

**OKLAHOMA STATE UNIVERSITY**  
**MET 2313: FUNDAMENTALS OF HYDRAULIC**  
**FLUID POWER**  
**SPRING 2018**

Lecture: MW 9:30 – 10:20 a.m., CLBN 202  
Lab Section 1: W 1:30 – 3:20 p.m., PTC\* 111  
Lab Section 2: W 3:30 – 5:20 p.m., PTC\* 111  
\* Petroleum Technology Classroom Building

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**INSTRUCTOR:** Dr. Young Chang  
570C Engineering North  
Email: young.chang@okstate.edu  
Office Hours: As available

**LAB ASSISTANT:** Robert Daugherty  
Email: robbie.daugherty@gmail.com  
Office Hours: Robert will be working as lab assistant in PTC 110 or 111 during these hours: Tuesday 12:00-3:00 p.m., Wednesday 1:30-5:30 p.m., and Thursday 12:00-3:00 p.m. He will assist you if you have questions on any topics related to this course.

**PREREQUISITE:** PHYS 2014 or 1114

**TEXTBOOKS:** *Hydraulic Specialist (HS) Study Manual*  
*Industrial Hydraulic Technician (IHT) Study Manual*  
*Industrial Hydraulic Mechanic (IHM) Study Manual*  
*Job Performance (JP) Study Manual*  
(International Fluid Power Society (IFPS) members can download all of them from [www.ifps.org](http://www.ifps.org) at no cost.)

**WORKBOOK:** *Hydraulic Fluid Power Workbook* by Young Chang (pdf file provided)

**COURSE DESCRIPTION**

Basic fluid power concepts, standard hydraulic symbols, component design and applications, fluid power system considerations, design and operation.

## COURSE OBJECTIVES AND OUTCOMES

Course Objectives	Outcomes
Provide hands-on experience with a CAD program for hydraulic circuit design	Be able to use Automation Studio to design and simulate various hydraulic circuits
Provide instruction in application of Pascal's law to engineering problems	Be able to analyze pressure-force relationship in hydraulic cylinders
Provide instruction in application of the continuity equation to engineering problems	Be able to analyze the relationship between flow rate and cylinder speed
Provide instruction in hydraulic components and systems	Become familiar with various types of hydraulic components and their use in systems
Encourage students to participate in professional organizations	Be active in the International Fluid Power Society

## TENTATIVE LECTURE AND EXAM SCHEDULE

No.	Date	Lecture Topics
1	1/17/18	Syllabus
2	1/22/18	Chapter 1: Introduction
3	1/24/18	Chapter 2: Basic Concepts
4	1/29/18	Chapter 2: Basic Concepts
5	1/31/18	Chapter 2: Basic Concepts
6	2/5/18	Chapter 3: Hydraulic Fluids
7	2/7/18	Chapter 3: Hydraulic Fluids
8	2/12/18	Chapter 3: Hydraulic Fluids
9	2/14/18	Chapter 4: Hydraulic Cylinders
10	2/19/18	<b>Exam 1</b>
11	2/21/18	Chapter 4: Hydraulic Cylinders
12	2/26/18	Chapter 4: Hydraulic Cylinders
13	2/28/18	Chapter 4: Hydraulic Cylinders
14	3/5/18	Chapter 4: Hydraulic Cylinders
15	3/7/18	Chapter 4: Hydraulic Cylinders
16	3/12/18	Chapter 5: Hydraulic Pumps
17	3/14/18	Chapter 5: Hydraulic Pumps
	3/19/18	<i>Spring Break</i>
	3/21/18	<i>Spring Break</i>
18	3/26/18	<b>Exam 2</b>
19	3/28/18	Chapter 5: Hydraulic Pumps
20	4/2/18	Chapter 6: Hydraulic Motors
21	4/4/18	Chapter 6: Hydraulic Motors
22	4/9/18	Chapter 7: Directional Control Valves
23	4/11/18	Hydraulics and Troubleshooting (Video)
24	4/16/18	<b>Exam 3</b>
25	4/18/18	Chapter 8: Pressure Control Valves
26	4/23/18	Chapter 9: Flow Control Valves
27	4/25/18	Chapter 9: Flow Control Valves

28	4/30/18	Chapter 10: Filtration
29	5/2/18	Chapter 10: Filtration
	5/9/18	<b>Final (8:00-9:50 a.m.)</b>

### TENTATIVE LAB SCHEDULE

No.	Date	Lab Topics
A	1/17/18	North Campus Lab Safety Training (Everyone is required to complete the safety training to attend labs for the remaining period of semester.)
B	1/24/18	Hydraulic Conduits
C	1/31/18	Hydraulic Fasteners and Fittings – Part 1
D	2/7/18	Hydraulic Fasteners and Fittings – Part 2
E-F*	2/14/18	Hydraulic Lab Safety; Tube Bending
G*	2/21/18	Vickers Trainers and Cylinder Speed
H-I*	2/28/18	Automation Studio; Pressure in the Cylinder
J*	3/7/18	Regenerative Circuits
K	3/14/18	Seminar (Speakers: Mr. Randy Nobles and Mr. Keith Rogers from Womack Machine Supply)
	3/21/18	<i>Spring Break</i>
L*	3/28/18	Friction between Piston Seals and Cylinder Wall
M*	4/4/18	Tractive Loads and Special Topics
N	4/11/18	Measurement of Hydraulic Components
O*	4/18/18	Pressure Control Valves
P*	4/25/18	Flow Control Valves
Q	5/2/18	To Be Announced

\* Everyone is required to wear long pants and closed-toe shoes.

