

WESTERN IOWA TECH COMMUNITY COLLEGE

Course Syllabus

Mechanical Technician Level 3

Course Title: Mechanical Technician – Level 3

Total Hours: 56

Meeting time/ location :TBA

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COURSE DESCRIPTION AND PREREQUISITES/COREQUISITES:

The Mechanical Maintenance Certificate combines the disciplines of Hydraulics, Power Transmission, and Pumps. Each of the levels contains portions of each of these disciplines to present a holistic and competency driven approach to the mastering of the skills necessary for an Mechanical Maintenance Technician. Each level is designed to be delivered in such a way that the student attends the levels in a sequential order to ensure a complete understanding of the material. This training can be transcribed into college credit. Test outs are available to ensure the students are prepared for each level prior to registering for the training.

COURSE OBJECTIVES

The course will provide information which should enable the student to:

- Describe the function of a relief valve and give an application
- Describe the operation of a direct-acting relief valve and give its schematic symbol
- Describe how a relief valve is used for system protection
- Describe how a relief valve is used for speed control assistance
- Describe the function of a check valve and give an application
- Describe the operation of three types of check valves and give their schematic Symbol
- Describe the function of the flow control valve and give an application
- Describe the operation of a flow control valve and give its schematic symbol
- Describe the effect of actuator load changes on flow control valve operation
- Describe the operation of a meter-in flow control circuit and give an application
- Describe the operation of a meter-out flow control circuit and give an application
- Define independent speed control and give an application
- Explain how speed control valves can be used to provide multiple speeds
- Describe how to calculate the extend speed of a hydraulic cylinder
- Describe how to calculate the retract speed of a cylinder
- Describe how to calculate the stroke time of a cylinder
- Describe the operation of four types of cylinders and give an application of each
- Describe the construction of two types of cylinders Ana give an application of each
- Describe three common cylinder mounting styles and give an application of each
- Describe three common cylinder feature options
- Describe the principle of cylinder regeneration and name an application
- Describe the operation of a basic regeneration circuit
- Describe how to calculate the extend speed of a cylinder in regeneration
- Describe how to calculate the extend force of a cylinder in regeneration
- Describe the function of a pressure-compensated flow control valve and name one application
- Describe the operation of a pressure-compensated flow control valve and give its schematic symbol
- Describe the function of a double-rod cylinder and name one
- Describe the operation of a double-rod cylinder and give its symbol
- Define application cylinder synchronization and name three applications
- Explain why cylinders do not operate in synchronization
- List and describe the operation of five methods used to synchronize cylinders
- Describe the function of a shaft and give an application
- List four types of shaft materials and give an application of each

Describe how shafts are specified

Describe the function of a bearing and give an application

Define three types of bearing loads and give an example of each

Describe how bearings are positioned to support a load

Describe the operation of a two categories of bearings and give an application of each

Describe two methods of mounting a shaft bearing and give an application of each

Describe the function of a coupling and give an application

Describe the function and application of four categories of mechanical couplings

Describe the operation of a flexible jaw coupling

Describe the purpose of shaft alignment and give two types of misalignment

Describe a general procedure for shaft alignment and give four measurement methods

Describe the operation of the straight edge and feeler gage alignment method

Describe the function of the three basic components of a belt drive

Define pitch and explain its importance

Define the pitch circle, pitch diameter and pitch length of a belt drive and explain their importance

Describe how to calculate the pulley ratio and explain its importance

Describe how to calculate the shaft speed and torque of a belt drive system

List five types of belt drives and give an application of each

List three types of V-belts and give an application of each

Describe the operation of a fractional HP V-belt drive

Describe how to install and align a V-belt drive

Describe how to determine belt tension for an application

Describe three methods of adjusting belt tension

Describe three methods of measuring belt tension and give an application of each

Describe the construction and operation of a timing belt drive system

Describe how to install and align a timing belt drive system

Describe the operation of an HTD belt drive system

Describe how to install and align an HTD belt drive system

Describe how to select an HTD belt and sprockets for a given application

Describe how to select a timing belt and pulleys for a given application

Describe how timing belts and pulleys are specified

Describe how HTD belts and sprockets are specified

Describe the six functions of a lubricant

Describe four types of lubricants and give an application of each

Describe the functions of nine types of lubricant additives

Describe the operation of five types of lubrication application methods and give an example

Describe three types of oils and give an application of each

Define viscosity and give its unit of measure

Describe the operation of a viscometer and give an application

Describe four types of grease and give an application of each

Describe how greases are specified

Describe five lubricant storage rules

Describe the function of a material safety data sheet (MSDS)

