

AGEN 100 Tractor Care & Maintenance
Course Outline

Hours Required:

Class – 2

Laboratory – 2

Lecture – 125 Marshall

Lab – 119 Marshall

Lecture – F. Bach

Lab – J. Taylor, F. Bach

Description:

Care, adjustments and maintenance of gasoline and diesel tractors used in farm and light industrial power applications. Course is designed for competence and performance. Principles of safety as applied to mobile machinery. Servicing tractor electrical, fuel and lubrication systems, maintenance, adjustments, valve lash, clutches, brakes, etc. Hydraulic system maintenance and adjustments. Diagnosis of malfunctions, complete tractor tune-up and dynamometer testing.

Objectives:

Competencies to be developed:

1. To develop the ability to recognize common machine hazards.
2. To develop tractor maintenance schedules related to students special interests.
3. To provide performance competencies in the care and maintenance of modern high horse power spark and compression ignition tractors.
 - a. To provide tractor maintenance competencies for selected agriculture production students.
 - b. To provide a foundation for Ag. Engineering majors to take AGEN 270 Tractor Repair.

Text: Fundamentals of Machine Operation – Preventive Maintenance, John Deere
Service Publications
Fundamentals of Service Electrical Systems, John Deere

Supplementary References:

1. Tractor tune-up and service specifications, AAVIM
2. Fundamentals of Machine Operation – Agricultural Machinery Safety
John Deere Service publications
3. Operators & Service Manuals for Selected Tractors
4. Tractor Maintenance – Principles & Procedures, AAVIM
5. Library Reserve Reading, Class Handouts

Student Responsibility:

1. To read this course outline and to ask questions if any of the material is unclear.
2. To make up any and all class work covered during their absence.
3. To attend scheduled lab unless previous arrangement has been made with the instructor.
4. To complete on time lab write-ups, study guides, problem sets and term projects, which reflect careful, neat, complete and individual effort.

Homework:

In relation to each lecture there will be reading assignments and problem sets the reading assignments reinforce and expand upon the lecture topic.

Lab: A specific area will be covered each week as outlined. Lab attendance is important, as no make up lab will be given. Missed lab work will lead to an F or incomplete in the course.

Lab: A lab write-up is due after each lab. They provide reinforcement of each lab topic and may stimulate further research or questions on the topic covered.

One (1) late lab will be permitted without, penalty; however, it must be submitted before or with the next week's lab. Lab write-ups submitted after that time will not be accepted unless under extenuating circumstances. After the first late lab, the lab grade for a given lab will drop one letter grade per day. Failure to attend lab on a given day or to hand in a lab report after the grace period will be recorded as a zero.

Lab sections are balanced therefore students are expected to attend their scheduled labs unless previous arrangements have been made to switch into another lab section.

Field trips and other sponsored events must be arranged prior to lab time so arrangements for make-up work can be planned.

Students are expected to conduct themselves in a safe manner. Any student who poses a hazard to themselves or others will not be allowed to work in the lab.

Term Project:

There will be a term project. Procedure and time will be announced later on during the semester.

Attendance Policy:

All attendance regulations as found in the student handbook, college catalog and faculty handbook shall be enforced in the agricultural engineering department. After 3 unexcused in lecture or lab, the student will be subject to review and may face possible termination from the course.

Make up Tests & Quizzes:

There will be no make-up quizzes in lecture or lab due to their unannounced nature.
Tests – Make-ups only under extenuating circumstances.

Cheating:

Cheating will be dealt with in the most severe manner possible. As outlined in the academic handbook, cheating could result in receiving an “F” in this course.

Grading:

At least 2 hour-long tests based on lab work, demonstrations, lectures, handouts, text, will be given – announced 1 week in advance. Unannounced quizzes will be given in lecture and lab based on previous lecture topics, readings, etc. Along with lab write-ups.

