Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B. Tech)

Subject: Oil Hydraulics & Pneumatics – BETME15317.

Type of course: Professional Elective courses.

Prerequisite: Physics, Fluid Mechanics & Hydraulic Machineries, Basic Electrical Engineering.

Rationale: Hydraulic and pneumatic systems play a crucial role in various industries, including manufacturing, automation, and heavy machinery. Understanding these systems enables students to design, operate, and maintain fluid power mechanisms efficiently. This course provides fundamental knowledge of hydraulic and pneumatic components, circuits, and applications, helping students develop practical skills for real-world industrial scenarios. By covering essential topics such as pumps, valves, actuators, and circuit design, the course bridges the gap between theoretical concepts and hands-on implementation. A strong foundation in these areas is vital for careers in mechanical, automation, and industrial engineering, ensuring students are well-prepared for modern engineering challenges.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	0	3	60	30	10	-	50	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

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Course Content:

Unit No	Course content	Hrs.	% Weightage
1	**Basics of Hydraulic Systems;** Introduction to fluid power, global scenario of hydraulics, advantages & disadvantages, basic hydraulic system components, principles of hydraulic power, hydraulic symbols, electrical elements used in hydraulic circuits.	10	20
2	**Hydraulic Components and Circuits:** Hydraulic oils and their properties, classification of hydraulic oils (mineral-based, fire-resistant, biodegradable), filtration and contamination control, classification of hydraulic pumps (gear, vane, piston, axial piston), hydraulic motors and actuators, basic hydraulic valves (direction control, pressure control, flow control, non-return), hydraulic reservoirs, accumulators, hoses, basic hydraulic circuits, industrial hydraulic circuits, power losses in flow control circuits.	15	35
3	**Pneumatic Systems and Components:** Introduction to pneumatics, basic requirements and applications, types of air compressors, selection criteria for air compressors, air receiver and pipeline layout, FRL (filter, regulator, lubricator) unit, types of pneumatic cylinders and motors, cushion assembly and mounting arrangements, pneumatic valves (direction control, quick exhaust, time delay, shuttle, twin pressure).	10	20
4	**Pneumatic Circuits and Industrial Applications:** Basic pneumatic circuits, development of single and multiple actuator circuits, cascade method for sequencing circuits, industrial applications of hydraulic and pneumatic systems.	10	25

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Hydraulic Symbols Chart:** Create a hand-drawn or digital chart of at least 10 commonly used hydraulic symbols with their names and functions and upload photos on GMIU web portal.	10
2	**Pneumatic System Demonstration:** Using household items (syringes, pipes, balloons), build a simple pneumatic system to demonstrate air pressure movement. Record a 1–3-minute video explaining how it works and mention short reflection on challenges faced during the experiment and submit on GMIU web portal.	10

3	**Hydraulic & Pneumatic Circuit Design** Draw one basic hydraulic circuit and one basic pneumatic circuit using standard symbols and submit photographs on GMIU web portal.	10
4	**Build a Simple Pneumatic Circuit** Students will be given a diagram of a basic pneumatic system with missing components (e.g., cylinders, valves). They must correctly identify and place the components in the circuit and upload findings on GMIU web portal.	10
5	**Pneumatic Actuator Selection Challenge** Students will be given different industrial scenarios (e.g., conveyor belt movement, robotic arm control) and must choose the correct pneumatic cylinder or motor based on force, speed, and application and upload work on GMIU web portal.	10
	Total	50

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage	20%	25%	25%	20%	10%	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Explain the fundamental principles of hydraulic systems, their advantages, limitations, and applications in various industries.
CO2	Identify and describe the working of hydraulic components such as pumps, motors, valves, and actuators, and analyze basic hydraulic circuits.
CO3	Explain the working principles of pneumatic systems, including compressors, cylinders, and valves, and their industrial applications.
CO4	Design and evaluate basic pneumatic circuits, compare hydraulic and pneumatic systems, and assess their efficiency in real-world applications.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] "Fluid Power with Applications" – Anthony Esposito

[2] "Oil Hydraulic Systems: Principles and Maintenance" – S. R. Majumdar

[3] "Industrial Hydraulics Manual" – Eaton Hydraulics

[4] "Fluid Power Engineering" – M. Galal Rabie.

[5] "Fundamentals of Fluid Power Control" – John Watton

[6] "Hydraulic Control Systems" – Noah D. Manring