

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Mechanical Engineering

SUBJECT NAME: Oil Hydraulics and Pneumatics

SUBJECT CODE: 2171912

B.E. 7th SEMESTER

Type of course: Elective

Prerequisite: None

Rationale: 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			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M) PA ALA		ESE (V) ESE OEP		PA (I)	
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Introduction, Global fluid power Scenario, Basic system of Hydraulics-Major advantages and disadvantages, Principles of Hydraulic Fluid power, Hydraulic Symbols, Electrical Elements used in hydraulic circuits.	5	10
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.	5	15
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.	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: 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.	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

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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

Course Outcome:

After learning the course, the students should 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. Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. Develop a circuit diagram.
3. Visualize how the hydraulic/pneumatic circuit will work to accomplish the function.
4. Selection and sizing of components of the circuit.

List of Experiments:

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.

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.

Design based Problems (DP)/Open Ended Problem: Student can be given an application of a power transmission system for which they can evaluate the functional requirements and design appropriate circuit. They must identify the components, and relevant parameters. The application must involve use of hydraulics/pneumatics and/or combinations of different power transmission systems.

Major Equipment:

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

List of Open Source Software/learning website:

1. Autosim Premium
2. Hydrosym

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.