



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

**Branch: Mechatronics Engineering /
Mechanical Engineering (CAD/CAM)**

Subject Code: DI05000321

Subject Name: Hydraulic & Pneumatic Systems

w. e. f. Academic Year:	2026-27
Semester:	5 th
Category of the Course:	PCC / PEC-03

Prerequisite:	Zeal to Learn the Industrial Application of Hydraulic & Pneumatic System.
Rationale:	Hydraulic and pneumatic operated machines and equipment are widely used in various industries due to its versatility and adaptability to automation. These technologies are required to maintain such systems in different segments of industries. The concepts of hydraulics and pneumatics are important and indispensable tools being used in the innovations, circuit design and improvement of engineering processes and devices. Different types of power sources, valves and actuators are essential elements in all the manufacturing industries, especially where automation and control is required. This course is designed to develop underpinning knowledge of hydraulic and pneumatic systems which are widely used for control and other purposes in machine tools, material handling, automobile, marine, elevators, mining, metal processing equipment and other fields. This course also enable s the diploma students to operate and troubleshoot different types of hydraulic and pneumatic systems in industries.

2. Course Outcome: After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Identify various components of Hydraulic & Pneumatic systems.	R/U/A
02	Select and operate various hydraulic and pneumatic elements.	R/A
03	Operate and maintain various hydraulic and pneumatic devices.	A/U
04	Summarize the various trouble shooting methods and applications of Hydraulic & Pneumatic systems	U/A

3. Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE(E)	PA(M)	PA (I)	ESE (V)	
03	00	02	04	70	30	20	30	150



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Legends: L-Lecture; T- Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, CA - Continuous Assessment; ESE-End Semester Examination.

4. Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Fluid Power Principles & Introduction to Hps	09	19
2.	Hydraulic & Pneumatic Elements	12	27
3.	Hydraulic and Pneumatic Devices	12	27
4.	Trouble Shooting and Applications	12	27
	Total	45	100

5. Suggested Specification Table with Marks (Theory):

Sr. No	Unit Title	Teaching Hours	Distribution of Theory Marks (in %)						Total Marks
			R	U	A	N	E	C	
1.	FLUID POWER PRINCIPLES & INTRODUCTION TO HPS	09	8	5	4	-	-	-	17
2.	HYDRAULIC & PNEUMATIC ELEMENTS	12	8	8	4	-	-	-	20
3.	HYDRAULIC AND PNEUMATIC DEVICES	12	4	6	8	-	-	-	18
4.	TROUBLE SHOOTING AND APPLICATIONS	12	2	3	10	-	-	-	15
		45	22	22	26	-	-	-	70
			31%	31%	38%	-	-	-	100%



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Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

6. Course Details:

Unit No.	Content	No. of Hours	% of Weightage
1.	FLUID POWER PRINCIPLES & INTRODUCTION TO HPS 1.1 Introduction to Fluid power – Advantages and Applications – Fluid power systems 1.2 Types of fluids (ISO & SAE Grades of Oil) - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law 1.3 General Layout of Hydraulic & Pneumatic System. 1.4 Applications, Merits, Limitations and oil hydraulic systems and Pneumatic systems. 1.5 ISO Symbols used in Hydraulic, Pneumatic System. 1.6 Hazard and Safety in Industrial hydraulics and pneumatics.	09	17
2.	HYDRAULIC & PNEUMATIC ELEMENTS 2.1 Hydraulic Actuators: Cylinders – Types and construction, Application. 2.2 Hydraulic pipes-Types, standards, designation methods and specifications, pressure ratings, applications and selection criteria. 2.3 Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation 2.4 Pneumatic Actuators and Control valves types, construction, working, materials and specifications. 2.5 Pneumatic Pipes materials, designations, standards, properties and piping layout. 2.6 Air compressors, Air receivers, air dryers, Air Filters, Regulators, Lubricators (FRL unit): their types, construction, working.	12	20
3.	HYDRAULIC AND PNEUMATIC DEVICES 3.1 Construction, working principle, major elements, and performance variables of: Automotive hydraulic brake, Industrial Fork lift, Hydraulic jack, Hydraulic press, Automotive power steering. 3.2 Construction, working principle, major elements, and performance variables of: Automotive pneumatic brake, Automotive air suspension, Pneumatic drill, Pneumatic gun.	12	18
4.	TROUBLE SHOOTING AND APPLICATIONS	12	15



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	4.1 Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. 4.2 Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, and Press and Forklift applications. 4.3 Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools. 4.4 Low cost Automation – Hydraulic and Pneumatic power packs		
	Total	45	100

7. SUGGESTED PRACTICAL EXERCISES:-

Sr. No.	Suggested Practical List	Approx. Hrs. required
1.	Preparatory activity: Tabulate physical properties of fluid, units and importance in fluid systems.	02
2.	Study of ISO Symbols used in Hydraulics & Pneumatics	04
3.	To study Linear actuators in Hydraulic and Pneumatics	02
4.	To study Rotary actuators in Hydraulic and Pneumatics	02
5.	Study of Various Hydraulic Pumps.	02
6.	Experimentation on Hydraulic Trainer using 1. Regenerative Circuit 2. Speed Control Circuit 3. Sequencing Circuit 4. Traverse and Feed Circuit	04
7.	Study of Compressor and FRL unit used in pneumatics.	02
8.	Linear and rotary actuators movement by direct method using suitable DC valves.	02
9.	Basic hydraulic circuit for the working of double acting cylinder and a hydraulic motor.	04



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10.	To Study of Basic pneumatic circuit for the working of single and double acting cylinder.	02
11.	Installation of Various Hydraulic & Pneumatic Devices & How to do Maintenance of Particular Devices	02
12.	Trouble Shooting of Hydraulic & Pneumatic Systems	02
	Total (Hours)	30

NOTES:-

I. More Practical Exercises can be designed and offered by the concerned course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a representative list.

II. It is compulsory to prepare log book/continuous records of exercises. It is also required to get each exercise recorded in log book/continuous records, checked and duly dated signed by teacher. CA component of practical marks is dependent on continuous and timely evaluation of exercises.

III. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.

a. Brief details of industry visited.

b. Type, location, products, rough layout, human resource, etc., of industry.

c. Details, description and broad specifications of machineries/processes observed.

d. Safety norms and precautions observed.

e. Student's own observation on industrial environment, productivity concepts, quality consciousness and quality standards, cost effectiveness, culture and attitude.

f. Any other details/ observations asked by accompanying faculty.

IV. For practical ESE part, students are to be assessed for competencies achieved. They should be assigned the necessary data and should be given any one experience to perform. The following are some sample 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above-listed Practical Exercises of this course required, which are embedded in the COs and, ultimately, the competency.



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8. References/Suggested Learning Resources:

(a) Books:

Sr. No	Title of Book	Author	Publication
1.	Oil Hydraulic system – Principal and maintenance	Majumdar S. R	McGraw Hill, New Delhi
2.	Pneumatic Systems - Principal and maintenance	Majumdar S. R	McGraw Hill, New Delhi
3.	Fluid Power with Applications	Esposito , Anthony	Pearson Education, Inc New Delhi
4.	Hydraulic & Hydraulic Machines	R.C. Patel & A.D. Pandya	Acharya Book Depot
5.	Hydraulic and Pneumatic Controls	Srinivasan, R.	Vijay Nicole Imprints Private Limited , New Delhi
6.	Hydraulic And Pneumatics A Technician's and Engineer's Guide	Parr, Andrew	Jaico Publishing House , New Delhi
7.	Hydraulic And Pneumatics Controls - Understanding Made Easy	Shanmuga Sundaram, K	S. Chand Company Ltd. Ltd., New Delhi,

(b) Open source software and website:

- <http://www.automationstudio.com/>
- www.boschrexroth.co.in
- <https://www.youtube.com/watch?v=iOXR0YHdCV0>
- <https://www.youtube.com/watch?v=xxoAm3X4iw0>
- <http://www.youtube.com/watch?v=YxxSmz86zDg>
- <http://www.youtube.com/watch?v=MbKrlieogNc>
- <http://www.youtube.com/watch?v=5q7YasmwXCs>
- <https://www.brighthubengineering.com/fluid-mechanics-hydraulics/>
- www.festo.com



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- x. Automation Studio 8.0 or higher version: <https://www.famictech.com/en/Support/Automation-Studio/Downloads>
- xi. Festo Fluidsim: https://www.festo.com/in/en/e/technical-education/digital-learning/virtual-simulation-and-modelling/fluidsim-id_1663056/
- xii. **OTHER SOFTWARES:** Hypneu, AUTOMSIM, LVSIM ®HYD, LVSIM ®PNEU, LogicLab, etc

9. MAJOR EQUIPMENT / INSTRUMENTS AND SOFTWARE REQUIRED

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Electro-hydraulic Trainer kit (with/without proportional valves) ii. Components required: Pump, Reservoir, pressure relief valve, check valves, Directional control valves (manual and electrically operated), Flow control valves (fixed and variable), pressure reducing valve, Cylinders, Motor, Accumulator, hosepipes, accessories and setup for electro-hydraulic circuits.	2 to 12
2.	Electro-pneumatic Trainer kit Components required: Compressor, pressure relief valve, check valves, Directional control valves (manual, pilot operated and electrically operated), Flow control valves (fixed and variable), pressure reducing valve, Cylinders, Motor, Accumulator, tubes, quick exhaust valve, time delay valve, limit switches, pressure switches, proximity sensors, setup for electro-pneumatic circuits.	2 to 12
3.	Working model of pumps, compressors, control valves and actuators.	3,4,5
4.	Cut section of various pumps, compressors, valves and actuators.	4,5
5.	Computer LAB with any Software for circuit design and automation	6,8,9,10

10. Suggested Project List & Student Activities:

Sr. No.	Activity.
1.	Prepare a chart/presentation to select a particular hydraulic pump for a particular application
2.	Visit a nearby related industry and prepare a summary of hydro-pneumatic devices used and their specifications.
3.	Solve as many numerical problems as possible related to theories taught in classroom.
4.	Prepare/Download a dynamic animation to illustrate the following: • Working principle of hydraulic pumps, air compressors. • Working principle of hydraulic and pneumatic valves and actuators.



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	Working of different types of hydraulic and pneumatic devices (applications).
5.	Download the catalogue of hydraulic and pneumatic devices.
6.	Prepare a Display chart of type of seals and gasket used in hydraulics.
7.	Prepare visit report of any automobile service station to observe use of pneumatic hand tool.
8.	Prepare a visit report of construction sites to observe use of earth moving equipment used there.

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