

Savitribai Phule Pune University Final Year of Mechanical Engineering (2015 Course) Course Code : 402041Course Name : Hydraulics and Pneumatics						
Teaching Scheme:		Credits		Examination Scheme:		
Theory	: 03 Hrs Per Week	TH	: 03	Theory	In-Sem : 30	PR : --
Practical	: 02 hrs per week	TW	: 01		End-Sem : 70	OR : 25
						TW : 25

Pre-requisites : Fluid Mechanics, Manufacturing Processes and Machines, Mechatronics

Course Objectives:

- To study governing laws used in fluid power systems
- To study fluid power applications
- To study working principles of various components
- To study selection of different components
- To study how to design fluid power systems
- To study low cost automation

Course Outcomes:

On completion of the course, students will be able to -

- Understand working principle of components used in hydraulic & pneumatic systems
- Identify various applications of hydraulic & pneumatic systems
- Selection of appropriate components required for hydraulic and pneumatic systems
- Analyse hydraulic and pneumatic systems for industrial/mobile applications
- Design a system according to the requirements
- Develop and apply knowledge to various applications

Course Contents

Unit 1: Basics of Fluid Power and Pumps

6 Hrs

Fluid power basics, advantages and limitations, fluid power distribution, standard symbols, energy loss in hydraulic systems.

Pumps - types, classification, principle of working and constructional details of vane pumps, gear pumps, radial and axial plunger pumps, screw pumps, power and efficiency calculations, and characteristics curves.

Unit 2: Actuators and Power Unit

6 Hrs

Linear and rotary actuators- types, construction and characteristics. Cylinder mountings, cushioning of cylinders.

Power units and accessories - types of power units, reservoir assembly, constructional details. Accumulators, Intensifiers, Pressure and Temperature switches /sensors, level sensors.

Unit 3: Fluid Power Control

6 Hrs

Direction control valves - center positions, methods of actuation, two stage valves, Flow control valves - pressure and temperature compensated. Pressure control valves - pressure reducing valve, sequence valve, unloading valve, brake valve, back pressure valve, counter balance valve, check

valves, prefill valve, servo valves, cartridge valves, proportional valves.

Unit 4: Hydraulic Circuits and Contamination Control

6 Hrs

Hydraulic circuits: Simple reciprocating, regenerative, speed control (meter in, meter out and bleed off), sequencing, synchronization, traverse and feed, automatic reciprocating, fail safe circuit, counter balance circuit, actuator locking, unloading circuit, motor breaking circuit etc.

Contamination control: Contamination, sources of contamination, suction strainer, filters, filtration, filter ratings.

Unit 5: Pneumatics – Components, Control Valves and Circuits

6 Hrs

Compressors - Types, principle of working and constructional details. Comparison of pneumatic with hydraulic power transmissions. Types of filters, pressure regulators, lubricators, mufflers, dryers, direction control valves, pneumatic actuators, shuttle valve, two pressure valve, quick exhaust valve and time delay valves, electro-pneumatics. Speed regulating methods, pneumatic circuits, reciprocating, cascading time delay etc. Application of pneumatics in low cost automation and in industrial automation.

Unit 6: System Analysis and Design

6 Hrs

Calculation of piston velocity, thrust under static and dynamic applications, considering friction, inertia loads, design considerations for cylinders, Design of hydraulic/pneumatic circuits for practical application, selection of different components such as reservoir, control elements, actuators, accumulator, intensifier, filters, pumps. (Students are advised to refer manufacturers' catalogues for design and use simulation tool like Automation Studio for analysis).

Books

Text :

1. Esposito A, Fluid Power with application, Prentice Hall
2. Majumdar S.R, Oil Hydraulic system- Principle and maintenance ,Tata McGraw Hill
3. Majumdar S.R, Pneumatics Systems Principles and Maintenance ,Tata McGraw Hill
4. Stewart H. L, Hydraulics and Pneumatics , Taraporewala Publication

References :

1. Pipenger J.J, Industrial Hydraulics, McGraw Hill
2. Pinches, Industrial Fluid Power, Prentice Hall
3. Yeaple, Fluid Power Design Handbook
4. Andrew A. Parr, Hydraulics and Pneumatics, Elsevier Science and Technology Books
5. ISO - 1219, Fluid Systems and components, Graphic Symbols
6. Standard Manufacturer's Catalogues

Term Work shall consist of following experiments and assignments:

1. Test on Gear/Vane/Piston pump and plotting performance characteristics
2. Following experiments to be done on hydraulic trainer (any 3)
 - a) Regenerative circuit
 - b) Speed control circuit
 - c) Sequencing circuit
 - d) Traverse and feed circuit etc.
3. Following experiments to be done on pneumatic trainer (any 3)

- a) Automatic reciprocating circuit
 - b) Speed control circuit
 - c) Pneumatic circuit involving Shuttle valve/ Quick exhaust valve / Two pressure valve
 - d) Electro pneumatic circuits
4. Test on pressure relief valve/flow control valve
 5. Test on linear /rotary actuator
 6. Design of simple hydraulic systems used in practice using manufacturers' catalogue and analysis using software such as Automation Studio.
 7. Design of simple pneumatic systems used in practice using manufacturers' catalogue and analysis using software such as Automation Studio.
 8. Industrial visit to study Hydraulic / Pneumatic based Automation systems
 9. Assignment: Symbols for different components as per standards
 10. Assignment: Trouble shooting procedures
 11. Assignment: Standard specifications of hydraulic/ pneumatic components using manufacturer's catalogues.