



CREDIT COURSE OUTLINE

I. COVER PAGE

(1) MAG 30	(2) EQUIPMENT TECHNICIAN: ELECTRICAL, HYDRAULIC SYSTEMS, & WELDING	(3) 11
Number	Title	Units

(4) Lecture / Lab Hours:	(8) Classification:	
Course Hours		
Weekly Lec hours: 8.00	Degree applicable:	X
Weekly Lab hours: 9.00	Non-degree applicable:	
Total Contact hours: 306.00	Basic skills:	
Lec will generate __ hour(s) outside work.	(9) RC Fulfills AS/AA degree requirement: (area)	
Lab will generate __ hour(s) outside work.	General education category:	
(5) Grading Basis: Grading Scale Only X	Major:	
Pass/No Pass option	Certificate of:	
Pass/No Pass only	Certificate in:	
(6) Advisories:	(10) CSU Baccalaureate:	X
(7) Pre-requisites (requires C grade or better):	(11) Repeatable: (A course may be repeated three times)	0
• Eligibility for English 252, English 262, and Mathematics 256	(12) C-ID:	
Corequisites:	Proposed Start Date:	Fall 2012

(12) Catalog Description:
 This course provides in-depth instruction in machine electrical systems, hydraulic systems found on mobile equipment, and welding and fabrication skills common to agriculture and construction equipment. Students will receive hands-on training on starting, charging, and electronic monitoring systems as they develop analytical skills needed for service and repair of diesel equipment. Hydraulic fundamentals and troubleshooting techniques will be reinforced through machine testing and adjusting. Students will also receive training and instruction in welding and fabrication principles and applications required for the entry level equipment technician.

II. COURSE OUTCOMES:

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

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

- I. Troubleshoot and repair common electrical problems and failures found on 12 and 24 volt direct current systems.
- II. Service, troubleshoot, and repair hydraulic and hydrostatic systems.
- III. Fabricate or repair tools, implements, and machines.

III. COURSE OBJECTIVES:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

- I. Demonstrate proper safety procedures related to electrical systems as well as the tools and equipment used to repair these systems.
- II. Explain the difference between electron and conventional theories of electricity.
- III. Use Ohm's law as it applies to series and parallel circuits to determine voltage, resistance and amperage.
- IV. Demonstrate knowledge of the laws and applications of magnets, electromagnets and magnetic fields.
- V. Demonstrate the ability to use digital multimeters and ammeters to measure voltage, resistance and amperage on various systems.
- VI. Analyze 12 and 24 volt starting systems using a digital voltmeter and ammeter and perform basic repairs to these systems.
- VII. Analyze 12 and 24 volt charging systems using digital voltmeter and ammeter and perform basic repairs to these systems.
- VIII. Troubleshoot and repair lighting and accessory systems used on mobile equipment.
- IX. Read, draw and interpret electrical schematics to perform basic electrical repairs on equipment.
- X. Use computer diagnostic tools to retrieve fault codes and perform diagnostic analysis of machine electrical systems.
- XI. Demonstrate the ability to diagnose and repair circuit faults such as opens, shorts and resistive faults.
- XII. Demonstrate the ability to use schematics to wire machine electrical systems.
- XIII. Diagnose and repair electronic monitoring systems.
- XIV. Demonstrate the ability to make repairs to various electrical connectors and wiring harnesses.

- XV. Demonstrate proper safety procedures relating to hydraulics as well as the tools and equipment used to repair these systems.
- XVI. Explain the physical laws related to enclosed liquids.
- XVII. Test basic hydraulic principles on systems including open and closed center systems.
- XVIII. Explain the principles of hydrostatic systems and their application.
- XIX. Evaluate gear, vane, and piston pumps/motors and their controls.
- XX. Describe the proper application of pressure, directional, and volume control valves.
- XXI. Demonstrate the proper function and operation of various hydraulic valves.
- XXII. Identify various hydraulic cylinders and describe their operation.
- XXIII. Solve problems involving pressure and flow to determine hydraulic cylinder force and speed.
- XXIV. Identify various hydraulic accumulators and describe their operation.
- XXV. Create a hydraulic hose assembly utilizing industry standards.
- XXVI. Identify fluid power fittings including STOR, ORFS, JIC, SAE, and NPTF.
- XXVII. Evaluate different filters based on efficiency, construction, and materials.
- XXVIII. Perform basic hydraulic maintenance procedures.
- XXIX. Use hydraulic system nomenclature and symbols to read and interpret schematics.
- XXX. Link principles of hydraulic theory to machine systems by interpreting pressure and flow readings from gauges.
- XXXI. Safely diagnose, troubleshoot, and adjust hydraulic and hydrostatic systems utilizing pressure gauges, flow gauges, and appropriate service literature.
- XXXII. Demonstrate proper safety procedures relating to welding and fabrication as well as the tools and equipment used.
- XXXIII. Demonstrate proper welding techniques using shielded metal arc welding, metal inert gas processes, and oxy-fuel processes.
- XXXIV. Prepare metal and materials for welding.
- XXXV. Demonstrate an understanding of the terminology associated with various welding processes.
- XXXVI. Select and order appropriate materials and supplies to construct a project.
- XXXVII. Demonstrate proper cutting technique using oxy-fuel processes and plasma processes.
- XXXVIII. Construct a project approved by the instructor.
- XXXIX. Accurately use measuring tools such as tape measures and squares to measure and lay out projects.
 - XL. Develop basic drawings and materials lists needed to construct a project.
 - XLI. Identify and use various hand and power tools related to welding and fabrication.

