I. **TITLE:**

Agricultural Power Units

II. **CATALOG DESCRIPTION:**

This course is a study of small power units relative to agriculture. Includes servicing, maintenance, repair, use types, and applications of: electrical motors, pumps, and small internal combustion engines. (Fall, even years)

Prerequisites: AGR 170.

III. **PURPOSE:**

To provide students with a background in pumps, electric motors, and small engines used in agriculture.

IV. **COURSE OBJECTIVES:**

A. To become familiar with the components of small engines, electric motors, and pumps.
B. To develop fundamental skills in selection, preventative maintenance, servicing, rebuilding, and performance evaluating of pumps, motors, and small engines.
C. To become familiar with basic formulas, equations, and calculations in pump, motor, and engine selection.

V. **CONTENT OUTLINE:**

A. Pumps
   1. Pumps – Lecture
      a. Recognition and classifications – types of:
         i. Shallow well jet pump
         ii. Deep well jet pump
         iii. Submersible pump
         iv. Centrifugal pump
         v. Piston
         vi. Positive displacement
         vii. Non-positive displacement
      b. Components
c. Types of systems
d. Application of theory
   i. Calculations
   ii. Rating and performance curves
   iii. Specifications

2. Pumps – Lab exercises
   a. Selection and evaluation
   b. Rebuilding
   c. Servicing
   d. Preventative maintenance
   e. Applications in agriculture

B. Small engines
   1. Small Engines – Lecture
      a. Unit 1: Operating principles
         i. 4 cycle
         ii. 2 cycle
      b. Unit 2: Measure and Testing Instruments
         i. Micrometer
         ii. Dial indicator
         iii. Plastigage
         iv. Thickness gauges
         v. Reject gauges
         vi. Torque wrenches
         vii. Compression tester
         viii. Cylinder wear gauges
         ix. Tachometer
         x. Dynamometers
      c. Unit 3: Ignition Systems
         i. Magnetos/breaker points
         ii. Coil
         iii. Armature
         iv. Breaker points
         v. Condenser
         vi. Sparkplugs
         vii. Flywheel magnets
         viii. Battery ignition systems-breaker points
         ix. Magneto systems-no breaker points
         x. CDI solid state
         xi. Ignition timing
      d. Unit 4: Compression System
         i. Power conversion
         ii. Crankcase – cylinder
         iii. Cylinder head
         iv. Flywheel
         v. Connecting rod
         vi. Bearing
vii. Pistons
viii. Rings
ix. Cylinder
x. Piston displacement
xi. Compression ratio
xii. Camshaft
xiii. Valves
xiv. Valve spring
xv. Valve timing
xvi. Valve tappet clearance
xvii. Reed valves
e. Unit 5: Lubrication Systems
   i. Oil slinger
   ii. Oil pump
   iii. Oil dipper
f. Unit 6: Carburetor
   i. Air cleaners
   ii. Dry element
   iii. Oil bath
   iv. Oiled sponge
   v. Fuel pump
   vi. Fuel tank
   vii. Fuel lines
viii. Type of carburetors
   1. Diaphragm
   2. Suction lift
   3. Float type
ix. Parts of carburetor
x. Principles of operation
g. Unit 7: Small Engine Safety
2. Small Engines – Lab Exercises
   a. Selection and evaluation
   b. Rebuilding
   c. Servicing
d. Preventive maintenance
   i. Fuels and fuel systems
   ii. Oil systems
   iii. Cooling systems
   iv. Crankcase breather
   v. Ignition system
   vi. Compression system
e. Application in agriculture
C. Electric motors
   1. Motors – Lectures
      a. Physical features
         i. Insulation class
ii. Temperature rise  
iii. NEMA design  
iv. Frame  
v. Ventilation  
vi. Shaft diameter  
vii. Manufacturing designation  
1. Type  
2. ID number  
3. Model number  
b. Motor classification  
i. Parts  
ii. Circuits  
iii. Magnetism  
iv. Running windings  
v. Starting systems  
c. Types of motors  
i. AC induction run  
1. Split phase start motors  
2. Capacitor start motors  
3. Shade pole start motors  
4. Repulsion start  
ii. AC single phase synchronous motors  
iii. AC universal motors  
iv. AC three phase motors  
v. Split phase two-speed  
vi. Permanent split capacitor  
vii. Changing voltage  
viii. Changing rotation  
ix. Changing motor speed  
d. Electric motors selection and performance testing  
i. Types of loads  
1. Continuous running steady loads  
2. Continuous running intermittent loads  
3. Adjustable speed loads  
4. Cyclical loads  
5. Motor characteristic  

2. Motors – Lab exercises  
a. Selection and evaluation – performance testing and design  
i. Equipment and test meters  
ii. Safety rules  
iii. Formulas  
iv. Analysis of data  
v. Speed vs. RPM  
vi. Definition of terms  
b. Numbers and kinds of windings  
c. Starter and running windings
d. Induction
e. Repulsion
f. Series
g. DC motors
h. AC motors
i. External features
   i. Mount and base
   ii. End bells and enclosure
   iii. Bearings and shafts
   iv. Lubrication
   v. Cooling system
   vi. Counting position
   vii. Nameplate
viii. Features
   ix. Hp
   x. Torque
   xi. Current
   xii. Phase
xiii. Cycle
xiv. Rev/min
xv. Volts/amps
xvi. Thermal production
xvii. Code
xviii. Service factor
  xix. Time
   xx. Efficiency maintenance
j. Applications in agriculture
k. Electrical service and control devices
   i. Electric motor circuit
   ii. Size of conductor
   iii. Running over current protection
   iv. Circuit over current protection
   v. Over current devices
   vi. Non-automatic devised
      1. Switches with overload protection
      2. Switches without overload protection
   vii. Motor controllers
viii. Automatic control devices for controlling devices
l. Motor installment
   i. Environmental factors
   ii. Alignment
   iii. Vibration
   iv. Drive systems
   v. Chain and gear
   vi. Direct drive
VI. INSTRUCTIONAL ACTIVITIES:

A. Lecture  
B. Discussion  
C. Demonstration  
D. Labs  
E. Field trips  
F. Computer programs  
G. Audio visual presentations

VII. FIELD AND CLINICAL EXPERIENCES:

Field trips used when applicable.

VIII. RESOURCES:

A. Lab facilities and tools  
B. Demonstration models of cutaways  
C. Buzz board  
D. Textbooks  
E. Handouts  
F. Local and area companies

IX. GRADING PROCEDURES:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>90-100</td>
<td>A</td>
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<tr>
<td>80-89</td>
<td>B</td>
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<tr>
<td>70-79</td>
<td>C</td>
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<td>60-69</td>
<td>D</td>
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<tr>
<td>Below 60</td>
<td>E</td>
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A. There will be 3 one-hour exams on each unit worth 100 points each. Each test will be announced at least one week in advance. The final will be comprehensive.

B. Final grade will be 50% weighted on lecture grades and 50% weighted on lab grades.

C. Missed exams and late assignments are permissible only if there is an acceptable legitimate excuse.

X. ATTENDANCE POLICY:

Please refer to the most current copy of the Murray State University’s Undergraduate Bulletin and Graduate Bulletin.
XI. **ACADEMIC HONESTY POLICY:**

(Adopted by the MSU Board of Regents)
Cheating, plagiarism (submitting another person’s material as one’s own), or doing work for another person which will receive academic credit are all impermissible. This includes the use of unauthorized books, notebooks, or other sources in order to secure or give help during an examination, the unauthorized copying of examinations, assignments, reports, term papers, or the presentation on unacknowledged material as if it were the student’s own work. Disciplinary action may be taken beyond the academic discipline administered by the faculty member who teaches the course in which the cheating took place.

NOTE: The School of Agriculture Faculty have adopted and implemented an Academic Honesty Policy in addition to the University Honesty Policy, which can be found in the current *Undergraduate Bulletin and Graduate Bulletin*. The policy sets guidelines regarding acts of dishonesty and the procedure to follow should an event occur. It is each Agriculture student’s responsibility to obtain and read a copy of this document. The School’s Academic Honesty Policy can be obtained by asking for a copy from any Agriculture Faculty member or the Secretary.

XII. **TEXT AND REFERENCES:**


Text provided: *Pump Fundamentals* by Gould.

XIII. **PREREQUISITES:**

None

XIV. **STATEMENT OF AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY:**

Murray State University endorses the intent of all federal and state laws created to prohibit discrimination. Murray State University does not discriminate on the basis of race, color, national origin, gender, sexual orientation, religion, age, veteran status, or disability in employment, admissions, or the provision of services and provides, upon request, reasonable accommodation including auxiliary aids and services necessary to afford individuals with disabilities equal access to participate in all programs and activities. For more information, contact Sabrina Y. Dial, Director of Equal Opportunity, Murray State University, 103 Wells Hall,
XV. MSU SCHOOL OF AGRICULTURE CELL PHONE POLICY

The School of Agriculture recognizes that in today’s world cell phones are a familiar and often necessary form of communication for students.

It shall be the policy of the School that no cell phone usage shall be allowed in class and/or labs without the prior consent of the course instructor. This shall include verbal calling, incoming calls, email, text messaging, and use of cell phone calculators on tests and quizzes.

Cell phones must be kept off and out of sight (i.e. secured to a person’s belt or kept in a bag or purse away from desks and lab counters).

Should a student’s cell phone be visible, ring, or other form of unauthorized usage that is interruptive to the class or lab, the student may be asked to leave class and not return for that class/lab period.

Upon prior consent of the instructor, a student may obtain permission to have their phone on in case of an emergency or in critical family situations.

This policy also includes pagers and other electronic equipment such as blackberries and/or computers/laptops.