Washtenaw Community College Comprehensive Report

FLP 225 Fluid Power Motion Control
Effective Term: Fall 2023

Course Cover

College: Advanced Technologies and Public Service Careers
Division: Advanced Technologies and Public Service Careers
Department: Advanced Manufacturing
Discipline: Fluid Power
Course Number: 225
Org Number: 14410
Full Course Title: Fluid Power Motion Control
Transcript Title: Fluid Power Motion Control
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Inactivation
Change Information:
Consultation with all departments affected by this course is required.
Rationale: Program discontinued - Last run of course W2023
Proposed Start Semester: Fall 2023
Course Description: This course reviews basic electrical principles and covers amplifier theory as applied to open loop and closed loop control. Proportional directional valves, flow control valves and pressure control valves are discussed along with hydraulic servo valves. Proper setup alignment of the drive amplifiers and troubleshooting of servo and proportional control systems are covered in class and laboratory sessions. Closed loop (PID) control theory and feedback transducers are also discussed.

Course Credit Hours

Variable hours: No
Credits: 3
Lecture Hours: Instructor: 30 **Student:** 30
Lab: Instructor: 45 **Student:** 45
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 75 **Student:** 75
Repeatable for Credit: NO
Grading Methods: Letter Grades
Audit
Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Requisites

Prerequisite
FLP 214

General Education

Request Course Transfer

Proposed For:

Student Learning Outcomes

Course Objectives

1. The student will be able to calculate current, voltage drops in series, parallel, and series-parallel resistor circuits and properly use a DMM to measure these valves.
2. The student will be able to descrive the operation of a potentiomenter.
3. The student will be able to describe the operation of a solenoid.
4. The student will be able to define terms as applied to amplifiers: gain, saturation, feedback and input impedance.
5. The student will be able to construct and confirm the operation of inverting and summing op amp circuits.
6. The student will be able to describe the purpose of proportional gain adjustment in open and closed loop control systems.
7. The student will be able to describe common feedback transduces and describe applications/limitations of each type.
8. The student will be able to define applications of proportional direction, flow and pressure control valves.
9. The student will be agble to connect a proportional directional valve to a drive amplifier and properly set up the amplifier.
10. The student will be able to describe the operation of open loop and closed loop proportional control systems.
11. The student will be able to describe the operation of hydraulic servo valves.
12. The student will be able to connect a servo valve to a drive amplifier and properly set up the amplifier and feedback loop.
13. The student will be able to troubleshoot a servo loop control system.
14. The student will be able to properly set up an adjust a proportional, integral and derivative (PID) closed loop control system.
15. The student will be able to troubleshoot open and close loop control circuits constructed within the lab.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Reviewer	Action	Date
Faculty Preparer:		
Allan Coleman	*Faculty Preparer*	*Jan 06, 2023*
Department Chair/Area Director:		
Allan Coleman	*Recommend Approval*	*Jan 06, 2023*
Dean:		
Jimmie Baber	*Recommend Approval*	*Jan 09, 2023*
Curriculum Committee Chair:		

Randy Van Wagnen *Reviewed* *Feb 13, 2023*

Assessment Committee Chair:

Vice President for Instruction:

Victor Vega *Approve* *Feb 14, 2023*

WASHTENAW COMMUNITY COLLEGE
COURSE-SYLLABUS APPROVAL FORM (CSAF)

For help screens, select a field and press F1

SECTION I. COURSE SUBMISSION INFORMATION

1. Course: (Enter proposed discipline, number & title here. If changing the number or title of an existing course, give old number or title in box 4 below.)

Discipline/No: FLP 225 **Title:** Fluid Power Motion Control

Division Code: TEC Department Code: INDT Effective Term: W01

☐ Do not publish in Time Schedule
☐ Do not publish in College Catalog

2. Type of Approval: (applies to both new courses and changes)

☒ Full Approval
☐ Conditional Approval

☒ This proposal previously received conditional approval for the Term: F2000 (major changes) in draft

3. Reason for Submission: This Course is being submitted for: (check all that apply)

☐ New Course Approval (Skip the rest of Section I and go directly to Section II.)
☒ Five-year Syllabus Review ☐ No changes to course
☒ Major Change(s)
☒ Minor Change(s) (If not due for review, submit sections I, II, and revised parts of Section III.)
☐ Reactivation of Inactive Course
☐ Inactivation (Submit Sections I and II only.)

