

**Course:** MECH 145 – Fluid Power 2, 2021W  
**Instructor:** Scott Li, Ph.D., P.ENG  
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## Calendar Description

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This course provides the foundation for the application of hydraulic theory by Weapon Engineering (WEng) System Maintainer. Topics include principles of fluid power and pneumatics as well as support material for the operation, construction, function and troubleshooting of standard and electro-hydraulic systems.

Offered: Winter Semester  
Credit: 4  
In-class workload: 3 hours Lecture, 2 hours Lab  
Out-of-class workload: 5 hours  
Prerequisites: None

This course is for delivery to Naval Weapon Engineering (WEng) System Maintainer Only.

## Intended Learning Outcomes

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Upon successful completion of this course a student will be able to:

- Explain basic hydraulic and pneumatic principles
- Determine flow/pressure in series/parallel circuits
- Construction and operate advanced pump controls
- Describe safety with respect to hydraulic and pneumatic systems
- Explain hydrostatic transmission principles
- Describe electro-hydraulic components and systems
- Describe aspects of electro-hydraulic servo and proportional systems
- Perform electro-hydraulic circuit troubleshooting
- Design and build basic fluid power circuits using industry standard symbols for manual, pneumatic, and PLC controlled & electrically-operated pneumatic and hydraulic systems
- Solve problems for flow and pressure, relating to pneumatic and hydraulic systems.
- Identify and describe components used in pneumatic and hydraulic systems
- Select suitable fluids for power transmission and the correct type and size of conductors for pneumatic and hydraulic systems.
- Select the correct pump or compressor (including receiver) and power source for pneumatic and hydraulic systems.
- Specify linear or rotary actuators based on force or torque, speed, fluid volumetric flow rate and pressure requirements
- Specify the operation and control of flow, pressure, and directional control valves for pneumatic and hydraulic systems
- Identify and draw graphic symbols of various components of pneumatic and hydraulic systems

**MECH 145 – Fluid Power 2 Course Outline**

**Course Content** (subject to modification, if necessary)

<b>Week</b>	<b>Lab</b>	<b>Assignment</b>	<b>Course Content</b>
<b>1</b> Jan.11 - 15	-	-	Course Information. Fluid Mechanics Background Review
<b>2</b> Jan.18 - 22	1	Assignment 1	Explain basic Hydraulic principles
<b>3</b> Jan.25 - 29	2	-	Hydraulic Fluids. Hydraulic Pumps. Pump characteristics, Types of pumps, Positive displacement pump, pump efficiencies etc.
<b>4</b> Feb.01 - 05	3	Assignment 2	Hydraulic Actuators – Hydraulic cylinders, Hydraulic motors. Actuator selection and calculations.
<b>5</b> Feb.08 - 12	4	Assignment 3	Hydraulic Valves: Directional, Pressure, Flow control valves. Proportional valves, Servo valves etc.
<b>6</b> Feb.15 - 19		-	Family Day - Reading Week
<b>7</b> Feb.22 - 26	5	-	Basic Hydraulic Circuit Analysis. Energy-saving Design – Pressure compressed and Load Sensing
<b>8</b> Mar.01 - 05	-	-	Midterm Review and Midterm Exam
<b>9</b> Mar.08 - 12	6	Assignment 4	Explain basic Pneumatic principles Basic Pneumatic Circuits; Simple Fluid Power Control Pneumatic Systems and Gas Laws, Air Flow Measurement (scfm); Fluid Power Schematic Drawings
<b>10</b> Mar.15 - 19	7	Assignment 5	Introduction to Programmable Logic Controllers (PLC's) PLC's and Ladder Logic Diagram PLC Sensors and Valve Actuators in Pneumatics Advanced PLC Commands and Features
<b>11</b> Mar.22 - 26	8	-	Pneumatic Components; Basic Pneumatic Circuits; Pneumatic Circuit Layout. Variations of Pneumatic Logic Control
<b>12</b> Mar.29 - Apr. 02	9	Assignment 6	Pneumatic Components (cont.); Basic Pneumatic Circuits (cont.); Pneumatic Timing Circuits. Variations of Pneumatic Logic Control (cont.)
<b>13</b> Apr.05 - 09	10	-	Pneumatic Circuit Layout (cont.), Valve Sizing, Flow Section, Valves in Parallel Connection Air Line Friction Losses.
<b>14</b> Apr.12 - 16	-	-	Final Review
<b>15</b> Apr.19 - 27	-	-	Final Exam

## Text & References

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***Fluid Power Technology***, F. Don Norvelle, West Publishing Company

This course is fully supported by D2L ©.

## Lab Reports

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Formal Lab Reports are expected for some labs. The Lab Reports and/or Lab simulation files are due one week after the lab period. There will be one Lab Report for each group. No late Lab Reports will be accepted.

## Assignments

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Assignments are required to be submitted to the Dropbox on D2L (Assignments) before due. No late assignments will be accepted.

## Evaluation

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<b><i>Assignments</i></b>	20%
<b><i>Labs</i></b>	20%
<b><i>Midterm Exam</i></b>	25%
<b><i>Final Exam</i></b>	35%

<b>A+</b>	90 - 100%	<b>B-</b>	70 - 72%
<b>A</b>	85 - 89%	<b>C+</b>	65 - 69%
<b>A-</b>	80 - 84%	<b>C</b>	60 - 64%
<b>B+</b>	77 - 79%	<b>D</b>	50 - 59%
<b>B</b>	73 - 76%	<b>F</b>	< 50%

Lab work and Assignments are to be handed in when due and must be completed to the instructor's satisfaction prior to sitting the final exam.

The final exam must be successfully completed (mark  $\geq 50\%$ ) for a passing grade in the course.

## College Supports, Services and Policies

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### Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ <http://camosun.ca/about/mental-health/emergency.html> or <http://camosun.ca/services/sexual-violence/get-support.html#urgent>

### College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <http://camosun.ca/>

### College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at <http://camosun.ca/about/policies/>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

### A. Grading Systems <http://camosun.ca/about/policies/index.html>

The following two grading systems are used at Camosun College:

#### 1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

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**2. Competency Based Grading System (Non GPA)**

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

<b>Grade</b>	<b>Description</b>
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

**B. Temporary Grades**

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at <http://camosun.ca/about/policies/index.html> for information on conversion to final grades, and for additional information on student record and transcript notations.

<b>Temporary Grade</b>	<b>Description</b>
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.