

**NCEES Principles and Practice of Engineering Examination  
AGRICULTURAL AND BIOLOGICAL ENGINEERING CBT Exam Specifications**

**Effective Beginning October 1, 2023**

- The PE Agricultural and Biological Engineering exam is computer-based. It is closed book with electronic references. Standards applicable to the PE Agricultural and Biological Engineering exam are shown on the last page.
- Examinees have 9.5 hours to complete the exam, which contains 85 questions. The 9.5-hour time includes a tutorial and an optional scheduled break. Examinees work all questions.
- The exam uses both the International System of Units (SI) and the U.S. 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 within each exam topic are not exclusive or exhaustive categories.

**1. Common System Applications**

**Number of Questions  
19–29**

- A. Pump principles (e.g., type, materials, sizing, selection, efficiencies, affinity laws)
- B. Fan and blower principles (e.g., type, materials, sizing, selection, efficiencies, affinity laws)
- C. Energy and mass balances
- D. Piping systems (e.g., gravity, pressure, components, layout)
- E. Energy sources (e.g., fossil fuels, solar, wind, biomass, hydro, geothermal)
- F. Engineering economics analysis (e.g., life-cycle costs, budgeting, replacement decisions, benefit-cost, time value of money, fixed and operating costs)
- G. Engineering graphics (e.g., drawings, maps, schematics, nomographs, charts, CAD, GIS)
- H. Environmental assessment (e.g., concerns, standards, methods)
- I. Health and safety (e.g., operating procedures, manuals, human exposure, operator interface, protective devices)
- J. Statistics (e.g., data analysis, experimental design, manufacturing and process control, risk analysis, probability)
- K. Strength of materials (e.g., deflection analysis, failure analysis, stress-strain relationships)
- L. Process analysis (e.g., efficiency, capacity, performance, durability, unit cost)
- M. Energy use assessment (e.g., windows, insulation, lighting, latent and sensible heat, energy auditing)
- N. Materials selection (e.g., corrosion resistance, weight, elasticity, cost, strength, machinability, constructability)

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- O. Materials handling, storage, and disposal (e.g., facilities, equipment, storage volumes, practices/procedures, codes and standards, containment, permeability of materials, composting, incineration, landfill)
  - P. Codes, regulations, and standards in specific areas of practice (e.g., air quality, water quality, fire protection, EPA, ANSI, ASABE, NIOSH, FSMA, IBC, NRCS, NEC, FEMA)
  - Q. Electrical circuits and controls (e.g., determining load, conductor selection, controls, overload/fault protection, grounding, power factor)
  - R. Sensors, instrumentation, data loggers, control circuits, communication systems, and devices (e.g., criteria for selection, application)
  - S. Project management (e.g., scheduling, labor, materials, resources, estimation, critical path)
  - T. Electric motors (e.g., ac, dc, variable frequency drives [VFDs], single-phase, three-phase, capacitor start, frame and enclosure types)
  - U. Engineering surveying principles (e.g., topographic, stakeout, GPS, cuts and fills, interpretation)

## **2. Natural Resources and Environmental Systems**

**15–23**

- A. Environmental systems analysis (e.g., interaction of plant/animal/microbial communities, constructed wetlands, stream restoration, floodplain, nitrification rate, chemical balance, water-holding capacity, oxidation/reduction, aerobic/anaerobic, loading N&P, pH)
- B. Erosion control, soil stabilization, and sedimentation (e.g., risk analysis, conservation practices, basin design, universal soil loss equation [USLE], sediment loading, vegetative filter strip [VFS], Stokes' law, detachment, transport, deposition, turbidity)
- C. Hydrology (e.g., precipitation, infiltration, runoff, flood routing, groundwater, hydrographs, time of concentration, evapotranspiration, runoff curve number)
- D. Irrigation principles (e.g., application methods/devices, efficiency, uniformity, pipeline design, pumping systems, evapotranspiration, rate, scheduling, consumptive use, managed allowable deficit [MAD])
- E. Nutrient management/loading rates in soils (e.g., budget, comprehensive nutrient management plan [CNMP] principles, crop nutrient uptake, vegetative treatment areas, allowable levels, hot spots)
- F. Open-channel hydraulics (e.g., natural and constructed channels, culverts, energy dissipation structures, partially filled conduits, weirs and flumes)
- G. Soil and water (e.g., soil mechanics, soil physics, gravimetric water content, volumetric water content, potential, bearing capacity, shear strength, compaction, slope stability, infiltration, moisture content, soil physical properties, shrink-swell)
- H. Surface and subsurface drainage (e.g., ditches, tile drainage, controlled drainage, pumped drainage)

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- I. Stormwater management (e.g., design of retention ponds, calculating trapping efficiencies, combined permeability of layers, design of grass waterways, swale design, reducing peak flows)
  - J. Computer modeling (e.g., hydrologic and hydraulic simulation, evapotranspiration, delineating watersheds, time to peak flow for a basin)
  - K. Environmental policy (e.g., TMDLs, NPDES permits, water rights, threatened and endangered species, wetland delineation, regulations)
  - L. Dams and reservoirs (e.g., sizing reservoirs, freeboard, design storm, dam height, spillways, side slopes)

