WESTERN IOWA TECH COMMUNITY COLLEGE

Course Syllabus

Mechanical Technician Level 2

Course Title: Mechanical Technician – Level 2
Total Hours: 56
Meeting time/ location :TBA
Instructor: Chris Sewalson
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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:

1. Describe how to calculate the force output of an extending cylinder
2. Describe how to calculate the force output of a hydraulic cylinder in retraction (pull)
3. State Pascal's Law and explain its significance in hydraulics
4. Explain how force is multiplied using Pascal's Law
5. Describe two types of resistance in a hydraulic system
6. Explain how Delta P describes hydraulic resistance
7. Explain how pressure is distributed in a hydraulic system
8. **Describe two methods of representing hydraulic pressure**
9. **Describe how oil flows on the suction side of the pump**
10. **Describe and explain the terms used to specify DCVs**
11. **Describe the function of a hydraulic 4/2 DCV and name one application**
12. **Describe the operation of a hydraulic 4/2 DCV and give its schematic symbol**
13. **Describe the function of a hydraulic 3/2 DCV and name one application**
14. **Describe the operation of a hydraulic 3/2 DCV and give its schematic symbol**
15. **Describe the function of a hydraulic pilot-operated DCV and name one application**
16. **Describe the operation of a hydraulic pilot-operated DCV and give a schematic symbol**
17. **Describe the function of a hydraulic cam-operated valve and name one application**
18. **List two types of hydraulic cam-operated valves and describe their application**
19. **Describe the operation of a hydraulic 4/2 cam-operated valve and give its schematic**
20. **Describe the function and operation of a key fastener**
21. **Describe the construction of six types of keys and give an application of each**
22. **Describe how keys and keyseats are specified**
23. **Describe how to measure the actual size of a key and keyseat**
24. **Describe six types of set screws**
25. **Describe how to assemble a hub to a shaft using a key**
26. **Describe two methods of loading a mechanical drive sy**
27. **Describe how to calculate rotary mechanical power**
28. **Describe how to calculate mechanical efficiency and explain its importance**
29. **Describe two methods of measuring shaft torque and give an application of each**
30. **Describe three methods of measuring electric motor current**
31. **Describe how v-belts are specified**
32. **Describe three methods of identifying belt size and type**

33. **Describe the function and operation of v belt match cod**
34. **Describe how bushings are specified**
35. **Describe how sheaves are specified**
36. **Describe how to select bushings, sheaves, and a v-belt for an application**
37. **Describe preventive maintenance**
38. **Describe nine preventive maintenance steps for v-belt drives**
39. **Describe how to troubleshoot a v-belt drive system**
40. **Describe three methods of measuring pump flow rate**
41. **Describe two units of flow rate measurement**
42. **Describe how to convert between mass and volumetric flow rate**
43. **Define head and give its units of measurement in terms of force per unit area and head**
44. **Describe how to convert between units of head and pressure**
45. **Define total dynamic head and explain its importance**
46. **Describe the characteristics of a system head curve**
47. **Describe the head/capacity characteristics of a centrifugal pump**
48. **Define the operating point of a centrifugal pump**
49. **Describe how to use a throttle control valve to adjust the flow rate of a centrifugal pump**
50. **Define total dynamic head in terms of suction and discharge head**
51. **Describe how to measure the total head of a centrifugal pump**

CONTENT OUTLINE:

1. HYDRAULIC PRESSURE VS. CYLINDER FORCE
2. HYDRAULIC LEVERAGE
3. FLUID FRICTION
4. ABSOLUTE VS. GAGE PRESSURE
5. OVERVIEW OF THE DCV
6. TWO-POSITION DCVs
7. PILOT-OPERATED DCVs
8. CAM-OPERATED DCVs
9. KEYSEAT FASTENERS
10. KEY ASSEMBLY
11. TORQUE AND POWER MEASUREMENT
12. MECHANICAL EFFICIENCY
13. V-BELT SIZE SPECIFICATION
14. V-BELT COMPONENT IDENTIFICATION
15. V-BELT DRIVE SELECTION
16. V-BELT MAINTENANCE AND TROUBLESHOOTING
17. PUMP FLOW RATE MEASUREMENT
18. HEAD CONCEPTS
19. CENTRIFUGAL PUMP HEAD/FLOW CHARACTERISTICS

COMPETENCIES:

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

1. Calculate the extension force of a cylinder given its size and pressure
2. Measure the force output of an extending cylinder
3. Calculate the retraction force of a cylinder given its size and pressure
4. Measure the force output of a retracting cylinder
5. Measure Delta P across a hydraulic component
6. Convert between absolute pressure and gage hydraulic pressure
7. Connect and operate a hydraulic DCV with a tandem center
8. Select the spool option for a hydraulic DCV based on the application information
9. Connect and operate a hydraulic 4/2 DC
10. Connect and operate a 4/2 DCV to function as a 3/2 DCV
11. Design a hydraulic circuit using a 2-position DCV
12. Connect and operate a hydraulic pilot-operated DCV
13. Connect, adjust and operate a cam-operated hydraulic valve
14. Design a hydraulic sequence circuit using a cam-operated hydraulic valve
15. Design a rapid traverse-slow feed hydraulic circuit using a cam-operated valve
16. Select a key size for a given application
17. Measure the actual size of a key and keyseat given a sample
18. Cut and file key stock to fit a keyseat
19. Assemble a hub to a shaft using a key fastener
20. Use a prony brake to measure shaft torque
21. Calculate rotary mechanical power
22. Convert between English and S.I. units of motor power
23. Calculate mechanical efficiency
24. Measure electric motor current
25. Use a belt code to determine the size and type of a v-belt
26. Use a belt gage to determine belt cross section size
27. Use measurement to determine the site and type
28. Use a sheave gage to identify a sheave size
29. Identify size and type of a sheave and bushing given a sample
30. Select bushings, sheaves, and a v-belt for a given application
31. Troubleshoot a v-belt drive system
32. Convert between mass and volumetric flow rate
33. Use a flow meter to measure centrifugal pump flow rate
34. Convert between units of head and pressure
35. Measure and graph a system heail curve
36. Measure total head for a centrifugal pump

EVALUATION/GRADING CRITERIA:

QUIZZES
OBJECTIVE TESTS
HANDS ON ASSESMENTS
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, (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 myWIT 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.