Marwadi University

Syllabus for Bachalor of Technology

Subject Code: 01ME0741

Subject Name: PNEUMATICAND HYDRAULIC CONTROLS

B.Tech. IV Year – (Sem-7) Mechanical Engineering

Type of course: PROGRAMME ELECTIVE

Prerequisite: None

Rationale: **T**here has been a huge advancement in fluid power technologyA design engineer will need knowledge of power transmission; needs to know the power transmission system of machine tools, presses, equipment. A design engineer must have knowledge of various selection and manufacturing techniques, control, procedure and application of hydraulic/pneumatic components.

Teaching and Examination Scheme:

Teaching Scheme (Hours)			**Credits**	**Evaluation Scheme**					Total Marks
				Theory Marks			Practical Marks		
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
4	---	2	5	50	30	20	25	25	150

Content:

Sr. No.	**Content**	**Total Hrs**	**% Weightage**
1	**Introduction:** Fundamentals of oil hydraulics and pneumatics, Functional requirements of a power transmission, Method of fulfilling requirements by various power transmission systems : mechanical, oil hydraulic, pneumatic, electrical or their combinations of these systems, Control functions of oil hydraulic systems; Comparison between Mechanical, Oil Hydraulic, Pneumatic and Electrical power transmission systems; Advantages, disadvantages and Applications of Oil Hydraulic and Pneumatic systems.	**3**	10%
2	**SystemComponents:** Hydraulic symbols , Pneumatic Symbols as per ISO1219, Properties of hydraulic fluids, selection of hydraulic fluid, Filtration, Hydraulic Reservoirs and Accumulators, Pressure Intensifiers , Seals.	**4**	5%
3	**Oil Hydraulic Pumps and Actuators:** Construction, working principle and operation of rotary & reciprocating pumps : Gear, Vane, Generated-Rotor, Screw, Axial Piston, Radial Piston, Pump characteristics, Pump Specifications and selection of pumps; Linear actuators: Ram type, Telescopic and Single acting or double acting, construction of pumps, types of mountings, cylinder materials.	**6**	15%

	Rotary actuators, specifications.		
4	**Control Valves:** Construction, working principle and operation of DCV, FCV and PCV; Check valve, Pressure relief valve, Compound Pilot operated Pressure Relief valve, Safety valve, Sequence valve, Pressure Reducing valve, Unloading, Counterbalance valves. Different types of center positions of Direction Control Valves, Methods of actuation of Direction control valves.	**8**	10%
5	**Hydraulic and Pneumatic Controllers used in Feedback Control systems:** Construction of controllers, working principleof Proportional and Servo control valves, Applications of servomotor systems, Servo-type Direction control valve: nozzle valve, flapper type valve, Mechanical valve, single stage and double stage servo valves.	**4**	10%
6	**Hydraulic Circuits:** Reciprocation, quick return, sequencing, flow control synchronizing circuits, accumulator circuits, industrial circuits : circuits of mechanical press , machine tool circuits, earth mover and forklift, circuits- design and selection of components.	**4**	15%
7	**Pneumatic Systems and Circuits:** Basic principles of Pneumatic, Construction, working principle and operation of pneumatic system, Power source, Filter Regulator and Lubrication unit, Actuators and control valves: DCV, FCV, PCV, time delay, quick exhaust, twin pressure, shuttle; Pneumatic circuits: reciprocating circuits, switching circuits, sequential circuits, hydro pneumatic circuits, solenoid operated circuits, simple logic circuits, Programmable logic circuits using PLC/Microcontroller and their applications; selection, sizing and specifications of pneumatic components.	**12**	35%

Reference Books:

1. Oil Hydraulic Systems, Principle and Maintenance Majumdar, McGraw-Hill.
2. Fluid Power with Applications by Anthony, Pearson.
3. Industrial Hydraulics by John Pippenger McGraw Hill.
4. The Analysis & Design of Pneumatic Systems by Anderson, John Wiley.
5. Control of Fluid Power Analysis and Design by Mc Clay Donaldson, Ellis Horwood Ltd.
6. Basic Pneumatic Systems, Principle and Maintenance by Majumdar**,** McGraw-Hill.
7. Basic fluid power Dudley, A. Pease and John J. Pippenger, , Prentice Hall

Course Outcome:

1. To analyze the functional requirements of a power transmission system for a given application.
2. To Design an appropriate hydraulic or pneumatic circuit and combination of these two circuit
3. Perform the hydraulic/pneumatic circuit operation to accomplish specific function.
4. Selection and sizing of components of the circuit.

List of Experiments:

A. Experiments on Hydraulics Trainer
    1) Extend and Retract the linear actuator Stop system of a rotary actuator.
    2) Use of Regenerative circuit.
    3) Circuits for Speed Control : meter-in, meter-out
    4) Circuit for Sequencing the operations
    5) Use of solenoid operated Direction Control Valve.
    6) Prepare Circuit for Rapid Traverse and Feed
B. Experiments on Pneumatic Trainer :
    1) Study of Compressor unit , Filter Regulator and Lubrication unit .
    2) Single and double acting actuators operations using 5/3 DCV and Pilot operated DCV.
    3) Application of Speed control circuits.
    4) Automatic Forward and Return motion of a pneumatic linear actuator.
    5) Application of Sequencing circuit
    6) Application of Time delay circuit
    7) Logical circuits using shuttle valve and twin pressure valve
C. Students should build up the above circuits on computer using software like Automation Studio Simulate the flow of fluid during the operation.

Design based Problems

Student must preapre an application of a power transmission system for which student should evaluate the functional requirements of power transmission and design appropriate circuit with due justification. He has to select and size the components, and specify the components. He should explain the working of circuit through a presentation. The application must involve use of hydraulics/pneumatics and/or combinations of different power transmission systems.

Major Equipment:

1. A hydraulic trainer.
2. A pneumatic trainer.
3. Software : Automation Studio

List of Open Source Software/learning website:

1) Autosim Premium
2) Hydrosym
3) Scilab