Grading Procedure on lab write-ups:

- + 95 – Well-done write-up, neat, complete which reflects work beyond required on the Write-up.
- 85 - Lab done – neat and complete, reflects understanding of material
- 75 - A lab that reflects the minimum effort but still complete
- X 60 – Lab write-up that has parts missing

Grading (continued)

- ½ - Lab write – ups
- ½ Quizzes & Tests -----> (2/3 tests – ½ quizzes)
- ½ Lab Write-ups & Term Project
- ½ Tests → ½ Final → ½ Tests & Quizzes
- Midterm & 2nd Half → Final Grade

Major Topics:

Part 1 – Major Components:

1. Agricultural Machinery Safety
2. Development of Maintenance
3. Engine Intake - Exhaust Systems
4. Engine Fuel Systems
5. Engine Cooling Systems
6. Engine Lubrication Systems
7. Power Trains
8. Hydraulic Systems

Part 2 – Other Components:

1. Operators Cab
2. Manual Steering
3. Manual Brakes
4. Tires

Part 3 – Engine Tune-up and Trouble Shooting:

Major Components – Part 1:

1. Agricultural Machinery Safety:
 - a. Design Safety
 - b. Recognizing Common machine hazards
 - i. Pinch points
 - ii. Wrap points
 - iii. Shear points
 - iv. Crush points
 - v. Pull-in points
 - vi. Free wheeling parts
 - c. Slow moving vehicles
2. Development of Tractor Maintenance Schedules:
 - a. Importance of preventive maintenance
 - b. Preparation of Schedules related to students interests
3. Tractor Intake & Exhaust Systems:
 - a. Intake System
 - b. Exhaust system
 - c. Air cleaners – ducts – damage from dirt
 - d. Types of air cleaners – dry & oil bath
 - e. Cleaning air filters
 - f. Intake manifold
 - g. Servicing intake manifolds
 - h. Intake & Exhaust valves – operation
 - i. Effect of valve clearance
 - j. Adjusting valve tappet clearance
 - k. Exhaust manifolds & mufflers
 - l. Crankcase ventilation
 - m. Testing the air intake system – intake manifold and manifold depression test
 - n. Testing engine compression – cylinder leakage test
 - o. Evaluation of compression readings

4. Engine Fuel Systems:
 - a. Compression & fuels
 - b. Selecting fuels for gasoline & diesel engines
 - c. Fuel storage
 - d. Refueling tractors
 - e. Gasoline fuel systems
 - f. Adjusting gasoline carburetors
 - g. Carburetor maintenance
 - h. Servicing sediment bowl & fuel strainer
 - i. Diesel fuel filters
 - j. Servicing the diesel fuel system
 - k. Bleeding air from diesel system
 - l. Injection pump timing
 - m. Governor testing

5. Engine Lubrication:
 - a. Functions of oil
 - b. Changing engine crankcase oil
 - c. Parts of lubrication system
 - d. Selection of engine oils
 - e. Changing oil & filter
 - f. Testing engine oil pressure

6. Engine cooling Systems
 - a. Principles of operation
 - b. Parts of the system
 - c. Selection of coolants & anti-freezes
 - d. Servicing the cooling systems
 - e. Stop-leak products
 - f. Preventing radiator corrosion
 - g. Flushing and cleaning the system
 - h. Testing the cooling system
 - i. Testing and replacement of thermostats

7. Engine Electrical Systems
 - a. Importance of service
 - b. Electrical system circuits
 - c. Charging circuits
 - d. A.C. charging circuits
 - e. D.C. charging circuits
 - f. Starting circuits
 - g. Ignition circuits
 - h. Servicing the battery
 - i. Operation of the battery
 - j. Maintaining the battery
 - k. Cleaning, checking, and charging batteries

- l. Use of booster cables
- m. Battery safety
- n. Servicing spark plugs
- o. Servicing the distributor
- p. Replacing & adjusting breaker points
- q. Checking cam angle and ignition timing
- r. Servicing, rebuilding & testing D.C. generators
- s. Servicing, rebuilding & testing A.C. generators
- t. Polarizing generators
- u. Testing generator & alternator output
- v. Testing & rebuilding cranking motors

8. Power Trains:

- a. Function of the power train
- b. Selecting transmission lubricants
- c. Viscosity and service classification of oils
- d. Transmission – hydraulic fluids
- e. Servicing of engine clutches
- f. Checking fluid levels
- g. Precautions of towing machines