4. Change Information: (Check all that apply. Make proposed changes in Section III, Course Syllabus.)

Minor Changes

☐ Course Discipline/Number (was _____)
☐ Course Title (was _____)
☒ Course Description
☐ Capacity (was: ____)
☐ Pre or Corequisites
☒ Course Objectives
☐ Distribution of Contact Hours (contact hours were: lect: ____ lab ____ clin ____ exp ____)
☐ Distance Learning - minor (Attach Preliminary Approval Form for Distance Learning & the Section Handout.)
☐ Other _____

Major Changes (Major changes will be reviewed by Curriculum Committee.)

☐ Credit hours (credits were: ____)
☐ Core Elements: (Elements to be added: _____) (Elements to be removed: _____)
☐ Grading
☐ Course Objectives affecting core elements
☒ Total Contact Hours (total contact hours were: 00)
☐ Honors (Attach Honors Section Approval Form.)
☐ Distance Learning - major (Attach Preliminary Approval Form for Distance Learning & the Student Handout for the Distance Section.)
☐ Other _____

5. Rationale for changes:

Adjust content from component repair base to open and closed loop control systems maintenance and troubleshooting.
Add open loop proportional valves to course content.

SECTION II. COURSE REVIEW INFORMATION AND SIGNATURES

1. Department Review (To be completed by department chair; if recommendation is no, initial and return to preparer with rationale attached.)

Will significant new resources be required? ☐ yes ☒ no (If yes, explain _____)
Have departments that may be affected by this course been consulted? ☒ yes ☐ no (Explain _____)
Does the department support approval of this course? ☒ yes ☐ no

Print: Jim Popovich (Faculty/Preparer) Signature _____ Date: 11/16/00

Print: Mr. Gary Schultz (Department Chair) Signature _____ Date: 11/16/00

2. Division Review (To be completed by division dean; if recommendation is no, initial and return with rationale attached.)

Will significant new resources be required? ☐ yes ☒ no (If yes, have they been secured? ☐ yes ☐ no)
Is this a curricular priority for your division? ☒ yes ☐ no (Comment _____)
What is your estimate of projected enrollment? 36

Recommendation ☒ Yes ☐ No Roger R. Burbey (Division Dean's Signature) Date: 11/20/00

3. Curriculum Committee Review (Attach additional comments if necessary.)

Recommendation ☐ Yes ☐ No _____ (Curriculum Committee Chair's Signature) Date _____

4. Vice President for Instruction and Student Services Approval (Attach additional comments if necessary.)

Approval ☒ Yes ☐ No _____ (Vice President's Signature) Date 4/10/01

Vice President's Office - ISS
JAN 10 2001

Log File 4/10/01 ACS Code 133 Catalog File Date 3/5/01 JCV Access Date 4/10/01

Core Elements Approved _____ New Syllabus Date Fall 2002

FEB 26 2001

Received DISTRIBUTED & FILED
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11/16/2000

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SECTION III. COURSE SYLLABUS **For help screens, select a field and press F1.**

A. COURSE DETAILS (discipline # and title will automatically be entered in 1 and 2 below upon saving or previewing)

1. **Course Discipline & No.:** FLP 225 **2. Course Title:** Fluid Power Motion Control

3. **Course Description:** This course reviews basic electrical principles and covers amplifier theory as applied to open loop and closed loop control. Proportional directional valves, flow control valves, and pressure control valves are discussed, along with hydraulic servo valves. Proper setup alignment of the drive amplifiers and troubleshooting of servo and proportional control systems are covered in class and laboratory sessions. Closed loop (PID) control theory and feedback transducers are also discussed.

4. **Credit Hours:** 3
   If Variable credit, Give Range:
   _____ to _____
   If repeatable for credit, how many times? _____

5. **Class Capacity:** 18
   (If nonstandard, attach Class Capacity Exception form.)

6. **Course Options:**
   - ☐ Distance learning (Attach preliminary distance approval form and Section Handout.)
   - ☐ Honors (Complete Part G.)
   - ☐ P/NP Grading (Attach rationale.)

7. **Contact Hours per Semester in:**
   - Lecture: 30
   - Lab: 45
   - Clinical: _____
   - Experiential: _____
   - **Total Contact Hrs:** 75

8. **Prerequisite(s):**
   FLP 213, FLP 214

9. **Corequisite(s):** (limit to 2)

10. **a. Course Purpose:**
    - ☒ Program Specialty
    - ☐ Program Support
    - ☐ Nonprogram Specialty
    - ☐ Transfer
    - ☐ Enrichment
    - ☐ Basic Skills

b. Is this course a requirement for a program?
- ☒ Yes (specify the program(s) below)
  CVFLPA (Fluid Power)
- ☐ No

c. Indicate schools to which you want Curriculum Services to send syllabus:
(If transfer is approved, attach documentation.)
- ☐ EMU
- ☐ UM
- ☐ Other _____

B. MAJOR INSTRUCTIONAL UNITS A major instructional unit is a grouping of topics that naturally relate to one another. List in order the major instructional units. Add additional numbers as needed.

