features & parameters governing the selection of various components necessary for building the elements, circuit design & analysis.
Industrial applications of fluid power & pneumatic systems, electro-hydraulic servo system, fluid logic control.

Learning outcomes:
1. Explain the conceptual features of Power hydraulics & pneumatics. (L2)
2. Describe the governing parameters for selection, design and analysis of Power hydraulics & pneumatics circuits. (L2)
3. Compare fluid power & pneumatic systems, electro-hydraulic servo system, fluid logic control. (L5)

UNIT-V   **(10-Lectures)**
PLC: Introduction, micro PLC, programming a PLC, logic functions, input & output modules, PLC processors, PLC instructors, documenting a PLC system, timer & counter instructions, comparison & data handling instructions, sequencing instructions, mask data representation, Typical PLC programming exercises for industrial applications and case studies.
Learning outcomes:
1. Describe the structure of PLC programming and documenting a PLC system. (L1)
2. Explain importance of timer & counter instructions in PLC programming. (L2)
3. Describe data handling instructions, sequencing instructions and mask data representation. (L1)

TEXT BOOKS:
1. M.P. Groover, *Automation, Production Systems and Computer Integrated Manufacturing*, Pearson and PHI, 3rd Edition, 2009.
2. N. Viswanandham and Y. Narahari, *Performance Modeling of Automated Manufacturing Systems*, IISc. Bangalore, PHI, New Delhi, 2015.

REFERENCE BOOKS:
1. Goodwin, *Fluid Power System*, McGraw Hill Press Limited, 1992.
2. Histand B.H., Alciatore D.G., *Introduction to Mechatronics and Measurement Systems*, 3rd Edition, Tata McGraw Hill, 2007.
3. Bolton W., *Mechatronics – Electronics Control Systems in Mechanical and Electrical Engineering*, 4th Edition, Pearson Education Press, 2010.