411082: Automation & Control Engineering

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 03 hours / week	Theroy: 03	In-Sem: 30 Marks End-Sem: 70 Marks

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Pre-requisites: Basic Electronics Engineering, Basic electrical engineering, Heat and fluid engineering

Course objectives:

1. To learn Basic principles of Industrial hydraulics.
2. To study design of hydraulic circuits & selection of various components.
3. To study pneumatic systems & circuit.
4. To understand concept of programmable automation viz microprocessor & control.
5. To study various control system & learn of programmable logic control.
6. To get well verse with the factory automation methods & system.

Outcomes: After learning this subject, the student will be able to:

1. Understand basic concepts of industrial hydraulics and pneumatics
2. Design the hydraulic and pneumatic circuits for given application
3. Use microprocessor and programmable logic controller for soft automation.
4. Apply electric, electronics and computer control systems used in automation.
5. Apply various innovative methods for factory automation.

Unit I: Introduction to Hydraulic Systems [7]

Introduction of fluid power system, Properties of fluids, Fluids for hydraulic systems, governing laws. Standards in circuit diagram representation, hydraulic symbols, Working Principle, design and analysis of reservoir, pumps, filters, valves, actuators, accumulators, intensifiers.

Unit II: Design and Analysis of Hydraulic Circuits [7]

Design considerations for hydraulic circuit, Detail analysis speed control, flow control, pressure control circuits, Industrial applications of hydraulic circuit design using proportional valves and servo valves.

Unit III: Pneumatic Systems [7]

Operational principles, Functions of different pneumatic components and selection, Valves for logic functions; Time delay valve; Examples of typical circuits using Displacement – Time and Travel-Step diagrams, cascade circuits, Construction of pneumatic controls and circuit diagrams for conveying, feeding, clamping, indexing, cutting and non-cutting operations.

Unit IV: Programmable Automation [7]

Microprocessor - Basic architecture and its Busses, programming model, internal data operation and registers, controls and status signals, instruction sets, addressing modes.

Microcontroller: Microcontroller based manufacturing systems.

Unit V: Control System [7]

Data conversion (ADC/DAC), Programmable logic controller, Interfacing circuits, Actuating signals, relays, contactors, Types of control systems- P, PI, PID , Optimal control system.

Case studies on electrohydraulic and electro-pneumatic circuits.

Unit VI: Advance Automated Systems [7]

Large scale control systems: Supervisory control and data Acquisition (SCADA), Human machine interface (HMI), Remote Terminal Unit (RTU), Digital Communication Unit (DCU).

Robotic systems: Manipulator kinematics, trajectory planning,

Artificial Intelligence in automation: Artificial Neural Networks, Fuzzy Logic, Image Processing

Text Books:

1. Kuo B.C., “Automatic control systems”, Prentice Hall India Pvt. Ltd., New Delhi, ISBN: 1305-5070-1
2. Peter Rohner, “Industrial hydraulic control”, Wiley Edition, 1995, ISBN: 0471334987
3. Mikell P Groover, “Automation, Production System and Computer Integrated Manufacturing”, Prentice Hall Publications, ISBN 9789332549814
4. Mujumdar S.R., “Pneumatic System”, Tata McGraw Hill, 2002 Edition. ISBN: 9780074602317
5. Gopal, “Control Systems Engineering”, Willey Eastern Ltd., ISBN 0-85226-605-7.

Reference Books:

1. Doebelin E.O, “Measurement System, Application and Design”, Tata McGraw HillPublications Ltd., New Delhi, ISBN 0-07—17338-9.
2. Bolton W., “Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering”, Pearson Education (Singapore) Pvt Ltd., ISBN 81-7808-339-6.
3. Rangan C.S., Sharma G.R., Mani V.S., “Instrumentation - Devices and Systems”, Tata McGraw Hill Publications Ltd., New Delhi, ISBN 0-07-463350-3.
4. Histand B.H., Alciatore D.G., “Introduction to Mechatronics and Measurement Systems”, ISBN 0-07-052910-8.
5. Johnson C.D., “Process Control Instrumentation Technology”, Prentice Hall of India pvt.Ltd., New Delhi, ISBN 81-203-0987-1.
6. HMT Mechatronics, HMT, ISBN 0-07-462147-5.
7. Vickers manual on hydraulics