1. Proportional Valves
2. Servo Valves
3. Amplifiers
4. Open loop control systems
5. Closed loop control systems
6. Feedback transducers
7. PID loops
8. Troubleshooting motion control systems

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C. CORE ELEMENT INFORMATION

1. Core Element Submission Information: (Please check all that apply)

☐ This course has been previously approved for core elements. List **currently** approved core elements: _____

☐ Please review this course for core elements marked in part 2 below. (Mark only core elements being added or those needing review because of proposed major changes to the course.)

☐ This course does not meet any core elements. Explain _____

2. Proposed Core Element(s): (Mark the boxes of only the elements to be reviewed at this time. For detailed information on the criteria for determining whether a course meets a core element, refer to the Core Element Annotations in the Curriculum Manual.)

☐ 1. To read and listen in a critical and perceptive way; to speak in an organized, clear, and effective manner.

☐ 2. To use information sources and information gathering techniques; to cite sources when producing written communications.

☐ 3. To develop, organize, and express thoughts in writing using Standard English.

☐ 4. To apply basic mathematics through the level of elementary algebra.

☐ 5. To represent and solve problems using mathematical techniques.

☐ 6. To interpret elementary descriptive statistics.

☐ 7. To comprehend and use concepts and ideas.

☐ 8. To develop, express, test, and evaluate ideas.

☐ 9. To analyze problems, develop solutions, and evaluate results in a clear, logical, and consistent manner.

☐ 10. To distinguish between fact and opinion; to recognize biases and fallacies in reasoning.

☐ 11. To use computer systems to achieve professional, educational, and personal objectives.

☐ 12. To apply the protocols of computer use and respect the legal and other rights of individuals or organizations.

☐ 13. To be aware of the artistic experience in personal and cultural enrichment, growth, and communication.

☐ 14. To be aware of the nature and variety of the human experience through the methods and applications of the humanities

☐ 15. To understand the basic principles of scientific inquiry.

☐ 16. To have a knowledge of basic human biological principles, including those related to wellness.

☐ 17. To understand the basic principles of the natural sciences, and their relationship to the environment.

☐ 18. To understand the basic principles and applications of technology.

☐ 19. To understand the principle of integrating technological elements into systems.

☐ 20. To understand the relationship of technology to individuals, society, and the environment.

☐ 21. To understand the methods and applications of the social sciences in exploring the dynamics of human behavior.

☐ 22. To understand those principles and values, including individual rights and civic responsibilities, which maintain and enhance democracy and freedom in a pluralistic society.

☐ 23. To have a working knowledge of the history, structure, and function of American social, political, and economic institutions.

☐ 24. To be aware of the contemporary global community, especially its geographical, cultural, economic, and historical dimensions.

DIRECTIONS: Each core element marked above must be included in the appropriate core element boxes next to the course objectives in SECTION D which directly support that core element.

3. Courses That Partially Satisfy A Core Element In Combination With Other Courses:

☐ If this course is part of a combination of courses that together meet a core element, mark this box. The courses must all be submitted and reviewed together for core element approval.

Other course(s) required _____

Dean's Comments:

Curriculum Committee's Comments:

Vice President's Comments:

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D. INSTRUCTIONAL OBJECTIVES AND CORE ELEMENTS SUPPORTED

DIRECTIONS: (These Units should match those listed in Section B.)Use student outcome based language. (Example: The student will develop and support a thesis in an essay.) If the objective is being used to directly support a core element, write the core element number in the box to the right. If needed, additional information on how the core element is to be met and/or assessed for accomplishment can be included under the objective. If desired you may add a section of "overall course objectives" which are not associated with a specific unit. This may be particularly helpful for addressing core elements.

Unit Objectives	Core Elements
Unit #1 Electricity Fundamentals	
# 1 The student will be able to calculate current, voltage drops in series, parallel, and series-parallel resistor circuits and properly use a DMM to measure these values.	
# 2 The student will be able to describe the operation of a potentiomenter.	
# 3 The student will be able to describe the operation of a solenoid.	
Unit #2 Operational Amplifiers	
# 1 The student will be able to define terms as applied to amplifiers: gain, saturation, feedback, input impedance.	
# 2 The student will be able to construct and confirm the operation of inverting and summing op amp circuits.	
# 3 The student will be able to describe the purpose of proportional gain adjustment in open and closed loop control systems.	
Unit #3 Feedback devices	
# 1 The student will be able to describe common feedback transduces and describe applications/limitations of each type.	
Unit #4 Proportional Valves	
# 1 The student will be able to define applications of proportional direction, flow and pressure control valves.	
# 2 The student will be able to connect a proportional directional valve to a drive amplifier and properly set up the amplifer.	
# 3 The student will be able to describe the operation of open loop and closed loop proportional control systems.	

