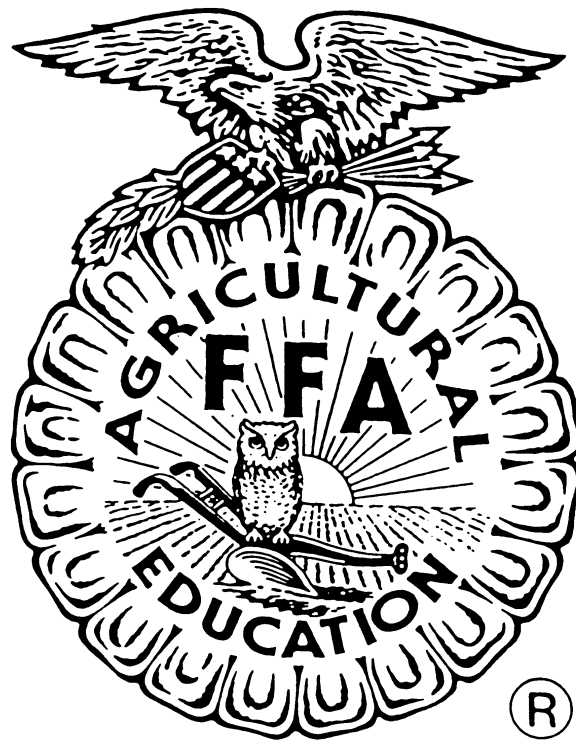


***AGRICULTURAL MECHANICS  
CAREER DEVELOPMENT EVENT***

*RULES AND REGULATIONS*

*TEAM COMPETITION*



***ALABAMA FFA ASSOCIATION***

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No person shall be denied employment, be excluded from participation in, be denied the benefits of, or be subjected to discrimination in any program or activity on the basis of disability, sex, race, religion, national origin, color, or age. Ref: Sec. 1983, Civil Rights Act, 42 U.S.C.; Title VI and VII, Civil Rights Act of 1964; Rehabilitation Act of 1973, Sec. 504; Age Discrimination in Employment Act; Equal Pay Act of 1963; Title IX of the Education Amendment of 1972: Title IX Coordinator, P.O. Box 302101, Montgomery, Alabama 36130-2101 or call (334) 242-8444.

# **AGRICULTURAL MECHANICS CAREER DEVELOPMENT EVENT**

## **PURPOSE**

This event is designed to recognize those students who have developed the competencies necessary for success in the changing workplace. The knowledge and skills of the technical content of agricultural mechanics will always remain important to the industry. This career development event will have a balance between a problem-solving focus performed by individuals working together as a team and individual knowledge and problem-solving/skill performance.

## **ELIGIBILITY AND REGULATIONS**

For specific eligibility of participants, refer to the Contest and Awards Booklet.

Only district eliminations will be held prior to the state event.

The top four place winners in the North, Central and South Districts will compete in the state finals.

## **EVENT AREAS**

The career development event will be developed from the following subject matter areas that are listed following each of the five systems associated with the agricultural mechanics industry.

- 1. Machinery and Equipment Systems:** repair and maintenance, materials handling, processing, adjustments, metal fabrication, maintenance and repair.
- 2. Industry and Marketing Systems:** customer relations, accounting, communication, economics, service, sales, reading and interpreting regulations, safety, operating instructions, manufacturer's recommendations.
- 3. Energy Systems:** mechanical power, electrical power, chemical power, wind power, solar power, engine operation, maintenance, trouble-shooting, repair.
- 4. Structural Systems:** structures, storage, concrete, masonry, plumbing, electrical, construction, building materials, ventilation, heating, air conditioning.
- 5. Environmental-Natural Resource Systems:** water quality, sustainable agricultural practices, soil and water conservation, waste handling.

## THEMES

A theme will be identified for each year's Agricultural Mechanics Career Development Event. The National Committee has selected the following themes for 2006 through 2010.

|                            |      |
|----------------------------|------|
| Animal Production Systems  | 2006 |
| Materials Handling Systems | 2007 |
| Processing Systems         | 2008 |
| Plant Production Systems   | 2009 |
| Integrated Pest Management | 2010 |

Information concerning each year's theme is published and distributed through the National FFA Organization, and posted at <http://web.missouri.edu/~pavt0689/natcon.html>, the agricultural mechanics web site. Information specific to each year's theme is posted on the web site during November and is updated periodically throughout the year. An example of an integrated pest management theme appears on page 57 in the National Career Development Handbook, with a written description shown on page 47.

Based on the selected "theme", competencies concerning the subject areas in each of the systems should be identified in preparation for the Agricultural Mechanics Career Development Event. Instructors will select related competencies from the list on Page AM-7.

## DISTRICT EVENT

1. The teams completing in the district events will be composed of a maximum of four members. The three highest scores will make up the team.
2. District Eliminations will consist of two phases.

**WRITTEN EXAMINATION** - This phase will consist of 75 multiple choice questions in the selected subject matter areas. Participants will have 40 minutes to complete 75 questions. [One (1) point per question, for a possible of 75 points.]

**PROBLEM SOLVING** - This phase will consist of identifying materials or solving problems related to the subject matter areas. Each participant will have 40 minutes to complete 25 problems. [Three (3) points per problem, for a possible 75 points.]