Describe the purpose of recycling lubricants

Describe four methods used to recycle lubricants

Describe how to dispose of spent lubricants

Describe the function of a turbine pump and give an application

Describe four types of vertical turbine pumps and give an application of each

Describe the operation of a vertical turbine line shaft pump

Describe how to install a vertical turbine line shaft pump

Describe the flow/pressure characteristics of a vertical turbine pump

Describe three methods of adjusting the flow rate of a vertical turbine pump

Describe how to maintain a vertical turbine pump

Describe how to disassemble and inspect a vertical turbine pump

Describe how to troubleshoot a vertical turbine pump

Describe the function of a diaphragm pump and give an application

List three types of diaphragm pumps

Describe the operation of an air-operated double-diaphragm pump

Describe how to install an air-operated double-diaphragm pump

Describe the function of a diaphragm pump and give an application

List three types of diaphragm pumps

Describe the operation of an air-operated double-diaphragm pump

Describe how to install an air-operated double-diaphragm pump
Describe the flow/pressure characteristics of an air-operated double-diaphragm pump
Describe how to adjust the flow rate of an air-operated double-diaphragm pump
Describe how to disassemble and inspect an air-operated double-diaphragm pump
Describe how to maintain an air-operated double-diaphragm pump Describe how to troubleshoot an air-operated double-diaphragm pump

CONTENT OUTLINE:

1. RELIEF VALVES
2. CHECK VALVES
3. FLOW CONTROL VALVES
4. METER-IN AND METER-OUT CIRCUITS
5. FLOW CONTROL CIRCUIT DESIGN
6. FLOW RATE VS. CYLINDER SPEED
7. CYLINDER TYPES
8. REGENERATION CIRCUITS
9. PRESSURE-COMPENSATED FLOW CONTROL VALVES
10. SYNCHRONIZATION CIRCUITS
11. LUBRICANT MANAGEMENT
12. GREASES
13. OILS
14. LUBRICATION CONCEPTS
15. LUBRICANT MANAGEMENT
16. GREASES
17. OILS
18. LUBRICATION CONCEPTS
19. TIMING BELT DRIVES
20. HIGH TORQUE DRIVE BELT DRIVES
21. SYNCHRONOUS BELT DRIVE SELECTION
22. SYNCHRONOUS BELT MAINTENANCE AND TROUBLESHOOTING
23. BELT TENSIONING
24. BELT TENSION MEASUREMENT
25. BELT DRIVE CONCEPTS
26. V-BELT OPERATION
27. SHAFT ALIGNMENT
28. INTRODUCTION TO BEARINGS
29. INTRODUCTION TO COUPLINGS
30. INTRODUCTION TO SHAFTS
31. PUMP MAINTENANCE AND TROUBLESHOOTING
32. PUMP SELECTION
33. PUMP INSTALLATION
34. PUMP OPERATION
35. PUMP OPERATION
36. PUMP INSTALLATION
37. PUMP MAINTENANCE AND TROUBLESHOOTING
38. Describe the function of a diaphragm pump and give an application
39. List three types of diaphragm pumps
40. Describe the operation of an air-operated double-diaphragm pump
41. Describe how to install an air-operated double-diaphragm pump
42. Describe how to maintain an air-operated double-diaphragm pump
43. Describe how to troubleshoot an air-operated double-diaphragm pump

COMPETENCIES:

At the conclusion of the course the student will be able to:

- Connect a relief valve in a circuit to limit pressure in the system
- Design a circuit to provide bypass flow
- Connect and adjust a flow control valve to control speed of an actuator
- Connect and operate a meter-in flow control circuit
- Connect and operate a meter-out flow control circuit
- Design an independent speed control circuit
- Design a two-speed actuator circuit
- Calculate the extend speed of a hydraulic cylinder given its size and a flow rate
- Calculate the retract speed of a cylinder given its size and a flow rate
- Calculate the cylinder stroke time given its size and a flow rate
- Select a cylinder mounting style for a given application
- Calculate the extend speed of a cylinder in regeneration
- Connect and operate a basic regeneration circuit
- Calculate the extend force of a cylinder in regeneration
- Connect and adjust a pressure-compensated flow control valve
- Set up, adjust and operate a cylinder synchronization circuit using flow control valves
- Effect of load changes on a cylinder synchronization
- Set up and operate a synchronization circuit using series actuators
- Connect a pilot-operated relief valve to unload a pump by venting
- Connect and operate a remotely controlled pilot-operated relief valve circuit
- Design a circuit to provide a two-pressure control with unloading
- Identify shaft size given a sample
- Install and adjust a pillow block antifriction bearing and shaft
- Install a flexible jaw coupling
- Align two shafts using a straight edge and feeler gage
- Calculate pulley ratio
- Calculate the shaft speed and torque of a belt drive system
- Install and align a fractional HP V-belt drive with a finished bore
- Determine the belt deflection force for a given application
- Adjust belt tension using an adjustable mounting base
- Use a belt tension tester to measure belt tension
- V-belt drive analysis
- Install and align a timing belt drive system
- Install and align an HTD belt drive system
- Identify the size and type of synchronous belt and pulley/sprocket given a sample
- Select a timing belt and pulleys for a given application
- Troubleshoot a synchronous belt drive system
- Select an HTD belt and sprockets for a given application
- Use a viscometer to measure oil viscosity
- Select an oil specification for a given application
- Select a grease specification for a given application
- Use a grease gun to lubricate a pillow block bearing
- Read and interpret a material safety data sheet
- Install a vertical turbine pump
- Start up and operate a vertical turbine pump
- Measure and graph the flow/pressure characteristics of a vertical turbine lineshaft pump
- Determine the size of a vertical turbine pump given nameplate data
- Troubleshoot a vertical turbine pump
- Disassemble and inspect a vertical turbine pump
- Install an air-operated double-diaphragm pump
- Start up and operate an air-operated double-diaphragm pump
- Measure and graph the flow/pressure characteristics of an air-operated double-diaphragm pump
- Determine the size of an air-operated double-diaphragm pump given nameplate data

