

COURSE TITLE	PNEUMATIC AND HYDRAULIC CONTROLS
COURSE CODE	01ME1741
COURSE CREDITS	4

Objective:

- 1 There has been a huge advancement in fluid power technology A design engineer will need knowledge of power transmission; needs to know the power transmission system of machine tools, presses, equipment. A design engineer must have knowledge of various selection and manufacturing techniques, control, procedure and application of hydraulic/pneumatic components..

Course Outcomes: After completion of this course, student will be able to:

- 1 Apply the principles of oil hydraulics and pneumatics to compare different power transmission systems for industrial applications.
- 2 Identify the construction and operation of hydraulic components such as pumps, actuators and valves to determine their suitability for specific applications.
- 3 Design hydraulic and pneumatic circuits, including speed control, reciprocating, sequencing and logic circuits, to meet given industrial requirements.
- 4 Analyze the construction and operation of pneumatic components such as compressors, actuators and valves to select appropriate components for pneumatic applications.

Pre-requisite of course:None

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction: Fundamentals of oil hydraulics and pneumatics, Basic functional requirements forHydraulics and Pneumatics System, Comparison between Mechanical, Oil Hydraulic, Pneumatic and Electrical power transmission systems,, Advantages- disadvantages and Applications of Oil Hydraulic and Pneumatic systems.Symbols ofHydraulics and Pneumatics System, Electrical Elements used in hydraulic and pneumatic circuits	6

Contents : Unit	Topics	Contact Hours
2	Hydraulic System Components: Hydraulic symbols as per ISO1219, Properties of hydraulic fluids, Types of hydraulic fluids, selection of hydraulic fluid, Filtration, Hydraulic Reservoirs and Accumulators, Pressure Intensifiers, Seals., Construction, working principle and operation of rotary & reciprocating pumps: Gear, Vane, Screw, Axial Piston, Radial Piston pump. Pump characteristics, Pump Specifications and selection of pumps. Construction of pumps, types of mountings., Linear and Rotary Actuators: Ram type, Telescopic and Single acting or double acting cylinders, types of rotary actuators.	8
3	Hydraulic Valves: Construction, working principle and operation of DCV, FCV and PCV, Check valve, Pressure relief valve, Pilot operated Pressure Relief valve, Safety valve, Sequence valve, Pressure Reducing valve, Unloading, Counterbalance valves., Different types of center positions of Direction Control Valves, Methods of actuation of Direction control valves.	6
4	Hydraulic Circuits: Reciprocation, quick return, sequencing, flow control synchronizing circuits, accumulator circuits, industrial circuits:circuits of mechanical press, machine tool circuits, earth mover and forklift	8
5	Pneumatic Systems Components: Basic principles of Pneumatic, Construction, working principle and operation of pneumatic system, Power source, Filter Regulator and Lubrication unit, Actuators and control valves: DCV, FCV, PCV, time delay valve, quick exhaust valve, twin pressure valve, shuttle valve	6
6	Pneumatic Circuits: Basic pneumatic circuits, Development of single actuator circuits, direct and indirect operations, speed control circuits, Development of multiple actuator circuits, reciprocating circuits, sequential circuits, solenoid operated circuits, logic circuits. PLC and its Application.	8
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Performance analysis of linear and rotary actuator Performance analysis of linear and rotary actuator	2
2	Analysis of Regenerative circuit used for lift excavator Analysis of Regenerative circuit used for lift excavator	2
3	Application of meter in and meter out circuit in shaper machine Application of meter in and meter out circuit in shaper machine	2
4	Evaluation of Sequencing pneumatic circuits in press tools Evaluation of Sequencing pneumatic circuits in press tools	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
5	Performance evaluation of DCV in shearing machine Performance evaluation of DCV in shearing machine	2
6	Application of rapid transverse and feed in CNC machine Application of rapid transverse and feed in CNC machine	2
7	Design of Pneumatic circuit using 5/3 DCV and single and double acting pilot operated DCV. Design of Pneumatic circuit using 5/3 DCV and single and double acting pilot operated DCV.	2
8	Application of Pneumatic control using speed control circuits. Application of Pneumatic control using speed control circuits.	2
9	Application of Pneumatic system in Slotter machine Application of Pneumatic system in Slotter machine	2
10	Application of pneumatic control in drilling and clamping process Application of pneumatic control in drilling and clamping process	2
11	Application of pneumatic system in packaging process Application of pneumatic system in packaging process	2
12	Two hand operated circuit for safety operation Two hand operated circuit for safety operation	2
Total Hours		24

Textbook :

- 1 Oil Hydraulic Systems, Principle and Maintenance, Majumdar, McGraw-Hill, 2003
- 2 Basic Pneumatic Systems, Principle and Maintenance, Majumdar, McGraw-Hill, 2002

References:

- 1 Fluid Power with Applications, Fluid Power with Applications, Anthony,, Pearson, 2009
- 2 Industrial Hydraulics, Industrial Hydraulics, John Pippenger, McGraw Hill, 2022
- 3 Basic fluid power, Basic fluid power, Dudley, A. Pease and John J. Pippenger,, Prentice Hall, 1999
- 4 The Analysis & Design of Pneumatic Systems, The Analysis & Design of Pneumatic Systems, Anderson, John Wiley, 2001
- 5 Control of Fluid Power Analysis and Design, Control of Fluid Power Analysis and Design, Mc Clay Donaldson, Ellis Horwood Ltd., 2003

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 PPT
- 2 Videos
- 3 Animations

Supplementary Resources:

- 1 <http://www.nptelvideos.in/2012/11/industrial-automation-and-control.html>
- 2 <http://nptel.ac.in/courses/112105046>
- 3 <http://nptel.ac.in/courses/112105047/>