



**CREDIT COURSE OUTLINE**

**I. COVER PAGE**

(1) MAG 30

(2) EQUIP TECH: ELECTRICAL, HYDRAULIC SYSTEMS, & WELDING

(3) 11

Number	Title	Units
(4)	Lecture / Lab Hours: Total Course Hours Total Lec hours: 144.00 Total Lab hours: 162.00 Total Contact hours: 306.00 Lec will generate <u>0</u> hour(s) outside work. Lab will generate <u>0</u> hour(s) outside work.	(8) Classification: Degree applicable: X Non-degree applicable: Basic skills:
(5)	Grading Basis: Grading Scale Only X Pass/No Pass option Pass/No Pass only	(9) RC Fulfills AS/AA degree requirement: (area) General education category: Major: MECHANIZED AGRICULTURE Certificate of: MECHANIZED AGRICULTURE Certificate in:
(6)	Advisories: Eligibility for Math 101 Eligibility for English 126 Eligibility for English 125	(10) CSU Baccalaureate: X (11) Repeatable: (A course may be repeated three times) 0
(7)	Pre-requisites (requires C grade or better): Corequisites:	

(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. Use acquired knowledge and skills to troubleshoot and repair common electrical problems and failures.
- II. Use acquired knowledge and skills to service, troubleshoot, or repair hydraulic and hydrostatic systems.
- III. Use acquired welding knowledge and skills to 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. Understand 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:

II. Other Readings

1. Recommended - *Machine Electrical Systems, Caterpillar, Inc. © 2004 Hydraulics, Caterpillar, Inc. © 2004 FOS Welding, John Deere, 8th edition, © 2000*
2. Recommended - *Service and repair manuals in text and computer format Supplemental materials 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.

<b>A. Writing</b>			
Check either 1 or 2 below			
X	<b>1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.</b>		
	<b>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.</b>		
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>B. Problem Solving</b>			
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.

<b>C. Skill demonstrations, including:</b>			
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.

<b>D. Objective examinations including:</b>			
X	a) multiple choice	X	d) completion
X	b) true/false	X	e) other (specify):
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)	<u>      </u>
Text is used in a college-level course	<u>      </u>
Used grading provided by publisher	<u>      </u>
Other: (please explain; relate to Skills Levels)	<u>      </u>

<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		

Comments:

       This course requires special or additional library materials (list attached).

X   This course requires special facilities:  
Requires Adequate Shop Facilities

Attached Files:

[CAT Equipment Technician Service Report](#)

<b>BASIC SKILLS ADVISORIES PAGE</b> The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least <u>three</u> major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.	
<p>(eligibility for Math 101) (as outcomes for Math 250)</p> <p><input type="checkbox"/> Performing the four arithmetic operations on whole numbers, arithmetic fractions, and decimal fractions.</p> <p><input type="checkbox"/> Making the conversions from arithmetic fractions to decimal fractions, from decimal fractions to percents, and then reversing the process.</p> <p><input type="checkbox"/> Applying the concepts listed above to proportions, percents, simple interest, markup and discount.</p> <p><input type="checkbox"/> Applying the operations of integers in solving simple equations.</p> <p><input type="checkbox"/> Converting between the metric and English measurement systems</p>	<ol style="list-style-type: none"> <li>1. Ability to measure and calculate allowable wear tolerances on powertrain components using micrometers and calipers.</li> <li>2. Ability to calculate fastener torque values in English and metric systems.</li> <li>3. Ability to calculate hydraulic system problems using force, pressure, and area of a cylinder.</li> <li>4. Ability to calculate electrical system problems using Ohm's Law and voltage, amperage, and resistance.</li> <li>5. Ability to convert metric prefixes for volts, amps, and ohms.</li> </ol>
<p>(eligibility for English 126) (as outcomes for English 262)</p> <p><input type="checkbox"/> Using phonetic, structural, contextual, and dictionary skills to attack and understand words.</p> <p><input type="checkbox"/> Applying word analysis skills to reading in context.</p> <p><input type="checkbox"/> Using adequate basic functional vocabulary skills.</p> <p><input type="checkbox"/> Using textbook study skills and outlining skills.</p> <p><input type="checkbox"/> Using a full range of literal comprehension skills and basic analytical skills such as predicting, inferring, concluding, and evaluating.</p>	<ol style="list-style-type: none"> <li>1. Ability to read and comprehend a textbook.</li> <li>2. Ability to read and comprehend various industry publications containing concepts and terms pertinent to subject.</li> <li>3. Ability to outline the textbook and classroom lectures, ideas, and analysis for unit tests, midterm, and final.</li> </ol>
<p>(eligibility for English 125) (as outcomes for English 252)</p> <p><input type="checkbox"/> Writing complete English sentences and avoiding errors most of the time.</p> <p><input type="checkbox"/> Using the conventions of English writing: capitalization, punctuation, spelling, etc.</p> <p><input type="checkbox"/> Using verbs correctly in present, past, future, and present perfect tenses, and using the correct forms of common irregular verbs.</p> <p><input type="checkbox"/> Expanding and developing basic sentence structure with appropriate modification.</p> <p><input type="checkbox"/> Combining sentences using coordination, subordination, and phrases.</p> <p><input type="checkbox"/> Expressing the writer's ideas in short personal papers</p>	<ol style="list-style-type: none"> <li>1. Ability to write lab reports.</li> <li>2. Ability to compose accurate and detailed industry machine service reports that record troubleshooting procedures and work performed.</li> <li>3. Ability to compose well organized analytical responses to short answer/essay question in unit tests, midterm, and final.</li> </ol>

utilizing the writing process in their development.

Check the appropriate spaces.

- Eligibility for Math 101 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.*

**CONTENT REVIEW**

**REQUISITES**

No requisites