



SILVER OAK UNIVERSITY
College of Technology (01)
Diploma in Mechanical Engineering
Subject Name: Oil Hydraulics and Pneumatics
Subject Code: 1010122239
Semester:4th

Prerequisite: Zeal to learn the subject

Objective:

Course gives idea about the basic system working on fluid power and compressed air. Also, different valves related to hydraulic and pneumatic systems are discussed in syllabus. Subject is also useful for designing the various hydraulic and pneumatic circuits for various engineering applications.

Teaching and Examination Scheme:

| Teaching Scheme | | | | | Evaluation Scheme | | | | Total Marks |
|-----------------|---|---|---------------|--------|-------------------|----------|-----------|----------|-------------|
| L | T | P | Contact Hours | Credit | Theory | | Practical | | |
| | | | | | CIE (TH) | ESE (TH) | CIE (PR) | ESE (PR) | |
| 3 | 0 | 2 | 5 | 4 | 40 | 60 | 30 | 20 | 150 |

Content:

| Unit No. | Contents | Teaching Hours | Weightage % |
|----------|--|----------------|-------------|
| 1 | Introduction to Power Transmission Systems: Functional requirements of a power transmission, how these requirements can be fulfilled by various power transmission systems like mechanical, oil hydraulic, pneumatic, electrical or their combinations; Fundamentals of oil hydraulics and pneumatics, Control functions of oil hydraulic systems; Comparison between various power transmission systems, Applications of oil hydraulic and pneumatic power transmissions. Electrical elements used in hydraulic circuits. | 5 | 20 |
| 2 | System Components, Hydraulic Oils, Fluid Properties and Filter: Hydraulic & Pneumatic Symbols as per ISO/ANSI, Types, Properties, physical characteristics & functions of hydraulic Oils, Classification- Mineral based, Fire resistant & Biodegradable Oils, Filters, Contaminations, location of filter | 6 | |
| 3 | Hydraulic Pumps, Motors and Actuators: Construction, working principle and operation of rotary & reciprocating pumps like Gear, Vane, Generated-Rotor, Screw, Axial Piston, Radial Piston, Pump characteristics, Specifications, sizing and selection of pumps, Linear actuators like ram type, telescopic and single acting/double acting, types of their constructions, types of | 8 | 15 |

| | | | |
|---|--|---|----|
| | mountings, cylinder materials, cushioning of hydraulic cylinders, Rotary actuators, Specifications, sizing and selection of actuators., Hydrostatic Transmission Systems. Selection of components for applications. | | |
| 4 | Hydraulic Valves and Hydraulic System Accessories: Construction, working principle and operation of direction control valves, flow control valves and pressure control valves including non-return, pressure relief, compound pilot operated pressure relief, safety, sequence, pressure reducing, unloading, counterbalance valves. Different types of center positions of DCVs, Methods of actuation of DCVs., Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for circuits. | 6 | 15 |
| 5 | Design of hydraulic circuits: Basic hydraulic circuits like Reciprocation, quick return, sequencing, flow control circuits, synchronizing circuits, Regenerative circuit, accumulator circuits, industrial circuits like press circuits, machine tool circuits, forklift, earth mover circuits - design and selection of components., Power losses in flow control circuits. | 9 | 15 |
| 6 | Introduction to Pneumatic Systems: Basic Requirements for Pneumatic System, Applications, Pneumatic fundamentals, Construction, working principle and operation of pneumatic power transmission system components like Power source, FRL unit, Actuators and control valves like DCV, FCV, PCV, time delay, quick exhaust, twin pressure, shuttle. | 5 | 10 |
| 7 | Pneumatic circuits: Basic pneumatic circuits like Development of single Actuator Circuits, Development of multiple Actuator Circuits, switching circuits, sequential circuits, hydro pneumatic circuits, solenoid operated circuits, simple logic circuits, Programmable logic circuits using PLC/Microcontroller and their applications, Selection, sizing and specifications of pneumatic components. Cascade method for sequencing. | 5 | 15 |
| 8 | Introduction to Automation in hydraulic and Pneumatic Systems., use of PLC and Ladder diagram to run an automatic circuit like cascade sequential circuits. | * | 10 |

***Note: Topic No. 8 of the above syllabus is to be covered in Practical Hours**

Course Outcome:

| Sr. No. | CO statement | Unit No |
|---------|---|-----------|
| CO-1 | Demonstrate components for hydraulic and pneumatic systems and their applications. | 1,2,3,4,6 |
| CO-2 | Interpret functions of different hydraulic and pneumatic valves and make use of them in circuit design. | 4,6 |
| CO-3 | Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. Develop a circuit diagram. | 5,7 |
| CO-4 | Compile and make use of automation in hydraulic and pneumatic systems. | 8 |

Teaching & Learning Methodology:

The various methods or tools follows by the faculties to teach the above subject are:

1. Chock and Board
2. PPT
3. Flip Class Room
4. Video Animations

List of Experiments/Tutorials:

A. Experiments on Hydraulics Circuits:

1. Extend-Retract and Stop system of a linear actuator.
2. Regenerative circuit.
3. Speed Control circuits: meter-in, meter-out and bleed off.
4. Sequencing circuit
5. Use of solenoid operated DCV.
6. Rapid Traverse and Feed circuit.

B. Experiments on Pneumatic Circuits:

1. Study of Compressor, FRL unit and 5/3 DCV.
2. Reciprocating motion of a single and a double acting actuator using 5/3 DCV.
3. Speed control circuits.
4. Automatic to & fro motion of a pneumatic linear actuator.
5. Sequencing circuit.
6. Logical circuits using shuttle valve.

C. Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit.

Major Equipment:

1. A hydraulic trainer
2. A pneumatic trainer
3. Simulation Software

Books Recommended:

1. Industrial Hydraulics by John Pippenger and Tyler Hicks, McGraw Hill.
2. Oil Hydraulic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.
3. Fluid Power with Applications by Anthony Esposito, Pearson.
4. Fluid Power: Generation, Transmission and Control, Jagadeesha T., Thammaiah Gowda, Wiley.
5. The Analysis & Design of Pneumatic Systems by B. W. Anderson, John Wiley.
6. Control of Fluid Power Analysis and Design by Mc Clay Donaldson, Ellis Horwood Ltd.
7. Hydraulic and Pneumatic Controls: Understanding made Easy, K.Shanmuga Sundaram, S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009)
8. Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.
9. Basic fluid power Dudley, A. Pease and John J. Pippenger, Prentice Hall, 1987

List of Open Source Software/learning website:

1. <https://nptel.ac.in/courses/112/106/112106300/>
2. <https://nptel.ac.in/courses/112/105/112105046/>
3. Autosim Premium
4. Hydrosym