

MECHANIZED SYSTEMS MANAGEMENT MSYM 232 -- Power and Machinery Principles

COURSE SYLLABUS

Aug 2021

Lecture Location and Time: CHA 116, 11:00 – 11:50 a.m. on Tuesdays and Thursdays
Laboratory Location and Time: SPL 102, Section 151, 3:00 – 4:50 p.m. on Thursdays
Section 152, 3:00 – 4:50 p.m. on Wednesdays

Instructor

Sam Marx
202 Splinter
Phone: 472-3949
E-mail: smarx2@unl.edu

Office Hours

W: 10:00-12:00
or by appointment

Description

MSYM 232. Power and Machinery Principles (3 cr II) Lec. 2, Lab 2.

Prereq.: MSYM 109 or PHYS 141 or PHYS 151 or PHYS 211. Operational characteristics of IC engines; field, materials-handling, and processing machines and their components. Includes analyses, estimations, and objective comparisons of performance; principles for adjustment and calibration of metering systems; and cost-effective sizing of machines. Exercises include using ASABE Standards and available reports of machine performance (tractor test reports, etc.).

Objectives

Upon completion of this course, students should be able to:

1. Describe operation, characteristics, and energy efficiency of power systems: internal combustion engines, electric motors (MSYM Outcomes 1 and 3).
2. Analyze torque/force/pressure, speed/flow rate, and power of mechanical drive trains: V-belt, chain, gear, U-joint, clutch, and hydraulic (ABET Outcome 1 and MSYM Outcomes 1, 3, and 4).
3. Analyze tractor performance (pull, slip, tractive efficiency, fuel efficiency, ballasting, estimate draft of planting and tillage equipment) (ABET Outcome 1 and MSYM Outcomes 1, 3, and 4).
4. Evaluate field machines for proper performance (planters, chemical applicators, etc.) (MSYM Outcomes 1, 3, and 4).
5. Determine field equipment optimum size (capacity, efficiency, costs, timeliness) (ABET Outcomes 1 and 4, and MSYM Outcomes 1, 3, and 4).
6. Select materials handling equipment (augers, conveyors, bucket elevators, pneumatic) to meet capacity and performance requirements (MSYM Outcome 5).
7. Demonstrate each of the five behaviors of an effective team member at least at the (CATME) Expected Behavior level (ABET Outcome 5).
8. Appropriately locate and use technical literature (ASABE Standards, NTTL tractor test reports) (ABET Outcome 7 and MSYM Outcome 7).

ABET Outcomes (assignments from this course will be used to assess student attainment of the

following ABET Outcomes):

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

MSYM Outcomes Upon graduation, Mechanized Systems Management graduates will:

1. Have a basic understanding of physical and biological sciences, social sciences, and humanities.
2. Have developed essential communication and leadership skills.
3. Have a fundamental background in scientific agriculture.
4. Understand the function, layout, application, and management of agricultural equipment and mechanized operations.
5. Be able to integrate equipment in systems.
7. Understand that professionalism involves continuing education.

Methods

This course is taught as a lecture/laboratory course. Lecture topics will be supplemented with assignments of homework problems to develop proficiency with operation, characteristics, use of technical literature, analyses, and estimations of machine performance, and equipment selection. Laboratory activities will include developing effective teamwork involving machine and analysis activities related to the lecture topics.

Required Materials

No textbook is required for this class. Students must be able to access class information in Canvas and technical literature available online. Students must have a scientific calculator for use on homework, labs, and exams. Students will be required, according to University Policy and State Law, to wear Industrial Quality eye protection when participating in lab activities that may result in hazards to the eyes.

References

Selected ASABE Standards and other works (pdf documents provided in Canvas).

Grading System

<u>Component of Work</u>	<u>Percentage of Course Average</u>	<u>Estimated Point Total</u>
Homework	20%	650
Lab assignments ¹	20%	900
Exams	40%	250
Final Exam	20%	100

¹ The lab grade will include a factor based on evaluation by lab group members

Semester <u>Average</u>	<u>Grade</u>	Semester <u>Average</u>	<u>Grade</u>	Semester <u>Average</u>	<u>Grade</u>
96.7 – 100%	A+	83.3 – 86.7%	B	70.0 – 73.3%	C-
93.3 – 96.7%	A	80.0 – 83.3%	B-	66.7 – 70.0%	D+
90.0 – 93.3%	A-	76.7 – 80.0%	C+	63.3 – 66.7%	D
86.7 – 90.0%	B+	73.3 – 76.7%	C	60.0 – 63.3%	D-
				0 – 60.0%	F

The semester average will be determined as a composite of the homework, laboratory, exam, and final exam grades. See the Laboratory Exercises section below for the description of the impact of your evaluation by your lab group members on the laboratory portion of your grade. The portion each component contributes to the semester average is shown in the table above. The grade assigned will be based on the semester average as shown in the table above. The instructor reserves the right to adjust the scale. Borderline grades will be decided based on completion of homework, labs and class participation.

