

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL ENGINEERING (19)

FLUID POWER ENGINEERING

SUBJECT CODE: 2151903

B.E. 5th SEMESTER

Type of course: Fundamental

Prerequisite: Elements of Mechanical Engineering

Rationale: The course is designed to provide the detailed understanding of fluid power and different major equipment which can produce power from fluid.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
PA	ALA	ESE		OEP						
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Hydropower Plant: Introduction, Major applications of hydropower plant, Classification of hydropower plant, Essential components of hydropower plant, Advantages and disadvantages of hydropower plant, selection of site for a hydropower plant	2	5
2	Impact of Jet: Introduction, Force exerted on stationary plate held normal and inclined to jet, Force exerted on curved plate, force exerted on moving plate held normal and inclined in direction of moving jet, Force on a plate when vane is moving in direction of jet, jet striking on curved vane tangentially at one tip and leaving at other end, jet propulsion in ships	7	20
3	Hydraulic Turbines: Introduction, Classification of turbines, Impulse and reaction turbines, construction, working and performance of Pelton, Francis and Kaplan Turbines, Draft tube, Governing of hydraulic turbines, Cavitation	7	20
4	Centrifugal Pumps: Pump classification and selection criterion, Centrifugal pumps, Velocity vector diagrams, Pump losses and efficiencies, Net positive suction head, Pressure rise in impeller, Characteristic curves of centrifugal pumps, priming, maximum suction limit - minimum starting speed to deliver the discharge, Multistage pumps, cavitation, pump selection	6	12
5	Reciprocating Pumps: Operation of Reciprocating pumps, discharge coefficient, volumetric efficiency, slip, work done and power required to drive reciprocating pumps, effect of air vessels, effect of friction on performance of reciprocating pump	3	8
6	Reciprocating Compressors: Construction and working, Multistage	3	5

	conditions for minimum work, Intercooling, Efficiency and control of air compressors		
7	Rotary Compressors: Introduction, Classification, roots blower, Vane type, Screw compressor, Scroll compressor	3	5
8	Centrifugal Compressors: Essential parts, Static and total head properties, Velocity diagram, Degree of reaction, surging and choking, Losses in centrifugal compressor	3	5
9	Axial Flow Compressors: Construction of an axial flow compressor, Aerofoil blading, Lift and drag, Performance characteristics	3	5
10	Hydraulic Machines: Construction and working of hydraulic press, Hydraulic accumulator, Hydraulic intensifier, Hydraulic crane, Hydraulic jack, hydraulic lift, Hydraulic ram, Fluid couplings, Fluid torque converter and air lift pump	5	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	25	25	15	10

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. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria & Sons.
2. Fluid Power Engineering by R.N. Patel and V.L. Patel Mahajan Publication
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan.
4. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
5. Turbines, Compressors and Fans by S.M. Yahya., TMH Publishers
6. Fluid Mechanics and Turbomachines by Das, Madan Mohan, PHI Learning

Course Outcome:

After learning the course the students should be able to:

- Learn the benefits and limitations of fluid power compared with other power transmission technologies.
- Understand the operation and use of different hydraulic machines like hydraulic crane, fluid coupling and fluid torque convertor etc.
- Formulate and analyze models of hydraulic components.
- Design and predict the performance of fluid power components.

List of Experiments:

1. To study about hydropower plant.
2. To Verify Impulse-momentum principle for impact of jet on stationary vane.
3. Performance test on Pelton turbine.
4. Performance test on Kaplan turbine.
5. Performance test on Francis turbine.
6. Performance test on Centrifugal pump.
7. Performance test on Reciprocating pump.

8. Performance test on Reciprocating compressor.
9. To study the constructional details of axial flow compressor and draw its characteristics curve.
10. Performance test on Centrifugal compressor.
11. Performance test on Hydraulic ram.
12. To study about hydraulic machines.

Design based Problems (DP)/Open Ended Problem:

1. Develop a working model of hydraulic car lift.
2. Develop a working model of hydraulic crane.
3. Develop a working model of hydraulic turbine (Pelton, Francis and Kaplan).
4. Study about Hydraulics used in Airplane/Jet plane.
5. Study about Optimal selection of Turbines for Hydroelectric power plant.

Major Equipment:

1. Test rig of Pelton turbine
2. Test rig of Kaplan turbine
3. Test rig of Francis turbine
4. Test rig of Centrifugal pump
5. Test rig of Reciprocating pump
6. Test rig of Centrifugal compressor
7. Test rig of Reciprocating compressor
8. Impact of jet apparatus
9. Test rig of Hydraulic ram

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>
2. <http://www.nfpa.com/>

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.