4ME63: OIL HYDRAULICS AND PNEUMATICS
CREDITS - 4 (LTP: 3, 0, 1)

Course Objective:

1. To develop a hydraulic/pneumatic circuit for a power transmission system.
2. To analyze operation and maintenance of a hydraulic/pneumatic circuit.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction:** 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 Mechanical, Oil Hydraulic, Pneumatic and Electrical power transmission systems: Advantages, disadvantages and Applications of Oil Hydraulic and Pneumatic power transmissions. **Symbols and Properties of Oil:** Hydraulic & Pneumatic Symbols as per ISO/ANSI, Properties and selection of hydraulic fluids, Filtration, Hydraulic Reservoirs.	10
2	**Oil Hydraulic Pumps and Actuators:** Construction, working principle and operation of rotary & reciprocating pumps like Gear, Vane, Generated-Rotor, Screw, Axial Piston, Radial Piston; Linear actuators like Ram type, Telescopic and Single acting/double acting, types of their constructions, types of mountings, cylinder materials, cushioning of hydraulic cylinders, Rotary actuators, specifications, sizing and selection of pumps and actuators.	9
3	**Control Valves and 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. Hydraulic Intensifiers, Accumulators, Seals and Packing.	10

Unit No.	Topics	Teaching Hours
4	**Pneumatic Systems:** 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 valves and their applications. Selection, sizing and specifications of pneumatic components.	5
5	**Hydraulic Circuits:** Reciprocation, quick return, sequencing, speed control circuits, synchronizing circuits, accumulator circuits, industrial circuits like press circuits, machine tool circuits, forklift, earth mover circuits- design and selection of components. **Pneumatic Circuits:** Pneumatic circuits like reciprocating circuits, switching circuits, sequential circuits, hydro pneumatic circuits, solenoid operated circuits, simple logic circuits, Selection, sizing and specifications of pneumatic components.	4
6	**Hydraulic and Pneumatic Controllers used in Feedback Control systems:** Construction, working principle and operation of Proportional and Servo control valves including Servo-type DCV like nozzle valve, flapper type valve, mechanical servo valve, single and double stage servo valves; Applications of servomotor systems in feedback control systems.	4
	Total	**42**

List of References:

1. Pippenger, John J., Hicks, Tyler G, "*Industrial Hydraulics*",*3rd Edition*, McGraw-Hill International, 1987.
2. Majumdar, S. R., "Oil Hydraulic Systems, Principle and Maintenance*"*, < *Edition*>>,Tata McGraw-Hill New Delhi, 2001.
3. Majumdar, S. R., *Basic Pneumatic Systems, Principle and Maintenance*, McGraw-Hill.
4. Anderson, B. W., *The Analysis & Design of Pneumatic Systems*, John Wiley.
5. Esposito, Anthony. *"Fluid Power with Application"*, << *Edition*>>, <<Pearson>>, << >>
6. Jagadeesha T., Thammaiah Gowda, *Fluid Power: Generation, Transmission and Control*, Wiley.
7. Mc Clay Donaldson, *Control of Fluid Power Analysis and Design*, Ellis Horwood Ltd.
8. Pease, A., Pippenger, John J., *Basic Fluid Power* Dudley, Prentice Hall, 1987

Course Outcomes (COs):

At the end of this course students will be able to …

1. Identify and analyse the functional requirements of a power transmission system for a given application. (Application involving fluid power transmission)
2. Illustrate construction and working principle of oil hydraulic pumps and actuators.
3. Illustrate construction and working principle of hydraulic control valves and accessories.
4. Understand fundamentals of pneumatic power transmission, components of pneumatic system and their applications.
5. Illustrate working of basic hydraulic and pneumatic circuits and design a hydraulic and/or pneumatic circuit to accomplish the specified task of power transmission.
6. Illustrate construction and working principle of hydraulic and pneumatic valves used in feedback control systems.