NCEES
advancing licensure for engineers and surveyors

Schedule

Oct 27 exam

Principles and Practice of Engineering Examination
MECHANICAL—MACHINE DESIGN AND MATERIALS 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 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 specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

	Approximate Number of Questions
I. Principles	**40**
A. Basic Engineering Practice	9
1. Engineering terms, symbols 6/12 Krulikowski pocket guide	
2. Interpretation of technical drawings 6/13	
3. Quality assurance/quality control (QA/QC)	
4. Project management and economic analysis	
5. Units and conversions	
6. Design methodology (e.g., identifying requirements, risk assessment, verification/validation)	
B. Engineering Science and Mechanics	10
1. Statics 7/3 FEDE-IV	
2. Kinematics	
3. Dynamics	
C. Material Properties	8
1. Physical (e.g., density, melting point, optical)	
2. Chemical (e.g., corrosion, alloys, oxidation)	
3. Mechanical	
a. Time-independent behavior (e.g., modulus, hardness, thermal expansion)	
b. Time-dependent behavior (e.g., creep, viscoelastic, thermal conductivity)	
D. Strength of Materials	10
1. Stress/strain (e.g., tension, compression)	
2. Shear	
3. Bending	
4. Buckling	
5. Torsion	

Week 1 6/5 - 6/11

Week 2 6/12 - 6/18

Week 3-5 7/4 - 7/9, 7/10 - 7/16, 7/17 - 7/23

Week 6-8 8/1 - 8/6, 8/14 - 8/20, 8/21 - 8/27

6. Fatigue
7. Failure theories (e.g., Von Mises, maximum shear stress)

E. Vibration 3

1. Natural frequencies (e.g., linear, bending, torsional) and acoustics
2. Damping (e.g., frequency, damping ratio, critical damping)
3. Forced vibrations (e.g., magnification factor, transmissibility, balancing, isolation)

8/28 - 9/10
Week 9-10 Buffer

II. Applications **40**

A. Mechanical Components 18

1. Pressure vessels and piping (e.g., thick/thin wall)
2. Bearings (e.g., types, lubrication analysis, life-load analysis)
3. Gears (e.g., types, speed analysis, force analysis)
4. Springs (e.g., types, force analysis, fatigue analysis)
5. Dampers (e.g., types, selection)
6. Belt, pulley and chain drives (e.g., types, force analysis)
7. Clutches and brakes (e.g., types, torque/force analysis)

Week 11
9/11 - 9/17

8. Power screws (e.g., types, lifting and lowering torque, locking conditions)
9. Shafts and keys (e.g., torsion, bending, static/fatigue failure, stress risers)
10. Mechanisms (e.g., linkages, cams, slider crank, levers, force analysis, kinetic analysis)
11. Basic mechatronics (e.g., electromechanical interfaces, sensors, basic circuits, basic controls)
12. Hydraulic and pneumatic components (e.g., pumps, cylinders, presses)
13. Motors and engines (e.g., energy conservation, efficiency)

Week 12
9/18 - 9/24

B. Joints and Fasteners 12

1. Welding and brazing (e.g., types, symbols, stress analysis)
2. Bolts, screws, rivets (e.g., grade/class selection, preload, fastener group force analysis)
3. Adhesives (e.g., types, analysis)

Week 13
9/25 - 10/1

C. Supportive Knowledge 10

1. Manufacturing processes (e.g., machining, molding, heat treatment)
2. Fits and tolerances
3. Codes and standards
4. Computational methods and their limitations (e.g., FEA, CAE)
5. Testing and instrumentation

Week 14
10/2 - 10/8

10/9 - 10/15 Week 15 Part I Exams etc tned

10/16 - 10/22 Week 16 Part II Exams etc tned

10/23 - 10/26 Week 17 Part I & II Exams

Oct 27th Exam