COURSE OUTLINE

TITLE AND COURSE NUMBER: Fluid Power - MCT 336 January 2002

CREDITS AND CONTACT HRS. (LECTURE/LABORATORY): 3 Credits hours, 3 Class hours

COURSE DESCRIPTION: Study of hydraulic fluid power components and systems used in industrial, mobile, and aerospace applications; standard symbols in circuit design; circuit analysis; specification for pumps, valves, cylinders, and circuits; seals; fluid conductors; contamination control; introduction to proportional and servo control. Includes application research project .

PREREQUISITES: MCT 231 Fluid Mechanics

CO-REQUISITES: MCT 336L Fluid Power Laboratory

TEXTBOOKS:
Vickers, Inc., INDUSTRIAL HYDRAULICS MANUAL, 4th Ed., 1999.
FLUID POWER DATA BOOK, Womack Educational Publ., 10th Ed.1999.
Lab Sheets and industrial literature.

REFERENCE(S)
American Society for Testing Materials - Standards for Petroleum Products.
Fluid Power Handbook and Directory, Penton Pub.
Hydroworks, PC software by Tech Team Inc.
Automation Studio, PC software by Famic
Hydraulic, Pneumatic, Electrical, Electronic Standards, Joint Industry Council.
NFPA Standards for Symbols, Circuits, Component Testing,
Component Design. National Fluid Power Assn.
O-Ring Handbook, Wynns - Precision, Inc.
SIC - Standard Industrial Classification Manual, U.S. Govt. Printing Office.
NAICS – North American Industry Classification System, U.S. Govt.
SAE Handbook, Society of Automotive Engineers.
Sullivan, FLUID POWER, 4th Ed.. Prentice-Hall . 1998

GOALS/OBJECTIVES:

1. To introduce students to hydraulic fluid power components and simple circuits using graphic symbols.
2. To provide the student experience performing the basic analytical computations of fluid power systems.
3. To expose the students to the appropriate industry standards and fluid power literature.
4. To acquaint the student with the techniques and procedures for designing a simple hydraulic circuit and selecting the components for a design Bill of Materials.

Upon successful completion of this basic fluid power course the student will be able to do the following at a beginning engineering technologist competence level.:

1. Read fluid power symbols and circuits.
2. Execute the graphic design of simple, original fluid power circuits using standard symbols.
3. Interpret recommended fluid power practice guidelines as per ANSI, NFPA, ISO, ASTM, and other industry standards, etc.
4. Interpret component assembly and detail drawings and understand the function of the various design features.
5. Determine system - pressure, flow and actuator size requirements (without the use of optimization) to produce the desired mechanical output.
6. Write an original fluid power sector analysis report using appropriate library resources.
7. Design simple safety devices into a system.
8. Select standard components based on design calculations.

9. Select the type of fluid and filtration level.
10. Determine component pressure drops and system efficiencies.
11. Calculate heat generation and determine cooling requirements.
12. Select auxiliaries such as reservoirs, instruments, safety devices, etc.
13. Trouble-shoot simple fluid power systems.

COURSE TOPICS AND LECTURE HOURS DEVOTED TO EACH TOPIC:

1. Introduction, historical perspective, world of fluid power, applications. (2 hr.)
2. Fluid power component engineering and distribution network, career opportunities. (2 hr.)
3. Principles of hydraulics (2 hr)
4. Fluid power sector report objectives and requirements.(1 hr.)
5. Pressure control valves: design types, functions and applications. (2 hrs.)
6. Flow control valves: design types, functions and applications. (2 hrs.)
7. Directional control valves: design types, functions and applications. (2 hrs.)
8. Introduction to proportional and servo control valves. (1 hour)
9. Linear hydraulic actuators: design types, introduction to computations and selection procedure using JIC/NFPA industrial manuals. (3 hrs.)
10. Fluid seals and packing: design types, materials, introduction to seal/gland design and selection. (2 hrs.)
11. Hydraulic pumps: fundamentals, basic computations and performance characteristics, sound level ratings, efficiencies, design types and introduction to selection. (2 hrs.)
12. Electric motors - squirrel cage induction, integral HP types: HP and NEMA frame sizes, styles, design types, introduction to pump drive calculations and motor selection. (2 hrs.)
13. Power unit design: reservoirs, coupling, heat exchangers - functions and types. (1 hr.)
14. Introduction to accumulators, intensifiers and boosters: design types and function. (1 hr.)
15. Hydraulic fluids: properties, types, selection. (2 hrs.)
16. Principles of lubrication (1 hr.)
17. Filtration and filters: types, location, introduction to sizing and ratings. (2 hrs.)
18. Contamination control (2 hr.)
19. Hydraulic motors and hydrostatic transmissions. (1 hr.)
20. Fluid conductors and fittings: design types, computation, selection (metallic tube, hose, pipe, manifolds). (2 hrs.)
21. Three one-hour tests, test review and one 2 hour final exam. (7 hrs.)

COMPUTER USAGE:

1. Students will be required to produce one hydraulic circuit using a PC based system such as AutoCAD, Hydroworks, or Automation Studio.
2. Students will be required to use software available from a variety of fluid power component manufacturers - these assist in the proper sizing and selection of components. Extensive catalog data will be used.

LABORATORY PROJECTS: Laboratory exercises will be conducted in the accompanying lab, MCT336L.

LIBRARY RESEARCH; INDUSTRY CONTACTS; ORAL AND WRITTEN COMMUNICATION REQUIREMENTS:

Students will be required to research one fluid power sector and one typical application in that sector. Report requirements will be provided. Students will be required to make brief presentations before the class or lab assembly.

PREPARED BY: Robert L. Wolff **DATE:** January 2002