

***AGRICULTURAL MECHANICS
CAREER DEVELOPMENT EVENT
TEAM COMPETITION***

Rules and Regulations Booklet



Alabama FFA Association

AGRICULTURAL MECHANICS CDE



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

1. For specific eligibility of participants, refer to the Contest and Awards Bookl
2. Only district eliminations will be held prior to the state event.
3. The top four place winners in the North, Central and South Districts will compete in the state finals.
4. If a cell phone is seen or heard in the possession of a competitor, that individual student will be disqualified from competition and receive a score of zero.
5. Competitors must enter their name on the scorecard or they will receive a score of zero. Judges will not attempt to figure out who the card belongs to.
6. The team will consist of a maximum of four members. The team's total score will be based on the sum of the points earned by the three highest scoring participants on the team.

DISCLAIMER

In the event that contests (CDE, LDE, TDE's) cannot be held in person, a virtual option may be conducted. Contest rules and guidelines are subject to change to meet the needs of a virtual experience.

ALTERNATE POLICY

For district level events, if a chapter brings alternates there will be no more than two alternates allowed per team. Alternates will use a copy of the scan form (not an original) for those events scored via judgingcard.com. If more than four official scan forms are turned in for a chapter in one event, the highest score(s) for that team will be disqualified and deleted until the chapter only has four team members in the scoring system. Alternates must not be in groups with official team members.

For state level events, alternates are not allowed.

INSTRUCTIONAL AREA

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:** repair and maintenance, materials handling, processing, adjustments, metal fabrication
2. **Electricity:** AC/DC power, electrical safety, electrical standards, sensing devices, electrical wiring, controls, electronics, motors and other electrical loads, operating instructions, and manufacturer's recommendations
3. **Compact Equipment:** Mechanical power, electrical power, hydraulic power, engine operation, maintenance, trouble-shooting, repair
4. **Structures:** Structures, storage, concrete, masonry, plumbing, electrical, fabrication, construction, building materials, ventilation, heating, air conditioning
5. **Environmental and Natural Resources:** Water quality, sustainable agricultural practices, soil and water conservation, surveying, biological waste handling

Based on the selected event, 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 included in this resource.

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. In the event of a tie for individual high scorer, the individual with the highest score in the problem solving will be the winner. If a tie still exists, the individual with the highest score in the written exam will be the winner.

STATE EVENT

1. The state event will be held during the State FFA Convention. The team will consist of a maximum of four members. The team's total score will be based on the sum of the points earned by the 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.

EVENT SCORING (District Event)

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

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

EVENT SCORING (State Event)

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

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 (3 participants) -----	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 AND SPONSORS

Refer to Alabama FFA Contests and Awards Booklet at:
http://www.alabamaffa.org/forms_applications.htm

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**

Getting Started with Geographic Information Systems
(ISBN: 0-13-923889-1) by Keith C. Clarke, 2nd. 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, 1st 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 19th 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, 2nd edition

Environmental Science, Addison-Wesley Publishing Company
by DuBay, Lapinski, Schoch, Tweed, 3rd 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.

