

Agricultural Mechanics

An Instructional Program in Vocational Agriculture



**California Vocational Agriculture
Curriculum Guidelines**

CALIFORNIA VOCATIONAL AGRICULTURE
CURRICULUM GUIDELINES

AGRICULTURAL MECHANICS

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AGRICULTURAL MECHANICS

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INTRODUCTION

The Agricultural Mechanics occupational cluster offers a wide variety of job opportunities. The entry level jobs for high school graduates range from tractor operator and welding mechanic to general farm repair and construction. Opportunities exist in six other occupational clusters that require skills gained in agricultural mechanics. These include landscape equipment operation and repair, service operations, processing mechanics, park maintenance and forestry mechanics. A good individual program in agricultural mechanics will include courses or instruction in one or more of the other programs.

The units of instruction included in this program will provide basic skills and knowledge in safety, construction, welding, equipment operation and repair, hydraulics and small engine repair. Because there are excellent materials and sources of information available, the units provide a basic sequential outline. It is recommended that the appropriate materials be obtained from the following sources:

Briggs and Stratton Corporation
Milwaukee, Wisconsin 53201
Small engine operation, maintenance and repair

John Deere Service Publications
Dept. F
John Deere Road
Moline, Illinois 61265
Equipment operation, maintenance and repair
Hydraulics

American Association for Vocational Instructional Materials
(AAVIM)
Engineering Center
Athens, Georgia 30602
Small gas engines, fencing
Equipment maintenance

Mid-America Vocational Curriculum Consortium (MAVCC)
1515 West Sixth Avenue
Stillwater, Oklahoma 74074
Diesel, small gas engines, chain saw repair

Vocational Instructional Materials
Texas A & M University
College Station, Texas 77843
Vocational Agriculture Core Curriculum I, II, III, IV

The James F. Lincoln Arc Welding Foundation
P.O. Box 17035
Cleveland, Ohio 44117
Arc welding

These sources offer texts, work sheets, transparency masters and slide sets that will be invaluable in a full agricultural mechanics program. The learning activities in this program guide are a starting point. Additional materials from the above sources will help build a strong program.

SHOP SAFETY AND MANAGEMENT

Instruction in Agricultural Mechanics requires considerations in addition to those of regular classroom instruction.

The first is to provide a safe work place for the students. The shop should be arranged and maintained in a hazard reducing manner. The students should be instructed in the safe use of equipment demonstrating their knowledge of safe procedures in practice and on a written test. Safety equipment such as gloves, clothing protectors and eye protection should be available for all involved in the shop. The California State Education Code provides for required eye protection.

Legal provisions concerning "School Eye Safety" are presented in sections 12090 through 12094 of the Education Code. The provisions that merit major attention follow:

It shall be the duty of the governing board of every school district, and of every county superintendent of schools . . . to equip schools with eye protective devices for the use of all students, teachers, and visitors It shall be the duty of the superintendents, principals, or teachers charged with the supervision of any class in which any such course is conducted, to require such eye protective devices to be worn by students, teachers, and visitors

The table "Selection of Eye- and Face-Protective Devices" presented in American Standard Safety Code for Head, Eye, and Respiratory Protection published by the American Standards Association, Inc., New York, lists types of permissible eye protective devices for certain hazards as follows:

Selection of Eye- and Face-Protective Devices

Hazard involved	part to be protected	types of permissible protective devices
Relatively large flying objects	Eyes, Face	Goggles, Spectacles, Face Shields
Dust and small flying particles	Eyes, Face	same as above
Dust and wind	Eyes	Goggles, Spectacles
MoHen metal	Eyes, Face	Goggles, Spectacles, Face Shields
Gases, fumes, and smoke	Eyes, Face	Goggles
Liquids	Eyes, Face	Goggles, Face Shields
Reflected light or glare	Eyes	Goggles, Spectacles
Injurious radiant energy (moderate)	Eyes	Goggles, Helmets, Hand Shields, Face Shields
Injurious radiant energy (intense)	Eyes, Face	Helmets, Hand Shields

Skill development is the second unique consideration of an agricultural mechanics program.

The purpose of instruction is to develop the student's skills in the use of tools and machines which will allow the student to produce a worthwhile product.

The use of skill check off sheets on display and up to date allows students to compare their productivity with that of other students.