3. Electronic calculators are allowed and encouraged.
4. In case of a tie, the team with the highest combined score in the written exam phase will be placed higher. If still tied, the team with the largest number of perfect or most nearly perfect scores in the written exam phase will be the winner.

## STATE EVENT

1. The state event will be held during the State FFA Convention. The team will consist of four members. The team standing will be based on the sum of the points earned by three highest scoring participants on the team.
2. Additional information will be mailed to the district winners prior to the state finals.
3. Electronic calculators are allowed and encouraged.
4. State finals will consist of four phases:

**WRITTEN EXAMINATION** - Each participant will have 60 minutes to complete 100 multiple choice questions.

**INDIVIDUAL PROBLEM SOLVING AND SKILL DEVELOPMENT ACTIVITIES** – Each participant is individually evaluated in each of the five systems areas. The specific activities occurring in each event are not publicized prior to the event. Each student is allowed 20 minutes to complete each of the five activities (100 minutes total).

**TEAM ACTIVITY** - The individuals will compete as a team to solve a problem associated with a theme selected prior to the state finals. Each team will have approximately 30 minutes to organize themselves and work together to solve the problem. The team will have a combined score that would be based on the process of how they worked together and the product.

5. In the event of a tie, the team with the highest combined score in the written examination phase will be placed highest. If still tied, the team with the highest combined score in the problem solving/skills phase will be placed highest.
6. Each participant will be responsible for personal safety equipment which includes industrial quality eye protection devices (spectacles or goggles).
7. All specialized safety equipment such as welding helmets, goggles, tools, manuals, supplies, face shields, gloves, and other materials will be furnished for the event, except pocket calculators.
8. Clothing - Each participant shall furnish and wear coveralls, a shop coat, or uniform for this event. Long sleeve clothing *must* be worn when arc welding or cutting.

**SCORING**

The following is an outline of the scoring for each individual team member:

**(DISTRICT)**

|   |     |
|---|-----|
| WRITTEN EXAMINATION - 75 questions          |     |
| 1 point per question -----                  | 75  |
| PROBLEM SOLVING - 25 problems               |     |
| 3 points per question -----                 | 75  |
| TOTAL POINTS ( <i>per individual</i> )----- | 150 |
| TOTAL TEAM POINTS (3 participants)-----     | 450 |

**(STATE)**

|  |     |
|--|-----|
| WRITTEN EXAMINATION - 100 questions                          |     |
| 1 point per question -----                                   | 100 |
| INDIVIDUAL PROBLEM SOLVING/SKILLS DEVELOPMENT –              |     |
| Five (5) Individual Problem Solving/Skills                   |     |
| Development Activities at 30 points each. -----              | 150 |
| TEAM ACTIVITY - Total points possible for team activity----- | 150 |
| TOTAL TEAM POINTS ( <i>3 participants</i> )-----             | 900 |

The first place team will represent Alabama in the National Finals. (Should the first place state team be unable to participate in the National Finals, then the next place team may go instead. In such a case, awards will be exchanged to take care of traveling expenses for the team).

**STATE AWARDS/SPONSOR(S):**

Refer to Alabama FFA Contests and Awards Booklet at:  
[http://www.alabamaffa.org/forms\\_applications.htm](http://www.alabamaffa.org/forms_applications.htm)

## **SUGGESTED REFERENCES**

This list of references is not intended to be inclusive. Other sources may be utilized and teachers are encouraged to make use of the very best instructional materials available. The goal of the FFA Agricultural Mechanics Career Development Event is to guide and promote quality instructional programs in agricultural mechanics. The following list contains references that may prove helpful during event preparation. The multiple-choice test questions are written to be generic in nature and are selected from a variety of sources. It is the intent of the event committee to reflect current technological practices, common to the agricultural production industry.

FOS. John Deere.

FOM John Deere

Agricultural Power and Machinery. (CD format) CEV Multimedia. LTD.

Mechanics in Agriculture. Interstate Publishers.

Agricultural Mechanics Fundamentals and Applications.  
Delmar Publishers.

Modern Agricultural Mechanics, Interstate Printers and  
Publishers.

Developing Shop Safety Skills. American Association for  
Vocational Instructional Materials.

Power Tool Safety and Operation. Hobar.

Agricultural Mechanics I Lesson Plans. UMC-IML.

Agricultural Mechanics II Lesson Plans. UMC-IML.

Agricultural Buildings and Structures. Reston Publications.

Practical Farm Buildings. Interstate Publishers.

National Electrical Code (latest edition). NFPA.

Agricultural Structures, Volumes I and II. UMC-IML.