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Unit #5 Servo Valves

1 The student will be able to describe the operation of hydraulic servo valves.

2 The student will be able to connect a servo valve to a drive amplifier and properly set up the amplifier and feedback loop.

3 The student will be able to troubleshoot a servo loop control system.

Unit #6 PID

1 The student will be able to properly set up and adjust a proportional, integral and derivative (PID) closed loop control system

Unit #7 Troubleshooting

1 The student will be able to troubleshoot open and close loop control circuits constructed within the lab.

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E. INSTRUCTIONAL METHODS AND EVALUATION

1. Instructional Methods: (Check the appropriate boxes and describe as needed.)

- ☒ Lecture/Discussion
- ☒ Field Trips
- ☐ Clinical Instruction
- ☐ Team Assignments
- ☐ Self-Paced Learning
- ☐ Telecourse
- ☐ Internet Instruction
- ☐ Video Seminar
- ☒ Computer Simulations
- ☒ Laboratory Assignments
- ☐ On-Site Work Experience
- ☐ Interactive TV
- ☐ Other

2. Evaluation Criteria:

- ☒ Attendance
- ☒ Quizzes
- ☐ Class Discussion
- ☒ Tests
- ☐ Papers
- ☐ Midterm
- ☐ Portfolio
- ☒ Final Exam
- ☐ Projects
- ☐ Home Work
- ☐ Reports
- ☐ Presentations
- ☐ Clinical/Work
- ☐ Performances
- ☒ Other Hands-on lab work

3. Attendance Requirements: (For Certification or nonevaluative purposes.)

F. EQUIPMENT, FACILITIES, TEXTS, MATERIALS, AND SUPPLIES

1. Special Equipment/Facilities : (Check the appropriate boxes and describe as needed.)

- ☒ Lab equipment Hydraulic trainers
- ☐ Testing Center
- ☐ LRC Reserves
- ☐ Student Competitions
- ☐ Computers
- ☐ Off-Campus Sites
- ☐ CD ROM
- ☐ Student Tutors
- ☐ Field Trips
- ☐ Distance Learning Classroom
- ☐ Other

2. Texts: (Please indicate if no text is required.)

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Title: Principles of Proportional Valves
Author: Steve Skinner Copyright Yr: _____
Publisher: Eaton Hydraulics Training Center Est. Cost: $14

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Other Texts: _____

3. Supplies and/or Uniforms Student will have to Own or Acquire for Course:
(e.g. calculators, uniforms, tools, and software, etc., excluding pen, pencil, paper, or textbooks.)

Descriptions	Cost Estimates

4. Reference Materials Students Will Use:
(e.g. journals, books, manuals, maps, LRC reserves, etc.)

5. Audio/Visual and Computer Materials Students Will Use:
(e.g. films, video tapes, slides, audio tapes, software, CDs, etc.)

Title	Source
ICLD Motion Control Software	Vickers/Eaton Training Center

c/s 9/01

Washtenaw Community College

Curriculum and Articulation Services

Course Descriptions

Division: Technology

Industrial Technology Department

FLP 214: Basic Hydraulic Circuits 3 Credit(s)

Last Updated: Winter 2001
Current Syllabus Date: Fall 2000

Prereqs: FLP 111
Coreqs: FLP 213
30 lecture, 30 lab, 0 clinical, 0 other, 60 total contact hours
Fulfills Core Elements: 5 7 8 9 18 19
Course Description:

FLP 214 parallels FLP 213, concentrating on a variety of hydraulic circuits. This course further develops the concepts of directional, pressure, and flow controls covered in FLP 111. Troubleshooting with hydraulic prints is emphasized, using conventional valving, servo and proportional valves, and modular valves such as cartridge valves and stack valves. Ladder logic and timing diagrams describing the sequencing of events within a control circuit are also covered. Lab time is an integral part of this course. FLP 213 is a co-requisite with this course.

FLP 225: Fluid Power Motion Control 4 Credit(s)

Last Updated: Winter 2001
Current Syllabus Date:

Prereqs: FLP 213 and FLP 214
Coreqs: None
30 lecture, 45 lab, 0 clinical, 0 other, 75 total contact hours
Fulfills Core Elements: 5 7 8 18 19

3. **Course Description:** This course reviews basic electrical principles and covers amplifier theory as applied to open loop and closed loop control. Proportional directional valves, flow control valves, and pressure control valves are discussed, along with hydraulic servo valves. Proper setup alignment of the drive amplifiers and troubleshooting of servo and proportional control systems are covered in class and laboratory sessions. Closed loop (PID) control theory and feedback transducers are also discussed control theory.

