The mechanical exam is a breadth and depth examination. This means that examinees work the breadth (AM) exam and one of the three depth (PM) exams.

The three areas covered in the mechanical engineering examination are HVAC and Refrigeration; Mechanical Systems and Materials; and Thermal and Fluids Systems. The breadth exam contains questions from these three areas of mechanical engineering. The depth exams focus more closely on a single area of practice in mechanical engineering.

Examinees work all questions in the morning session and all questions in the afternoon module they have chosen. Depth results are combined with breadth results for final score.

The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour AM session, and 40 multiple-choice questions in the 4-hour PM session.

Questions in Sections I–IV of the breadth module will be in either USCS or SI units. Questions in Section V of the breadth module will be in USCS units. Questions in the depth module will be in either USCS or SI units.

The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application. Some problems may require knowledge of engineering economics.

The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

The specifications for the AM exam and the Thermal and Fluids Systems PM exam are included here.

### MECHANICAL BREADTH Exam Specifications

<table>
<thead>
<tr>
<th>Section</th>
<th>Approximate Number of Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Basic Engineering Practice</td>
<td>12</td>
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<tr>
<td>A. Basic Engineering Practice</td>
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<tr>
<td>1. Engineering terms and symbols</td>
<td>12</td>
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<tr>
<td>2. Economic analysis</td>
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<td>3. Project management</td>
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<td>4. Interpretation of technical drawings</td>
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<td>5. Electrical concepts</td>
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<td>6. Units and conversions</td>
<td></td>
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<tr>
<td>II. Mechanical Systems and Materials</td>
<td>8</td>
</tr>
<tr>
<td>A. Principles</td>
<td></td>
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<tr>
<td>1. Statics and dynamics</td>
<td>5</td>
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<tr>
<td>2. Strength of materials</td>
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<tr>
<td>3. Stress analysis</td>
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<tr>
<td>4. Fatigue theory</td>
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</tbody>
</table>
B. Applications
   1. Mechanical components (e.g., springs, gears, pressure vessels)
   2. Joints and fasteners (e.g., welding, bolts, adhesives)
   3. Vibration/dynamic analysis
   4. Materials selection (e.g., corrosion, weight, strength)

III. Hydraulics and Fluids
A. Principles
   1. Compressible flow
   2. Incompressible flow
B. Applications
   1. Hydraulic and fluid equipment (e.g., pumps, turbines, compressors)
   2. Piping systems and components

IV. Energy/Power Systems
A. Principles
   1. Thermodynamic cycles
   2. Thermodynamic properties
   3. Energy balances
   4. Mass balances
   5. Heat transfer
   6. Combustion
B. Applications
   1. Power conversion systems
   2. Energy/power equipment (e.g., turbines, boilers, engines)
   3. Heat exchangers

V. HVAC/Refrigeration
A. Principles
   1. Psychrometrics
   2. Refrigeration cycles
   3. Heat transfer
B. Applications
   1. HVAC/refrigeration systems
   2. HVAC/refrigeration components (e.g., air handlers, compressors)
   3. Heating/cooling loads
MECHANICAL–THERMAL and FLUIDS SYSTEMS DEPTH Exam Specifications

Approximate Number of Questions

I. Principles 18
   A. Materials Properties (e.g., density, viscosity) 2
   B. Fluid Mechanics 4
      1. Compressible fluids (e.g., Mach number, nozzles, diffusers)
      2. Incompressible fluids (e.g., friction factor, Reynolds number, lift, drag)
   C. Heat Transfer Principles (e.g., convection, conduction, radiation) 4
   D. Mass Balance Principles (e.g., evaporation, dehumidification, combustion) 3
   E. Thermodynamics 4
      1. Thermodynamic cycles (e.g., combined, Brayton, Rankine)
      2. Thermodynamic properties (e.g., enthalpy, entropy)
      3. Energy balances (e.g., 1st and 2nd Laws)
      4. Combustion (e.g., stoichiometrics)
   F. Related Principles 1
      1. Strength of materials (e.g., stress-strain, yield strength)
      2. Fatigue theory (e.g., Goodman diagram)
      3. Statics and dynamics
      4. Stress analysis (e.g., pipe stress, pipe hangers, hoop stress)
      5. Psychrometrics (e.g., dew point, relative humidity)
      6. Welding (e.g., processes, symbols)
      7. Safety (e.g., OSHA, industrial, ergonomics, sanitation)
      8. Quality control/quality assurance

II. Applications 22
   A. Equipment 7
      1. Pumps
      2. Turbines
      3. Compressors, fans, blowers
      4. Boilers, steam generators
      5. Engines and drive trains
      6. Pressure vessels
      7. Heat exchangers/condensers/heat water heaters
      8. Cooling towers
      9. Control devices (valves, flow measurement)
   B. Systems 13
      1. Power hydraulics
      2. Pneumatic
      3. Fluid distribution
      4. Power conversion
      5. Energy recovery
      6. Cooling/heating (cycles)
      7. Power cycles
   C. Codes and Standards 2