National FFA Agricultural Mechanics web site:  
<http://web.missouri.edu/~pavt0689/natcon.html>

Differential GPS Explained, by Jeff Hurn, Trimble Navigation Ltd.  
645 North Mary Avenue, P.O. Box 3642, Sunnyvale, CA 94088

GPS - A Guide to the Next Utility, by Jeff Hurn, Trimble Navigation Ltd.  
645 North Mary Avenue, P.O. Box 3642 Sunnyvale, CA 94088

**AM-6**

**Getting Started with Geographic Information Systems**  
(ISBN: 0-13-923889-1) by Keith C. Clarke, 2<sup>nd</sup> edition, 1999.  
Prentice Hall, Upper Saddle River, NJ 07458

**The GPS Manual - Principles and Applications**  
(ISBN: 0-917893-29-8) by Steve Dye with Dr. Frank Baylin, 1<sup>st</sup> edition, 1997.  
Baylin Publications, 1905 Mariposa, Boulder, CO 80302

**The Precision Farming Guide for Agriculturists**  
Textbook (ISBN: 0-86691-245-2)  
Instructors Guide (ISBN: 0-86691-263-0)  
Deere & Company, John Deere Publishing TIAC Building, 1300 19<sup>th</sup> Street, East Moline, IL  
61244

**Environmental Science for Agriculture and the Life Sciences**  
(ISBN: 0-8273-5025-2) by William G. Camp & Roy L. Donahue,  
Delmar Publishers, Inc., 3 Columbia Circle, Box 15-015, Albany, NY 12212-5015

**Environmental Science Ecology and Human Impact**  
(ISBN: 0-201-46889-1) by Bernstein, Winkler, Zierdt-Warshaw, 2<sup>nd</sup> edition

**Environmental Science, Addison-Wesley Publishing Company**  
by DuBay, Lapinski, Schoch, Tweed, 3<sup>rd</sup> edition,  
(ISBN: 0-201-32134-3) Scott Foresman-Addison Wesley Longman, Inc.  
New York, NY

**Applying Pesticides Correctly: A Guide for Private and Commercial Applicators.** U.S. EPA,  
USDA and Extension Service, revised 1991.

**Applying Pesticides Correctly: A Supplemental Guide for Private Applicators.** U.S. EPA,  
USDA and Extension Service, December 1993, Publication E-2474.

**The Worker Protection Standard for Agricultural Pesticides - How to Comply: What  
Employers Need to Know.** U.S. EPA, July 1993, Publication EPA 735-B-93-001.

Turner, J. H. (1987). **Small Engines: Operation Maintenance and Repair.** American  
Association for Vocational Instructional Materials. Tab Books Inc.

Cooper, E. L. (1987). **Agricultural Mechanics: Fundamentals and Applications.** Delmar  
Publishers Inc.

**Instruction Book. Push Mower. Murray Model 20111x78A**

**Repair Manual for Single Cylinder 4-Cycle Engines.** Briggs & Stratton Corp.

**EVENT-RELATED COMPETENCIES**

The following list of statements with specific understandings and performances are provided as examples for the systems areas identified.

Examination questions are primarily developed from "problem solving" categories. The "skills" categories are the basis for performance activities. Problem-solving activities are developed from both "problem solving" and "skills" categories. In each systems area, the requirements for effective communication, problem solving activities, and the application of modern technology - specifically computers and computer software - are strongly emphasized. Industry has recently identified important skills, abilities and competencies needed by new employees. These important attributes are described following the list of system competencies.

**MACHINERY/EQUIPMENT SYSTEMS  
COMPETENCIES****Problem Solving**

1. Identify safe tractor operation practices for field and highway conditions.
2. Identify the recommended service and maintenance operations from the operator's manual.
3. Select lubricants for machinery and equipment.
4. Identify functions of machinery components.
5. Identify parts and functions of hydraulic systems.
6. Identify and compute harvest losses.
7. Prepare machinery for storage.
8. Identify and select reduced tillage and conservation tillage equipment.
9. Explain principles of machinery management.
10. Describe functions of chemical application, fertilizing, harvesting, materials handling, processing, planting, seeding, and tillage equipment.
11. Select arc welding machines and accessories.
12. Read drawings and welding symbols.
13. Control distortion in arc welding.
14. Select appropriate electrodes and wires.
15. Select hard surfacing alloys.
16. Prepare materials and equipment for arc welding.
17. Test weld quality and strength.
18. Select shielding gases.
19. Describe the science of the welding processes.
20. Select gas welding, plasma arc and cutting equipment and supplies.
21. Assemble gas welding, plasma arc and cutting equipment.
22. Check equipment for leaks.
23. Select welding rods and fluxes.
24. Select hard surfacing alloys.
25. Start-up and shut down of welding equipment.
26. Select shielding gases.
27. Describe the science of welding and cutting processes.
28. Describe cylinder sizes and gas flow extraction rates. Calculate the volume of acetylene that can be delivered per cylinder per hour.
29. Explain the functions of flashback arresters and reverse flow check valves.
30. Identify appropriate shapes of tool and equipment cutting edges.
31. Select abrasives for grinding and sharpening.
32. Describe the application of simple machines to cutting edges.
33. Identify safe adjustment (level) on power equipment.
34. Identify kinds of metal used in tool construction.
35. Identify various types and shapes of metals.
36. Select soldering equipment and tools.
37. Prepare metals for soldering.
38. Identify hand metal working tools by types and sizes.
39. Determine tap and drill sizes.
40. Select files and saw blades.
41. Read metal working plans and prints.

