ILLINOIS VALLEY COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Workforce Development

COURSE: IMT 1205; Industrial Hydraulics

Date: Spring 2014

Credit Hours: 3.0

Prerequisite(s):

Delivery Method:	☒ **Lecture**	**2 Contact Hours (1 contact = 1 credit hour)**
	☐ **Seminar**	**0 Contact Hours (1 contact = 1 credit hour)**
	☒ **Lab**	**2 Contact Hours (2 contact = 1 credit hour)**
	☐ **Clinical**	**0 Contact Hours (3 contact = 1 credit hour)**
	☐ **Online**	
	☐ **Blended**	

Offered: ☒ **Fall** ☒ **Spring** ☐ **Summer**

IAI Equivalent –***Only for Transfer Courses***-go to *http://www.itransfer.org*:

CATALOG DESCRIPTION:
This course is designed to safely introduce all components, circuits, and principles commonly used in industry, and to fully acquaint the student with principles of hydraulic fluid power. Practical working circuits with many variations will be developed in a laboratory environment. Electro-mechanical demonstrations tie machine fluid power and electrical behavior together for industrial situations. Also basic trouble-shooting techniques will be addressed. This course is competency-based instruction.

GENERAL EDUCATION GOALS ADDRESSED

[See the last page of this form for more information.]

Upon completion of the course, the student will be able:

[Choose those goals that apply to this course.]

☒ To apply analytical and problem solving skills to personal, social and professional issues and situations.
☒ To communicate orally and in writing, socially and interpersonally.
☐ To develop an awareness of the contributions made to civilization by the diverse cultures of the world.
☐ To understand and use contemporary technology effectively and to understand its impact on the individual and society.
☒ To work and study effectively both individually and in collaboration with others.
☒ To understand what it means to act ethically and responsibly as an individual in one's career and as a member of society.
☐ To develop and maintain a healthy lifestyle physically, mentally, and spiritually.
☒ To appreciate the ongoing values of learning, self-improvement, and career planning.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals.]

Upon completion of the course, the student will be able to:

The student will:

1.0 Apply basic formulas to determine force, work, power, and pressure.
2.0 Understand the use of terminology common to hydraulic applications.
3.0 Understand the basic skills of maintaining hydraulic systems.
4.0 Demonstrate the basic skills of maintaining hydraulic systems.
5.0 Perform calculations necessary to determine the size of actuators required in various applications.
6.0 Understand the operation of and the hydraulic circuitry required for:
   a. Check valves
   b. Accumulators
   c. Cylinders
   d. Flow control valves
   e. Directional control valves
   f. Pressure control valves
   g. Pumps
   h. Motors
   i. Reservoirs
   j. Coolers
   k. Filters
7.0 Design a basic hydraulic circuit to accomplish a simplified task.
8.0 Demonstrate the proper way to systematically diagnose problems and how to correct them in hydraulic systems.

COURSE TOPICS AND CONTENT REQUIREMENTS:

I. Machines
   A. Force
   B. Work
   C. Energy
   D. Pressure
II. Transmission of Force and Energy
   A. Pascal's Law

- B. Viscosity
- C. Positive Displacement Pumps
- D. Pressure Gauges
- E. Friction
- F. Fluid Velocity
- G. Fluid Flow Rate

III. Fluids
- A. Petroleum based fluids
- B. Fire resistant fluids

IV. Operation at the Suction Side of a Pump
- A. Atmospheric Pressure
- B. Absolute Pressure
- C. Vapor Pressure
- D. Vacuum Pressure Scale
- E. Cavitation

V. Hydraulic Actuators
- A. Cylinders
- B. Motors
- C. force and Torque Calculations
- D. Horsepower Calculations

VI. Control of Hydraulic Energy
- A. Pressure Control Valves
- B. Control of Actuator Direction
- C. Directional Control Valves
- D. Flow Control Valves

