



**CREDIT COURSE OUTLINE**

**I. COVER PAGE**

(1) MAG 20	(2) EQUIPMENT TECHNICIAN: DIESEL ENGINES, SERVICE FUNDAMENTALS, MACHINE SYSTEMS	(3) 11
Number	Title	Units

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

(12) Catalog Description:  
 This course provides in-depth instruction in diesel engines, service department skills and expectations, and specific instruction on agricultural and construction machines. The design and construction of diesel engines, principles and theories of operation, and dis-assembly and reassembly of engine components will be covered. Instruction on technical reference materials, parts and service books, computer systems and programs used by the service technician will be covered. Students will also receive training on the service and operation of various machine and engine systems common to the equipment industry.

**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. Successfully perform a diesel engine overhaul.
- II. Properly service, maintain and operate construction and agricultural equipment
- III. Enter the work force with the knowledge base, work ethic and employability skills required to become an equipment technician.

**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 relating to rebuilding diesel engines as well as the tools and equipment used to repair these systems
- II. Demonstrate the proper use of lifting tools
- III. Explain the theory and operation of a four-stroke engine
- IV. Explain compression ratio as it relates to diesel engines
- V. Demonstrate troubleshooting techniques used in industry
- VI. Utilize service literature for maintenance, service and repair practices
- VII. Demonstrate component rebuild of basic diesel engine components
- VIII. Identify engine system components
- IX. Describe the function of engine subsystem components
- X. Analyze and Identify the re-usability of diesel engine components
- XI. Demonstrate proper torquing techniques used on diesel engine repair

- XII. Demonstrate the ability to remove and install cylinder sleeves
- XIII. Demonstrate ability to diagnose and repair common engine starting problems
- XIV. Demonstrate proper safety procedures common to repair facilities
- XV. Demonstrate proper safety as applied in the use of hand tools
- XVI. Demonstrate the ability to use precision measuring tools
- XVII. Exhibit the use of service literature (Service Information Systems) including repair manuals and computerized/ web based resources
- XVIII. Define and describe the goals, objectives and corporate structure related to company operations
- XIX. Demonstrate the use of industry service reports
- XX. Identify company product lines
- XXI. Understand the importance of MSDS sheets
- XXII. Define the role of various safety organizations that pertain to the equipment repair industry
- XXIII. Demonstrate the ability to complete forms, time cards, and other written forms of communication
- XXIV. Demonstrate proper safety procedures related to construction and agricultural machine operation
- XXV. Perform walk around inspection on construction and agricultural equipment
- XXVI. Identify components on various types of construction and agricultural equipment
- XXVII. Demonstrate service procedure on different construction and agricultural equipment types
- XXVIII. Demonstrate proper implement hitching and unhitching on construction and agricultural equipment
- XXIX. Effectively complete lift truck operation training
- XXX. Identify service points on construction and agricultural equipment

#### IV. COURSE OUTLINE:

#### Lecture Content:

- A. Introduction to Diesel Engines
  - 1. Safety
  - 2. Tools and equipment
  - 3. Engine oil and diesel fuel
  - 4. Cycle operation/combustion chamber
  - 5. Basic engine components
  - 6. Engine disassembly
- B. Diesel Engine Components and Service
  - 1. Cylinder block
  - 2. Camshaft
  - 3. Crankshaft
  - 4. Piston and rings
  - 5. Cylinder head and valves
- C. Diesel Engine Systems
  - 1. Air intake systems
  - 2. Exhaust systems
  - 3. Cooling systems
  - 4. Lubricating systems
- D. Fuel Injection Systems
  - 1. Governors
  - 2. Emission controls
  - 3. Fuel injection nozzles and holders
  - 4. Lubricating systems
- E. Electrical Systems
  - 1. Electricity and magnetism
  - 2. Electrical systems
  - 3. Batteries
  - 4. Starting systems
  - 5. Charging systems
- F. Troubleshooting Diesel Engines
  - 1. Proper starting procedure
  - 2. Diagnosis
  - 3. Tune-up
- G. Introduction to Machine Specific Instruction
  - 1. Role of equipment technician
  - 2. Technical reference material
  - 3. Machine/shop safety
- H. Machine Operation, Pre-delivery Inspection, Machine Operation, and Preventive Maintenance
  - 1. Track-type tractors
  - 2. Hydraulic excavators
  - 3. Wheel loaders
  - 4. Challenger agriculture tractors
  - 5. Backhoe loaders

## 6. Forklifts

- I. Review of machine types, service department forms, and technical manuals
- J. Service Department Policies and Procedures
  1. Personnel management – time cards, hours worked, salary/benefits
  2. Customer relations
  3. Work assignments
  4. Personal tools
  5. In-service training
- K. Service Work Orders
  1. Preparation
  2. Itemizing parts
  3. Recording time spent
  4. Communicating with customers
- L. Technical Reference Material
  1. Serial numbers and models
  2. Operators manuals
  3. Service manuals
  4. Service fiche/computer
  5. Machinery updates
- M. Parts Orders
  1. Parts books
  2. Parts fiche/computer
  3. Procedures and forms
  4. Proper nomenclature and numbers
- N. Time Management/Warranty
  1. Employee productivity
  2. Flat rates
  3. Hourly rates
  4. Processing warranties

