

Division: Technical
Subject Code: ELME
Course Title: Mechanical Systems I

Course: 104

Thaddeus Stevens College of Technology

Master Course Form

Catalog Description: This course introduces the principles and applications of the most commonly found mechanical drive and fluid power components in an industrial manufacturing environment. Topics include mechanical power transmission devices, hydraulics and pneumatics through a fundamental level along with related construction and troubleshooting techniques. All course material is supplemented with practical hands-on exposure to the items described.

Digital Description:

- Credit Hours: 4
- Lecture Hours: 2
- Lab Hours: 6

Prerequisites:

- None

Minimum Grade Required

Corequisites:

- MATH 131 – Intermediate Algebra
or
MATH 207 – Pre-Calculus
- ELME 105
- ELME 107

Objectives:

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

1. Understand pneumatic circuits as applied in industry at an introductory level.
2. Understand hydraulic circuits as applied in industry at an introductory level.
3. Understand mechanical drives (belt, chain, gear) as applied in industry at an introductory level.
4. Perform speed calculations for belt drives, gear drives, and chain drives.
5. Identify types of power transmission devices (belt types, gear types, chain drives)
6. Understand the effects of compressing air for a fluid power system.
7. Calculate force, area, and pressure in fluid power systems/cylinders.
8. Understand how force is transmitted through a hydraulic system.
9. Identify losses in a system given the efficiency of the components

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Competencies:

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Upon successful completion of the course, each student will demonstrate the ability to:

1. Apply basic safety rules for working with mechanical, pneumatic and hydraulic equipment
2. Calculate speed, torque, power, pitch, ratio, mechanical efficiency, and motor current in both English and S.I. units for a variety of drive types and configurations
3. Measure speed, torque, power, pitch, ratio, mechanical efficiency, and motor current in both English and S.I. units for a variety of drive types and configurations
4. Describe the function and application of shafts, bearings, keys, and couplings
5. Install and align electric motors using shafts, bearings, keys, and couplings
6. Describe the construction and operation of bushings; sheaves; idlers; conventional, multiple, wedge, notched, and variable speed belt systems
7. Demonstrate how to select, install, align and tension bushings; sheaves; idlers; conventional, multiple, wedge, notched, and variable speed belt systems
8. Describe preventive and reactive maintenance steps and troubleshooting procedures for v-belt drive systems
9. Perform preventive and reactive maintenance steps and troubleshooting procedures for v-belt drive systems
10. Describe the construction and operation of sprockets; master links; single roller, multiple strand and silent chain drives
11. Demonstrate how to remove, install, align, adjust sag and lubricate these chain drive systems
12. Describe maintenance and troubleshooting operations on chain drive systems
13. Perform maintenance and troubleshooting operations on chain drive systems
14. State Pascal's and Boyle's laws
15. Apply Pascal's and Boyle's laws to calculate and measure force, flow, pressure and speed in pneumatic circuits
16. Identify schematic symbols of pneumatic relief valves, pressure regulators, filters, fittings, cylinders, directional control valves, motors, mufflers, needle valves, rotameters, check valves, and flow control valves
17. Describe functions, applications of pneumatic relief valves, pressure regulators, filters, fittings, cylinders, directional control valves, motors, mufflers, needle valves, rotameters, check valves, and flow control valves
18. Draw a pneumatic schematic diagram using these components; connect, adjust and operate the circuit
19. Describe methods and components used to perform the maintenance procedures to properly condition and lubricate air used for industrial pneumatic systems
20. Perform the maintenance procedures to properly condition and lubricate air used for industrial pneumatic systems.
21. Identify schematic symbols of pneumatic relief valves, pressure regulators, filters, fittings, cylinders, directional control valves, motors, mufflers, needle valves, rotameters, check valves, and flow control valves

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22. Describe the functions, applications of pneumatic relief valves, pressure regulators, filters, fittings, cylinders, directional control valves, motors, mufflers, needle valves, rotameters, check valves, and flow control valves pressure reducing valves
23. Describe the function, application and operation of pneumatic directional control valves
24. Design, install and operate circuits using manual, cam and pilot operated directional control valves
25. Describe troubleshooting techniques for directional control and flow control valves
26. Apply troubleshooting techniques for directional control and flow control valves
27. Describe the function, application and operation of pneumatic power cylinders, pneumatic motors and air bearings
28. Calculate torque, speed and air consumption for various loads, cylinders and motors
29. Measure torque, speed and air consumption for various loads, cylinders and motors
30. Demonstrate the ability to install and operate cylinders and motors
31. Describe troubleshooting techniques for pneumatic cylinders, motors and rotary actuators
32. Apply troubleshooting techniques for pneumatic cylinders, motors and rotary actuators
33. Describe the function, application and operation of pneumatic logic
34. Demonstrate the ability to design and simulate pneumatic logic circuits
35. Demonstrate the ability to design, build and operate pneumatic circuits
36. Draw a hydraulic schematic diagram using these components, connect, adjust and operate the circuit
37. Describe the functions and operation of hydraulic speed, flow and pressure control and cylinder synchronization and regeneration
38. Demonstrate the operation of hydraulic speed, flow and pressure control and cylinder synchronization and regeneration
39. Describe the features, construction and functions of various types of fluid power hoses, metallic and non-metallic tubing and piping.

Planned Sequence of Learning Activities:

- Basic Mechanical Drives
 - Mech. Power Transmission
 - Bearing intro
 - Light Duty V-Belt Drives and Chain Drives
 - Heavy Duty V-belt Drives

- Fluid Power
 - Pneumatics
 - Hydraulics

List of Texts, References, Selected Library Resources or other Learning Materials:

1. Industrial Mechanics, 3rd Edition, American Technical Publishers, Inc., ISBN-13 978-0826937056
2. Fluid Power Systems, 2nd Edition, American Technical Publishers, Inc., ISBN-13 978 -0826936349
3. Lab-Volt Pneumatic Fundamentals Lab
 - Lab-Volt E-series - Pneumatics
4. Lab-Volt Hydraulic Introduction & Fundamentals Lab
 - Lab-Volt E-series – Hydraulics
5. Lab-Volt Mechanical Training System Level 1 Lab
 - Lab-Volt E-series – Mechanical Trainer

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Date: 1/20/15

This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership



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