Mechanical Engineering Dept. Department

Syllabus
ME 438: Pumping Machinery (3-0-3)

Course Catalog Description:

A detailed analysis of the types of pumping machines that are most important in engineering applications will be presented. More emphasis is given to the design aspects and performance characteristics of various types of pumps. Upon completion of the course, the student should be able to design or select the pump required for a specific use and also to solve various problems that may arise in related Engineering practice.

Course Pre-requisites:

- ME 311: Fluid Mechanics

Course Objectives:

1. The main objective of this course is to provide Mechanical Engineering senior students with the main principles underlying all forms of pumping machinery.

Course Learning Outcomes:

CLO1. Understand the function and performance of the main components of a pumping system.

CLO2. Understand of main principles of energy transfer in pumps, fans and compressors.

CLO3. Understand the effect of pump components design on various types of losses and factors causing deviation from theoretical characteristics.

CLO4. Understand the performance characteristics of various types of pumps and analysis of different methods of flow rate control.

CLO5. Conduct a performance analysis of a centrifugal compressor and solve various operational-type problems.

CLO6. Carry out various design tasks for solving operational-type problems in different pumping systems.

CLO7. Select the proper pump for a specific application and the proper method for flow rate control.

Learning Resources:

- Pumping Machinery Theory and Practice by H.M. Badr and W.H. Ahmed
- 1. Pump Handbook Edited by I. Karassik 3. Pumps and Pump Systems by W. Chan. 5. Centrifugal and Axial Flow Pumps by A. J. Stepanoff. 6. Pumps and Blowers by A. J. Stepanoff. 11. Centrifugal Pumps: Design and Applications by Lobanoff. 13. Centrifugal Compressors and Pump Stability,

Stall, and Surge by P.C. Tramm and R.C. Dean. 14. Centrifugal Compressors by I. Guro. 15. Reciprocating and Rotary Compressors by V. Chlumsky. 16. Axial Flow Compressors by J.H. Horlock.

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
second major exam	10	20.0%
small project	12	5.0%
Final Major exam (comprehensive exam)	15	35.0%
first major exam	6	15.0%
quizes	biweekly	15.0%
Homeworks	weekly	10.0%

Lecture Weekly Schedule:

Week#	Topics
1	Introduction, classification of pumps, definitions and terminology, affinity laws
2	Characteristics of various types of pumps and analysis of pumping systems
3	Characteristics of various types of pumps and analysis of pumping systems (Continue)
4	Energy transfer between pump rotor and fluid, theoretical performance and analysis of various types of losses
5	Energy transfer between pump rotor and fluid, theoretical performance and analysis of various types of losses (Continue)
6	Axial and radial thrusts and related design considerations
7	Common problems in centrifugal pump operation
8	Common problems in centrifugal pump operation (Continue)
9	Axial flow pumps
10	Reciprocating and rotary displacement pumps
11	Reciprocating and rotary displacement pumps (Continue)
12	Reciprocating and rotary displacement pumps (Continue)
	Introduction to centrifugal fans and compressors
13	Introduction to centrifugal fans and compressors (Continue)
14	Introduction to centrifugal fans and compressors (Continue)
15	Introduction to centrifugal fans and compressors (Continue)
	Pump selection guidelines