42. Identify metal alloys and their strength.
  43. Identify and select power shears, benders, brakes and saws.
  44. Calculate materials costs.
  45. Identify pipe, valves and fittings by type.
  46. Select pipe threading and cutting tools.
  47. Select types of pipe and tubing.
  48. Calculate lengths of pipe.
  49. Joining dissimilar plumbing materials.
  50. Select pipe sizes to meet pressure and flow requirements.
  51. Select valves and controllers for turf and drip irrigation systems.
  52. Identify and select pipe sealants.
  53. Identify characteristics and applications of fiberglass and plastic.
  54. Identify types of damage that can occur to fiberglass and plastic.
  55. Identify repair procedures and techniques.
  56. Select repair material needed for specific jobs.
  57. Identify the appropriate tools to use when welding plastics.
  58. Identify the types and properties of plastics.
- Skills**
1. Check and adjust driveline components.
  2. Adjust equipment hitches and drives.
  3. Install, adjust and service belt and chain drives.
  4. Select and use test equipment including meters, tachometers and timing devices to determine proper machine operation.
  5. Adjust and/or calibrate chemical application, seeding, fertilizing, harvesting, processing and materials handling machinery.
  6. Operate, test, and maintain machine systems.
  7. Install, adjust and evaluate machine systems.
  8. Inflate tires to proper air pressure to carry the heaviest load.
  9. Adjust equipment to field and crop condition.
  10. Identify different types of metals.
  11. Lay out and prepare metal for arc welding.
  12. Recommending metals based on load bearing strength.
  13. Weld basic joints in all positions.
  14. Join pipe for welding.
  15. Prepare for and apply hard surfacing alloys.
  16. Adjust cutting machines for different metals, joints and thickness.
  17. Start-up and shut down for welding equipment.
  18. Light and adjust the torch flame for specific welding or cutting operations.
  19. Lay out and prepare metal for welding or cutting.
  20. Fuse and braze welding basic joints on mild steel and cast iron.
  21. Cut mild steel, including pipe, all shapes.
  22. Join steel pipe, tubing or shapes by welding.
  23. Estimate and calculate welding materials costs.
  24. Adjust machines for various types of thickness of metal.
  25. Identify the type of metals used in agricultural instruction.
  26. Cut metal with plasma cutting unit.
  27. Prepare grinding and sharpening equipment.
  28. Recondition hand tools such as hammers, twist drills, chisels, punches and screwdrivers.
  29. Recondition keen edge wood cutting tools.
  30. Recondition keen edge metal cutting tools.
  31. Recondition chain saw, horticultural and turf cutting tools.
  32. Recondition rotary lawn mower blades.
  33. Adjust bed knife on reel mowers.
  34. Solder copper joints and sheet metal.
  35. Solder electrical connections.

36. Join metals with appropriate fasteners.
37. Cut threads with taps and dies.
38. Lay out and drill holes with twist drill.
39. Operate power tools such as nibblers, drills, and saws.
40. Operate hand tools such as saws and files.
41. Bend sheet and strap steel to angles or shapes.
42. Repair damaged threads.
43. Select appropriate metals for projects (strength).
44. Shape hot and cold metals using power shears, benders, brakes and saws.
45. Cut and assemble plastic pipe.
46. Cut, thread and assemble steel pipe.
47. Connect flare and compression fittings.
48. Solder copper fittings and tubing.
49. Assemble dissimilar plumbing materials.
50. Installing and setting programmable timers.
51. Select tools and materials for specific repair jobs.
52. Repair structural or cosmetic damage using proper materials.
53. Select and use appropriate safety equipment.
54. Fuse plastic parts using plastic welding processes.
55. Construct plastic projects.
56. Compile thermoplastic welds.
57. Weld plastic using hot air method.
58. Identify the types of plastics to be welded.
59. Describe the methods of welding plastics.
60. Select and use plastic welding equipment.
61. Identify weldable plastic by burn tests.
62. Weld plastics using the basic weld parts.

#### INDUSTRY AND MARKETING SYSTEMS COMPETENCIES

##### Problem Solving

1. Complete and interpret pre-delivery and delivery instructions.
2. Describe importance of customer relations and communications.

3. Comprehend cab and environment controls (air conditioning and heating).
4. Compare costs of ownership, lease, rental and custom agreements.
5. Interpret and follow recommended service and maintenance schedules.
6. Determine proper practices and procedures for storing an engine.
7. Use of operator's manuals.
8. Identify safe machinery operating practices.
9. Select machinery parts using manufacturer's catalogs, microforms, microfiche or computers.
10. Evaluate building warranties.
11. Determine finance and insurance needs.
12. Identify and be able to describe safety practices.
13. Read and interpret drawings, plans, symbols, and figuring of bill of materials.

##### Skills

1. Adhere to safe operating practices during the completion of all activities.
2. Perform pre-delivery setup and adjustment.
3. Demonstrate interaction with customer/fellow employee.
4. Identify and use international operator symbols.
5. Adjust operator controls for best fit.
6. Select appropriate tools and equipment.

#### ENERGY SYSTEMS COMPETENCIES

##### Problem Solving

1. Identify safe tractor operation practices for field and highway conditions.
2. Identify the recommended service and maintenance operations from the operator's manual.
3. Describe how to repair a specific component or system.
4. Select fuels, lubricants, hydraulic fluids and coolants for proper operation.