9. Hydraulic Systems

- a. Importance of proper service
- b. Selecting hydraulic fluids
- c. Operation of hydraulic system
- d. Servicing the hydraulic system
 - i. Checking fluid levels
 - ii. Checking oil cooler
 - iii. Locating leaks
- e. Maintaining remote cylinders
- f. Filling & bleeding hydraulic system
- g. Maintenance of hydraulic system
- h. Preventing leaks
- i. Testing hydraulic system

Other Components – Part 2:

- 1. Operators cab (air filter & air conditioning maintenance)
 - a. Cleaning screens
 - b. Adjusting belts
 - c. Determining refrigerant level
- 2. Manual Steering
 - a. Adjusting backlash
 - b. Lubricating steering axle and wheel bearings
 - c. Cleaning, adjusting & packing wheel bearings

- d. Adjusting wheel toe in
- 3. Manual Brakes
 - a. Adjusting mechanical disc and shoe brakes
 - b. Bleeding hydraulic brakes
- 4. Tires
 - a. Proper tire inflation
 - b. Effects of over and under inflation
 - c. Tire inflation rules
 - d. Tire ballast
 - e. Tire failures
 - i. Abuse
 - ii. Under inflation
 - iii. Over inflation
 - f. Tire safety
- 5. Operation of Grease Fittings
 - a. Types of grease
 - b. Lubrication procedures
- 6. Lighting & Electrical Accessories
 - a. Lighting circuits
 - b. Circuit breakers & fuses
 - c. Adjusting headlights
 - d. Lamp failures
 - e. Circuit breakers & fuses
 - f. Wiring system & harness
 - g. Gauges & gauge failures
- 7. Cleaning the Machine
 - a. Degreasing procedures & use of steam cleaner

Tune-up & Trouble Shooting – Part 3

- 1. Tune-up
 - a. Visual inspection
 - i. Oil & water leakage
 - ii. Electrical system
 - iii. Cooling system
 - iv. Air intake system
 - b. Use of engine tune-up charts
 - c. Dynamometer tests before and after tune-up

2. Trouble Shooting:
 - a. Trouble shooting procedures
 - b. Use & interpretation of trouble shooting charts

Laboratory – 32 Hours

Laboratory work may be completed concurrently with lecture material or it may follow. The following competencies will be developed by demonstration or participation.

1. Preparation of Tractor Maintenance Schedule
2. Valve lash adjustment
3. Compression & cylinder leakage tests
4. Disassembly, cleaning, rebuilding and adjustment of carburetors
5. Servicing diesel fuel systems
6. Lubrication service – testing and adjusting engine oil pressure
7. Cooling system servicing and testing
8. Battery care and service
9. Generator tests and rebuilding
10. Alternator tests and rebuilding
11. Cranking motor servicing
12. Servicing and adjusting the ignition system. Engine timing
13. Testing and adjusting the hydraulic system
14. Complete tractor tune-up
15. Dynamometer testing
16. Trouble shooting and analysis

Week	Lecture	Lab topic	Assignment
1	Tractor safety	Valve adjustment	1-6
2	Air cleaners Compression and manifold tests	Cylinder leakage Compression test	8-27 Vacuum test
3	Intake & exhaust systems	Carburetor rebuild	
4	Engine fuel systems Selecting & storing fuel	Wheel bearings	30-51
5	Engine lubrication Engine oils & filters	Air cleaners Oil viscosity test	56-67
6 104-196	Care & handling of bearings Bearing failures		Cooling systems
7	Cooling systems Parts of cooling systems	Batteries	72-83
8	Importance of electrical Service- batteries	Distributor Disassembly	86-117
9	Charging circuits AC Charging circuits DC Regulation	Timing and testing Coils & condenser	
10	Ignition circuit	Timing lab	208-213

	Primary	Spark plug test	
11	Cranking motor Tractor wiring systems	Cranking motors	
12	Tractor power trains & lubes	Generators	126-136
13	Tire care & balancing Tune-up procedures	Testing and rebuilding Starters	179-185
14	Diesel fuel systems	Alternators	
15	Hydraulics	Regulators	142-158
16		Test	