B.E Semester: VI Mechanical Engineering

Subject Name: Fluid Power Engineering

A. Course Objective

- To present a problem oriented in depth knowledge of Fluid Power Engineering.
- To address the underlying concepts, methods and application of different Fluid Power Engineering Concepts.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
ME604	Fluid Power Engineering	4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus

1 **Hydropower Station:** Principles of generation of hydropower, components of the plant, layout of plant, various types of hydro power plants.

2 **Impact of Jet:** Impact of jet on different types of flat and curved plates, fixed and moving, single and series of plates, derivation of efficiency, condition for maximum efficiency and value of maximum efficiency, hinged plate and pipe bends, water jet propulsion, principle and propulsion of ships.

3 **Hydraulic Turbines:** Introduction and development of turbines, classification of turbines, impulse and reaction. Radial and axial, tangential and mixed flow turbines, major components of different turbines, expressions for work done and efficiency of Pelton wheel, bucket of Pelton wheel, size and number of buckets, single jet and multi jet Pelton wheel, Francis turbine, Kaplan turbine and propeller turbines. Construction, working problems on each type.

4 **Performance of turbines:** Specific speed, range of specific speed for different turbines, performance curves of turbine, selection of turbines according to available head, discharge and load, governing of turbines.

5 **Pumps:** Rotodynamic pumps, centrifugal turbine pumps and axial flow pumps, constructional features and working theory, pressure rise through impeller, characteristic curves of C.F. pump, priming, maximum suction limit - minimum starting speed to deliver the discharge, Sealing of shafts for water and toxic fluids specific speed of pumps. Testing of pumps as per BIS.

6 **Other pumps:** Submersible pumps, deep well pumps, ejector pump, mud pump, chemical pumps. Problems and testing of submersible pump as per BIS.

7 **Reciprocating compressors:** Actual indicator diagram, Multistage conditions for minimum work, Intercooling, Heat rejected in compressors and intercoolers, mean effective pressure, Indicated power, Mechanical efficiency, Isothermal efficiency, merits and demerits of multistage, control of delivery of air compressors, compressed air motors.

8 **Rotary Compressors:** Introduction, Classification, roots blower, vane type, screw compressor, scroll compressor, centrifugal and axial flow compressors.

Centrifugal Compressor : Construction and Operation, Ideal energy transfer (Euler's work) velocity diagram, Isentropic efficiency, static and total temperatures, power input factor, slip and slip factor, pressure co-efficient, pre-whirl, effect of blade shape on performance, losses in centrifugal compressors, blade angles, impeller diameter, impeller width, vaneless and vanned diffusers, effect of change in pressure ratio, surging and choking.

Axial flow compressors: Introduction, construction and operation, velocity diagram and work done factor, pressure ratio and static pressure rise, degree of reaction, choice of reaction, blade loading and flow co-efficient, aerofoil blading, drag and lift co-efficient. Radial equilibrium theory. Free vortex, forced vortex.
Characteristics of curves of centrifugal and axial flow compressors.

9 **Miscellaneous Machines:** Demonstrate of constructional details of hydraulic press, hydraulic accumulator, hydraulic intensifier. Hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings and fluid torque converter and problems on above machines.

D. Lesson planning

SR.NO	DATE/WEEK	UNIT NO	%WEIGHTAGE	TOPIC NO
1	1^{ST} , 2^{ND} , 3^{RD}	1,2	20	1,2
2	4^{TH} ,5^{TH} , 6^{TH}	3,4	20	3,4
3	7^{TH} ,8^{TH} , 9^{TH}	5,6	20	5,6
4	10^{TH} ,11^{TH} , 12^{TH}	7,8	20	7,8
5	13^{TH} ,14^{TH} , 15^{TH}	9	20	9

E. Instructional Method & Pedagogy

1. At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
3. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4. One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5. Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7. The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
8. Term Work should be as per below:

    1. To demonstrate hydro power plant
    2. Performance test on pelton wheel turbine
    3. To demonstrate francis turbine
    4. Governing of hydraulic turbine
    5. To evaluate theoretical force and actual force of impact of jet on curved and inclined plates
    6. Performance test on two stage reciprocating air compressors
    7. To demonstrate centrifugal air compressor
    8. Performance test on axial flow compressor
    9. Performance test on centrifugal pump
    10. Performance test on gear pump
    11. Demonstration of various hydraulic devices

9. Practical / Oral: The candidate shall be examined on the basis of term-work.

F. Students Learning Outcomes

- The student can identify different areas of Fluid Power Engineering.
- Can find the applications of all the areas in day to day life.

G. Recommended Demonstrate Materials

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K.Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
4. Fluid Mechanics and Hydraulic Machines by K.R. Arora, Standard Pub.
5. Hydraulic Machines by V.P. Vasandani., Khanna Pub.