

Subject Code: 01AE0506

Subject Name: Hydraulic and Pneumatic system

B.Tech. III Year – (Sem-5) Automobile Engineering

Course Type: Under Graduate

Prerequisite: None

Rationale: The subject gives in-depth knowledge of different system working on fluid power and compressed air with understanding of different valves used in the hydraulic and pneumatic system. This subject also gives useful understanding for designing of circuits for system related to hydraulic and pneumatic system.

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Practical Marks		
				ESE(E)	IA	CSE	Viva(V)	Term Work(TW)	
3	0	2	4	50	30	20	25	25	150

Course Outcome

After learning the course, the students should be able to:

1. Identify and analyze operation of industrial fluid power and pneumatics systems, including the design, application, and trouble-shooting.
2. Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. Develop a circuit diagram.
3. Identify different symbols of components used in hydraulic and pneumatic system.
4. Demonstrate the needed analytical skills in handling basic hydraulic and pneumatic calculations.
5. Selection and sizing of components of the circuit.

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Fundamentals and basic principal of Hydraulics, advantages and disadvantages of Hydraulics and Pneumatics Systems, hydraulic power principles, Symbols, hydraulic circuit electrical components. Comparison between a hydraulic and a pneumatic system	5	10
2	Hydraulic System Components, Hydraulic Oils, Fluid Properties and Filter: Hydraulic & Pneumatic system Symbols as per ISO/ANSI, Fluid Classification,	5	15

	governing Principles and Laws.		
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, Linear and Rotary Actuators, Hydrostatic Transmission Systems. Selection of components for applications. Comparison of different power systems	6	20
4	Hydraulic Valves and Hydraulic System Accessories: Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for circuits.	6	18
5	Design of hydraulic circuits: Basic hydraulic circuits, Industrial hydraulic circuits, Power losses in flow control circuits.	6	10
6	Introduction to Pneumatic Systems: Fundamentals and basic requirements of pneumatic system with application, Construction and working principle of pneumatic power transmission system. Preparation compressed air. Components like Power source, FRL unit, Actuators and control valves like DCV, FCV, PCV, time delay, quick exhaust valve, Use of Memory Valve (Double Piloted Valve), shuttle Valve.	6	12
7	Pneumatic circuits: Basic pneumatic circuits, Development of single Actuator Circuits, Development of multiple Actuator Circuits, Cascade method for sequencing.	6	10
8	Introduction to Automation in hydraulic and Pneumatic Systems.	3	5

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Create
10	15	15	10	10	10

Legends: **R:** Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze, and **E:** Evaluate

Reference Books :

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 Experiments (Any 10)

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 actuators 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.
 7. Cascading Circuit
- 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.

List of Open Source Software/learning website

1. Autosim Premium
2. Hydrosym