

32152 - INDUSTRIAL AUTOMATION

DETAILED SYLLABUS

I Fluid power – Pump and Motor

Introduction to Fluid Power System and its basic components – Basic law – applications of fluid power – Advantages and drawbacks of fluid power. Classification – Positive displacement Pumps - Gear pump, Lobe pump, Vane pump, Piston pump – Pump performance – Pump noise – Pump selection. Cylinder mountings and mechanical linkages – Cylinder force, velocity and Power – Cylinder loads due to moving of weights – Cylinder loading through mechanical linkages – Hydraulic cylinder cushions and shock absorbers. Analysis of torque capacity – Gear motor – Vane motor – Piston motor – Hydraulic motor theoretical torque, power and flow rate – Hydraulic motor performance.

II Control Valves and Circuits

Pressure Control Valves (PCV): Simple pressure relief valve, Compound pressure relief valve, Pressure reducing valve, Unloading valve, Sequence valve, Counter balance valve.

Flow Control Valves (FCV): Orifice as flow control valve, Needle valve, Pressure compensated and Non-pressure compensated valve.

Direction Control Valves (DCV): Check valve, Pilot operated check valve, three-way valve, four-way valve: Manual/Mechanical/Solenoid operated valves. Servo valves: Definition – Mechanical-hydraulic servo valve – Electrohydraulic servo valves.

Accumulators: Reservoirs and accumulators – Types of accumulators – Charging and discharging of accumulators – Accumulator circuits.

Deceleration circuit – Intensifier circuit – Regenerative circuit – Synchronizing circuit – Automatic cylinder reciprocating circuit – Sequencing circuit.

Safety Circuits: Two-hand safety control circuit – Fail-safe control circuit by using emergency cut-off valve.

III Selection of devices

Selection of Hydraulic Cylinder: Speed of a hydraulic cylinder – Cylinder thrust – Acceleration and deceleration of cylinder loads – Local deceleration – Cylinder cushioning – Cylinder preferred sizes – Piston rod buckling.

For Syllabus, Notes, Question Papers, Question Banks & Many More

Selection of Hydraulic Motor: Hydro-static drives – Hydro-static drive characteristics – Braking of hydrostatic drives – Matching motor to load.

Selection of Control Valves: Relief valves – Flow control valves – Direction control valves.

Selection of Other Devices: Seals and its classification – Filters and its types – Filter location. Selection of filters – Selection of conduits - tubing and hoses – Selection of pump – Pressure losses – Reservoir and its design – Sizing of accumulator.

IV Pneumatic system

Comparison of pneumatic system with hydraulic system – Basic pneumatic system: Air filter, Pressure regulator, Lubricator and Muffler – Pneumatic valves: Direction control valve, Flow control valve, Shuttle valve, Two-pressure valve, Quick exhaust valve and Time delay valve. Cylinders – Air-motors and its types – Basic pneumatic circuits: Simple circuit, Material handling circuit. Hydro-pneumatics: Air-oil reservoir – Air-oil cylinder – Air-oil intensifier – Comparison of hydraulic, pneumatic and hydro pneumatic systems. Advantages – Pneumatic sensors – Position sensors and its types – Pressure sensor – Switching elements. Operation of single-acting cylinder – Operation of double-acting cylinder – Air-pilot control of double- acting cylinder – Cylinder cycle timing system – Two-step speed control system – Two-handed safety control system – Control of air motor – Deceleration air cushion of cylinder.- circuit – Control of pneumatic cylinder using flip-flop.

V Programmable Logic Controller

Introduction to PLC – evolution – advantages – criteria for selection of suitable PLC – Block diagram of PLC – Programming devices – programming methods – STL and CSF, FBD and Ladder methods – simple instructions – programming NC and NO contacts – timer instructions – on-delay and off-delay timer – converting simple relay ladder diagram into PLC relay ladder diagram – PID and PWM functions. Simple PLC implementations for automatic star-delta starter and 4 floor lift system. Introduction and brief history of SCADA – hardware and software

Text Books

- 1 Pneumatic Systems Principles and Maintenance, S.R. Majumdar – Tata McGraw Hill Pub co
- 2 Introduction to Programmable Logic Controllers, Gary Dunning – Thomson Delmar Learning Second Edition Second reprint 2003