Faculty is required to have the outline submitted to the Academic Affairs Office. The course outline is the form used for approval of new courses by the Academic Affairs and Standards Council.

DEPT. MECH                COURSE NUMBER: 2100

NUMBER OF CREDITS: 3 credits (2 lect., 1 lab)

COURSE TITLE: Advanced Systems Calculations

CATALOG DESCRIPTION: Provides students with knowledge and skills of sizing systems in both mobile and industrial applications.

AUDIENCE: Mechatronics students

FULFILLS MN TRANSFER CURRICULUM AREA(S) \textit{(Leave blank if not applicable)}

Area: by meeting the following competencies:
Area: by meeting the following competencies:
Area: by meeting the following competencies:

PREREQUISITES OR NECESSARY ENTRY SKILLS/KNOWLEDGE:
Successful completion year one of the Mechatronics diploma or A.A.S. degree program or equivalent work experience.

LENGTH OF COURSE: semester

THIS COURSE IS USUALLY OFFERED:
Every other year ☐ fall ☒ spring ☐ summer ☐ undetermined ☐

Four goals are emphasized in course at Minnesota West Community & Technical College:

1) ACADEMIC CONTENT: The academic objectives of this course are:
   a. Achieve basic knowledge and skills needed to size and select hydraulic and pneumatic components.

2) THINKING SKILLS: This course will help students improve the effectiveness of their thinking skills through:
   a. Develop test taking skills
   b. Analyze problems and propose solutions
3) COMMUNICATIONS SKILLS: This course will help students improve their oral and written communication skills through:
   a. Demonstrate both written and oral communication skills during lab presentations
   b. Interact and collaborate other students in lab assignments

4) HUMAN DIVERSITY: This course will help students recognize, understand, and appreciate human diversity through:
   a. Help students recognize, understand and appreciate working in groups to solve problems

TOPICS TO BE COVERED:
1. Hydraulic motor volumetric/mechanical/overall efficiencies
2. Hydraulic motor starting efficiencies
3. Hydraulic motor starting pressure
4. Hydraulic motor torque (running/start-up)
5. Hydraulic motor output torque under load at start-up
6. Hydraulic motor displacement and selection factors
7. Gear reducer requirements
8. Selecting gear reducer ratios
9. Applications for motor/gear reducer combinations
10. Hydraulic pump selection factors
11. Hydraulic pump efficiencies
12. Pump displacement selection factors
13. Cylinder selection factors
14. Cylinder force/pressure
15. Rolling resistance and grade resistance
16. Adhesion coefficient
17. Tractive effort/drawbar pull
18. Vehicle torque/wheel RPM
19. Accumulator applications
20. Sizing accumulators
21. Accumulator selection factors
22. SCFM for air cylinder (dcv sizing)
23. SCFM for air cylinder (compressor flow)
24. CV for directional control valves
25. Efficiency for dual PSI circuits
26. SCFM for air motor
27. Air motor torque
28. Hydraulic system heat generation
29. Open center system heat loads
30. Closed center system heat loads
31. Tandem center systems
32. Vented relief valve systems
33. High-low systems
34. HP limiting systems
COURSE LEARNING OUTCOMES (GENERAL):
1. The student will be demonstrate the ability to size and select hydraulic and pneumatic components to meet different system requirements.

STUDENT LEARNING OUTCOMES (SPECIFIC):
1. Evaluate hydraulic motor efficiencies
2. Identify hydraulic motor starting pressure
3. Assess hydraulic motor torque
4. Examine hydraulic motor displacement and selection factors
5. Examine gear reducer application requirements and ratios
6. Identify hydraulic pump selection factors and efficiencies
7. Identify cylinder selection factors
8. Calculate cylinder force/pressure
9. Calculate rolling and grade resistance
10. Determine adhesion coefficient
11. Examine vehicle tractive effort/drawbar pull/torque and wheel RPM
12. Identify accumulator applications, sizing and selection factors
13. Calculate SCFM for pneumatic system components
14. Determine CV for directional control valves
15. Calculate efficiency for dual PSI circuits
16. Calculate air motor SCFM and torque
17. Calculate hydraulic system heat generation
18. Calculate open and closed center system heat loads
19. Design and implement tandem center systems
20. Design and implement vented relief valve systems
21. Design and implement high-low systems
22. Examine horse power limiting systems

LEARNING/TEACHING TECHNIQUES used in the course are:
- Collaborative Learning
- Problem Solving
- Student Presentations
- Interactive Lectures
- Creative Projects
- Individual Coaching
- Lecture
- Films/Videos/Slides
- Demonstrations
- Other (describe below)
- Lab

ASSIGNMENTS AND ASSESSMENTS FOR THIS CLASS INCLUDE:
- Reading
- Tests
- Oral Presentations
- Individual Projects
- Textbook Problems
- Collaborative Projects
- Group Problems
- Term Paper
- Other (describe below)

Veteran Services: Minnesota West is dedicated to assisting veterans and eligible family members in achieving their educational goals efficiently. Active duty and reserve/guard military members should advise their instructor of all regularly scheduled military
appointments and duties that conflict with scheduled course requirements. Instructors will make every effort to work with the student to identify adjusted timelines. If you are a veteran, please contact the Minnesota West Veterans Service Office.

The information in this course outline is subject to revision

To receive reasonable accommodations for a documented disability, please contact the campus Student Services Advisor or campus Disability Coordinator as arrangements must be made in advance. In addition, students are encouraged to notify their instructor.

This document is available in alternative formats to individuals with disabilities by contacting the Student Services Advisor or by calling 800-658-2330 or via your preferred Telecommunications Relay Service.

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Revised 10/1/16