GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Plastics Engineering

Subject Code: DI04023071

Subject Name: Hydraulics and Pneumatics System

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Professional Elective - II

Prerequisite:	NA
Rationale:	As Diploma Plastic engineer has to supervise operations and maintenance of various molding machines. This competency requires the knowledge of construction and working of different components of hydraulic and pneumatic systems. The course deals with various types of Hydraulic components, Valves, Accessories, Pumps, Motors etc., also deals with Pneumatic components. Subject is also useful for designing the various hydraulic and pneumatic circuits for various plastic engineering applications. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Use & Interpret various hydraulic symbols & apply basic hydraulic laws.	R,U
02	Operate & maintain different types of pumps, motors & accessories used in hydraulic systems	R,U,A
03	Maintain different valves and auxiliaries.	R,U,A
04	Develop efficient hydraulic circuits for simple application.	R,U,A
05	Operate and Maintain the pneumatics system.	R,U,A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit – I	**Basic Concepts of Hydraulics** 1.1 Introduction & Definitions of important terms like Hydraulics, Pressure, Flow, Force, Vacuum etc. 1.2 Pascal's Law and its Application to Hydraulics 1.3 Bernoulli's Principle 1.4 Hydraulic Jack 1.5 Hydraulic Symbols 1.6 Advantages and Disadvantages of Hydraulic System. 1.7 Hydraulic Oil • Purpose of Hydraulic Oil • Ideal Characteristics of Hydraulic Oil • Maintenance of Hydraulic Oil	08	19 % (13 Marks)
Unit – II	**Accessories, Pumps & Motors in Hydraulic System** **2A: Accessories** 2.1 Connectors • Steel pipe • Tubing • Hose • Fittings 2.2 Pressure Gauges 2.3 Packing & Seals- Types & applications 2.4 Filters & Strainers 2.5 Hydraulic Tank **2B: Pumps** 2.6 Pump Specifications 2.7 Construction & Working of • Gear Pump • Vane Pump • Radial Piston Pump 2.8 Pump Maintenance & Trouble Shooting **2C: Motors** 2.9 Hydraulic Motor Specifications 2.7 Construction & Working of • Gear Motor • Vane Motor • Radial Piston Motor	10	22 % (15 Marks)

	2.8 Servo Motor- Construction & Working		
Unit – III	**Hydraulic Valves And Auxiliaries** **3A: Hydraulic Valves** 3.1 Directional Control Valves • Check valve – Ball type, Poppet type, pilot operated • Two way valve • Three way valve • Four way valve 3.2 Pressure Control Valves • Relief valve – Simple and balanced piston type • Unloading valve • Sequence valve • Counterbalance valve • Pressure reducing valve 3.3 Decompression valve 3.4 Pressure compensated Flow Control Valves 3.5 Cartridge Valves- Introduction & Applications 3.6 Servo Valves- introduction & Applications **3B: Auxiliaries** 3.7 Pressure Intensifiers- Single stage & two stage 3.8 Accumulators – Principle & working • Gravity type • Spring loaded • Gas loaded – Separator, non-separator and bladder type 3.9 Pressure switches	13	28 % (20 Marks)
Unit – IV	**Hydraulic Circuits in Injection molding machine** 4.1 Clamp Control Circuit 4.2 Injection Control Circuit 4.3 Reciprocating Screw Circuit 4.4 Oil Filtration Circuit 4.5 Deceleration Circuit 4.6 Pre-fill Circuit 4.7 Hi-Low Pump Circuit 4.8 Hydraulic Motor Circuit 4.9 Overview of Electro-Hydraulic Circuit	08	19 % (13 Marks)
Unit – V	**Pneumatic System** 5.1 Pneumatic system introduction 5.2 Comparison with Hydraulic System 5.3 Air Compressors:	06	12 % (09 Marks)

	• Single Acting • Double Acting 5.4 Components of Pneumatic System 5.5 Air receiver and pressure control 5.6 Stages of Air Treatment • Inter-cooler • Lubricator • Filter • Air dryer 5.7 Pneumatic Circuit for Plastic Processing Machine		
	Total	**45**	**100 %** (70 Marks)

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
32	**48**	**20**	---------	_____	_____

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

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Oil Hydraulic System- Principles & Maintenance	Majumdar S.R.	Publication: McGraw Hill, New Delhi Year:2002 ISBN: 9780074637487
2	Pneumatic Systems- Principles & Maintenance	Majumdar S.R.	Publication: McGraw Hill, New Delhi Year:1996 ISBN: 9780074602317
3	Hydraulics and Pneumatics: A Technician's and Engineer's Guide	Andrew Parr	Publication: Butterworth-Heinemann Year: 2011 ISBN: 978-0080966748
4	Injection molding theory and practice	Irvin I. Rubin	Publication: Wiley Year:2014 ISBN: 978-81-265-4576-6

5	Injection molding machine	A.Whelan	Publication: Elsevier applied science Year: 1984 ISBN: 0-85334-245-8
6	Industrial Hydraulics Manual	----	Vickers Systems International (Company Manual) Year:2010 ISBN: 9780978802202

(b) Open-source software and website:

1. https://www.cesim.com/simulations
2. https://nptel.ac.in/courses/112106175
3. https://nptel.ac.in/courses/112105047
4. https://www.youtube.com/watch?v=KM3ivQL6W6w
5. https://www.youtube.com/watch?v=y2DM1iSNre0
6. https://www.youtube.com/watch?v=xLc70lxQpcU
7. https://www.e4training.com/simulate/index.php
8. https://play.google.com/store/apps/details?id=com.engadven.simulate&hl=en&gl=US
9. http://www.eaton.in/EatonIN/ProductsServices/Aerospace/Hydraulicsystem/index.htm
10. www.boschrexroth.com
11. https://www.eaton.com/in/en-us.html?percolateContentId=post%3A1

Suggested Practical List:

Sr. No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx. Hrs Required
1	Draw graphical symbols used in Hydraulic & Pneumatic.	2
2	Demonstrate application of Pascal's law in hydraulic system.	2
3	Select various accessories and find their uses in hydraulic system.	2
4	Demonstrate use of directional control valves.	4
5	Demonstrate use of pressure control valves.	4
6	Apply use of pressure intensifier.	2
7	Demonstrate application of flow control valves.	2
8	Select appropriate pump/motor from various types of pumps/motors.	2
9	Operate and maintain hydraulic pumps.	2
10	To connect and interpret injection control circuit.	2
11	To connect and interpret clamp control and reciprocating screw circuits.	2

12	To operate single stage air compressor.	4
	Total	**30**

Suggested Activities for Students:

1. Students will prepare chart of different hydraulic symbols, Hydraulic/Pneumatic Circuit etc.
2. Students will collect information related to troubleshooting of various hydraulic & Pneumatic problems in Plastic Processing machines.
3. Students will collect information like animations on internet for understanding functioning of various hydraulic and pneumatic components through internet.
4. Students will visit nearby industry & check functions of various Hydraulic & Pneumatic components & prepare data sheet for same.
5. Students will prepare working model for various Hydraulic/Pneumatic components.

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