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.

I. Common System Applications

A. Pump principles (e.g., type, materials, sizing, selection)
B. Energy balances
C. Piping systems (e.g., gravity, pressure, components, layout)
D. Energy sources (e.g., fossil fuels, solar, wind, biomass, hydro)
E. Engineering economics analysis (e.g., life-cycle costs, budgeting, replacement decisions, benefit-cost, time value of money, fixed and operating costs)
F. Engineering graphics (e.g., drawings, maps, schematics, nomographs, charts, CAD, GIS)
G. Environmental assessment techniques (e.g., standards, methods, reporting, sampling)
H. Health and safety (e.g., operating procedures, manuals, human exposure, operator interface, protective devices)
I. Statistics application (e.g., experimental design, manufacturing and process control)
J. Stress-strain relationships (e.g., deflection analysis, material strength, failure analysis)
K. Process analysis (e.g., efficiency, capacity, performance, durability, cost per ton)
L. Energy use assessment (e.g., windows, insulation, lighting, latent and sensible heat)
M. Materials selection (e.g., corrosion resistance, weight, elasticity, cost, strength, machinability, constructability)
N. Regulated materials handling, storage, and disposal (e.g., facilities, equipment, storage volumes, practices/procedures, codes and standards, containment, permeability of materials, composting, incineration)

O. Air-quality requirements (e.g., odor, gases, particulate matter, pathogens, emissions inventory)

P. Codes, regulations, and standards in specific areas of practice (e.g., air quality, water quality, fire protection, EPA, ANSI, ASABE, NIOSH, GMPs, HACCP, IBC, NRCS, NEC)

Q. Electrical circuits and controls (e.g., determining load, conductor selection, controls, overload protection, grounding, power factor)

R. Sensors, instrumentation, data loggers, and control circuits and devices (e.g., criteria for selection, application)

II. Natural Resources and Ecology

A. Ecological processes (e.g., interaction of plant/animal/microbial communities, constructed wetlands, stream restoration)

B. Erosion control and soil stabilization (e.g., risk analysis, conservation practices, basin design)

C. Hydrology (e.g., precipitation, infiltration, runoff, flood routing, ground water, hydrographs, ET)

D. Irrigation principles (e.g., application methods/devices, efficiency, uniformity, pipeline design, pumping systems, evapotranspiration, rate, timing)

E. Nutrient management/loading rates in soils (e.g., budget, CNMP principles, crop nutrient uptake, vegetative treatment areas)

F. Open-channel hydraulics (e.g., natural and constructed channels, energy dissipation structures, partially filled conduits, weirs and flumes)

G. Soil-water relationships (e.g., gravimetric water content, volumetric water content, potential)

H. Surface and subsurface drainage

I. Engineering surveying principles (e.g., topographic, stakeout, GPS, cuts and fills, interpretation)

J. Soil mechanics principles (e.g., forces, bearing capacity, shear strength, compaction, slope stability)

K. Soil physics principles (e.g., infiltration, moisture content, soil physical properties, shrink-swell)

L. Sediment processes (e.g., detachment, transport, deposition)

III. Process Engineering

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, constitutive relationships, coefficient of friction, density)

D. Mass transfer between phases (e.g., drying, extraction, leaching, evaporative cooling)
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. Physical/chemical separation processes (e.g., filter selection, settling, distillation, ion exchange, decanting, centrifugation)

G. Reactor vessel design (e.g., types, sizing, mixing, materials)

H. Fuel characteristics (e.g., energy values, products of combustion, emissions, storage, efficiency)

I. Applied psychrometric processes (e.g., grain drying, livestock environments, dehydration, crop water use, evaporation)

J. Mass balances

IV. Facilities

A. Animal facilities (e.g., total confinement, pasture, open feedlots, runoff control, layout, animal comfort, space, manure systems, mortality management)

B. Plant facilities (e.g., environment, space requirements, lighting, nutrients)

C. Biomaterials processing and storage facilities (e.g., food additives, biofuels, digestion, fermentation, algae growth, grain handling)

D. Building materials (e.g., strength, corrosion resistance, moisture resistance, durability, concrete mixes, steel, aluminum, lumber, composites)

E. Foundation design (e.g., soil bearing strength, drainage, loading, reinforcement)

F. Post-frame building design (e.g., livestock shelters, bulk material storage, packing sheds, warehouses)

G. Structural analysis (e.g., one- and two-story buildings, bins, silos, retaining walls, waste storage)

H. Ventilation rate requirements (e.g., heat removal, moisture removal, gas 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, and concrete; dead, live, snow, and wind loads)

V. Machines

A. Hydraulic power component performance (e.g., pumps, motors, conduit, 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. Electric motors (e.g., AC, DC, variable-frequency drives [VFDs], single-phase, three-phase, capacitor start)

E. Kinematic modeling (e.g., relative position, velocity, acceleration, clearance)
F. Machine and component power requirements (e.g., electrical, hydraulic, mechanical, pneumatic)
G. Machines for materials handling/conveyance (e.g., milking, feed handling, waste handling)
H. Machines for offroad/field use (e.g., harvesters, planters, sprayers, heavy equipment, tillage equipment)
I. Machines for processes (e.g., mills, grinders, coolers, separators)
J. Mechanical power transmission (e.g., chains, belts, clutches, gears, shafts, CVT, pulleys, U-joints)
K. Performance analysis of a machine (e.g., efficiency, throughput, suitability, purity)
L. Machine stability analysis (e.g., stationary, in-motion or moving)
M. Structural analysis of machine components (e.g., power transmission systems and drive trains, frames)
N. Component design (e.g., structural elements, functional elements, fasteners, screw elements, shafts, weld design)
O. Electronic integration (e.g., measurement and control, remote sensing, circuit components, geospatial guidance systems)