NCEES Principles and Practice of Engineering Examination
AGRICULTURAL Exam Specifications

Effective Beginning with the October 2010 Examinations

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.
- The exam uses both the International System of units (SI) and the US Customary System (USCS).
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

		Approximate Percentage of Examination
I.	**Engineering Principles and Professional Practices**	**20%**
A.	Circuits, Controls, and Sensors	5%
1.	Electrical circuits and controls (e.g., determining load, conductor selection, controls, overload protection, grounding, power factor)	
2.	Sensors, instrumentation, data loggers, and control circuits (e.g., criteria for selection, application)	
B.	Codes, Graphics, and Safety	3%
1.	Codes, regulations, and standards in specific areas of practice (e.g., air quality, water quality, EPA, ANSI, ASABE, NIOSH, GMPs, HACCP)	
2.	Health and safety (e.g., operating procedures, manuals, human exposure, operator interface, protective devices)	
3.	Preparation and interpretation of engineering graphics (e.g., blueprints, drawings, maps, schematics, nomographs, charts)	
C.	Economics and Statistics	5%
1.	Engineering economics analysis (e.g., life-cycle costs, budgeting, replacement decisions, benefit-cost, time value of money)	
2.	Statistics application (e.g., experimental design, manufacturing and process control)	
D.	Physical Operations	7%
1.	Mass and energy balances	
2.	Applied psychrometric processes (e.g., grain drying, livestock environments, dehydration, crop water use, evaporation)	
3.	Pump principles (e.g., type, materials, sizing, selection)	
II.	**Facility Engineering: Plant, Animal, and Commodity Environments and Structures**	**15%**
A.	Environment	7.5%
1.	Air-quality requirements in and around agricultural buildings/confined spaces for humans, animals, plants and produce (e.g., odor, gases, particulate matter, pathogens)	
2.	Animal and plant facilities (e.g., total confinement, pasture, open feedlots, runoff control, layout, animal comfort, space, greenhouses, manure systems)	
3.	Hazardous materials handling and storage (e.g., facilities, equipment, storage volumes, practices/procedures, codes and standards, containment, permeability of materials)	

4. Ventilation rate requirements (e.g., heat removal, moisture removal, gas removal)
5. Ventilation system requirements (e.g., animal housing, greenhouses, product storage facilities, air distribution, fan selection, control strategy, natural and/or mechanical)

B. Structures 7.5%
1. Construction materials (e.g., strength, corrosion resistance, moisture resistance, durability, concrete mixes)
2. Foundation design (e.g., soil bearing strength, drainage, loading)
3. Post-frame building design (e.g., livestock shelters, feed storages, packing sheds, warehouses)
4. Structural analysis of buildings (e.g., one- and two-story, bins, silos, retaining walls)
5. Structural specification/codes and standards (e.g., wood, steel, and concrete materials; dead, live, snow, and wind loads)

III. Machine Systems: Power, Electrical/Electronic, Machines, Controls, and Sensors 25%

A. Agricultural Machines 6%
1. Field and farmstead agricultural machines (e.g., harvesters, planters, sprayers, material handling systems, milkers, manure handling)
2. Stability analysis (e.g., vehicular, overturning, stability of structural elements)

B. Machine System Design 8%
1. Machine component design (e.g., structural elements, functional elements, fasteners, screw elements)
2. Materials selection (e.g., corrosion resistance, weight, elasticity, cost)
3. Stress/strain relationships (e.g., deflection analysis, material strength)
4. Structural analysis of machines (e.g., power transmission systems and drive trains, frames)

C. Power Systems 5%
1. Combustion and fuels (e.g., energy values, products of combustion, emissions, storage, efficiency)
2. Internal combustion engines (e.g., power curves, specific fuel consumption, power density, combustion cycles)
3. Power requirement analysis (e.g., electrical, hydraulic, mechanical)

D. Power Transmission Systems 6%
1. Hydraulic power circuits (e.g., pumps, motors, conduit, pipe size, heat generation, valves, cylinders, logic controls)
2. Mechanical power transmission (e.g., chains, v-belts, clutches, gears, shafts)

IV. Natural Resource Engineering: Soil, Water, and Plant Systems 30%

A. Applications 11%
1. Environmental assessment techniques (e.g., standards, methods, reporting, sampling)
2. Irrigation principles (e.g., application methods/devices, efficiency, uniformity, pipeline design, pumping systems, evapotranspiration)
3. Open-channel hydraulics (e.g., earthen and concrete channels, energy dissipation structures, partially filled conduits, weirs and flumes, streams)
4. Surface and subsurface drainage

B. Fundamentals 8%
1. Hydrology (e.g., precipitation, infiltration, runoff, flood routing, ground water)
2. Soil mechanics principles (e.g., forces, bearing capacity, shear strength)
3. Soil physics principles (e.g., infiltration, water characteristics, soil physical properties)
4. Soil-water relationships (e.g., gravimetric moisture content, volumetric content, potential)

C. Interactions among Natural Resources 11%
   1. Ecological processes (e.g., interaction of plant/animal/microbial communities at all levels, ecological engineering, integrated pest management)
   2. Erosion control and slope stabilization
   3. Nutrient management/loading rates in soils (e.g., budget, CNMP plans)
   4. Sediment processes (e.g., basin design, transport)

V. Process Engineering: Food, Feed, Fiber, and Fuel Products 10%

A. Energy Sources (e.g., Fossil Fuels, Solar, Wind, Biomass, Hydro) 1%
B. Facilities Layouts, Including Functional and Space Requirements for Processing Facilities (e.g., Animal Products, Plant Products, Grain, Layout, Storage) 1%
C. Mass Transfer Between Phases (e.g., Drying, Extraction, Leaching, Evaporative Cooling) 4%
D. Materials Properties 4%
   1. Biological materials—physical and chemical properties and compatibility (e.g., rheology, thermal properties, electrical properties, optical properties, corrosion, mixability, contamination, sensory quality)
   2. Bulk solids characterization (e.g., angle of repose, constitutive relationships, coefficient of friction)