IV. COURSE OUTLINE:

Lecture Content:

- A. Shop Safety Practices
- B. Metals
- C. Arc Welding Processes
- D. Oxyacetylene Welding Processes
- E. Project Design and Construction
- F. Theory of Electricity
- G. Electrical Diagnostic Equipment
- H. Starting Systems
- I. Charging Systems
- J. Accessory Circuits
- K. Electronic Monitoring Systems
- L. Basic Principles of Hydraulics
- M. Hydraulic Pumps and Motors
- N. Hydraulic Valves
- O. Hydraulic Cylinders
- P. Hydraulic Accessories
- Q. General Maintenance
- R. Diagnosis and Testing of Hydraulic Systems

Lab Content:

- Electrical Labs
- Lab 1: CAT DMM, Electrical Symbols and Schematics
- Lab 2: Current, Volts, and Resistance Measurements
- Lab 3: Machine Component Identification and Location
- Lab 4: Series and Parallel Circuits
- Lab 5: Testing Relays, Diodes, and Transistors
- Lab 6: Battery Load Test
- Lab 7: Starting System Tests
- Lab 8: Electrical Connector
- Lab 9: Alternator Output Test
- Lab 10: Building Circuits
- Lab 11: Troubleshooting Circuits
- Lab 12: Testing Components
- Lab 13: Engine Wiring
- Lab 14: Machine Electrical Troubleshooting
- Hydraulic Labs
- Lab 1: Intro to Hydraulic Trainers
- Lab 2: Relief Valve Operation and Resistance in Parallel
- Lab 3: Machine Component Identification
- Lab 4: Filters and Fluids

- Lab 5: Hydraulic Hoses
- Lab 6: Gear Pumps
- Lab 7: Vane Pumps
- Lab 8: Piston Pumps
- Lab 9: Cylinders
- Lab 10: Control Valves
- Lab 11: Disassemble and Assemble Backhoe Control Valves
- Lab 12: Pressure Control Valves
- Lab 13: D3C Hydrostatic Tests
- Lab 14: PSI Readings on 246 Skid Steer Loader
- Lab 15: PSI Readings on IT 14G Loader
- Lab 16 PSI Readings on 416C Backhoe
- Lab 17: PSI Readings on Challenger 65
- Welding Labs
- Lab 1: Oxyacetylene Welding Assignments
- Lab 2: Oxyacetylene Cutting
- Lab 3: Shielded Metal Arc Welding Assignments
- Lab 4: Gas Metal Arc Welding Assignments
- Lab 5: Project Plans and Bill of Materials
- Lab 6: Project Construction

V. APPROPRIATE READINGS

Reading assignments may include but are not limited to the following:

- I. Sample Text Title:
 1. Recommended - FOS *Welding*, ed. 9th John Deere, 2008,
 2. Recommended - CAT *Machine Electrical Systems*, Caterpillar, Inc, 2004,
 3. Recommended - CAT *Hydraulics*, Caterpillar, Inc., 2004,
- II. Other Readings
 1. Recommended - *Service and Repair manuals in text and computer format.*
 2. Required - *Provided by instructor*

- Global or international materials or concepts are appropriately included in this course
- Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

A. Writing			
Check either 1 or 2 below			
X	1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.		
	2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.		
X	a) essay exam(s)	X	d) written homework
X	b) term or other paper(s)		e) reading reports
X	c) laboratory report(s)		f) other (specify)