A shop card filled out each day by the student indicating the activity for that period with a space for instructors score and comments serves two purposes.

1. It will provide the student a daily score on work habits and usually reduces the repetition of undesirable activities.
2. It will provide the instructor with a daily notation of student activities which facilitates accurate student evaluation.

Maintaining evidence of providing safety instruction, of providing adequate supervision, and of eliminating hazards is the third unique consideration for any shop program. In the event of an accident the instructor must establish that he or she was not negligent. If negligence does not exist on the part of the instructor the school district's liability insurance will come into effect.

Safety instruction is a must to reduce the hazards to the students of learning to use tools and machinery. An instructor who maintains completed safety tests and a certificate of completion on file for each student before that student engages in shop activity has a positive indication that safety instruction has been provided.

Organizing the shop plan and class activities so that the students are within the sight of the instructor, and maintaining a class load within the work station capacity of the shop make adequate supervision possible.

Reporting safety hazards and malfunctioning equipment to the principal and to those responsible for district wide repairs is further evidence that the instructor is making an effort to maintain a safe shop. The reports need to be made in writing and a copy kept on file in the shop office.

Productivity is not the only criterion of excellence in Ag Mechanics. Excellence must be based on demonstrated skill using good work habits, proper tool use, and participation in shop clean up and housekeeping activities.

The agricultural mechanics program provides the student with an excellent opportunity to build marketable skills and work habits. Attention to the special aspects of a shop program will improve the learning experience.

The units of instruction were identified by vocational agriculture teachers. Each contains goals, objectives, teaching outline, learning activities, resource materials, student evaluation, transparency masters and general references. The outlines vary in their depth and complexity as each was outlined or written by different agricultural mechanics instructors. As each unit is used add your own information, change what you find inappropriate for your program and make comments on the strengths. In this way the units can be made more useful for you and more realistic at a time of future updating.

Many people have contributed to the development and production of this guideline. There are many great ideas - use **it** in good faith.

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AGRICULTURAL MECHANICS

INSTRUCTIONAL PROGRAM CURRICULUM GUIDELINES

An instructional program designed to prepare students for employment or entrepreneurship in agricultural mechanics occupations including farm power, construction, welding, machinery and equipment, operation and repair. The program also prepares persons to continue in advanced post-secondary occupational training programs in this field.

The topic outline emphasizes the **all-encompassing** area of agricultural mechanics. The topics included are intended to be all inclusive for an Agricultural Mechanics program as designed by the Vo-Ag teacher and will undoubtedly require several courses over three or four years to complete. This is in addition to the basic and fundamental mechanics skills taught in the 'Introduction to Agriculture' course.

AGRICULTURAL MECHANICS

Program Goals

The goal of the instructional program in Agricultural Mechanics is the following:

- Supply students with the knowledge and skills required for entry into and successful progress in those agricultural mechanics occupations that do not require education beyond the secondary school level.
- Prepare students for advanced post-secondary level vocational education in agricultural mechanics.
- Assist students to make informed career choices in the field of agricultural mechanics.
- Enable students to acquire an understanding of the economic and social impact of the agricultural mechanics industry upon society and its relationship to agriculture in general.
- Provide the agricultural mechanics industry with appropriate numbers of persons adequately prepared for successful employment in those occupations which presently exist and which are developing in the industry.

The agricultural mechanics industry is involved in farm power, construction, welding, machinery and equipment operation and repair.

AGRICULTURAL MECHANICS

TYPICAL OCCUPATIONS IN THE CLUSTER, "AGRICULTURAL MECHANICS"

The occupations listed here are typical of those included in the Agricultural Mechanics cluster which require agricultural competencies of the job holder.

A person satisfactorily completing a high school level program in Agricultural Mechanics should be qualified to immediately enter and succeed in the occupations listed in the "high school" column.

If a person wishes to begin work in an occupation listed in the "community college" column, it is recommended that he or she complete a high school level program in Agricultural Mechanics, then continue in appropriate advanced training designed to prepare one for that occupation. Advanced training may be in appropriate community college agricultural courses, private training programs or specialized on-the-job training in a lower level occupation.

The occupations listed in the "baccalaureate" column are professional level. These usually require four or more years of agricultural education at the college level.

