Fall 9-1-2020

DST 225.B01: Hydraulics

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THE UNIVERSITY OF MONTANA
COLEGE OF TECHNOLOGY
INDUSTRIAL TECHNOLOGY DEPARTMENT

COURSE SYLLABUS

COURSE NUMBER AND TITLE: DET 225T Hydraulics

DATE REVISED: Fall 2020
SEMESTER CREDITS: 6

CONTACT HOURS PER SEMESTER: Lecture 10 hours per week
Lab 15 hours per week

PREREQUISITES: None

Faculty: Jim Harris
Phone number: 406.243.7649
E-mail address: jim.harris@umontana.edu
Office location: DET Lab upstairs

Office Hours: By appointment or as posted on Faculty office door

RELATIONSHIP TO PROGRAM: Hydraulics contributes to the objectives of the Diesel Technology program by increasing the student's knowledge of the principles, operating, maintenance and repair of those components that make-up a working hydraulic systems.

COURSE DESCRIPTION: Theory and application of hydraulics relative to mobile construction equipment and industrial hydraulic systems. Includes valves, pumps, motors, actuators, and related hydraulic components, system maintenance, troubleshooting, and repair.

STUDENT PERFORMANCE OUTCOMES:
Occupational Performance Objectives
Upon completion of this course, the student will be able to:

1. Understand the principles of a hydraulic system
2. Identify, rebuild, troubleshoot, and maintenance of the following components.
    A. Pumps
    B. Motors
    C. Cylinders
    D. Valves
    E. Actuators
    F. Hoses, hydraulic fittings, pipe, and plumbing
    G. Filters, and filtering systems
    H. Leakage and sealing
    I. Reservoirs and accessories
3. Understand the working principles of hydrostatic systems.
4. Repair and maintain hydrostatic pumps and motors.
5. Learn correct safety procedures when working with hydraulics.

STUDENT PERFORMANCE ASSESSMENT METHODS AND GRADING PROCEDURES:

Grading Scale:

90 – 100	A
80 - 89	B
70 – 79	C
60 – 69	D
59 & below	F

Lecture: **Counts for 50% of course final grade.**
1. Includes four (4) tests, work ethic, attitude, and attendance.
2. There will be no test make-up. All students will start testing at the same time**. Any student who enters the classroom late will not be allowed to take the test.**
3. To receive a final course grade of 'A' the student must earn a grade average of 'A' on tests and written papers.
4. Attendance (SEE ATTENDANCE POLICY BELOW) will count as part of the lecture grade.
5. A student must earn a grade of 'C-' or better in lecture in order to pass the course

Lab: Counts for 50% of course final grade.
1. Includes lab sheets signed off by the instructor at the time of completion ONLY. No late sign-offs will be allowed.
2. Attitude, work ethic, attendance (SEE ATTENDANCE POLICY BELOW) and quality of work will count as part of the lab grade.
3. If the lab project is not done to the instructor's satisfaction the student will be asked to repeat the project. The lab grade can only raise a student's final course grade one letter grade overall.
4. Each student will complete his or her own job sheet assessment for each exercise as the engine is disassembled and reassembled. Each student will be expected to do the work sheets on his/her own (SEE ACADEMIC INTEGRITY POLICY BELOW).
5. Upon completion, each job sheet assessment must be signed by the instructor or a score of zero (0) will be assigned.
6. Signed job sheets will be turned in at the end of the course in a three-ring binder which also contains all handouts, notes, etc. This portfolio will count as a portion of the final course grade.
7. A student must earn a grade of 'C-' or better in lab in order to pass the course.

Notebook:
1. Each student is required to keep a three-ring notebook to contain the following: Course handouts arranged in date order (oldest to most current), class notes, and lab job sheets signed by the instructor in order of completion.
2. Do not place unsigned job sheets in the notebook.
3. Missing job sheets will count against the final lab grade.

Lab Safety:
1. Students shall follow all College of Technology West Campus safety policies and procedures.
2. Each student will always work in a safe manner or **REMOVAL FROM CLASS WILL RESULT!!!**
3. SAFETY GLASSES must be worn when working around the press or anytime eyes may sustain injury.
4. HORSEPLAY will not be tolerated and will result in the offending student(s) being required to leave the lab area immediately,

NOTE: Courses must be passed with a 'C minus (C-)' or greater to count toward degree/certificate requirements.