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

<ol style="list-style-type: none">1. Identify safe machinery operational practices.2. Identify the recommended service and maintenance operations from the operator's manual.3. Identify and use Nebraska Tractor Test or PAMI results.4. Identify functions of machinery components.5. Identify parts and functions of hydraulic systems.6. Identify and compute harvest losses.7. Select lubricants for machinery and equipment.8. Identify safe adjustment [level] on power equipment.9. Select pipe sizes to meet pressure and flow requirements.10. Match tractors to implement.11. Check and adjust driveline components.12. Adjust equipment hitches and drives.13. Install, adjust and service belt and chain drives.14. Select and use test equipment including meters, tachometers and timing devices to determine proper machine operation.15. Adjust and/or calibrate chemical application, seeding, fertilizing, harvesting, processing and materials handling machinery.16. Install, operate, maintain, adjust and evaluate machine systems for field conditions.17. Inflate tires to proper air pressure (e.g. load inflation tables).18. Join metals with appropriate fasteners.19. Select tools and materials for specific repair jobs.20. Select and use appropriate safety equipment.21. Identify safe machinery operation practices for field and highway conditions.	<ol style="list-style-type: none">22. Identify the recommended service and maintenance operations from the operator's manual.23. Select fuels, lubricants, hydraulic fluids and coolants for proper operation.24. Operation and interpretation of circuit diagrams and flowcharts for electrical, hydraulic, fuel, oil, cooling, intake and exhaust systems.25. Identify the function and operating principles of clutches, transmissions, control devices and brakes.26. Describe principles of power transmission.27. Identify the parts and functions of electrical, hydraulic, lubrication, cooling, governor and fuel systems.28. Select proper ballast for machinery weighting.29. Conduct a pre-operation inspection of a tractor or implement.30. Start, stop and operate machinery/engines.31. Perform recommended periodic service jobs (as found in operator's manuals).32. Conduct on-board tractor monitor checks as identified in operator's manual.33. Select and use engine overhaul equipment, including valve, cylinder, piston, seal and bearing tools.34. Service and maintain fuel, air intake and exhaust, cooling and lubrication systems.35. Operate engine and adjust or check ignition timing, engine speed and carburetor adjustments.
---	--

ELECTRICAL SYSTEMS COMPETENCIES

<ol style="list-style-type: none">1. 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.2. Identify the characteristics of single and three-phase circuits.3. Plan and evaluate proper grounding systems and ground-fault protection.4. Determine volt, amp and ohm relationships (Ohm's and other application laws.)5. Select adequate and appropriate lighting fixtures.6. Select motors based upon type of application.7. Interpret electric motor nameplate data.8. Identify methods of providing electric motor protection.9. Interpret power (horsepower, kilowatt), power factor, torque and other motor selection criteria.10. Calculate heating and cooling loads.	<ol style="list-style-type: none">11. 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.12. Select control from supply catalogs/websites.13. Select appropriate wire sizes and protection devices for specific loads and lengths of circuits.14. Use low-voltage electrical control equipment.15. Use electrical test instruments such as VOA (volt-ohm-amp) meter, DMM (digital multimeter) and tachometer.16. Read schematics and sketch wiring circuits.17. Install service entrance for single phase 120/240V service or three-phase power.18. Connect and operate electrical motors to power source.19. Change the direction of electric motor rotation.20. Select and mount an electric motor on a machine.
---	--

COMPACT EQUIPMENT SYSTEMS COMPETENCIES (Compact equipment is defined as being 30 horsepower or less.)

<ol style="list-style-type: none">1. Interpret horsepower, torque and other power measurement.2. Compare costs of alternative machine use.3. Describe operating principles of two-stroke and four-stroke spark or compression ignition engines.4. Evaluate engine/electric motor performance under load and no-load operation.5. Determine hydraulic cylinder force and speed.6. Interpret wiring diagrams/schematics.7. Identify and select devices for automated systems.8. Match tractors to implements.9. Select energy efficient equipment and materials10. Identify energy conservation measures to reduce costs and operation(s).11. Determine energy consumption and cost savings of alternatives.12. Conduct equipment pre-operation inspection.13. Start, stop and operate machinery and engines.14. Perform recommended periodic service jobs (as found in operator's manuals.	<ol style="list-style-type: none">15. Use measuring tools and test instruments such as, micrometer 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.16. Remove, service and replace electrical components.17. Test and service batteries, charging, lighting, warning and cranking systems.18. Select and use engine overhaul equipment, including valve, cylinder, piston, seal and bearing tools.19. Service and maintain fuel, air intake and exhaust, cooling and lubrication systems.20. Operate engine and adjust or check ignition timing, engine speed and carburetor adjustments.21. Measure energy output from or consumption of devices and cost savings of alternatives.
--	--

