Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NMED521	Design of Fluid Power Systems	3	0	0	3

Course Objective

- This course emphasizes Basic theories of fluid mechanics applicable to fluid power systems.
- Selection of hydraulic fluid and its impact on the fluid power system, Design, and operation of positive displacement pump,Design and operation of hydraulic actuators and valves.
- This course would help students to Design Design of hydrostatic transmission system

Learning Outcomes

Upon successful completion of this course, students will be able to:

- To understand the introduction to the hydraulic system and its applications. Design of Fluid power circuits with standard symbols.
- To Design of hydraulic actuators and valves and their selection for various applications.
- To design proportional and servo-valves, Energy storage devices, and low-cost automation circuits for various industrial applications.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	**Introduction to fluid power-** Basic theories of fluid mechanics applicable to fluid power systems. Advantages and disadvantages of hydraulic power over others. ISO symbols of hydraulic components and understanding hydraulic circuits.	4	Basic introduction to the hydraulic system and its applications. Design of Fluid power circuits with standard symbols.
2.	**Selection of hydraulic fluid and its impact on fluid power system-** Properties of hydraulic fluid, Different types of hydraulic fluid used in power transmission systems. Fire-resistant fluid. Gaps as a basic hydrostatic element. Thermal and inertia effects on fluid properties in gaps.	3	Properties of fluid and their selection for different applications.
3.	**Design and operation of positive displacement pump-** Classifications of positive displacement pumps. Design, construction, and operation of gear pump, vane pump, axial and bent-axis pump, and radial piston pump. Understanding the design variables of a pump for various applications. Pump ripple. Performance characteristics of positive displacement pumps.	8	Design of positive displacement pump and their selection for various applications.
4.	**Design and operation of hydraulic actuators-** Classifications of hydraulic actuators. Design, construction, and operation of rotary actuators like gear motor, vane motor, axial and bent-axis motor, and radial piston motor. Design, construction, and operation of linear actuators. Understanding the design variables of a hydro-motor for various applications. Performance characteristics of positive displacement actuators.	6	Design of hydraulic actuators and their selection for various applications.

5.	**Design and operation of hydraulic valves-** Classification, construction, performance characteristics of different types of direction, flow and pressure control valves, and their applications based on performances. Construction of single-stage and two-stage hydraulic valves. Different design geometries of hydraulic valve component and their responses. Understanding performance parameters of various hydraulic valves.	7	Design of hydraulic valves, their application and performance characteristics.
6.	**Design and operation of proportional and servo-hydraulic valves-** Understanding the need for proportional and servo-valves. Constructional difference between proportional and servo-valves. Differentiating the performance parameters of proportional and servo-valves.	4	Design of proportional and servo-valves, their application and performance characteristics.
7.	**Design principles of energy storage devices and hydraulic accessories-** Hydraulic accessories and their operations. Design of reservoir, hydraulic power pack, hoses, accumulator, etc. Design variables of hydraulic accessories and their performance characteristics.	6	Design of hydraulic accessories, their application, and performance characteristics.
8.	**Design of hydrostatic transmission system-** Classification, design, and application of various types of industrial hydraulic systems. Open-circuit closed-circuit systems. Making various hydraulic circuits e.g. Counter balance circuits, sequencing circuits, tandem actuators of hydraulic actuators, steering circuits used in automobiles, Hydraulic press circuit operation, and Accumulator circuits for intermittent operation of actuators. Recent innovations in the design of hydraulic systems to reduce fuel/energy consumption.	4	Design and develop low-cost automation circuits for various industrial applications.
	Total	42	

Text Books:

1. Majumdar, S. R. (2013). Hydraulic systems: Principles and maintenance. Tata McGraw-Hill Education.
2. Majumdar, S. R. (2010). Pneumatic systems: Principles and maintenance. Tata McGraw-Hill Education.

References Books:

1. Merritt, H., Merritt, H. E., & Merritt, H. E. (1967). *Hydraulic control systems*. John Wiley & Sons.
2. Manring, N. (2005). *Hydraulic control systems*. New York: Wiley.
3. Pinches, M. J., & Ashby, J. G. (1988). *Power hydraulics*. Prentice Hall Publication.
4. Cundiff, J. S. (2001). *Fluid power circuits and controls: fundamentals and applications*. CRC Press.
5. Watton, J. (2009). Fundamentals of fluid power control. Cambridge University Press.