

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

Course: 116

Thaddeus Stevens College of Technology

Master Course Form

Catalog Description: This course covers 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 and pneumatics and hydraulics through an intermediate 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:

- ELME 104

Minimum Grade Required

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Corequisites:

- MATH 141 – Trigonometry
or
MATH 207 – Pre-Calculus
- ELME 109
- ELME 117

Objectives:

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

1. Understand pneumatic circuits as applied in industry at an intermediate level.
2. Understand mechanical drives (belt, chain, gear) as applied in industry at an intermediate level.
3. List and describe common types of bearings.
4. Identify common causes of bearing failure.
5. List and describe methods for shaft alignment.
6. List and describe common types of lubricants.
7. Describe the different types of air compressors.
8. Describe the different types of components in pneumatic conditioning devices.
9. Describe the different types of control equipment used to control fluid power systems.

Competencies:

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

1. Describe the function, application and operation of single and two stage air compressors and air compressor controls
2. Apply the ideal gas law to air compressor operation and sizing
3. Demonstrate the ability to operate and test air compressors
4. Use instruments to measure operating conditions.
5. Describe troubleshooting techniques for conditioning equipment of an air system
6. Apply troubleshooting techniques for conditioning equipment of an air system
7. Describe the function, application and operation of vacuum systems including vacuum producing equipment; measuring units and equipment; vacuum switches; and vacuum cups and lifters.
8. Use Bernoulli's Law to explain a venturi
9. Use Bernoulli's Law to calculate vacuum lifting forces
10. Demonstrate the ability to connect and operate a vacuum system for handling material
11. Describe troubleshooting techniques for vacuum equipment and systems
12. Apply troubleshooting techniques for vacuum equipment and systems
13. Describe component and system level troubleshooting techniques, use a troubleshooting flowchart and troubleshoot electro-pneumatic systems using PLC indicator lights
14. Apply component and system level troubleshooting techniques, use a troubleshooting flowchart and troubleshoot electro-pneumatic systems using PLC indicator lights
15. Construct and assemble fluid components using techniques such as cutting, crimping, flaring, soldering, threading, and bending
16. Describe how to determine needs from schematics and drawings, how to specify components, how to size components and calculate pressure drops, how to make and install attachments, how to use expansion joints and insulation and how to maintain fluid power conductors
17. Apply basic safety rules for working with mechanical and pneumatic equipment, industrial lubricants, and conveyor systems.
18. Describe the function, construction and operation of synchronous timing and high torque drive belt systems
19. Select components for, install, align, tension and troubleshoot synchronous belt systems
20. Describe proper maintenance procedures for synchronous belt systems
21. Measure the components of spur, bevel, helical, worm, and right angle gears
22. Calculate speed and torque of gear systems
23. Disassemble, install, adjust backlash and align shafts in systems using various gear train types
24. Describe how gear systems are specified
25. Apply lubrication and maintenance techniques for gear drive systems
26. Describe the function and operation of plain, ball, roller, and antifriction bearings
27. Explain how to specify, select, apply and lubricate these bearings

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28. Demonstrate the ability to remove, install, align, adjust, inspect, maintain and troubleshoot bearings using appropriate tools and methods
29. Describe the function, construction and operation of gaskets, sealants, and seals
30. Demonstrate the ability to elect, install, remove, inspect and troubleshoot gaskets and seals for various applications
31. Describe the purpose and function of lubricant types and additives
32. Describe the methods of applying lubricants
33. Demonstrate the proper use of manual lubricating equipment
34. Describe the properties of a lubricant, measure the properties of a lubricant, and select the proper lubricant for an application.
35. Describe the purpose, function, components and operation of central lubrication systems
36. Describe the operation, installation and maintenance of a series/progressive lubrication system
37. Demonstrate the operation, installation and maintenance of a series/progressive lubrication system
38. Describe the operation of a central lubrication controller
39. Configure a central lubrication controller
40. Demonstrate the ability to troubleshoot and repair a series/progressive system and controller
41. Describe the operation and function of various types of shaft couplings using conventional methods
42. Demonstrate the ability to install and precision align a variety of types of shaft couplings using conventional methods

Planned Sequence of Learning Activities:

- Compressors
- Pneumatic Systems
- Belt Drives 2
- Gear Drives 2
- Bearings, Gaskets, Seals
- Chain Drives 2
- Lubrication
- Alignment and Couplings

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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