ATTENDANCE POLICY:
1. Attendance will be taken at least once a day and sometimes more.
2. Each student is expected to be on time and present at the beginning of each class.
3. One (1) unexcused absence will drop the final grade one letter. Each subsequent unexcused absence will drop the final grade one additional letter grade. If the grade of "F" is reached, the student will be asked to withdraw from the course.
4. Any student late to class will be assessed an unexcused absence.
5. Each student will be allowed 3 excused absences during the semester without points being deducted. Once the student starts to accumulate excused absences beyond 3, the following scale will be used to dock points.

4th day	1% point
5th day	2% points
6th day	6% points
7th day	10% points
8th day	16% points
9th day	18% points
10th day	20% points
11th day	25% points
12th day	30% points

REQUIRED TEXTBOOKS: CDX Learning Systems Fundamentals of Mobile Heavy Equipment

SUGGESTED REFERENCE MATERIALS: Service manuals as per engine manufacturer.

SUPPLIES: Hand tools per Diesel Technology Program requirements. See Diesel Technology Required Tool List.

ACADEMIC INTEGRITY: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/SA/VPSA/index.cfm/page/1321.

DISABILITY ACCOMMODATION: Eligible students with disabilities will receive appropriate accommodations in this course when requested in a timely way. Please contact me after class or in my office. Please be prepared to provide a letter from your DSS Coordinator. For more information, visit the Disability Services website at http://www.umt.edu/dss/ or call 406.243.2243 (Voice/Text).

NOTE: Faculty reserves the right to modify syllabi and assignments as needed based on faculty, student, and/or environmental circumstances.

COURSE OUTLINE:
A. Hydraulic Principles
   1. Pressure
   2. Flow
   3. Force

4. Pascal's Law
5. Velocity and Speed
6. Work and Energy
7. Bernoulli's Principle
8. Power

B. Reservoirs and Accessories
1. Reservoirs
2. Shape, Size and Location
3. Vented or Pressurized
4. Maintenance
5. Fabrication

C. Fluid Maintenance (Filtering)
1. Filters
2. Strainers
3. Micron Ratings
4. Beta Ratings
5. Location
6. Flow conditions

D. Oil Coolers
1. Water-Oil
2. Air-Oil

E. Accumulators
1. Gas charged
2. Weighted
3. Spring loaded
4. Maintenance and charging procedures
5. Disassembly Procedures and Safety

F. Principles and Pump Operation
1. Vane pumps
2. Piston pumps
3. Gear pumps
4. Pump rebuild procedures
5. Failure analysis

G. Principles of Actuator Operating
1. Linear or rotary actuators
2. Cylinders, rams and motors
3. Classification of cylinders
4. Cylinder construction
5. Cylinder cushions
6. Cylinder force output
7. Pressure and speed of cylinders
8. Motor ratings and operation
9. Motor configurations (piston, vane or gear)
10. Disassemble and rebuild procedures
11. Failure analysis

H. Principles and Valve Operation
1. Pressure control valves
2. Directional valves
3. Flow control valves
4. Disassemble and repair procedures
5. Failure analysis

I. Mobile Circuits and Circuit Diagrams
   1. Types of diagrams
   2. Identifying component symbols
   3. Understanding hydraulic diagrams, symbols and circuits
   4. Constructing a workable hydraulic diagram

J. Hydrostatic Systems
   1. Traction drive systems
   2. Operating controls
   3. Speed and torque
   4. Integral or split hydrostatic systems
   5. Pumps and motors
   6. Displaced controls
   7. Hydrostatic drive circuits

K. Hydraulic Tubing, Piping, Hoses and Fittings
   1. Traction drive systems
   2. Operating controls
   3. Speed and torque
   4. Integral or split hydrostatic systems
   5. Pumps and motors
   6. Displacement controls
   7. Hydrostatic drive circuits

L. Leakage Identification and Control
   1. Planned and unplanned leakage
   2. Seals and their application
   3. Static and dynamic seals and sealing

M. Lubrication and Maintenance
   1. Lubricating oils
   2. Maintenance procedures and recommendations

N. Safety When working with Hydraulics
   1. Pressure hazards
   2. Temperature hazards
   3. Component failure

O. Testing and Adjusting Hydraulic Systems
   1. Flow testing
   2. Pressure testing
   3. Cycle time testing
   4. Valve Adjusting (pressure and flow controls)

CELL PHONE,PAGERS,IPADS If the cell phone/pager is not emergency related,turn them off.If the cell phone interfers with the process of the class,you may be asked to leave the class. If there is a reason to keep your cell phone on please place on vibrate.If you receive a call,please leave the classroom quietly to take the message. Cell phones,IPads and other tablets must be turned off during exams.