Select an air-operated double-diaphragm pump for an application
Troubleshoot an air-operated double-diaphragm pump
Disassemble and inspect an air-operated double-diaphragm pump

EVALUATION/GRADING CRITERIA:

QUIZZES
OBJECTIVE TESTS
HANDS ON ASSESSMENTS
FINAL TEST

NOTE: REVIEWS AND QUIZZES WILL NOT BE ACCEPTED LATE AFTER THE INDIVIDUALLY ASSIGNED DATE
!!!! REVIEWS OR QUIZZES NOT TURNED IN ON TIME WILL BE GIVEN "0" MISSED PRACTICAL TESTS AND
FINAL EXAM CAN BE MADE UP ONLY BY THE APPROVAL OF THE INSTRUCTOR.

ATTENDANCE:

Students are expected to attend all sessions of classes for which they are enrolled. Absences do not excuse the student from meeting the course requirements. The student must take the initiative in making up any missed work. Each instructor will provide policies concerning course attendance.

ACADEMIC HONESTY:

Students are responsible for their own learning and development. They have a responsibility to be an active learner by attending class, completing class and laboratory assignments, and preparing in advance of the scheduled class session. Students are expected to understand and maintain high standards of academic honesty. Examples of academic dishonesty include, but are not limited to, the following:

- Cheating
- Plagiarism
- Fabrication
- Dual Submission
- Facilitating Academic Dishonesty

COMPUTER CONDUCT:

College computer systems are provided by WITCC for use by students, faculty, and staff for the purpose of furthering the educational mission of the College. This includes course work, college-related educational endeavors, and business operations. Each user is expected to follow established computer conduct policies and not to interfere with or disrupt the orderly processes of WITCC resources. Users accept the responsibility for utilizing services in ways that are ethical, that demonstrate academic integrity and respect for others who share this resource. Users must follow all existing federal, state, and local laws as they relate to computer conduct.

AMERICANS WITH DISABILITIES ACT (A):

Persons with documented disabilities may request reasonable accommodations through Disability Services, located in the Admissions & Advising Center, A300, or at (712) 274-8733, Ext. 3216.

DISCRIMINATION:

Western Iowa Tech Community College does not discriminate on the basis of race, creed, color, gender, national origin, religion, age, disability, sexual orientation, gender identity, veteran status or any other protected basis as defined in Iowa or federal law as amended from time to time in its educational programs, activities, admission procedures or employment practices. Individuals who believe they have been discriminated against may file a complaint through the College's Grievance or Complaint Procedures. Complaint or Grievance Forms and Procedures may be obtained from the WITCC Human Resources Department, Dr. Robert H. Kiser Building, Room A242, and (712) 274-6400, Ext. 1220.

SAFETY AND SECURITY:

WITCC has produced videos regarding safety features and procedures that can be taken by students, staff and faculty. These videos have been posted on the my WIT homepage under the "Safety" tab and may be viewed at any time. An Emergency Response Guide along with Tornado, Fire and Secure Your Area posters have been placed in each classroom and work space area which list specific precautions that should be taken. If you have any questions

or concerns, please call the Safety/Security Supervisor at 712-274-8733, extension 3210. If you have an emergency situation at the Sioux City campus, call 1316 or 911 from any telephone on campus immediately. For the outlying campuses call 911 immediately.

As a comprehensive community college, our mission is to provide quality education and to economically enhance the communities we serve.