

**NCEES Principles and Practice of Engineering Examination  
MECHANICAL—HVAC AND REFRIGERATION CBT Exam Specifications**

**Effective beginning April 2020**

- **The exam topics have not changed since April 2017 when they were originally published.**
- The exam is computer-based. It is closed book with an electronic reference.
- Examinees have 9 hours to complete the exam, which contains 80 questions. The 9-hour time includes a tutorial and an optional scheduled break. Examinees work all questions.
- The exam uses U.S. Customary System (USCS) units.
- Sea level conditions apply unless otherwise noted.
- The exam is developed with questions that 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.

	<b>Number of Questions</b>
<b>I. Principles</b>	<b>28–43</b>
A. Basic Engineering Practice	4–6
1. Units and conversions	
2. Economic analysis	
3. Electrical concepts (e.g., power consumption, motor ratings, heat output, amperage)	
B. Thermodynamics	4–6
1. Cycles	
2. Properties	
3. Compression processes	
C. Psychrometrics (e.g., sea level, 5,000-ft elevation)	7–11
1. Heating/cooling processes	
2. Humidification/dehumidification processes	
D. Heat Transfer	6–9
E. Fluid Mechanics	3–5
F. Energy/Mass Balances	4–6
<b>II. Applications</b>	<b>42–64</b>
A. Heating/Cooling Loads	7–11
B. Equipment and Components	16–24
1. Cooling towers and fluid coolers	
2. Boilers and furnaces (e.g., efficiencies, fuel types, combustion)	
3. Heat exchangers (e.g., shell and tube, plate and frame)	
4. Condensers/evaporators (e.g., chillers, variable refrigerant flow, heat pumps)	
5. Pumps/compressors/fans (e.g., laws, efficiency, selection)	

- 6. Cooling/heating coils
- 7. Control systems components (e.g., valves, dampers)
- 8. Refrigerants (e.g., properties, types)
- 9. Refrigeration components (e.g., expansion valves, accumulators)
- C. Systems and Components 16–24
  - 1. Air distribution (e.g., air handlers, duct design, system type, terminal devices)
  - 2. Fluid distribution/piping (e.g., hydronic, oil, fuel gas, compressed air, steam, system type)
  - 3. Refrigeration (e.g., food storage, cooling and freezing)
  - 4. Energy recovery (e.g., enthalpy wheels, heat pipes, run-around systems)
  - 5. Basic control concepts (e.g., economizer, temperature reset)
- D. Supportive Knowledge 3–5
  - 1. Codes and standards
  - 2. Air quality and ventilation (e.g., filtration, dilution)
  - 3. Vibration control (e.g., transmission effect, isolation)
  - 4. Acoustics (e.g., sound control, absorption, attenuators, noise-level criteria)