DESIGN OF FLUID POWER SYSTEMS
(Professional Elective -III)

II Semester

Course Code: 19ME2160

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Course Outcomes: At the end of the course, the student will be able to
CO1: Summarize hydraulic reservoir and different hydraulic pumps.
CO2: Explain working of hydraulic valves, cylinders and motors.
CO3: Design the hydraulic circuits for control of hydraulic systems.
CO4: Explain pneumatic systems, cylinders, motors, valves and circuits.
CO5: Explain electrical controls in pneumatic systems, and parts of hydraulic cylinders.

UNIT-I **(10-Lectures)**

Introduction to hydraulic systems and ancillary hydraulic systems: Design and construction of hydraulic reservoir and sizing, gravity type, spring-loaded and gas loaded type accumulators.
Hydraulic pumps: Gear pumps, vane pumps and piston pumps, sizing of hydraulic pumps, selection of hydraulic pumps.
Learning outcomes:

1. Summarize hydraulic reservoir. (L2)
2. Explain working of accumulators and hydraulic pumps. (L2)
3. Calculate the performance of pumps. (L3)

UNIT-II **(10-Lectures)**

Hydraulic control valves: direction control valves, pressure control valves, flow control valves, servo valves.
Hydraulic cylinders and motors: hydraulic cylinder operation and cylinder mountings - hydraulic cylinder design and cushions, hydraulic motors - gear, vane and piston motors – hydraulic motor theoretical torque, power and flow rate - hydraulic motor performance - hydrostatic transmissions.
Learning outcomes:

1. Explain working of hydraulic valves. (L2)
2. Explain working of cylinders. (L2)
3. Explain working motors. (L2)

UNIT-III **(10-Lectures)**

Hydraulic circuit design and analysis: Control of single and double acting cylinders, regenerative and pump unloading circuit, hydraulic cylinder sequence and synchronizing circuits, speed control of hydraulic cylinder and motor, hydraulic motor braking system.
Learning outcomes:

1. Design the hydraulic circuits for single and double acting cylinders. (L6)
2. Design the hydraulic circuits for regenerative and pump unloading circuit. (L6)
3. Design the hydraulic circuits for hydraulic cylinder sequence and synchronizing circuits. (L6)

UNIT-IV **(10-Lectures)**

Pneumatics: Basic requirements for pneumatic system – air compressor– pneumatic cylinders and air motors – pneumatic valves - basic pneumatic circuits.
Maintenance and troubleshooting of hydraulic and pneumatic systems: oxidation and corrosion of hydraulic fluids - maintaining and disposing of fluids - wear of moving parts due to solid particle contamination of the fluid - problems caused by gases in hydraulic fluids - troubleshooting of hydraulic system - maintenance and troubleshooting of pneumatic systems.

Learning outcomes:

1. Explain working of pneumatic systems. (L2)
2. Explain working of pneumatic cylinders and valves. (L2)
3. Summarize pneumatic circuits. (L2)

UNIT-V **(10-Lectures)**

Electrical controls in fluid power systems: Basic electrical devices – electrical components, electrical controls in pneumatic systems, examples of simple electro-pneumatic circuits with solenoid operated direction control valve for the control of single and double-acting cylinders.

Design of hydraulic cylinder parts: Barrel, cap, head, piston, piston rod and piston seals.

Learning outcomes:

1. Explain electrical controls in pneumatic systems. (L2)
2. Design hydraulic cylinder parts like barrel and cap. (L6)
3. Design hydraulic cylinder parts like head, piston and piston rod. (L6)

TEXT BOOKS:

1. Anthony Esposito, *Fluid Power with Applications*, 7th Edition, Pearson Education, Inc. New Delhi, 2008.
2. Q. S. Khan, *Design and Manufacturing of Hydraulic Cylinders*, Tanveer publication, vol 2, 2009.

REFERENCE BOOKS:

1. S.R.Majumdar, *Oil Hydraulic Systems – Principles and Maintenance*, Tata McGraw Hill Publishing Company Ltd., 2012.
2. Andrew Parr, *Hydraulics and Pneumatics – A Technician's and Engineer's Guide*, Nineth Jaico Impression, Jaico Publishing House, Mumbai, 2005.