VII. Check Valves, Accumulators, and Cylinders
- A. Function of a Check Valve
- B. Pilot-Operated Check Valves
- C. Piston Accumulator
- D. Spring-Loaded Accumulator
- D. Diaphragm Accumulator
- E. Diaphragm Accumulator
- F. Cylinder Construction
    1. Cushions
    2. Stroke Adjusters
    3. Stop Tubes
    4. Mounting Styles

VIII. Flow Control Valves
- A. Orifice
- B. Gate
- C. Globe
- D. Needle
- E. Pressure Compensated
- F. Pressure-Temperature Compensated
- G. By-Pass

IX. Directional Control Valves
- A. 4-Way
- B. 3-Way
- C. 2-Way

1. Manual
2. Solenoid
3. Pilot

D. Servo and Proportional

X. Pressure Control Valves
- A. Adjustment
- B. Uses
  1. Sequencing
  2. Brake
  3. Counterbalance
  4. Unloading

XI. Pilot Operated Pressure Control Valves
- A. Construction
- B. Operation
- C. Venting
- D. Differential Unloading

XII. Hydraulic Pumps
- A. Vane
- B. Gear
- C. Gerotor
- D. Piston
- E. Volumetric Efficiency
- F. Overall Efficiency

XIII. Hydraulic Motors
- A. Vane
- B. Gear
- C. Gerotor
- D. Piston
- E. Torque Rating
- F. Shaft Speed

XIV. Reservoirs, Coolers, and Filters
- A. Reservoir Operation
- B. Types of Reservoirs
- C. Types of Coolers
- D. Filters
  1. Types
  2. Ratings
  3. Location
  4. Indicators

XV. Piping and Sealing
- A. Pipe, Tubing, Hoses
- B. Fittings - Flare, Compression, and O-Ring
- C. Seals, O-Rings, Piston Rings

XVI. Circuits
- A. Sequencing
- B. Regenerative
- C. Rapid Advance and Feed
- D. Pump Unloading

E. Meter In and Meter Out
F. Accumulator
G. Counterbalance
H. Open and Closed Loop Hydrostatic Drives

XVII. Trouble-Shooting Techniques
A. Seven Basic Steps
B. Applied Trouble-Shooting

INSTRUCTIONAL METHODS:

1. Lecture
2. Demonstration
3. Videos
4. Laboratory experiments

INSTRUCTIONAL MATERIALS:

Industrial Hydraulics Technology, The Parker Hannifan Corporation.

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

1. Ability to work as a member of a team.
2. Satisfactory performance on all written exams.
3. Satisfactory performance on all laboratory assignments.

OTHER REFERENCES

Industrial Fluid Power, Volume 1, 3rd edition, Womack Educational Publications.

Course Competency/Assessment Methods Matrix

IMT 1205; Industrial Hydraulics	**Assessment Options**																															
For each competency/outcome place an "X" below the method of assessment to be used.	**Assessment of Student Learning**	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	**Direct/ Indirect**	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D						
1.0 Apply basic formulas to determine force, work, power, and pressure.		X						X	X			X																			
2.0 Understand the use of terminology common to hydraulic applications.		X						X	X			X																			
3.0 Understand the basic skills of maintaining hydraulic systems.					X			X	X			X																			
4.0 Demonstrate the basic skills of maintaining hydraulic systems.				X	X	X		X	X			X			X																	
5.0 Perform calculations necessary to determine the size of actuators required in various applications.					X			X	X			X																				

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6.0 Understand the operation of and the hydraulic circuitry required for: a. Check valves b. Accumulators c. Cylinders d. Flow control valves e. Directional control valves f. Pressure control valves g. Pumps h. Motors i. Reservoirs j. Coolers k. Filters				X	X			X	X			X																				
7.0 Design a basic hydraulic circuit to accomplish a simplified task.				X	X			X	X			X			X																	
8.0 Demonstrate the proper way to systematically diagnose problems and how to correct them in hydraulic systems.				X	X										X																	