Pass/No Pass option – Students enrolled under this grading option must achieve at least the minimum percentage required for a grade of C to receive a passing grade (P). See <https://registrar.unl.edu/academic-standards/grade-information/>.

University policy regarding grades of I (incomplete) (<https://registrar.unl.edu/academic-standards/policies/incomplete-grade/>) and W (withdraw) (<https://registrar.unl.edu/student/registration/add-drop-withdraw/#Withdrawals>) will be followed in this course.

Homework

Homework must be neatly done following the format presented in this section. Assignments not submitted at the scheduled time will be worth ½ of the earned credit if submitted within one week of the scheduled time. Homework assignments submitted more than one week late will not be accepted. The format for homework problems should include: a brief summary of the problem, all concept equations used, definitions of all variables shown in the concept equation(s) with given data, all algebra and calculation work, units shown all the way through the problem with a unit analysis, and the answer(s) should be identified (boxed, circled, etc.) and labeled. Clear, orderly and neat communication of the process used to solve problems, as well as accuracy is very important so points will be awarded based on adherence to this format.

Laboratory Exercises

Most people learn best by doing, and lab is where you get to work with the concepts and principles discussed in lecture. As best I can, I will have the handout for lab available in Canvas on Tuesday each week. Read the lab exercise and make any preparations you can before the lab period in order to save time in lab. Some lab periods will be devoted to exercises for you to complete. Other lab periods may be used: as recitations (homework help sessions), to work through extensive analyses, to review for exams, and to take exams.

Learning to write good lab reports is critical to your success after graduation. Those who do good technical work in an efficient manner and prepare a concise, well written report will be appreciated more (larger raises, faster promotions) than those who don't. Laboratory reports not submitted at the scheduled time will be worth ½ the credit earned if submitted within one week

of the scheduled time. Lab reports submitted more than one week late will not be accepted. Lab work will be done in teams, with one report due from each team, unless otherwise stated.

Attendance Policy

Attendance at all officially scheduled class meetings (class and lab sections) is expected. Students are responsible for knowing all material discussed in class meetings. Changes to the class and lab schedules and assignments will be announced in class, lab or in the announcements page in Canvas.

Academic Dishonesty

Students are expected to adhere to guidelines concerning academic dishonesty described in the UNL Student Code of Conduct (<http://stuafs.unl.edu/ja/code/>), particularly Article III, Section B. The BSE Department documentation regarding academic dishonesty can be accessed at <https://engineering.unl.edu/bse/bse-academic-resources/> under the heading “Planning for Success”. Students are encouraged to contact the instructor for clarification of these guidelines if they have questions or concerns.

Exams

Exams are tentatively scheduled to be given in the laboratory sections on September 29/30 and November 3/4. Questions and problems on the exams will be from the learning objectives as announced in class and/or in Canvas approximately one week before each exam. Alternate exam times, or makeup exams may be arranged at the discretion of the instructor if arrangements are made **in advance**.

Final Exam

The final examination will be given on Monday, December 23, 2021 from 10:00 a.m. to noon in the room normally scheduled for lecture.

Information for Emergency Response

Fire Alarm (or other evacuation): In the event of a fire alarm: gather belongings (purse, keys, cell phone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to building unless told to do so by emergency personnel.

Tornado Warning: When sirens sound, move to the lowest interior area of building or designated shelter. Stay away from windows and stay near in inside wall when possible.

Active Shooter

Evacuate: If there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions.

Hide out: If evacuation is impossible secure yourself in your space by turning out lights, closing blinds and barricading doors if possible.

Take action: As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter.

UNL Alert: Notifications about serious incidents on campus are sent via text message, email, unl.edu website, and social media. For more information go to: <https://unlalert.unl.edu/unlalert/>. Additional emergency planning and preparedness information can be accessed at: <https://emergency.unl.edu>.

Services for Students With Disabilities

Students with disabilities are encouraged to contact the instructor or teaching assistant for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodations to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 ADMN, 402-472-3787, <https://www.unl.edu/ssd/>.