<u>HIGH SCHOOL</u>	<u>COMMUNITY COLLEGE</u>	<u>BACCALAUREATE</u>
Tractor Driver	Tractor Operation Super-Specialized Equipment Operator	Wholesale/Retail Sales
Truck Driver	Equipment Service	Ranch Management
Harvesting Equipment Operator	Specialized Equipment Maintenance	Farm Management
Landscape Equipment Operator	Service Foreman	Contract Operation
Processing Equipment Operator	Welder-General	Bank Agricultural Officer
Light Construction Equipment Operator	Welder-Specialized	Managerial Consultant
Equipment Service/Helper	Welder-Fabrication	Equipment Management
Equipment Service	Tractor Mechanic	Purchasing Management
Equipment Greaser	Equipment Mechanic	Personnel Management
Welder Helper	Hydraulic Mechanic	Research and Development
Welder	Equipment Sales	Job Shop Manager
Welder-Fabrication	Diesel Mechanic	Plant Operations
Tractor Mechanics Helper	Parts person	Application Engineering
Equipment Repairer	Grounds Caretaker	Vocational Agriculture Instructor
Equipment Assembler	General Farm Mechanic	Governmental Extension
Small Engine Mechanic	Farm and Ranch Foreman	College Educator
Farm Hand	Farm and Ranch Owner/Operator	Governmental Service
General Farm Mechanic	Farm Hand	Field Representative
Fence Builder or Repairer	Landscape Gardener	Utility Service Advisor
General Maintenance Mechanic	Nursery Laborer	Service Management
Assembler Helper	Cannery Maintenance	Safety Advisor
Cannery Mechanic/Helper	Cannery Mechanic	
Landscape Gardener		
Nursery Laborer		
Landscape Maintenance		

AGRICULTURAL MECHANICS

INSTRUCTIONAL PROGRAM
CURRICULUM GUIDELINES

PROGRAM COMPLETION STANDARDS

To complete the instructional program in Agricultural Mechanics, a student should meet, at the minimum, the following standards which are listed in the categories of knowledge of facts and concepts; skills and abilities; and attitudes and personal traits. It is anticipated that in addition to these minimum completion standards, each school conducting an instructional program in Agricultural Mechanics will have additional completion standards which are appropriate for its own unique situation. This augmentation of the instructional program should be based upon factors such as the nature of the local Agricultural Mechanics industry, facilities and equipment available for the program, instructor competencies, and student interest.

KNOWLEDGE OF FACTS AND CONCEPTS	SKILLS AND ABILITIES (BE ABLE TO:)	ATTITUDES AND PERSONAL TRAITS
1. Identification of tools a. Non-power b. Portable power c. Stationary	1. Practice basic shop safety.	1. Finish what is started.
2. Shop safety.	2. Use tool sand machinery safely.	2. Responsible.
3. Identification of hardware and fasteners.	3. Select, maintain and repair tools.	3. Confident.
4. Internal combustion engines a. Nomenclature (parts) b. Principles of operation c. Types of fuels and lubricants.	4. Select and install hardware fasteners.	4. Cooperative.
5. Lubrication of machines.	5. Service internal combustion engines. a. Drain oil and refill b. Change filters c. Fuel safety	5. Respectful.
6. Tractor and equipment operating procedures.	6. Conduct prestart and running checks.	6. Enthusiastic.
	7. Start and stop engines.	7. Safety conscious.
		8. Follows directions.
		9. Honest.
		10. Customer relation.
		11 • Loyal to firm.

KNOWLEDGE OF
FACTS AND CONCEPTS

SKILLS AND ABILITIES
(BE ABLE TO:)