### CLASS ATTENDANCE

You are expected to attend all lecture sessions and to be on time. Attendance will be checked at the beginning of each class. You will lose two points per absence. Late attendance or leaving early will result in a loss of one point per occurrence. If you missed a class, were late, or left early you are expected to email Dr. Chang with a valid reason within seven days. Late enrollment cannot be a reason for absence because no one is prohibited from attending the class before enrolling. If you handle a cell phone (regardless of the purpose) or a notebook computer (except for note taking) during class, you will be asked to leave the room, and it will be considered an unexcused absence.

Walking in and out of class is highly discouraged. Please be mindful that walking in and out of class is disruptive to the instructor and students. Most importantly, do not leave the class to use a cell phone. If it becomes necessary to leave the classroom because of an unforeseen situation, please leave the room with your belongings and email Dr. Chang about the situation within seven days.

If you missed a class, you should obtain all information from a classmate. If you have any questions about the topics discussed while you were absent, you should ask for help from a classmate. Everyone should form a group of three or more students who can help each other.

## **LAB ATTENDANCE**

Commit two hours to each lab session. There will be no make-up labs. Lab attendance policy is identical to that of class attendance except that you will lose three points, instead of two points, for each absence from lab.

## **LAB SAFETY**

Depending on the type of lab activities, you may be required to wear long pants, closed-toe shoes, and eye protection. You may bring your own eye protection if you do not feel comfortable with the eye protection provided. Over-the-glass eye protection is available in the lab for those who wear prescription glasses.

If you notice an oil spill on the floor, please clean it up immediately. The smooth-surfaced lab floor becomes very slippery when wet and may result in serious injuries. Liquid degreasers and absorbent granules are available in the lab.

## **ASSIGNMENTS**

With rare exceptions (Assignment #1 and Automation Studio Assignment), every homework assignment will require you to answer questions on paper (printed copy of assignment) and to take an online quiz. For each calculation problem you should write equations, substitution of given conditions, and the result with proper units. You are to take the quiz only after you have completed the assignment on paper. Some quiz questions are identical to those on paper. You will know in advance whether the quiz questions and the questions on paper are identical or different. If you find that a quiz was set up incorrectly, please email Dr. Chang at the earliest possible time. The first person who reports the error will receive an advantage (one point of extra credit or deletion of his/her first attempt record depending on situation).

You are encouraged to work with other students when you work on the paper so that you may teach or learn from each other. When you take the online quiz, however, there should be no communication of any kind with other students. You will have one hour to finish the online quiz. You are allowed to take the quiz twice. Make sure to study the question(s) you missed prior to the second attempt. If you take the quiz twice, the average score will be recorded.

You will be given one or two assignments each week, and each assignment will be due 11:00 p.m. on Monday or Wednesday with rare exceptions. You may request a late submission time by writing to Dr. Chang. Late work may be accepted for partial credit up to three times a semester. The maximum late submission extension is 48 hours after the original deadline. Your late submission request should include the following information:

- Course: MET 2313
- Your name:
- Assignment number:
- This is my first/second/third request for late submission.
- I need 24/48 hours of extension.

Late work is only for partial credit as follows:

- First late submission: 1 points of reduction per 24 hours
- Second late submission: 2 points of reduction per 24 hours
- Third late submission: 3 points of reduction per 24 hours

No late work will be accepted for the last assignment before each exam. That is because correct answers will be posted soon after the due time for your study before the exam.

One or more assignments may require the use of Automation Studio. All electronic files should be submitted by use of Dropbox. Do not submit any electronic files by email.

## **STUDY GROUP**

Everyone should belong to a study group. You may help each other when you work on homework assignments or study for exams. If you miss a class you will be able to get help from your group members.

## **EXAMS**

There will be four exams including a final. Each exam is worth 100 points. All exams are closed-book, closed-notes, and computer-based. Equation sheets and scratch paper will be provided for each exam. Do not write anything on the equation sheets. Submit both the scratch paper and equation sheets at the end of exam. The scratch paper will not be graded.

**Calculator Policy:** The only calculator models you are allowed to use are the same calculator models approved for the FE Exam.

- Casio: All fx-115 and fx-991 models (Any Casio calculator must have “fx-115” or “fx-991” in its model name.)
- Hewlett Packard: The HP 33s and HP 35s models, but no others
- Texas Instruments: All TI-30X and TI-36X models (Any Texas Instruments calculator must have “TI-30X” or “TI-36X” in its model name.)

If you do not have a proper calculator, you may take the exam without a calculator. You may be allowed to borrow a calculator during the exam, but it will result in a reduction of five points. Keeping any calculator other than the approved one(s) in your possession during the exam will warrant a semester final letter grade F! regardless of whether you used it or not during the exam.