COVID Guidelines

This course has a lab section, a such university policy states:

Students in this course must work in close physical proximity to one another for extended periods of time in order to achieve the academic goals of the course. For this reason, the Department of Biological Systems Engineering and the College of Agricultural Sciences and Natural Resources have determined that face coverings will be required in this course. If you are unwilling to comply with this requirement, please visit with your advisor about possible alternative courses that you might take in lieu of this one.

As of now, it is my understanding that masks will not be required in the lecture portion of this course. However, be prepared to have that policy amended at any time during the course. I will send an announcement through Canvas should this policy change at any time. It would be a good idea to keep a mask with you when on campus to ensure the ability to wear a mask should the situation depend upon it.

For more information and to see up to date policy changes, please visit: <https://covid19.unl.edu/>

MSYM 232 Power and Machinery Principles
TENTATIVE class schedule, Fall 2021

Week/Date	Topic	Assignment	Assignment due date
1. 8/24	Intro & First Day, 1. Power source efficiencies, IC engines, electric motors		
1. 8/26	1. Power source efficiencies, IC engines, electric motors		
2. 8/31	1. Power source efficiencies, IC engines, electric motors	Homework 1	9/7
2. 9/2	2. Mechanical Power Transmission		
3. 9/7	2. Mechanical Power Transmission		
3. 9/9	2. Mechanical Power Transmission		
4. 9/14	2. Mechanical Power Transmission	Homework 2a	9/21
4. 9/16	2. Mechanical Power Transmission		
5. 9/21	2. Mechanical Power Transmission		
5. 9/23	2. Mechanical Power Transmission	Homework 2b	9/30
6. 9/28	3. Tractor Performance and Testing		
6. 9/30	3. Tractor Performance and Testing		
7. 10/5	3. Tractor Performance and Testing	Homework 3	10/12
7. 10/7	4. Planting Machines		
8. 10/12	4. Planting Machines		
8. 10/14	4. Planting Machines	Homework 4	10/21
9. 10/19	Fall Break-No Class		
9. 10/21	5. Chemical Application		
10. 10/26	5. Chemical Application	Homework 5	11/2
10. 10/28	6. Machine Efficiencies and Capacities		
11. 11/2	6. Machine Efficiencies and Capacities	Homework 6	11/9
11. 11/4	7. Machine Costs		
12. 11/9	7. Machine Costs		
12. 11/11	8. Machine Size Selection		
13. 11/16	8. Machine Size Selection		
13. 11/18	9. Materials Handling Equipment		
14. 11/23	9. Materials Handling Equipment	Homework 7	12/2
14. 11/25	Thanksgiving-No Class		
15. 11/30	10. Irrigation Equipment		
15. 12/2	10. Irrigation Equipment		
12/7&9	Catch Up/Review		
12/13-17	Final Exam week		

MSYM 232 Power and Machinery Principles
TENTATIVE Lab schedule, Fall 2021

Week/Date	Topic	Assignment	Assignment due date
1. 8/25,26	Lab 1 Homework format, Excel, Equation editor, Team Assignments	Lab 1/Team Flyer	9/1,2
2. 9/1,2	Lab 2 Larsen Tractor Museum Tour/I.C. Engine Theory	Lab 2	9/8,9
3. 9/8,9	Lab 3 Gears, Chains, Belts	Lab 3	9/15,16
4. 9/15,16	Lab 4 U-Joints/Hyd. Cylinders	Lab 4	9/29,30
5. 9/22,23	Lab 5 Career Fairs	Lab 5	9/29,30
6. 9/29,30	Exam 1		
7. 10/6,7	Lab 6 NTTL Tour	Lab 6	10/13,14
8. 10/13,14	Lab 7 Tractor Ballasting	Lab 7	10/20,21
9. 10/20,21	Lab 8 Chemical Application	Lab 8	10/27,28
10. 10/27,28	Lab 9 Field Efficiencies	Lab 9	11/3,4
11. 11/3,4	Exam 2		
12. 11/10,11	Lab 10 Machine Costs	Lab 10	11/17,18
13. 11/17,18	Lab 11 Machine Size	Lab 11	11/24,25
14. 11/24,25	Thanksgiving-No Lab		
15. 12/1,2	Lab 12 Irrigation Equipment	Lab 12	12/8,9
12/8,9	Review for Final Exam/Optional Final		
12/13-17	Final Exam week		