### **3. Processing Systems**

**12–18**

- A. Biological and chemical kinetics (e.g., rates, yields)
- B. Biological transformation (e.g., fermentation, biofiltration, nitrification, denitrification)
- C. Bulk solids characterization (e.g., angle of repose, coefficient of friction, density)
- D. Mass transfer (e.g., drying, extraction, leaching, evaporative cooling, cooking)
- E. Physical and chemical properties of biological materials (e.g., rheology, thermal properties, electrical properties, optical properties, corrosion, mixability, contamination, compatibility, water activity, *D*-value)
- F. Applied psychrometric processes (e.g., drying, dehydration, crop water use, evaporation)
- G. Physical and chemical properties of water in all phases (e.g., enthalpy, latent heat of vaporization, latent heat of fusion)
- H. Process heating and cooling (e.g., heat transfer, pasteurization, coolers)
- I. Food safety and quality control (e.g., quality control point [QCP], critical control point [CCP], allergen control, good manufacturing practice [GMP], hazard analysis and risk-based preventive controls [HARPC], pathogen control, pest control, condensation control)

### **4. Facilities and Structures**

**12–18**

- A. Animal facilities (e.g., environment, total confinement, pasture, open feedlots, runoff control, layout, animal welfare, space, manure systems, mortality management)
- B. Plant production facilities (e.g., greenhouses, environment, space requirements, lighting, nutrients)
- C. Food and biomaterials processing and storage facilities (e.g., sanitary design, layout, drainage, material movement, allergen control, hygienic zones, food additives, biofuels, fermentation, grain handling)
- D. Building materials (e.g., strength, corrosion resistance, moisture resistance, pest management, durability, concrete mixes, steel, aluminum, lumber, composites, cost)
- E. Foundation design (e.g., soil bearing strength, footing, frost level, drainage, loading, reinforcement, floating pads, soil physics)

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- F. Post-frame building design (e.g., livestock shelters, bulk material storage, packing sheds, warehouses, post footing, diaphragms)
  - G. Structural analysis (e.g., one- and two-story buildings, bins, silos, tanks, retaining walls, waste storage, wood structures)
  - H. Ventilation rate requirements (e.g., heat removal, moisture removal, gas removal, odor removal)
  - I. Ventilation system requirements (e.g., air distribution, fan selection, control strategy, natural and/or mechanical, pressure drop)
  - J. Structural specification/codes and standards (e.g., wood, steel, concrete; dead, live, snow, and wind loads)

## **5. Machinery Systems**

**12–18**

- A. Hydraulic power component performance (e.g., pumps, motors, pipe size, valves, cylinders, logic controls)
- B. Hydraulic circuit analysis (e.g., heat generation, pressure drop, constant pressure, constant flow, load sensing, unloading, sequencing)
- C. Internal combustion engines (e.g., power curves, specific fuel consumption, power density, combustion cycles, efficiency)
- D. Machine and component power requirements (e.g., electrical, hydraulic, mechanical, pneumatic)
- E. Machines for materials handling/conveyance/processing (e.g., milking, feed handling, waste handling, grain elevator, size reduction)
- F. Machines for off-road/field use (e.g., harvesters, planters, sprayers, heavy equipment, tillage equipment)
- G. Mechanical power transmission (e.g., chains, belts, clutches, gears, shafts, CVT, pulleys, U-joints)
- H. Performance analysis of a machine (e.g., efficiency, throughput, suitability, purity, stability, vibration)
- I. Structural analysis of machine components (e.g., power transmission systems and drive trains, frames, fatigue failure)
- J. Component design (e.g., structural elements, functional elements, fasteners, screw elements, shafts, weld design, rollover protective structure)

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**NCEES Principles and Practice of Engineering Examination  
PE AGRICULTURAL AND BIOLOGICAL ENGINEERING Standards**

**Effective with Exams Beginning October 1, 2025**

ASABE standards will be supplied to examinees on exam day as searchable pdf files in the exam if they are required to answer an exam question. The collection is available on ASABE.org. Examinees are not allowed to bring any reference material into the exam room.

Solutions to exam questions that reference a standard of practice are scored based on this list and the revision year shown. Solutions based on other standards will not receive credit.

<b>ASAE D271.3 DEC 2023</b>	Psychrometric Data
<b>ASAE D272.3 MAR 1996 (R2021)</b>	Resistance to Airflow of Grains, Seeds, Other Agricultural Products, and Perforated Metal Sheets
<b>ASAE D497.7 MAR 2011 (R2020)</b>	Agricultural Machinery Management Data
<b>ASAE EP270.5 DEC 1986 (R2022)</b>	Design of Ventilation Systems for Poultry and Livestock Shelters
<b>ASAE EP285.8 FEB 2014 (R2023)</b>	Use of SI (Metric) Units
<b>ANSI/ASAE EP302.4 FEB 1993 (R2022)</b>	Design and Construction of Surface Drainage Systems on Agricultural Lands in Humid Areas
<b>ASAE EP393.3 DEC 1998 (R2023)</b>	Manure Storages
<b>ANSI/ASAE EP403.4 FEB 2011 (R2020)</b>	Design of Anaerobic Lagoons for Animal Waste Management
<b>ASAE EP473.2 JAN 2001 (R2020)</b>	Equipotential Plane in Livestock Containment Areas
<b>ANSI/ASAE EP484.3 DEC 2017 (R2022)</b>	Diaphragm Design of Metal-Clad, Wood-Frame Rectangular Buildings
<b>ANSI/ASAE EP486.3 SEP 2017 (R2021)</b>	Shallow Post and Pier Foundation Design

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**ASAE EP496.3**  
**FEB 2006 (R2020)**

Agricultural Machinery Management

**ASAE EP542.1**  
**NOV 2019**

Procedures for Using and Reporting Data Obtained with the Soil Cone Penetrometer

**ANSI/ASAE EP545**  
**MAR 1995 (R2019)**

Loads Exerted by Free-Flowing Grain on Shallow Storage Structures

**ANSI/ASAE S433.1**  
**JAN 2019**

Loads Exerted by Free-Flowing Grain on Bins

**ASAE S526.4**  
**SEP 2015 (R2019)**

Soil and Water Terminology