

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

Effective beginning with the April 2017 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 U.S. Customary System (USCS) units.
- Sea level conditions apply unless otherwise noted.
- 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 Number of Questions
I. Principles	32
A. Basic Engineering Practice	4
1. Units and conversions	
2. Economic analysis	
3. Electrical concepts (e.g., power consumption, motor ratings, heat output, amperage)	
B. Thermodynamics	4
1. Cycles	
2. Properties	
3. Compression processes	
C. Psychrometrics (e.g., sea level, 5,000-ft elevation)	8
1. Heating/cooling processes	
2. Humidification/dehumidification processes	
D. Heat Transfer	7
E. Fluid Mechanics	4
F. Energy/Mass Balances	5
II. Applications	48
A. Heating/Cooling Loads	8
B. Equipment and Components	18
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 18
 - 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 4
 - 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)