5. Identify importance of oil analysis as a management tool.
6. Operation and interpretation of circuit diagrams, and flowcharts for: electrical, hydraulic, fuel, oil, cooling, intake and exhaust systems.
7. Identify the function and operating principles of clutches, transmissions, control devices and brakes.
8. Explain and describe principles of power transmission.
9. Identify the parts and functions of electrical, hydraulic, lubrication, cooling, governor and fuel systems.
10. Interpret horsepower, torque and other power measurement criteria.
11. Identify and use OECD (Organization for Economic Cooperation and Development) and/or Nebraska Tractor Test results.
12. Interpret metric units in measurements.
13. Select proper ballast and machinery weighting.
14. Compare costs of alternative machine uses.
15. Understand interactive electronic components.
16. How to use load/inflation table for tires (constant deflection table).
17. Describe operating principles of two-stroke and four-stroke spark or compression ignition engines.
18. Identify the use and function of engine repair tools.
19. Evaluate engine performance under load and no-load operation.
20. Evaluate engine parts or short blocks for replacement or servicing.
21. Determine hydraulic cylinder force and speed.
22. Use appropriate standards for agricultural applications, including the National Electrical Code (NEC), Electrical Testing Laboratory (ETL), Factory Mutual, Underwriters Laboratory (UL), Canadian Standard Association (CSA) and/or OSHA standards.
23. Plan safe electrical circuits.
24. Select conductor type and size for specific applications.
25. Calculate voltage drop.
26. Determine electrical power requirements.
27. Identify the characteristics of single and three-phase circuits.
28. Plan and evaluate proper grounding systems and ground-fault protection.
29. Determine volt, amp and ohm relationships (Ohm's and other application laws).
30. Select adequate and appropriate lighting fixtures.
31. Make connections in a computer-simulated wiring task.
32. Select motors based upon type of application.
33. Interpret electric motor nameplate data.
34. Service electric motors.
35. Identify electric motors and motor parts.
36. Identify methods of providing electric motor protection.
37. Interpret power (horsepower, kilowatt), power factor, torque and other motor selection criteria.
38. Select, size and isolate standby power generators.
39. Calculate heating and cooling loads.
40. Interpret wiring diagrams.
41. Identify and describe basic principles of controls including thermostats; humidistat; photoelectric; magnetic relays; programmable controllers; proximity switches and sensors; ultrasonics; timers and other time-delay equipment; and pressure, motion, limit, float and sail switches.
42. Select controls from supply catalogs, microforms, microfiche or computers.
43. Select controls for electrical applications.
44. Use low-voltage electrical control equipment.
45. Identify and select devices for automated systems.
46. Select aquaculture air delivery systems.

47. Select aquaculture water heating devices.
  48. Determine water filtration needs.
  49. Establish ballast and tire pressures.
  50. Use safe wiring practices for specific applications.
  51. Select standby power generators and isolation equipment for specific applications.
  52. Match tractors to implements.
- Skills**
1. Connect electrical and hydraulic motor drives.
  2. Conduct a pre-operation inspection of a tractor.
  3. Starting, stopping and operating the machinery engine.
  4. Perform recommended periodic service jobs (as found in operator's manuals).
  5. Use measuring tools and test instruments such as: micro metering and telescoping gauges, dial indicator, compression tester, torque wrench, VOA (volt-ohm-amp)-meter, DMM (digital multi-meter), timing devices, tachometer and dynamometer for determining test procedures.
  6. Test and troubleshoot electronic sensing devices.
  7. Remove, service and replace electrical components.
  8. Test and service batteries, charging, lighting, warning and cranking systems.
  9. Test and service cooling systems.
  10. Make hitch and PTO adjustments to the implement.
  11. Adjust wheel tread spacing.
  12. Adjust steering linkage.
  13. Match tractors to implements.
  14. Conduct on-board tractor monitor checks as identified in operator's manual.
  15. Test and service air conditioning systems.
  16. Test engine for emissions.
  17. Select and use engine overhaul equipment, including valve, cylinder, piston, seal and bearing tools.
  18. Service and maintain fuel, air intake and exhaust, cooling and lubrication systems.
  19. Operate engine and adjust or check ignition timing, engine speed and carburetor adjustments.
  20. Read schematics and sketch wiring circuits.
  21. Attach conductors to terminals.
  22. Install plugs and cord connector bodies.
  23. Make proper splices and connections.
  24. Troubleshoot electrical circuits using proper testing equipment and measuring devices.
  25. Measure electrical circuits for voltage, amperage, resistance and wattage.
  26. Install service entrance for single phase 120/240V service or three-phase power.
  27. Wire 120/240V service outlets.
  28. Install electrical circuits, switching devices and appliances.
  29. Install ground-fault circuit interrupters.
  30. Make connections in a computer-simulated wiring task.
  31. Troubleshoot electric motor circuits using proper testing equipment.
  32. Connect a dual voltage motor to power source.
  33. Change the direction of electric or hydraulic motor rotation.
  34. Disassemble and reassemble an electric motor.
  35. Provide suitable motor over-current protection.
  36. Service and lubricate an electric motor.
  37. Check the running amperage and voltage of a motor.
  38. Select and mount an electric motor on a machine.
  39. Connect electric motor controls.
  40. Install timer circuits and automation devices.
  41. Install thermal and solid-state delay/relay controls.
  42. Install a low-voltage motor control system.
  43. Install sensing devices including thermostats; humidistat; photoelectric; magnetic relays; programmable controllers; proximity switches and sensors; ultrasonics; timers

- and other time delay equipment; and pressure, motion, limit, float and sail switches.
44. Wire devices that are capable of providing artificial heat.
  45. Select and install aquaculture control and sensing systems.