ATTITUDES AND
PERSONAL TRAITS

- | | | |
|--|---|--|
| <p>7. Identification and association.
a. Types of tractors and power units used in agriculture.
b. Types of equipment used in agriculture.</p> | <p>8. Use grease guns.</p> | <p>12. Profits from constructive criticism.</p> |
| <p>8. Safe practices in welding.</p> | <p>9. Operate tractors and equipment safely.
a. Field and road
b. Wheel and crawler</p> | <p>13. Dependable attendance.
14. Budgets time wisely.</p> |
| <p>9. Knowledge of welding equipment and supplies.</p> | <p>10. Operate welding equipment safely.</p> | <p>15. Perceptive of emerging needs.</p> |
| <p>10. Welding procedures
a. Preheating
b. Post-heating
c. Distortion
d. Heat treating</p> | <p>11. Set up equipment and operate electric arc and acetylene welding equipment.
a. Beads-vertical, flat, horizontal, overhead
b. Build-up and hard surfacing.
c. Cutting torch (use of)
d. Brazing and other procedures</p> | <p>16. Willing to work--project a positive job attitude.
17. Flexible to change.</p> |
| <p>11. Metallurgy</p> | <p>12. Prepare, layout and finish.</p> | <p>18. Punctual.</p> |
| <p>12. Basic electricity.</p> | <p>13. Select welding materials, i.e., electrodes, metals, alloys, damps, fluxes, etc. (Identify the above)</p> | |
| <p>13. Identification of electrical hardware.</p> | <p>14. Identify special weldable metals.</p> | |
| <p>14. Electrical safety.</p> | <p>15. Perform basic electrical wiring.</p> | |
| <p>15. Basic electrical code (ordinances)
a. Wire color and sizes
b. Connectors
c. Grounding</p> | | |

KNOWLEDGE OF
FACTS AND CONCEPTS

SKILLS AND ABILITIES
(BE ABLE TO:)

ATTITUDES AND
PERSONAL TRAITS

- | | |
|---|--|
| <p>16. Electrical motor maintenance.</p> <p>17. Types of electric motors</p> <p>18. Reading plans and drawings
a. Basic symbols
b. Types of drawings</p> <p>19. Measurements in agricultural mechanics.
a. Land (area, volume, distance)
b. Construction, structures
c. Shop fabrication</p> <p>20. Identification of measuring and leveling equipment
a. Note keeping</p> <p>21. Identification and selection of construction materials and structures.
a. Wood
b. Metal
c. Paving material
d. Concrete
e. Aggregate
f. Fencing</p> <p>22. Construction techniques, framing and layout, fencing, foundations.
a. Re-bar
b. Reinforcing</p> | <p>15. (cont.)
a. Simple circuits (standard series - Milli-volt)
b. Conduits: bend, cut and joint
c. Wire selection
d. Hardware selection
e. Circuit testing</p> <p>16. Clean and lubricate electrical motors.</p> <p>17. Identify basic electric motor (for voltage).</p> <p>18. Identify drawing symbols
a. Electrical
b. Welding
c. Plumbing
d. Construction
e. Landscaping</p> <p>19. Read a simple plan.</p> <p>20. Read a scale drawing.</p> <p>21. Make simple working sketches.</p> <p>22. Read foot, inch, scale, 1/12 of an inch, engineer scale, 1/10 and surveying rod.</p> <p>23. Pace-off and convert land measurements.</p> <p>24. Chain (use surveyors chain).</p> |
|---|--|

KNOWLEDGE OF FACTS AND CONCEPTS	SKILLS AND ABILITIES (BE ABLE TO:)	ATTITUDES AND PERSONAL TRAITS
23. Selection and identification of pipe and pipe fittings. a. Galvanized (metal) b. Plastic and tile c. Copper	25. Use 3-4-5 method to establish a 90° angle. 26. Use levels. 27. Identify common woods used in agriculture construction.	
24. Power transmission-Identification and selection. a. V-belts b. Chains c. Bearings and gears d. Hydraulics and pneumatics e. Drive shafts	28. Cut, thread, and join pipe (metal and plastic). 29. Select and apply preservatives (paints, creosote, stains). 30. Drill, tap, and thread in cold metal (plate and bolt material).	
25. Area and volume measurements.	31 • Construct simple concrete forms. 32. Mix, place and finish concrete. 33. Install decorative concrete and masonry. 34. Set fence post and braces. 35. Hang and splice fence wire: barbed, hog wire, and chain link, etc. 36. Select and use plumbing fixtures and fittings: Galvanized, black pipe, copper, and plastic 37. Service and lubricate bearings. 38. Recognize signs of maladjustment. 39. Adjust and place safety devices.	