~~This course has Conditional Approval for: Fall 2000~~

FLP 226: Pneumatics 3 Credit(s)

Last Updated: Fall 2000
Current Syllabus Date: Fall 1992

Prereqs: FLP 111
Coreqs: None
30 lecture, 30 lab, 0 clinical, 0 other, 60 total contact hours
Fulfills Core Elements: 5 18 19

3. **Course Description:** Industrial air systems for controlling conveyors, presses, clamps, etc. are covered. The course includes operation and practical use of; compressors, distribution systems, actuators, and valves. The second half of the course concentrates on the design of pneumatic control and power circuits using ANSI and ISO symbols and also the Moving Part Logic technique (pneumatic ladder logic).

* Note: These 2 courses still had the old course descriptions. I have attached the ones that were approved this past year.

eff. 9/01

FLP 213: Hydraulic Controls 3 Credits

Prerequsites: FLP 111
Corequisites: FLP 214
30 lecture, 30 lab, 0 clinical, 0 other, 60 total contact hours
Fulfills Core Elements: 5 7 8 9 10 18 19

FLP 213 parallels FLP 214 concentrating on the controls used in hydraulic circuits. The course further develops the concepts of directional, pressure, and flow controls covered in FLP 111. Print reading is emphasized, with the addition of modular valves such as cartridge valves and stack valves. Ladder logic and timing diagrams describing the sequencing of events within a control circuit are also covered. Lab time is an integral part of the course. FLP 214 is a co-requisite with this course.

FLP 214: Basic Hydraulic Circuits 3 Credits

Prerequsites: FLP 111
Corequisites: FLP 213
30 lecture, 30 lab, 0 clinical, 0 other, 60 total contact hours
Fulfills Core Elements: 5 7 8 9 18 19

FLP 214 parallels FLP 213, concentrating on a variety of hydraulic circuits. This course further develops the concepts of directional, pressure, and flow controls covered in FLP 111. Troubleshooting with hydraulic prints is emphasized, using conventional valving, servo and proportional valves, and modular valves such as cartridge valves and stack valves. Ladder logic and timing diagrams describing the sequencing of events within a control circuit are also covered. Lab time is an integral part of this course. FLP 213 is a co-requisite with this course.

FLP 225: Fluid Power Motion Control 3 Credits

Prerequsites: FLP 213 and FLP 214
Corequisites: None
30 lecture, 45 lab, 0 clinical, 0 other, 75 total contact hours
Fulfills Core Elements: 5 7 8 18 19

This course reviews basic electrical principles and covers amplifier theory as applied to open loop and closed loop control. Proportional directional valves, flow control valves, and pressure control valves are discussed along with hydraulic servo valves. Proper setup alignment of the drive amplifiers and troubleshooting of servo and proportional control systems are covered in class and laboratory sessions. Closed loop (PID) control theory and feedback transducers are also discussed

needs period

FLP 226: Pneumatics 3 Credits

Prerequsites: FLP 111
Corequisites: None
30 lecture, 30 lab, 0 clinical, 0 other, 60 total contact hours
Fulfills Core Elements: 5 18 19

Industrial air systems for controlling conveyors, presses, clamps, etc. are covered. This course includes operation and practical use of compressors, distribution systems, actuators, and valves. The second half of the course concentrates on the design of pneumatic control and power circuits using ANSI and ISO symbols and also the Moving Part Logic technique (pneumatic ladder logic).

FLP 274: FLP Co-op Education II 1-3 Credits

Prerequsites: FLP 174 and Consent required
Corequisites: None
0 lecture, 0 lab, 0 clinical, 120 other, 120 total contact hours
Fulfills Core Elements: None

In this course, students gain skills from a new experience in an approved, compensated, industry-related position. Together with the instructor and employer, students set up work assignments and learning objectives to connect classroom learning with career-related work experience. This is the second of two Co-op courses. Instructor consent is required to register for this course.

French FRN

FRN 111: First Year French I 4 Credits

Prerequsites:
Corequisites: None
45 lecture, 15 lab, 0 clinical, 0 other, 60 total contact hours
Fulfills Core Elements: 13 14 24

This is a beginning and transferable course in French which emphasizes the aural-oral approach. Classroom work and language laboratory sessions assist the student in establishing and perfecting basic conversational tools in the language.