

SOUTHEAST COMMUNITY COLLEGE
CONSTRUCTION MANUFACTURING AND TECHNOLOGY DIVISION
Electrical/Electromechanical Technology Program
Revision Date: August 22, 2022

I. CATALOG DESCRIPTION

Course Number: ELEC1356
Course Title: Fluid Power
Prerequisite(s): ELEC1131
Catalog Description: Study of fluid power (hydraulic and pneumatic) systems. Circuitry and various components, their design, operation, application, and maintenance.

Credit Hours: 4
Class Hours: 45
Lab Hours: 45
Total Contact Hours: 90

II. COURSE OBJECTIVES: *Course will:*

- A. Introduce fluid power principles.
- B. Introduce cylinders and their ANSI graphic symbols.
- C. Introduce directional control valves and their ANSI graphic symbols.
- D. Introduce pressure control valves and their ANSI graphic symbols.
- E. Introduce flow control valves and their ANSI graphic symbols.
- F. Introduce hydraulic pumps and motors and their ANSI graphic symbols.
- G. Introduce accessory items and their ANSI graphic symbols.
- H. Introduce circuit and schematic drawings and construction of live circuits.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

- A. Student Learning Outcomes: *Student will be able to:*
 - 1. Define Pascal's Law.
 - 2. Calculate power transmission (pressure & flow).
 - 3. Know the various types of fluid power symbols.
 - 4. Calculate cylinder force and speed.
 - 5. Identify directional control valves and their symbols.
 - 6. Use directional control valves in a circuit design.
 - 7. Identify pressure control valves and their symbols.
 - 8. Use pressure control valves in a circuit design.
 - 9. Identify flow control valves and their symbols.
 - 10. Use flow control valves in a circuit design.
 - 11. Know the difference between pump types.
 - 12. Identify pump and motor mechanisms.
 - 13. Describe components necessary for a reservoir.
 - 14. Know the ANSI symbols for accessory items.
 - 15. Demonstrate "clamp and work" circuits using sequence valves.
 - 16. Construct and test various hydraulic and pneumatic circuits in lab.
- B. General Education Learning Outcomes (GELOs)
 - 1. GELO #3: Critical Thinking & Problem Solving
Outcome 1: Collect, identify, interpret and analyze data.

IV. CONTENT/TOPICAL OUTLINE

A. FLUID POWER PRINCIPLES

1. Goal Statement: Student will become familiar with the “how or why” fluid power works.
 - a. Pascal’s Law
 - b. Power transmission (pressure and flow)
 - c. Viscosity ratings
 - d. Static head pressure
 - e. Vacuum
 - f. Flow rate vs. pressure drop
 - g. Pump function
 - h. Pump cavitation
 - i. Parallel circuitry
 - j. Series circuitry
 - k. Hydraulic horsepower

B. CYLINDERS & THEIR ANSI SYMBOLS

1. Goal statement: Student will become familiar with various types of cylinders and their options as well as being able to select and size a cylinder for given job.
 - a. Types
 - b. Nomenclature
 - c. Cushions
 - d. Force
 - e. Speed
 - f. Selection or application
 - g. Pressure intensification

C. DIRECTIONAL CONTROL VALVES

1. Goal statement: Student will become familiar with the various types of directional control valves, their function, construction, application and ANSI symbols, as well as general examples of pilot and electrical control circuitry and repair procedures. To familiarize student with various types of electro-hydraulic servo valves.
 - a. Types
 - b. Actuators
 - c. Pilot operated check valves
 - d. Control circuitry
 - a. pilot
 - b. electrical
 - e. Pilot operated, solenoid controlled hyd. directional valve
 1. internal- external supply change over
 2. internal- external pilot drain changeover
 - f. Electro-hydraulic servo valves
 1. types of valves
 2. ANSI symbols
 3. valve feed back

D. PRESSURE CONTROL VALVES

1. Goal statement: Student will become familiar with various pressure control valves, their function, construction, application and ANSI symbols.
 - a. Relief valves
 1. simple
 2. compound
 3. RC options
 - b. Unloading valves

- c. Counterbalance valves
 - d. Sequence valves
 - e. Pressure reducing valves
 - 1. simple
 - 2. compound
 - f. Repair procedure for compound relief valve and regulators.
 - 2. REMARKS: Lab includes disassembly of valves for inspection of components.
- E. FLOW CONTROL VALVES & THEIR ANSI SYMBOLS**
- 1. Goal statement: Student will become familiar with various flow control valves, their function, construction, application and ANSI symbols.
 - a. Application
 - 1. meter – in
 - 2. meter – out
 - 3. bleed off
 - b. Types
 - 1. simple restrictor
 - 2. pressure compensated restrictor, or 2-port
 - 3. by pass or 3-port (if time permits)
 - 4. priority divider
 - 5. proportional divider
- F. HYDRAULIC PUMPS AND MOTORS AND THEIR ANSI SYMBOLS**
- 1. Goal statement: Student will become familiar with the various types of hydraulic pumps and motors as well as being able to select and size them and learn basic repair procedures.
 - a. Positive displacement vs. non-positive displacement
 - b. Fixed displacement
 - c. Variable displacement
 - d. Pressure compensate
 - e. Construction
 - 1. gear
 - 2. vane – change direction of rotation
 - 3. piston
 - 4. screw
 - f. Efficiency ratings
 - g. Selecting and sizing motors
 - 1. RPM
 - 2. torque
 - h. Hydrostatic transmissions open and closed loop.
- G. ACCESSORY ITEMS & THEIR ANSI SYMBOLS**
- 1. Goal statement: Student will become familiar with the various accessory items, their function and application in fluid power systems.
 - a. Reservoirs
 - b. Heat exchangers
 - c. Filtering
 - d. Pneumatic F-R-L
 - e. Pneumatic dryers
 - f. Accumulators
 - g. Gauges
 - h. Hydraulic fluids
- H. CIRCUIT & SCHEMATIC DRAWING PROJECTS**

1. Goal statement: Student will have an opportunity to work with the various components and ANSI symbols in a complete system on paper by developing the schematic drawings and building various circuits.
 - a. “Clamp and work” utilizing sequence valves
 - b. Building various hydraulic circuits
- I. REMARKS: Hydraulic projects will be used to test Pascal’s Law principles and give the student the understanding of valves, cylinders, and motors for use in future projects which will include sequencing, pressure reducing, counterbalancing, and pilot operated check valves.

V. INSTRUCTIONAL MATERIALS

- A. Required Text(s):
 1. *Industrial Fluid Power*, Volume 1
 2. *Industrial Fluid Power*, Volume 2
 3. *Fluid Power Data Book*
- B. Other Resources: Classroom handouts

VI. METHODS OF PRESENTATION/INSTRUCTION

- A. Methods of presentation typically include a combination of the following:
 1. Lecture
 2. Lab

VII. METHODS OF EVALUATION

- A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:
 1. Participation
 2. Exams and Quizzes
 3. Homework
 4. Lab performance

VIII. SPECIFIC COURSE REQUIREMENTS

- A. A minimum grade of 60% is required.
- B. Cheating within the Manufacturing Division: Any violation of academic integrity on assignments, quizzes, or tests will result in a grade of 0 on that assignment, quiz, or test. A second violation in any course after the initial infraction will result in a grade of F for that course. Any additional violations while in the program will result in a suspension from the program.
- C. Credit by Examination: Credit for the course CANNOT be earned through Credit by Examination.