AGRICULTURAL MECHANICS

INSTRUCTIONAL PROGRAM CURRICULUM GUIDELINES

Topical Outline

- I. Orientation and Shop Safety
 - A. Tool Identification
 - B. Basic Hand Tools
 - 1. Construction tools
 - a. Measuring and layout
 - b. Cutting, boring, and shaping
 - c. Hammers, axes, sledges
 - 2. Small engine tools
 - 3. Electrical tools
 - C. Power tools
 - 1. Portable
 - 2. Stationary
- II. Agricultural Equipment
 - A. Types of Equipment Used in Agriculture
 - 1. Seedbed preparation
 - a. Plows
 - b. Rippers
 - c. Disks
 - d. Harrows
 - e. Furrowers
 - f. Bed shapers
 - 2. Planters
 - a. Row crop (mounted, pull behind)
 - b. Grain drill
 - c. Broadcast-air application
 - 3. Fertilizing
 - a. Row crop (liquid, dry, gaseous)
 - b. Broadcast
 - c. Drill
 - 4. Cultivating and insect control
 - a. Field crops (harrows, rod weeders)
 - b. Row crop-ground contact (disks, shovels, knives)
 - 5. Harvesters
 - a. Grain (small grains, milo, corn)
 - b. Row crop (vegetable, field, fiber)
 - c. Haying (mowers, rakes, swathers, balers, loaders)
 - B. Adjustment and Safe Operation of Agricultural Equipment
 - 1. Seedbed preparation
 - 2. Planters
 - 3. Fertilizing
 - 4. Cultivators
 - 5. Harvesters
 - 6. Insect control

- II. C. Service and Maintenance of Agricultural Equipment
 - 1. Seedbed preparation
 - 2. Planters
 - 3. Fertilizing
 - 4. Cultivators and insect control
 - 5. Harvesters

III. Agricultural Power

- A. Types of Power Units and Tractors
 - 1. Internal combustion engines
 - a. 4-stroke, gas
 - b. 4-stroke, LPG
 - c. Diesel (2 - 4-stroke)
 - 2. Wheel tractors
 - a. Row crop
 - b. Heavy field
 - c. Utility
 - d. Industrial
 - 3. Crawlers
- B. Using the Operator's Manual
 - 1. Safe and proper starting and operating procedures
 - 2. Correct adjustments and maintenance
 - 3. Intervals and procedures
 - 4. Recognition of "out of adjustment" parts
- C. Adjustments and Repairs on Tractors and Engines
 - 1. Engine (tune-up)
 - a. Fuel system
 - b. Electrical
 - 2. Power train adjustments
 - a. Clutches
 - b. Brakes
 - c. Tracks
 - d. Tractor tires
 - 3. Lubrication
- D. Small Gas Engine Types
 - 1. Four-stroke cycle
 - a. Single cylinder
 - b. Multiple cylinder
 - 2. Two-stroke cycle, single cylinder
 - 3. Vertical crankshaft
 - 4. Horizontal crankshaft
 - 5. ID of engine components
- E. Small Engine Systems
 - 1• Carburetion
 - a. Fuel, fuel supply and filters
 - b. Air filters
 - 1) Dry type
 - 2) Oil bath
 - 3) Wire mesh
 - 4) Polyurethane
 - c. Carburetor types
 - 1) Float
 - 2) Diaphragm
 - 3) Suction
 - 4) Pump

- III. E. 2. Ignition-Magnetos
 - a. Internal flywheel
 - 1) Solid state
 - 2) Coil type
 - b. External flywheel
- 3. Lubricating systems
 - a. Pump-plunger
 - b. Dipper
 - c. Splash
 - d. Splash and pump
 - e. Crankcase breathers
- 4. Starter systems
 - a. Rope and pulley
 - b. Recoil
 - c. Impulse
 - d. Electric
- F. Maintenance and Operation of Small Engines
 - 1. Oils and lubrication, servicing engines
 - 2. Fuel and air, servicing engines
 - a. Fuel tanks-filters
 - b. Air filters
 - 3. Starting and running
 - a. Controls: throttle, choke
 - b. Governors
 - 1. Centrifugal
 - 2. Air-vane
- G. Trouble Shooting of Small Engines
 - 1. Carburetion
 - 2. Ignition
 - 3. **Compression**
- H. Overhaul and Repair of Small Engines:

Follow the guide provided by the engine manufacturer as there are many individual suggestions, recommendations and specifications for each type of make of engine. Engine manufacturers such as Briggs and Stratton, Tecumseh Products, Inc., Kohler Wisconsin, and James Bermann of VEP and others have excellent books available with repair and overhaul instructions and specifications.