### **Lab Content:**

#### Diesel Engines

- Lab 1: 3406 B Engine Data
- Lab 2: Four Stroke Operation
- Lab 3: Crankshaft Seal and Wear Sleeve
- Lab 4: Compression Ratio Calculation
- Lab 5: Piston Group Orientation
- Lab 6: Crankshaft Measurement
- Lab 7: Cylinder Block and Liner Measurement
- Lab 8: Cylinder Head Measurement
- Lab 9: Camshaft Measurement
- Lab 10: Pistons, Cam Rod, Rings
- Lab 11: Lubrication System Relief Valve
- Lab 12: Engine Parts List (SIS)
- Lab 13: Torque Values and Procedures
- Lab 14: Valve Adjustment
- Lab 15: Engine Starting Procedures
- Lab 16: Dynamometer Procedures

#### Service Fundamentals

- Lab 1: Caterpillar Engine Series
- Lab 2: Product Line
- Lab 3: Dealer Visitation – Selma
- Lab 4: Service Information Systems (SIS)
- Lab 5: Micrometers
- Lab 6: Dial Indicators
- Lab 7: Fastener Identification / Torque
- Lab 8: Fastener Repair
- Lab 9: Fluid Fittings
- Lab 10: Dealer Visitation – Corcoran
- Lab 11: Technician Tools
- Lab 12: Portfolio

#### Machine Systems

- Lab 1: Lift Trucks
- Lab 2: Agricultural Tractors
- Lab 3: Backhoes
- Lab 4: Skid Steer Loaders

- Lab 5: Wheel Loaders
- Lab 6: Track-Type Tractors
- Lab 7: Hydraulic Excavators

V. APPROPRIATE READINGS

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

I. Sample Text Title:

1. Recommended - Dagele, J.F., Brady R.N. *Diesel Engine and Fuel System Repair*, ed. 5th Prentice Hall, 2002, ISBN: 0130929816

II. Other Readings

1. Recommended - *Miscellaneous service literature, Caterpillar, Inc. Caterpillar Systems Operation Manuals Machine Manuals, Caterpillar, Inc. Appropriate Engine Service Manuals, Caterpillar, Inc.*

- 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	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.		
	a) essay exam(s)	X	d) written homework
	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:

Completion of CAT Equipment Technician Service Report - See Attached

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

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

Problem solving activities to include calculating compression ratios, displacement of cylinders, torque and horsepower, gear ratios, and other computations. In addition students will have to diagnose common starting problems as well as engine failures.

<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 laboratory practicals in the area of precision measurement, component identification, and component adjustment and repair.

<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)
- 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>  X  </u>	<u>      </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 - Dagle, J.F., Brady R.N. *Diesel Engine and Fuel System Repair*, ed. 5th Prentice Hall, 2002, ISBN: 0130929816

Comments:

- This course requires special or additional library materials (list attached).
- X   This course requires special facilities:
- This course has a laboratory component requiring a shop facility.

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 101. 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.

(eligibility for Math 101)  
(as outcomes for Math 250)

- X   Performing the four arithmetic operations on whole numbers, arithmetic fractions, and decimal fractions.
- X   Making the conversions from arithmetic fractions to decimal fractions, from decimal fractions to percents, and then reversing the process.
- X   Applying the concepts listed above to proportions,

1. Ability to calculate engine cylinder bore, stroke, displacement, compression ratios, HP, and torque.

<p>percents, simple interest, markup and discount.</p> <p><input checked="" type="checkbox"/> Applying the operations of integers in solving simple equations.</p> <p><input checked="" type="checkbox"/> Converting between the metric and English measurement systems</p>	
<p>(eligibility for English 126) (as outcomes for English 262)</p> <p><input checked="" type="checkbox"/> Using phonetic, structural, contextual, and dictionary skills to attack and understand words.</p> <p><input checked="" type="checkbox"/> Applying word analysis skills to reading in context.</p> <p><input checked="" type="checkbox"/> Using adequate basic functional vocabulary skills.</p> <p><input type="checkbox"/> Using textbook study skills and outlining skills.</p> <p><input checked="" type="checkbox"/> Using a full range of literal comprehension skills and basic analytical skills such as predicting, inferring, concluding, and evaluating.</p>	<p>1. Ability to outline the textbook and classroom lectures; ability to outline ideas and analyze for unit tests, midterms, and final.</p>
<p>(eligibility for English 125) (as outcomes for English 252)</p> <p><input checked="" type="checkbox"/> Writing complete English sentences and avoiding errors most of the time.</p> <p><input checked="" type="checkbox"/> Using the conventions of English writing: capitalization, punctuation, spelling, etc.</p> <p><input checked="" 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 checked="" type="checkbox"/> Expanding and developing basic sentence structure with appropriate modification.</p> <p><input checked="" type="checkbox"/> Combining sentences using coordination, subordination, and phrases.</p> <p><input checked="" type="checkbox"/> Expressing the writer's ideas in short personal papers utilizing the writing process in their development.</p>	<p>1. Ability to compose accurate and detailed industry machine service reports that record troubleshooting procedures and work performed.</p>
<p><u>Check the appropriate spaces.</u></p> <p><input checked="" type="checkbox"/> Eligibility for Math 101 is advisory for the target course.</p> <p><input checked="" type="checkbox"/> Eligibility for English 126 is advisory for the target course.</p> <p><input checked="" type="checkbox"/> Eligibility for English 125 is advisory for the target course.</p> <p><i><u>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.</u></i></p>	

**CONTENT REVIEW**

**REQUISITES**

No requisites

**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.

1.  The prerequisite/corequisite is required by law or government regulations.  
Explain or cite regulation numbers:
2.  The health or safety of the students in this course requires the prerequisite.  
Justification: Indicate how this is so.
3.  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.
4.  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.
5.  Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.  
Justification: Cite the statistical evidence from the research.
6.  The prerequisite course is part of a sequence of courses within or across a discipline.
7.  Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course: