GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS ENGINEERING (20)

HYDRAULIC & PNEUMATIC SYSTEMS

SUBJECT CODE: 2162004

B.E. 6th Semester

Type of course: Engineering Science

Prerequisite: NA

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
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	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

Contents:

Sr No	Contents	Teaching 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	10.42
2	**Hydraulic Oils, Fluid Properties and Filter:** Types, Properties, physical characteristics & functions of hydraulic Oils, Classification-Mineral based, Fire resistant& Biodegradable Oils, Filters, Contaminations, location of filter.	5	10.42
3	**Hydraulic Pumps, Motors and Actuators:** Classification of hydraulic pumps, Gear Pumps, Vane Pumps, Piston Pumps, Axial piston pumps, Hydraulic motors, Linear and Rotary Actuators, Hydrostatic Transmission Systems.	8	16.70
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.	7	14.52
5	**Design of hydraulic circuits:** Basic hydraulic circuits, Industrial hydraulic circuits, Power losses in flow control circuits.	5	10.42
6	**Introduction to Pneumatics:** Basic Requirements for Pneumatic System, Applications.	2	4.17
7	**Air Compressor and Service Unit:** Types & Selection criteria for Air	4	8.34

	Compressors, Air receiver, Pipeline Layout, Air filter, Pressure regulator and Lubricator (FRL unit).		
8	**Pneumatic Cylinders, Motors and Valves:** Types of Pneumatic Cylinders & Air motors, Cushion assembly, mounting Arrangements, Pneumatic Direction control valves, Quick exhaust, Time delay Shuttle and Twin pressure valves.	5	10.42
9	**Pneumatic circuits:** Basic pneumatic circuits, Development of single Actuator Circuits, Development of multiple Actuator Circuits, Cascade method for sequencing.	4	8.34
10	Introduction to Automation in hydraulic and Pneumatic Systems	3	6.25

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
45	**20**	**20**	**5**	**5**	**5**

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. S R Majumdar, Oil Hydraulic Systems, Tata McGraw-Hill
2. S R Majumdar, Pneumatic Systems Tata McGraw-Hill
3. John Pippenger & Taylor Hicks, Industrial Hydraulics McGraw-Hill
4. Anthony Esposito, Fluid Power Prentice Hall
5. Andrew Parr, Hydraulics & Pneumatics Jaico Publications

Course Outcomes:

After successful completion of the course the students shall be able to:

1. Apply working principles of Hydraulic and Pneumatic Systems in industry automation.
2. Get idea about oil and air behavior in Hydraulic and Pneumatic systems.
3. Understand design and working principle of different valves and accessories used in Hydraulic as well as Pneumatic systems.
4. Design and simulate the Hydraulic, Pneumatic, Electro-Hydraulic and Electro-Pneumatic circuits using software and experimentation.

List of Practical:

1. Graphical Symbol as per DIN-ISO: 1219
2. To understand working and construction of hydraulic components and basic circuits.
3. To understand working and construction of pneumatic components and basic circuits.

4. (A) Speed control of Hydraulic cylinder through Throttle valve.
   (B) Speed control of Hydraulic cylinder through The Flow control valve in Bypass.
   (C) Flow control valve in Meter-in & Meter-out circuit.
5. Electro Hydraulic circuit –Speed and Pressure control of double acting cylinder.
6. Electro Hydraulic circuit—Sequential operation of double acting cylinder through Limit switches.
7. (A) To control Double acting pneumatic cylinder through 5/2 D.C. Valve.
   (B) To control Double acting pneumatic cylinder by 3/2 push button valves and Shuttle Valve.
8. (A) To understand use of Logic element 'OR' gate and 'AND' gate
   (B) To understand use of Quick Exhaust & Flow control valve.
9. (A) To illustrate the use of Time Delay valve with 'OR' gate and 'AND' gate
   (B) To illustrate pneumatic circuit involving two cylinders.

10. To control double acting cylinder through 5/2 solenoid operated D.C. valve and PLC Controller (Counter based circuit).

Open ended problem

Student may be given a task to exhibit the knowledge of the course studied during the academic year.

Major Equipments:

1. Hydraulic trainer
2. Pneumatic trainer
3. PLC

List of Open Source Software/learning website:

The website of NPTL may be utilized for additional learning

Active learning Assignments (AL) : Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ part of chapters to groups of students so that the entire syllabus of Hydraulic and Pneumatic Systems is covered. The power-point slides should be put up on the web-site of the college/Institute, along with the name of the group, the name of faculty, Department and College on the first slide. The best three works should be sent on achievements@gtu.edu.in.