IV. Hydraulics

- A. Hydraulics. Theory and Principles
 - 1. Hydrostatics-liquid under pressure
 - a. Pressure-force relationships
 - b. Flow (rate of speed)
 - 2. Hydrodynamics-hydrostatic relationships
 - 3. Work and energy
 - a. Energy transfer
 - b. Power
 - 4. Basic hydraulic systems
 - a. Parts
 - b. Theory of operation
- B. Hydraulic System Components
 - 1. Reservoirs
 - a. Design
 - b. Location
 - c. Cleanliness and filters
 - d. Accumulators

- IV. B 2. Pumps
 - a. Classifications and characteristics
 - b. Ratings
 - c. Types
 - 1) Reciprocating
 - 2) Vane
 - 3) Gear
 - 4) Piston
 - d. Actuators
 - 1) Cylinders-Rams
 - a) Single acting
 - b) Double acting
 - c) Seals
 - 2) Motors
 - a) Ratings
 - b) Types-vanes. piston. bent axis
 - 3) Hydrostatic drives
 - e. Valves
 - 1) Pressure control
 - 2) Check
 - 3) Relief
 - 4) Flow control
 - a) Open center
 - b) Closed center
 - f. Conductors
 - 1) Types
 - 2) Piping, hose. fittings
- C. Maintenance and Repair Procedures
 - 1. Maintaining the system
 - a. Cleanliness
 - b. Oil and filter changes
 - c. Draining and flushing system
 - d. Filling the system-correct level
 - e. Preventing leaks
 - 1) Internal
 - 2) External
 - f. Preventing overheating
 - g. Checking system before operation
 - 2. Trouble shooting
 - a. Know the system and how it operates
 - b. Operate machine. question operator
 - c. Inspect. list possible causes
 - d. Test systematically
 - e. Make necessary repairs and/or replace parts

V. Ornamental Horticulture Mechanics

- A. Ornamental Horticulture Structures. Planning and Construction
 - 1. Wood construction
 - a. Basic propagating structures (cold frames and seed flats)
 - b. Mist houses, green houses and lath houses design
 - c. Planter boxes and tubs
 - d. Ornamental garden fences
 - e. Steps. decks, benches and header boards

- V. A. 2. Concrete construction
 - a. Retaining walls and fences
 - b. Building foundations and floors
 - c. Walks and steps
 - d. Waterfalls, pools and other non-formed concrete works
- 3. Glass and synthetic materials
 - a. Glass, repair and installation
 - b. Plastic and saran, types and installation
- B. Power Gardening Equipment
 - 1. Safety rules
 - 2. Types of equipment available
 - 3. Maintaining and servicing
 - 4. Trouble shooting
 - 5. Adjustments

VI. Agricultural Construction

- A. Agricultural Construction Measurements
 - 1. Feet, inches
 - 2. Scales
 - 3. Engineers rod
 - 4. Areas-volumes
- B. Types of Drawings
 - 1. Sketches and sketching
 - 2. Seale drawi ngs
 - 3. Compl icated and simpl e plans
- C. Common Materials of Agricultural Construction
 - 1. Wood
 - 2. Metal
 - 3. Concrete
 - 4. Concrete blocks
- D. Selecting a Project
 - 1. Needs and available funds
 - 2. Making a cut list
 - 3. Ordering materials
- E. Construction Techniques
 - 1. Layout and cutting
 - a. Metal and wood saws
 - b. Oxy-acetylene
 - 2. Assembly
 - a. Bolting, nailing, using screws
 - b. We lding
 - c. Riveting
 - 3. Finish-painting of projects
 - a. Hardware
 - b. Wood
 - e. Concrete
 - d. Steel

VII. Utilities-Planning and Installation

- A. Pl umbi ng
 - 1. Types and sizes of pipe
 - 2. Cutting, threading, measuring, fitting of pipe
 - 3. Installation techniques

- VII. A. 4. Planning, determining costs
- 5. Drain pipe and tile
- 6. Sprinkler system
- 7. Mist system