**Cell Phone Policy:** Your cell phone should be turned off and kept in your backpack, and your backpack should be placed at a designated location. Keeping the cell phone turned on or in your possession during the exam will warrant a semester final letter grade F! regardless of whether you used it or not during the exam. The same policy is applied to all communication or data storage devices.

**Makeup Exams:** If it is necessary for you to be out of town on the day of exam, you may take the exam early. If you take the exam after the time set for the class, you will receive only partial credit regardless of your circumstances. If you miss an exam, you may be given an opportunity to take a makeup test depending on the situation (illness, injury, etc.). If you take a makeup test after the time set for the class, you will receive only partial credit as follows:

- If you take the makeup exam on the same day and complete it before 5:00 p.m., your score will be reduced by 10 points. You may take the exam at a designated place of the fifth floor of Engineering North.
- If you take the makeup exam the following day (Tuesday), your score will be reduced by 20 points. No makeup test may be given after this deadline. Makeup exams on Tuesday may be administered by UAT. It is your responsibility to make an appointment and forward the confirmation email to Dr. Chang one day before the exam.
- In case you are late on the day of exam, you may choose one of the two options:
  - Take the exam and complete it before 10:25 a.m. and receive full credit.
  - Continue the exam until the 55-minute period has expired and lose 10 points.

**SDS Exams:** All Student Disability Services (SDS) exams should be administered by UAT. Students with disabilities are required to make appointments for all exams in the beginning of semester and forward the confirmation email to Dr. Chang. All midterm exams should start at 9:30 a.m. or earlier, and the final exam should start as soon as UAT opens. If the student did not make a reservation early enough to take the exam at specified time, he should take the exam with other students in class with privilege such as extended time.

### **IFPS MEMBERSHIP**

Everyone is to be a fee-paying, student member of the International Fluid Power Society (IFPS). There are multiple reasons for this requirement.

- All textbooks for this class are provided as free downloads from the IFPS website for members.
- Useful materials related to job search and career development are provided.
- Some assignments will require access to members-only pages on the IFPS website.
- You can take a certification test at the student member rate (\$135 instead of \$300). There are also certification test scholarship opportunities for student members with a GPA 3.0 or higher.

### **MISBEHAVIOR**

Your cellphone should be on the silent mode during every class or lab session. Anyone who handles a cellphone during a class or lab session, inside or outside the room, will be asked to leave. You will be asked to leave the room for any of these reasons:

- Using a cell phone
- Browsing the internet
- Reading newspapers or doing a crossword puzzle
- Playing games
- Working on an assignment
- Listening to music

## ACADEMIC INTEGRITY

Everyone is expected to act with honesty at all times. Please become familiar with the University Policies on Academic Integrity by visiting [academicintegrity.okstate.edu](http://academicintegrity.okstate.edu). Some issues related to the academic integrity that are specific to this class are listed below:

	Violations	Sanctions
Assignments	<ul style="list-style-type: none"> <li>Communicating with another student while taking a quiz,</li> <li>borrowing any electronic files to do an assignment,</li> <li>giving any electronic files to another student to help with an assignment.</li> </ul>	<ul style="list-style-type: none"> <li>Zero points for the assignment</li> </ul>
Exams	<ul style="list-style-type: none"> <li>Looking at another student's work,</li> <li>showing work to another student,</li> <li>exchanging information,</li> <li>using forbidden sources of information,</li> <li>having in possession a prohibited calculator, a cell phone, or any communication or data storage device during the exam regardless of whether you used it or not,</li> <li>keeping the cell phone turned on during the exam, regardless of whether you used it or not.</li> </ul>	<ul style="list-style-type: none"> <li>Zero points for the exam and an F! as the final semester grade.</li> </ul>

## GRADING CRITERIA

Four exams	400 points
Homework assignments	140-170 points <sup>1</sup>
Attendance	40 points <sup>2</sup>

<sup>1</sup> The actual value will depend on the total number of assignments and the type of each assignment. For example, if there are 16 assignments and each assignment is worth 10 points, the maximum possible score will be 160 points.

<sup>2</sup> Two points will be lost per absence from class and three points per absence from lab. One point will be lost for each late attendance or early leave. If you miss many class or lab sessions, your attendance score will become negative.

Letter grades will be based on the criteria shown below. The criteria may be lowered if conditions warrant it.

A	90% ≤ score ≤ 100%
B	80% ≤ score < 90%
C	70% ≤ score < 80%
D	60% ≤ score < 70%
F	score < 60%

## **MISCELLANEOUS NOTES**

- Please check your email at least once a day. When you write to Dr. Chang, have the subject line start with “MET 2313” and include your full name at the end of your email.
- Remove your cell phone, backpack, and all unnecessary items from the table before class or lab starts.
- Please do not leave trash in the lab.
- These are considered crucial qualifications when students need recommendations:
  - Absolutely no behavior problem (never walked in and out during a class, never used a cell phone during a class, etc.)
  - Not more than three absences during the entire semester
  - Never had any issues related to academic integrity (never did anything that could cause suspicion)