ENVIRONMENTAL AND NATURAL RESOURCES SYSTEMS COMPETENCIES

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. Conduct land surveying practices
5. Select terracing and water diversion options for soil conservation.
6. Selecting strip-cropping principles and practices.
7. Select water management techniques including grassed-waterways, parallel terrace outlets, tile outlet systems and erosion control structures.
8. Determine types of vegetative cover and mulch for erosion stabilization.
9. Determine and select appropriate cultural tillage or mechanical practices of equipment for specific soil type and residue management.
10. Calculate soil loss using universal equations and determine effects of the components of the equations.
11. Determine appropriate types, locations, and uses of erosion and sedimentation control basins.
12. Describe and/or calculate surface and subsurface drainage and irrigation techniques.
13. Determine land shaping and grading requirements.
14. Select irrigation systems for specific conditions.

15. Select irrigation equipment and techniques.
16. Determine power requirements and pump size for specific applications.
17. Interpret pump characteristics curves.
18. Utilize GPS systems and components.
19. Lay out grade stakes for cut/fills.
20. Determine soil types and select appropriate structures or practices.
22. Use water-testing equipment.
23. Lay out and map contour lines.
24. Measure crop residue on the land.
25. Identify soil limitations and determine the effects on land use.
26. Assemble turf irrigation equipment.
27. Install drainage systems or components.
28. Install components of irrigation systems for specific applications.

STRUCTURES SYSTEMS COMPETENCIES

<ol style="list-style-type: none"> 1. Determine the size, specifications and layout of building. 2. Develop a bill of materials. 3. Interpret plans and working drawings. 4. Select and plan concrete construction. 5. Interpret lumber and manufactured wood product grade stamps. 6. Determine ventilation air requirements for intake and exhaust fan capacity. 7. Select alternative construction styles and components (stud frame, pot frame, rigid arch and stressed skin). 8. Select arc welding machines and accessories. 9. Read drawings and welding symbols. 10. Test weld quality. 11. Select, assemble and check welding equipment and supplies. 12. Operate welding equipment and accessories for metal joining operations. 13. Select tools and perform operations for cold metal working. 14. Read metal working plans and prints. 	<ol style="list-style-type: none"> 15. Select paint and other finishing materials. 16. Use and maintain concrete and masonry tools and equipment. 17. Fabricate and install reinforcing steel bar and welded wire mesh. 18. Select and apply appropriate roofing, insulation and vapor barrier materials. 19. Identify types of metals. 20. Recommend metals based on load bearing strength. 21. Fuse and braze welding basic joints on mild steel and cast iron. 22. Estimate and calculate welding materials costs. 23. Cut metal with plasma cutting unit. 24. Operate power tools such as nibblers, drills and saws. 25. Operate hand tools such as saws and files. 26. Select appropriate metals for projects (strength). 27. Cut and assemble plastic pipe. 28. Solder copper fittings, tubing and copper wire.
---	---

GENERAL CLUSTER SKILLS

<ol style="list-style-type: none"> 1. Determine strong interpersonal communication abilities. 2. Knowledge combined with leadership qualities and the ability to delegate responsibilities. 3. Use people skills to deal with customers, the public and large groups. 4. Identify and interpret the correct resources to make an educated decision. 5. Understand and apply principles of mathematics, economics, biology and physics. 6. Have a high level of common sense, logic and critical thinking skills. 7. Think independently and analytically. 8. Ability to understand and follow detailed instruction – written and oral. 9. Motivated to learn from various methods of instruction. 10. Utilize current technologies – computers, electronics, mechanical systems, etc. 11. Calculate cost per units, per hour, per bushel, per acre, etc. 12. Estimate value of equipment and recommend future buying decisions. 13. Use technology to eliminate waste of time and resources. 14. Use computer hardware, software, internet, etc. 15. Productively use time, money and people. 16. Be knowledgeable of global agriculture-encompassing planning, production, marketing and finance. 	<ol style="list-style-type: none"> 17. Use cash flow for critical business planning and operation. 18. Measure and estimate costs and develop plans for business/industry improvements. 19. Write annual goals with specific objectives and measurement tools for review. 20. Demonstrate skills in business operations and management. 21. Use on-board computerized systems that monitor, test, store and report equipment operation. 22. Be familiar with computerized systems that monitor, test, store and report equipment operation. 23. Be familiar with computerized recognition of crop productivity and quality, field conditions and pests. 24. Understand electrical circuits – amperage, watts, voltage, resistance and transistors. 25. Understand hydraulic system operation – flow, resistance and temperature. 26. Understand mechanical system operation – mechanical advantage, material specifications and gear design. 27. Read schematics, replace components – including control modules. 28. Diagnosis electrical, computer, mechanical and hydraulic systems. 29. Analyze mechanical failures.
--	---