VI II. Structures-Carpentry, Fencing

- A. Building Parts and Design
 - 1. Foundations
 - a. Frame building
 - b. Concrete block building
 - 2. Floors
 - a. Wood
 - b. Concrete
 - 3. Walls
 - a. Frame
 - b. Block
 - 4. Roofs and ceilings
 - a. Rafters
 - b. Coverings
- B. Construction Skills
 - 1. Concrete work
 - a. Laying out a building
 - b. Forms and forming
 - c. Foundations and floors
 - d. Mix, place and finish concrete
 - 2. Framing structures
 - a. Subfloors and floors
 - b. Walls and partitions
 - c. Roofs and ceilings
 - 3. Surfacing
 - a. Flooring
 - b. Walls
 - c. Roofing
- C. Fencing
 - 1. Types
 - a. Selection
 - b. Materials
 - c. Costs
 - 2. Planning and layout
 - a. Location of gates, braces, stretch posts
 - b. Measurement
 - 3. Construction-set fence posts and braces
 - a. Wire-field, hog, barbed, etc.
 - b. Wood-corral
 - c. Ornamental

IX Agricultural Electricity

- A. Basic Principles of Electricity
 - 1. Electrical safety
 - 2. Electron theory and how we measure electricity
 - 3. Electrical terms
 - 4. AC and DC current

- IX. B. Electrical Circuits
 - 1. AC-series and parallel
 - 2. Theory of grounding
 - 3. Polarizing
 - 4. Tracing circuits and circuit testing
 - 5. Service entrance and branch circuits
- C. Basic Wiring and Devices
 - 1. Types and sizes of wires
 - 2. Wire selection
 - 3. Over-current devices
 - 4. Outlet and switch boxes
- D. Wiring Installation Techniques
 - 1. Planning and installation
 - 2. Installing service entrance and ground
 - 3. Stripping and connecting wires and making splices
 - 4. Installation of switches, outlets and other devices
- E. Electric Motors
 - 1. Theory and principles
 - 2. Starting and operating protection devices
 - 3. Reversing electric motors
 - 4. Lubrication and service of motors

- X. Welding
 - A. The Arc Welding Process
 - 1. Fundamental steps and principles
 - a. Heat control (amperage)
 - b. Speed of travel
 - c. Angle of electrode
 - d. Length of arc
 - 2. Types of welders, equipment and selection
 - a. AC
 - b. DC
 - c. Accessories
 - 3. Rod selection (AWS classification)
 - 4. Running welds in all positions
 - a. Butt
 - b. Tee fillet
 - c. Lap
 - d. Vee butt
 - B. The Oxy-Acetylene Process
 - 1. Safety
 - 2. Equipment and accessories
 - a. Acetylene tanks, regulators
 - b. Oxygen tanks, regulators
 - c. Hoses, torches, tips
 - 3. Setting up and adjusting equipment
 - a. Setting up and safety check
 - b. Lighting and adjusting torch
 - c. Shut down and secure equipment
 - 4. Joining metals, techniques
 - a. Fusion welding mild steel
 - b. Brazing

- X. B. 5. Oxy-acetylene cutting process
 - a. Set up and adjustment
 - b. Cutting techniques
 - c. Shut down and storing equipment
 - C. Preparation, Layout and Finishing of Welding Projects
 - D. Special Weldable Materials
 - 1. Identification
 - 2. Techniques for preparing, welding, finishing
- XI. Surveying-Water Management
- A. Land Measurement and Area Calculation
 - 1. Measuring distances
 - a. Pacing
 - b. Chaining
 - c. Keeping notes
 - 2. Calculating areas
 - a. Methods and formulas
 - b. Square and odd-shaped fields
 - B. Differential Leveling
 - 1. Basic fundamentals
 - a. Definitions
 - b. Keeping notes
 - 2. Equipment
 - a. Care and safety of instruments
 - b. Setting up and adjusting instruments
 - c. Reading the rod
 - 3. Types of leveling
 - a. Profile
 - b. Contours
 - c. Land grading
 - C. Irrigation and Water Management
 - 1. Soil and water relationships
 - a. Water holding capacity
 - b. Infiltration rates
 - 2. Irrigation methods
 - a. Sprinkler
 - b. Furrow
 - c. Border strip
 - 3. Surveying for irrigation
 - a. Field slopes
 - b. Ditches and drains