Required assignments may include but are not limited to the following:

Service reports will be written for all lab assignments. Students will complete lab write-ups and reports outlining service literature used, procedures followed, and details concerning machine or system status.
See Attached CAT Equipment Technician Service Report

B. Problem Solving			
Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)	X	d) laboratory reports
X	b) quizzes	X	e) field work
X	c) homework problems		f) other (specify):

Required assignments may include but are not limited to the following:

Problem solving activities to include:
 Calculating force, pressure, area, and volume of hydraulic actuators.
 Troubleshooting electrical systems using voltage, amperage, and resistance measurements.
 Troubleshooting hydraulic systems utilizing pressure and flow.

C. Skill demonstrations, including:			
X	a) class performance(s)	X	c) performance exams(s)
X	b) field work		d) other (specify)

Required assignments may include but are not limited to the following:

Skill demonstrations to include:
 Measuring voltage, resistance, and amperage in a given electrical circuit.
 Measuring pressure and flow in a given hydraulic circuit.
 Performing various welding procedures.

D. Objective examinations including:			
X	a) multiple choice	X	d) completion
X	b) true/false	X	e) other (specify): Drawing schematics, short answer
X	c) matching items		

COURSE GRADE DETERMINATION:

Description/explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.

Exams and Quizzes 25% Assignments 25% Lab Participation 25% Lab Assignments 25%

VII. EDUCATIONAL MATERIALS

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):	College-Level Criteria Met	
	YES	NO
Textbook	<u> X </u>	<u> </u>
Reference materials	<u> X </u>	<u> </u>
Instructor-prepared materials	<u> X </u>	<u> </u>
Audio-visual materials	<u> X </u>	<u> </u>

Indicate Method of evaluation:

Used readability formulae (grade level 10 or higher)
 Text is used in a college-level course X
 Used grading provided by publisher
 Other: (please explain; relate to Skills Levels)

<i>Computation Level</i> (Eligible for MATH 101 level or higher where applicable)	<u> </u>	<u> X </u>
Content		
Breadth of ideas covered clearly meets college-level learning objectives of this course	<u> X </u>	<u> </u>
Presentation of content and/or exercises/projects:		
Requires a variety of problem-solving strategies including inductive and deductive reasoning.	<u> X </u>	<u> </u>
Requires independent thought and study	<u> X </u>	<u> </u>
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.	<u> X </u>	<u> </u>
List of Reading/Educational Materials		
Recommended - FOS <i>Welding</i> , ed. 9th John Deere, 2008,		
Recommended - CAT <i>Machine Electrical Systems</i> , Caterpillar, Inc, 2004,		
Recommended - CAT <i>Hydraulics</i> , Caterpillar, Inc., 2004,		

Comments:

- _____ This course requires special or additional library materials (list attached).
 _____ This course requires special facilities:
X Requires Adequate Shop Facilities

Attached Files:

[CAT Equipment Technician Service Report](#)

BASIC SKILLS ADVISORIES PAGE The skills listed are those needed for eligibility for English 125, 126, and Math 201. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

Check the appropriate spaces.

- _____ Eligibility for Math 201 is advisory for the target course.
 _____ Eligibility for English 126 is advisory for the target course.
 _____ Eligibility for English 125 is advisory for the target course.

If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.

REQUISITES

Prerequisite -- ENGL 260 BASIC READING

- | | |
|---|--|
| <ul style="list-style-type: none"> • apply a variety of skills (including use of dictionary) to determine definitions of new vocabulary words while reading text. • apply a variety of prereading, reading and postreading strategies that facilitate comprehension of below 8th grade level texts. • distinguish between major supporting details and minor supporting details in text. • interpret visual data and determine its supporting relationship to text. | <ul style="list-style-type: none"> • Evaluate gear, vane, and piston pumps/motors and their controls. • Identify fluid power fittings including STOR, ORFS, JIC, SAE, and NPTF. • Evaluate different filters based on efficiency, construction, and materials. • Use hydraulic system nomenclature and symbols to read and interpret schematics. • Demonstrate the ability to use schematics to wire machine electrical systems. • Explain the principles of hydrostatic systems and their application. • Demonstrate an understanding of the terminology associated with various welding processes. • Explain the difference between electron and conventional theories of electricity. • Read, draw and interpret electrical schematics to perform basic electrical repairs on equipment. • Use computer diagnostic tools to retrieve fault codes and perform diagnostic analysis of machine electrical systems. • Explain the physical laws related to enclosed liquids. |
|---|--|

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

_____ Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.

Justification: Indicate how this is so.

