B. E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - V

FLUID POWER ENGINEERING

Course Code	18ME55	CIE Marks	40
Teaching Hours /Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into the capabilities of hydraulic and pneumatic fluid power.
- To understand concepts and relationships surrounding force, pressure, energy and power in fluid power systems.
- To examine concepts cantering on sources of hydraulic power, rotary and linear actuators, distribution systems, hydraulic flow in pipes, and control components in fluid power systems.
- Exposure to build and interpret hydraulic and pneumatic circuits related to industrial applications.
- To familiarize with logic controls and trouble shooting.

Module-1

Introduction to fluid power systems

Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications.

Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes. Fluid conditioning through filters, strainers; sources of contamination and contamination control; heat exchangers.

Module-2

Pumps and actuators

Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, pump selection factors, problems on pumps.

Accumulators: Types, and applications of accumulators. Types of Intensifiers, Pressure switches /sensor, Temperature switches/sensor, Level sensor.

Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, mounting arrangements, cushioning, special types of cylinders, problems on cylinders.

Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Theoretical torque, power, flow rate, and hydraulic motor performance; numerical problems. Symbolic

Module-3

Components and hydraulic circuit design Components:

Classification of control valves, Directional Control Valves-symbolic representation, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, and check valves.

Pressure control valves - types, direct operated types and pilot operated types.

Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

Hydraulic Circuit Design: Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, counter balance valve application, hydraulic cylinder sequencing circuits, hydraulic circuit for force multiplication; speed control of hydraulic cylinder- metering in, metering out and bleed off circuits. Pilot pressure operated circuits.

Module-4

H. O. D.
Dept. Of Mechanical Engineering
Alva's Institute of Engg. & Technology
Mijar, MOODBIDRI-574 225

Pneumatic power systems

Introduction to Pneumatic systems: Pneumatic power system, advantages, limitations, applications, Choice of working medium. Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit.

Pneumatic Actuators: Linear cylinder – types of cylinders, working, end position cushioning, seals, mounting arrangements, and applications. Rotary cylinders- types, construction and application, symbols.

Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols.

Module-5

Pneumatic control circuits

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical examples involving the use of logic gates.

Multi- Cylinder Application: Coordinated and sequential motion control, motion and control diagrams. Signal elimination methods, Cascading method- principle, Practical application examples (up to two cylinders) using cascading method (using reversing valves).

Electro- Pneumatic Control: Principles - signal input and output, pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple signal cylinder application.

Learning Assignment:

The faculty will allocate one or more of the following experiments from group A and B to group of students (containing not more than four students in a group):

Group A: Experiments on hydraulic trainer:

a. Speed control circuit using metering in and metering out technique
b. Regenerative and sequencing circuits.
c. Extend-Retract and Stop system of a linear actuator
d. Rapid Traverse and Feed circuit.

Group B: Experiments on pneumatic trainer:

a. Automatic reciprocating circuit
b. Speed control circuit
c. Pneumatic circuit involving shuttle valve/ quick exhaust valve
d. Electro pneumatic valves and circuit

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. Record of experiments shall be submitted in the form of journal. Due credit must be given for this assignment.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Identify and analyse the functional requirements of a fluid power transmission system for a given application.
CO2: Visualize how a hydraulic/pneumatic circuit will work to accomplish the function.
CO3: Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro- pneumatics for a given application.
CO4: Select and size the different components of the circuit.
CO5: Develop a comprehensive circuit diagram by integrating the components selected for the given application.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Book/s				
1	Fluid Power with applications	Anthony Esposito	Pearson edition	2000
2	Oil Hydraulics	Majumdar S.R	Tata McGRawHIIL	2002
3	Pneumatic systems - Principles and Maintenance	Majumdar S.R	Tata McGraw-Hill	2005
Reference Books				
1	Industrial Hydraulics	John Pippenger, Tyler Hicks	McGraw Hill International Edition	1980
2	Hydraulics and pneumatics	Andrew Par	Jaico Publishing House	2005
3	Fundamentals of Pneumatics, Vol I, II and III.	FESTO		
4	Hydraulic Control Systems	Herbert E. Merritt	John Wiley and Sons, Inc	
5	Introduction to Fluid power	Thomson	PrentcieHall	2004
6	Fundamentals of fluid power control	John Watton	Cambridge University press	2012