

Agricultural Systems Management – ASM 499 **Hydraulic Power Principles and Applications**

Instructor: Elton Solseng

Office: 204 ABEN

Phone: 701-231-7269

Fax: 701-231-1008

e-mail: Elton_Solseng@ndsu.nodak.edu

Credits: 3 (2 lectures/week, 1-3 hr. laboratory/week)

Textbook: Industrial Hydraulics Manual 4th ed. Vickers Incorporated (req.)

Prereq.: Math 103 and Physics 211

Time: 11:00-11:50 AM Monday -Wednesday

Room: Lecture ABEN 208, Laboratory ABEN 123

Office Hrs: To be announced

Course Objectives:

1. Develop an understanding of fluid power principles and hydraulic system components
2. Integrate component knowledge and hydraulic principles to understand hydraulic systems
3. Apply system principles and knowledge to analyze hydraulic system operation, maintenance, and failures
4. Develop understanding of principles of electrohydraulic systems

Please note:

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor as soon as possible.

Goals:

This course is about the principles and applications of fluid power. Fluid power has numerous applications in both mobile and stationary applications. Fluid power implies either liquids or gases can be used as the working fluid in a system. Principles of fluid power are introduced. Laboratory exercises are planned to illustrate the principles. This

course will emphasize liquids (hydraulic fluids) as the principle means of transmitting power. Use of gases (pneumatics) will be briefly presented.

An introductory list of hydraulic applications includes:

- * Hydraulic cylinders to produce large forces to move and position loads
- * Hydraulic motors to provide mechanical system power
- * Automatic control systems, such as a constant draft system (i.e. a 3 pt. hitch tractor hydraulics)
- * Incorporating electrohydraulics systems for robotics or automatic systems

Understanding the operating principles of fluid power systems is necessary to properly size and select components to create a functional system. In this course the basic components used in hydraulic power systems will be examined. Electrohydraulic systems will also be examined. System operation and the role of preventative maintenance in avoiding damage to systems and prolonging life will be discussed.

Student evaluation:

Half-hour to one-hour exams will be given every two or three weeks. The tests will be combinations of types of questions which may include short answer, problems, multiple choice, and fill in the blank questions, depending on what works best for the material covered. Quizzes of 10 pts each may be given throughout the semester and may be either announced or unannounced. The quizzes will draw from the same question styles as the major exams. **The final exam will be comprehensive.**

There is no makeup for missed quizzes. The lowest quiz grade will be dropped. Missed quizzes may be entered as "not counted" which neither aids nor harms a student's grade if there is an excused absence such as illness, family emergencies, or field trips for other classes or activities. A missed test may be made up, but will be subjected to a 5 % penalty with exceptions such as illness or family emergencies. The instructor is the final judge of exceptions.

The student is responsible to obtain missed lecture notes and handouts from classmates or to visit the instructor to obtain these materials. Be sure to find someone in class that you know and can get the notes and information from.

Homework is due one week from the day it is assigned, or if there is no class that day, the next class day after the one-week time period. Unexcused, late homework will be accepted but will be penalized 30%.

Laboratory report requirements will be discussed during the first laboratory period. Laboratory reports will be due one week after the laboratory exercise is completed.

Students will make two oral presentations during the semester as part of their laboratory work. Students study their assigned topic in hydraulics, collect pertinent information from available resources, and present their findings to their peers in a laboratory session. A typical presentation is approximately 5-7 minutes and uses appropriate visual aids for an informative presentation.

A straight grading system, consisting of A => 90%, B => 80%, C => 70%, and D => 60%, will be used. The breakdown of the grading system for this course is shown below:

Weekly Quizzes	40%
2 - laboratory presentations	10%
Homework	10%
Laboratory reports	20%
Final Exam	20%
Total	<u>100%</u>

Tentative Course Outline: (may be modified to meet the needs of the class)

Week #	Subject	
1	Introduction to hydraulics	Chapter 1
2	Principles of hydraulics	Chapter 2
3	Schematics	Appendix B
4	Hydraulic fluids/Contamination	Chapters 3 & 6
5	Hydraulic pumps	Chapter 15
6	Hydraulic pumps/Hydraulic actuators	Chapter 7
7	Hydraulic actuators	Chapter 7
8	Hydraulic fluid conductors and seals	Chapter 4
9	Directional valves	Chapter 8
10	Pressure controls	Chapter 10
11	Reservoirs/Accessories	Chapters 5 & 17
12	Electrical principles	Chapter 9
13	Proportional valves and servo valves	Chapters 12, 13, & 14
14	Systems	Chapter 18
15	Systems	Chapter 18

Laboratory Exercises: (order to be determined later)

Visit to Catco
 Visit to Bobcat
 Visit to General Diesel
 Gear and vane pumps
 Spool valves and hydraulic cylinders
 Component identification and explanation
 Circuit construction and principles of operation
 Electrohydraulic fundamentals and measurements