**ENVIRONMENT AND NATURAL RESOURCES SYSTEMS COMPETENCIES**

**Problem Solving**

1. Identify environmental problems in livestock and crop handling and processing buildings.
2. Read and interpret maps including conservation, land use, soils, topographic, aerial and remote sensing, and geological surveys.
3. Describe principles involved in appropriate conservation and/or land use planning.
4. Read legal land descriptions.
5. Determine land areas.
6. Identify the types and parts of leveling instruments.
7. Determine the difference in elevation of two or more points.
8. Determine cuts, fills, cut/fill ratios, and volumes.
9. Describe the characteristics of a profile-leveling plot.
10. Identify water quality criteria for aquaculture.
11. Read and interpret a topographic map.
12. Select terracing and water diversion options for soil conservation.
13. Selecting strip-cropping principles and practices.
14. Select water management techniques including grassed waterways, parallel terrace outlets, tile outlet systems and erosion control structures.
15. Determine types of vegetative cover and mulch for erosion stabilization.
16. Determine and select appropriate cultural tillage or mechanical practices of equipment for specific soil type and residue management.
17. Compare effects of traffic patterns on soil compaction.
18. Calculate soil loss using universal equations and determine effects of the components of the equations.
19. Determine practices to improve or maintain water quality and recharge.
20. Determine appropriate types, locations and uses of erosion and sedimentation control basins.
21. Determine appropriate types, locations and uses of water impoundment structures.
22. Describe surface and subsurface drainage and irrigation techniques.
23. Calculate subsurface drainage and irrigation requirements.
24. Determine if drainage or irrigation is economically and physically feasible.
25. Select appropriate drainage including open drainage, closed gravity and pumping systems.
26. Determine land shaping and grading requirements.
27. Determine economics of alternative systems.
28. Determine water needs.
29. Select irrigation systems for specific conditions.
30. Select irrigation equipment and techniques.
31. Determine soil moisture and temperature.
32. Select surface and subsurface irrigation systems for specific application.
33. Identify and select fittings for irrigation systems.
34. Identify size system components.

35. Determine power requirements and pump size for specific applications.
36. Calculate irrigation system requirements.
37. Make water management choices.
38. Understand water quality impacted by drainage and irrigation.
39. Understand pressure, flow and head.
40. Select pumps and power sources and compare efficiencies.
41. Interpret pump characteristics curves.
42. Determine appropriate waste disposal methods.

#### **Skills**

1. Set up and level the surveying instrument.
2. Take rod readings.
3. Measure distance with tape and/or instruments.
4. Lay out corners using instruments.
5. Determine direction by use of a compass.
6. Record field notes for differential, profile, and topographic leveling.
7. Lay out contour lines.
8. Lay out grade stakes for cut/fills.
9. Determine soil types and selecting appropriate structures or practices.
10. Use automatic leveling and laser equipment.
11. Use water-testing equipment.
12. Lay out and mapping contour lines.
13. Measure crop residue on the land.
14. Determine soil losses.
15. Measure cross-sectional areas of a grass waterway, drainage ditch, and earthen embankment.
16. Determine field slope and length.
17. Identify soil limitations and determine the effects on land use.
18. Use maps to make selection and determine location of conservation practices or land use changes.

19. Assemble turf irrigation equipment.
20. Determine soil moisture.
21. Estimate soil permeability and infiltration rates.
22. Determine and compare evaporation losses.
23. Install drainage systems or components.
24. Determine cuts, fills and grade lines.
25. Lay out contour ditches, basins, borders, contour levees, furrow, and corrugation systems for irrigation.
26. Determine proper waste disposal procedures.
27. Lay out and assemble solid-set, lateral move, center-pivot and traveling gun irrigation systems and components.
28. Lay out and assemble trickle and drip irrigation systems or components including mainlines, lateral lines, control devices, valves, pressure regulators, gauges and filters.
29. Select and install components of irrigation systems for specific applications.
30. Calculate well capacity and demand.
31. Determine delivery rates of pumps.
32. Select pumps and power units.
33. Calculate chemical injection rates.
34. Determine percent of slope or grade.

#### **STRUCTURES SYSTEMS COMPETENCIES**

##### **Problem Solving**

1. Select and evaluate building sites.
2. Determine the size, specifications and layout of building.
3. Select appropriate framing, siding, roofing, insulation and vapor barrier materials.

