



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering (Part Time)

Subject Code: 2941907

Semester – IV

**Subject Name: Oil Hydraulics and Pneumatics**

**Type of course:**

**Prerequisite:** Nil

**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	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs
1	<b>Introduction:</b> Introduction, Global fluid power Scenario, Basic system of Hydraulics-Major advantages and disadvantages, Comparison among Electrical, Hydraulics and Pneumatics System, Principles of Hydraulic Fluid power, Hydraulic Symbols, Electrical Elements used in hydraulic circuits. Basic Requirements for Pneumatic System, Basic Symbols of Pneumatic Systems, Applications of Pneumatics. Electrical elements used in Pneumatic System.	08
2	<b>Hydraulic Oils, Fluid Properties and Filter:</b> Types, Properties, physical characteristics & functions of hydraulic Oils, Classification Mineral based, Fire resistant & Biodegradable Oils, Filters, Contaminations, location of filter.	06
3	<b>Hydraulic Pumps, Motors, Valves and Actuators:</b> Classification of hydraulic pumps, Gear Pumps, Vane Pumps, Piston Pumps, Axial piston pumps, Hydraulic motors, Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Types of Hydraulic Actuators, Selection criterion of Actuators, Linear and Rotary Actuators, Hydrostatic Transmission Systems.	10
4	<b>Air Preparation and Service Unit:</b> Types & Selection criteria for Air Compressors, Air receiver, Pipeline Layout, Air filter, Pressure regulator and Lubricator (FRL unit).	05
5	<b>Pneumatic Cylinders, Motors and Valves:</b>	05



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	Types of Pneumatic Cylinders & Air motors, Cushion assembly, mounting Arrangements, Pneumatic Direction control valves, Quick exhaust, Time delay Shuttle and Twin pressure valves.	
6	<b>Circuit Design:</b> Basic hydraulic circuits, Industrial hydraulic circuits, Power losses in flow control circuits, Basic pneumatic circuits, Development of single Actuator Circuits, Development of multiple Actuator Circuits, Cascade method for sequencing	06
7	<b>Automation and Simulation of Hydraulics and Pneumatics:</b> Introduction to Automation in hydraulic and Pneumatic Systems, Case study of Automation using Hydraulics and pneumatics. Introduction to software of hydraulic and Pneumatic system, Circuit designing in software, Simulation in software, Simulation with actual component using software like automation in industry	04
	<b>Total</b>	<b>45</b>

### Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	30	30	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



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## Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify the functional requirements of a power transmission system for a given application.	20
CO-2	Selection and sizing of components of the circuit.	30
CO-3	Design hydraulic, pneumatic circuit and combination circuit for a given application.	35
CO-4	Simulation and Automate hydraulic/pneumatic circuits.	15

## Term Work:

The term work shall be based on the topics mentioned above.

## 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.

## Major Equipment:

1. A hydraulic trainer



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2. A pneumatic trainer
3. Simulation Software

## **List of Open Source Software/learning website:**

1. NPTEL
2. Simulation Software of Hydraulic Pneumatic system.

## **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.