Division: Technical
Subject Code: ELME **Course: 204**
Course Title: Mechanical Systems III

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:	**Minimum Grade Required**
• ELME 116	D

Corequisites:

- PHYS 213 – General Physics
- ELME 208
- ELME 215

Objectives:

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

1. Understand hydraulic circuits as applied in industry at an advanced level.
2. Understand mechanical drives (belt, chain, gear) as applied in industry at an advanced level.
3. Identify the different types of pipes, tubing, and hoses used in fluid power systems.
4. List and describe preventive, predictive, and reliability maintenance systems.
5. Understand how vibration and laser alignment tools are implemented in maintenance systems.
6. List and describe the purpose of the major components of a linear motion system.
7. Distinguish between the different types of hydraulic pumps that are used in hydraulic systems.
8. Describe the different types of hydraulic cylinders and their applications.
9. Describe common fluid power system troubleshooting methods.

Competencies:

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

1. Construct and assemble fluid components using techniques such as cutting, crimping, flaring, soldering, threading, and bending

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2. 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
3. Describe the function, construction and operation of linear ball bushings and ball screws
4. Explain how to specify, select, and apply linear components
5. Demonstrate the ability to install, adjust, inspect, maintain and troubleshoot linear ball bushings and ball screws
6. Describe the function, construction and operation of mechanical and electrical clutches, brakes, and clutch/brake combinations
7. Perform calculations to specify clutches and brakes
8. Demonstrate the ability to install and adjust clutches and brakes
9. Demonstrate the ability to inspect, troubleshoot and maintain clutches and brakes
10. Describe the operation and function of laser shaft alignment
11. Determine alignment tolerances, use a laser system to align, and store, recall and print alignment data on a power transmission system
12. Describe the operation and function of conveyor systems
13. Calculate conveyor lengths and speeds
14. Demonstrate the ability to install, adjust and maintain flat belt conveyors
15. Define preventive maintenance, predictive maintenance and total predictive maintenance
16. Explain how vibration analysis may be used to implement various maintenance techniques
17. Apply preventive maintenance, predictive maintenance and total predictive maintenance
18. Explain how vibration analysis may be used to implement various maintenance techniques.
19. Describe the physics of vibration
20. Demonstrate the ability to apply vibration sensors and interpret results of vibration measurements
21. Describe causes of vibration in different types of components
22. Demonstrate the ability to correct, isolate or dampen vibration
23. Draw a hydraulic schematic diagram using these components, connect, adjust and operate the circuit
24. Describe the functions and operation of hydraulic speed, flow and pressure control and cylinder synchronization and regeneration
25. Demonstrate the operation of hydraulic speed, flow and pressure control and cylinder synchronization and regeneration
26. Describe the operation and function of a pressure-compensated hydraulic pump and its components.
27. Describe troubleshooting techniques for hydraulic components, pumps, and systems including systems operated by programmable logic controls (PLCs)
28. Apply troubleshooting techniques for hydraulic components, pumps, and systems including systems operated by programmable logic controls (PLCs)

Planned Sequence of Learning Activities:

- Piping Systems
- Ball Bushings and Ball Screws
- Clutches and Brakes
- Laser Alignment
- Floor Standing Conveyors
- Vibration Analysis
- Advanced Hydraulics
- Hydraulics Troubleshooting

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Required Texts:

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 Advanced Pneumatic Lab
    - Lab-Volt E-series – Advanced Pneumatics – Servo Control
4. Lab-Volt Hydraulic Lab
    - Lab-Volt E-series – Hydraulics – Servo Control
5. Lab-Volt Mechanical Training System Level 4 and 5 Lab
    - Lab-Volt E-series – Mechanical Trainer

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