4. Develop a bill of materials.
  5. Interpret plans and working drawings.
  6. Identify structural components of buildings.
  7. Select preservatives for building materials.
  8. Evaluate building construction techniques.
  9. Select hand, electric and pneumatic tools.
  10. Estimate handling materials, cost and construction time.
  11. Plan footings, foundations, and concrete finishing.
  12. Identify and select materials for concrete form construction.
  13. Determine quantity and cost of materials for concrete and masonry jobs.
  14. Determine the appropriate water-cement ratio and aggregate for concrete masonry construction.
  15. Select materials for concrete and masonry construction.
  16. Order "ready-mix" concrete.
  17. Identify procedures for mixing and placing concrete in cold or hot weather.
  18. Identify materials and techniques to reinforce concrete and masonry construction.
  19. Identify techniques for placing, finishing and curing concrete and masonry units.
  20. Identify concrete additives to increase strength and reduce cracking.
  21. Identify concrete additives to control hydration rate.
  22. Identify and select masonry materials.
  23. Describe and select masonry mortar.
  24. Identify and select tools and equipment for concrete and masonry construction.
  25. Interpret lumber and manufactured wood product grade stamps.
  26. Determine ventilation air inlet size based on exhaust fan capacity.
  27. Identify alternative construction styles (stud frame, post frame, rigid arch, and stressed skin).
  28. Identify structural components for each alternative construction style.
  29. Specify materials for the construction of wood foundation systems.
  30. Develop plans for selected enterprises.
  31. Calculate and compare the installation and maintenance costs of crushed rock and concrete materials in the construction of feedlot surfaces.
  32. Determine size and quality of aggregates and materials.
  33. Select aggregates, concrete and mortar-mixes, and prepare a trial mix.
  34. Calculate masonry units needed for a given application.
  35. Use traditional, electronic and laser tools in concrete and masonry construction.
  36. Evaluate building systems and construction practices based on standards provided in one of the following model building codes: UBC, BOCA or SBC.
  37. Specify and plan windbreak structures for livestock protection and reduction of snow accumulation in feedlot and farmstead drive areas.
- Skills**
1. Lay out a building foundation.
  2. Identify, select and apply construction fasteners.
  3. Use and maintain hand, electric and pneumatic tools and measuring instruments for building construction.
  4. Construct buildings or building components.
  5. Lay out and cut structural components.
  6. Construct trusses with different building materials.
  7. Install composition shingles, metal and fiberglass roofing materials.
  8. Apply paint and other finishing materials.
  9. Prepare a site for concrete and masonry construction.
  10. Construct forms.

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| <ul style="list-style-type: none"> <li>11. Calculate concrete or mortar mix.</li> <li>12. Determine moisture content in sand.</li> <li>13. Mix concrete or mortar on the job site.</li> <li>14. Conduct and evaluate a slump test.</li> <li>15. Place concrete or masonry reinforcement.</li> <li>16. Lay out and make isolation, control and construction joints.</li> <li>17. Place, consolidate, finish and cure concrete.</li> <li>18. Place and finish concrete masonry units.</li> <li>19. Produce special finishes on concrete.</li> <li>20. Use and maintain concrete and masonry tools and equipment.</li> <li>21. Calculate types and amount of concrete or mortar mix for a job.</li> <li>22. Adjust ventilation air inlet openings.</li> <li>23. Fabricate and install reinforcing steel bar and welded wire mesh.</li> <li>24. Specify and use admixtures that entrain air, retard set, reduce water requirements and/or improve concrete mix workability in concrete mixes.</li> <li>25. Set-up manufactured form systems for poured-in-place foundation walls.</li> <li>26. Select and apply appropriate framing, siding, roofing, insulation and vapor barrier materials.</li> </ul> | <ul style="list-style-type: none"> <li>7. Be an independent thinker with an analytical mind.</li> <li>8. Ability to understand and follow detailed instruction - written and oral.</li> <li>9. Motivated to learn and having the ability to learn from various methods of instruction.</li> <li>10. Be literate and remain literate in current technologies - computers, electronics, mechanical systems, etc.</li> <li>11. Know how to calculate cost per units, per hour, per bushel, per acre, etc.</li> <li>12. Know how to estimate value of equipment and recommend future buying decisions.</li> <li>13. Know how to use technology to eliminate waste of time and resources.</li> <li>14. Know about computer hardware, software, Internet, etc.</li> <li>15. Know how to be productive with time, money, and people.</li> <li>16. Be knowledgeable with global agriculture - encompassing planning, production, marketing, and finance.</li> <li>17. Understand how cash flow is critical for business planning and operation.</li> <li>18. Know how to measure and estimate costs and develop plans for business/industry improvements.</li> <li>19. Be able to write annual goals with specific objectives and measurement tools for review.</li> <li>20. Have skills in business operations and management.</li> <li>21. Have experience with general accounting and cash flow management.</li> <li>22. Be able to effectively implement the use of technology in the workplace.</li> <li>23. Understand how to use a systematic approach to diagnose equipment problems.</li> <li>24. Know how to service and maintain equipment so that productivity can be maintained.</li> </ul> |
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**GENERAL SKILLS**