TEAM TABULATION SHEET (District)

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)		
		Participant # 1's Total (Maximum score possible is 150 points.)		
Name of Participant # 2		Written Exam (75 points)		
		Problem Solving (75 points)		
		Participant # 2's Total (Maximum score possible is 150 points.)		
Name of Participant # 3		Written Exam (75 points)		
		Problem Solving (75 points)		
		Participant # 3's Total (Maximum score possible is 150 points.)		
Name of Participant # 4		Written Exam (75 points)		
		Problem Solving (75 points)		
		Participant # 4's Total (Maximum score possible is 150 points.)		
TEAM RANKING		TOTAL TEAM SCORE (The three highest individual participant scores will make up the team score. Maximum score possible is 450 points.)		

TEAM TABULATION SHEET (State)

AGRICULTURAL MECHANICS CAREER DEVELOPMENT EVENT

CHAPTER _____

<i>Participant</i>	<i>Event Phase</i>	<i>Participant Score</i>	<i>Participant Total</i>
Name of Participant 1	Written Examination (100 pts.):		
	Problem/Skill 1 (30 pts.):		
	Problem/Skill 2 (30 pts.):		
	Problem/Skill 3 (30 pts.):		
	Problem/Skill 4 (30 pts.):		
	Problem/Skill 5 (30 pts.):		
Participant # 1's Total (Maximum score possible is 250 points.)			
Name of Participant 2	Written Examination (100 pts.):		
	Problem/Skill 1 (30 pts.):		
	Problem/Skill 2 (30 pts.):		
	Problem/Skill 3 (30 pts.):		
	Problem/Skill 4 (30 pts.):		
	Problem/Skill 5 (30 pts.):		
Participant # 2's Total (Maximum score possible is 250 points.)			
Name of Participant 3	Written Examination (100 pts.):		
	Problem/Skill 1 (30 pts.):		
	Problem/Skill 2 (30 pts.):		
	Problem/Skill 3 (30 pts.):		
	Problem/Skill 4 (30 pts.):		
	Problem/Skill 5 (30 pts.):		
Participant # 3's Total (Maximum score possible is 250 points.)			
Name of Participant 4	Written Examination (100 pts.):		
	Problem/Skill 1 (30 pts.):		
	Problem/Skill 2 (30 pts.):		
	Problem/Skill 3 (30 pts.):		
	Problem/Skill 4 (30 pts.):		
	Problem/Skill 5 (30 pts.):		
Participant # 4's Total (Maximum score possible is 250 points.)			
Team Activity (Maximum score possible is 150 points)			
TEAM RANKING	TOTAL TEAM SCORE (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)		

Revised September 2018

Alabama State Department of Education, Dr. Eric G. Mackey, State Superintendent of Education

The Alabama State Board of Education and the Alabama State Department of Education do not discriminate on the basis of race, color, disability, sex, religion, national origin, or age in its programs, activities, or employment and provide equal access to the Boy Scouts and other designated youth groups. The following person is responsible for handling inquiries regarding the non-discrimination policies: Title IX Coordinator, Alabama State Department of Education, P.O. Box 302101, Montgomery, AL 36130-2101, telephone (334) 694-4746.