_____ The health or safety of the students in this course requires the prerequisite.

Justification: Indicate how this is so.

_____ The prerequisite course is part of a sequence of courses within or across a discipline.

_____ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.

Justification: Indicate how this is so.

_____ The prerequisite/corequisite is required by law or government regulations.

Explain or cite regulation numbers:

_____ The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

X The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

___ Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

Justification: In order for students to be successful as Power Equipment Technicians they need to be able to read and comprehend text. Our industry advisory committee strongly recommends this course as a prerequisite.

Prerequisite -- ENGL 252 Writing Improvement

- unified supporting details for each body paragraph which begin with a topic sentence
- complete sentences which includes correct capitalization, spelling, use of homophones, etc.
- an avoidance of major grammatical errors including verb tense issues, subject-verb agreement, pronoun agreement problems, fragments, fused sentences and comma splices
- writing that is free from plagiarism
- an evaluation and analysis of ideas at the appropriate course level
- appropriate use of academic language and descriptive vocabulary
- Plan and revise with guidance, employing all stages of the writing process when necessary.

- Demonstrate knowledge of the laws and applications of magnets, electromagnets and magnetic fields.
- Troubleshoot and repair lighting and accessory systems used on mobile equipment.
- Evaluate different filters based on efficiency, construction, and materials.
- Develop basic drawings and materials lists needed to construct a project.
- Explain the difference between electron and conventional theories of electricity.
- Read, draw and interpret electrical schematics to perform basic electrical repairs on equipment.
- Demonstrate the ability to diagnose and repair circuit faults such as opens, shorts and resistive faults.
- Explain the physical laws related to enclosed liquids.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

___ Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.

Justification: Indicate how this is so.

___ The health or safety of the students in this course requires the prerequisite.

Justification: Indicate how this is so.

___ The prerequisite course is part of a sequence of courses within or across a discipline.

___ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.

Justification: Indicate how this is so.

___ The prerequisite/corequisite is required by law or government regulations.

Explain or cite regulation numbers:

___ The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

___ Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

Justification: In order for students to be successful as Power Equipment Technicians they need to be able to write. Our industry advisory committee strongly recommends this course as a prerequisite.

Prerequisite -- MATH 250 COLLEGE ARITHMETIC

- Apply the four arithmetic operations to fractions.
- Apply the four arithmetic operations to integers.
- Apply the four arithmetic operations to decimals.

- Demonstrate the ability to use digital multimeters and ammeters to measure voltage, resistance and amperage on various systems.
- Analyze 12 and 24 volt starting systems using a digital voltmeter and ammeter and perform basic repairs to these systems.
- Analyze 12 and 24 volt charging systems using digital voltmeter and ammeter and perform basic repairs to these systems.
- Solve problems involving pressure and flow to determine hydraulic cylinder force and speed.
- Link principles of hydraulic theory to machine systems by interpreting pressure and flow readings from gauges.
- Safely diagnose, troubleshoot, and adjust hydraulic and hydrostatic systems utilizing pressure gauges, flow gauges, and appropriate service literature.
- Accurately use measuring tools such as tape measures and squares to measure and lay out projects.
- Use Ohm's law as it applies to series and parallel circuits to determine voltage, resistance and amperage.
- Explain the physical laws related to enclosed liquids.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.

Justification: Indicate how this is so.

The health or safety of the students in this course requires the prerequisite.

Justification: Indicate how this is so.

The prerequisite course is part of a sequence of courses within or across a discipline.

The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.

Justification: Indicate how this is so.

The prerequisite/corequisite is required by law or government regulations.

Explain or cite regulation numbers:

The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

Justification: In order for students to be successful as Power Equipment Technicians they need to be able to do basic math. Our industry advisory committee strongly recommends this course as a prerequisite.

JUSTIFICATION OF LIMITATION ON ENROLLMENT

Enrollment in courses or blocks of courses may be limited based on performance, honors, or other performance based criteria. Be mindful of the disproportionate impact the limitation will have on specific groups of students. It is important to determine if the limitation will disproportionately keep under-represented students from enrolling in the course or block of courses.

Describe the reasons for limiting the enrollment.

Course Designator: MAG 30

Course Title(s): EQUIPMENT TECHNICIAN: ELECTRICAL, HYDRAULIC SYSTEMS, & WELDING

Rationale for Limiting Enrollment:

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