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| <ul style="list-style-type: none"> <li>1. Strong interpersonal communication abilities.</li> <li>2. Knowledge combined with leadership qualities and the ability to delegate responsibilities.</li> <li>3. People skills to deal with customers, the public and large groups.</li> <li>4. Identify and interpret the correct resources to make an educated decision.</li> <li>5. Understand and apply principles of mathematics, economics, biology and physics.</li> <li>6. Have a high level of common sense, logic, and critical thinking skills.</li> </ul> | <ul style="list-style-type: none"> <li>7. Be an independent thinker with an analytical mind.</li> <li>8. Ability to understand and follow detailed instruction - written and oral.</li> <li>9. Motivated to learn and having the ability to learn from various methods of instruction.</li> <li>10. Be literate and remain literate in current technologies - computers, electronics, mechanical systems, etc.</li> <li>11. Know how to calculate cost per units, per hour, per bushel, per acre, etc.</li> <li>12. Know how to estimate value of equipment and recommend future buying decisions.</li> <li>13. Know how to use technology to eliminate waste of time and resources.</li> <li>14. Know about computer hardware, software, Internet, etc.</li> <li>15. Know how to be productive with time, money, and people.</li> <li>16. Be knowledgeable with global agriculture - encompassing planning, production, marketing, and finance.</li> <li>17. Understand how cash flow is critical for business planning and operation.</li> <li>18. Know how to measure and estimate costs and develop plans for business/industry improvements.</li> <li>19. Be able to write annual goals with specific objectives and measurement tools for review.</li> <li>20. Have skills in business operations and management.</li> <li>21. Have experience with general accounting and cash flow management.</li> <li>22. Be able to effectively implement the use of technology in the workplace.</li> <li>23. Understand how to use a systematic approach to diagnose equipment problems.</li> <li>24. Know how to service and maintain equipment so that productivity can be maintained.</li> </ul> |
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25. Understand on-board computerized systems that monitor, test, store, and report equipment operation.
26. Be familiar with computerized recognition of crop productivity and quality, field conditions, and pests.
27. Understand electrical circuits - amperage, watts, voltage, resistance, and transistors.
28. Understand hydraulic system operation - flow, resistance, and temperature.
29. Understand mechanical system operation - mechanical advantage, material specifications, and gear design.
30. Have experience in reading schematics, replacing components - including control modules.
31. Know how to diagnosis electrical, computer, mechanical, and hydraulic systems.
32. Have experience in analyzing mechanical system failures.
33. Have experience with CAD software and know how to produce mechanical drawings.

**AGRICULTURAL MECHANICS  
CAREER DEVELOPMENT EVENT**

CHAPTER \_\_\_\_\_

| Participant             | Participant Number | Event Phase  | Participant Score | Participant Total |
|-------------------------|--------------------|--|-------------------|-------------------|
| Name of Participant # 1 |                    | Written Exam (75 points)   |                   |                   |
|                         |                    | Problem Solving (75 points)  |                   |                   |
|                         |                    | <b>Participant # 1's Total</b><br>(Maximum score possible is 150 points.)  |                   |                   |
| Name of Participant # 2 |                    | Written Exam (75 points)   |                   |                   |
|                         |                    | Problem Solving (75 points)  |                   |                   |
|                         |                    | <b>Participant # 2's Total</b><br>(Maximum score possible is 150 points.)  |                   |                   |
| Name of Participant # 3 |                    | Written Exam (75 points)   |                   |                   |
|                         |                    | Problem Solving (75 points)  |                   |                   |
|                         |                    | <b>Participant # 3's Total</b><br>(Maximum score possible is 150 points.)  |                   |                   |
| Name of Participant # 4 |                    | Written Exam (75 points)   |                   |                   |
|                         |                    | Problem Solving (75 points)  |                   |                   |
|                         |                    | <b>Participant # 4's Total</b><br>(Maximum score possible is 150 points.)  |                   |                   |
| TEAM RANKING            |                    | <b>TOTAL TEAM SCORE</b>  |                   |                   |
|                         |                    | (The three highest individual participant scores will make up the team score. Maximum score possible is 450 points.) |                   |                   |

**AGRICULTURAL MECHANICS  
CAREER DEVELOPMENT EVENT**

Chapter \_\_\_\_\_

Revised Sept. 2009

| Participant   | Event Phase   | Participant Score | Participant Total |
|---|---|-------------------|-------------------|
| <b>Name of Participant 1</b>  | <b>Written Examination (100 pts.):</b>  |                   |                   |
|   | <b>Problem/Skill 1 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 2 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 3 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 4 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 5 (30 pts.):</b>   |                   |                   |
| <b>Participant # 1's Total</b><br>(Maximum score possible is 250 points.) |   |                   |                   |
| <b>Name of Participant 2</b>  | <b>Written Examination (100 pts.):</b>  |                   |                   |
|   | <b>Problem/Skill 1 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 2 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 3 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 4 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 5 (30 pts.):</b>   |                   |                   |
| <b>Participant # 2's Total</b><br>(Maximum score possible is 250 points.) |   |                   |                   |
| <b>Name of Participant 3</b>  | <b>Written Examination (100 pts.):</b>  |                   |                   |
|   | <b>Problem/Skill 1 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 2 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 3 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 4 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 5 (30 pts.):</b>   |                   |                   |
| <b>Participant # 3's Total</b><br>(Maximum score possible is 250 points.) |   |                   |                   |
| <b>Name of Participant 4</b>  | <b>Written Examination (100 pts.):</b>  |                   |                   |
|   | <b>Problem/Skill 1 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 2 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 3 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 4 (30 pts.):</b>   |                   |                   |
|   | <b>Problem/Skill 5 (30 pts.):</b>   |                   |                   |
| <b>Participant # 4's Total</b><br>(Maximum score possible is 250 points.) |   |                   |                   |
| <b>Team Activity</b><br>(Maximum score possible is 150 points)            |   |                   |                   |
| <b>TEAM RANKING</b>   | <b>TOTAL TEAM SCORE</b><br>(The three highest individual participant scores will make up the team score. Maximum score possible is 750 points, plus Team Activity (150 points)= 900 points) |                   |                   |