THE NEW FE EXAM
BEGINS JANUARY 2014

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NCEES
advancing licensure for engineers and surveyors

About NCEES

- Develops, administers, and scores examinations used for professional engineering and surveying
- Facilitates professional mobility
- Promotes uniformity for the U.S. licensure processes through member boards and licensees

The FE exam

- 1965–First FE exam is administered.
- 1984–All state licensing boards use FE exam.
- 1996–Afternoon portion of FE is offered in six discipline-specific modules.
  - first step in the licensure process
  - used for outcomes assessment requirement for ABET re-accreditation

The New FE exam

- Computer-based
- Shorter
- Different format
- Different topics covered

Why CBT?

- Candidate convenience
- Quicker score turnaround
- Uniformity in testing conditions
- Enhanced security
- More innovative way to test

Will there be any changes?

- Length
  - Appointment time at test center will be 6 hours
    - Tutorial–5 minutes
    - Nondisclosure agreement–5 minutes
    - Exam time–5 hours, 20 minutes with a 25-minute scheduled break after approximately 55 questions
    - Post-exam survey–5 minutes
  - Total of 110 questions

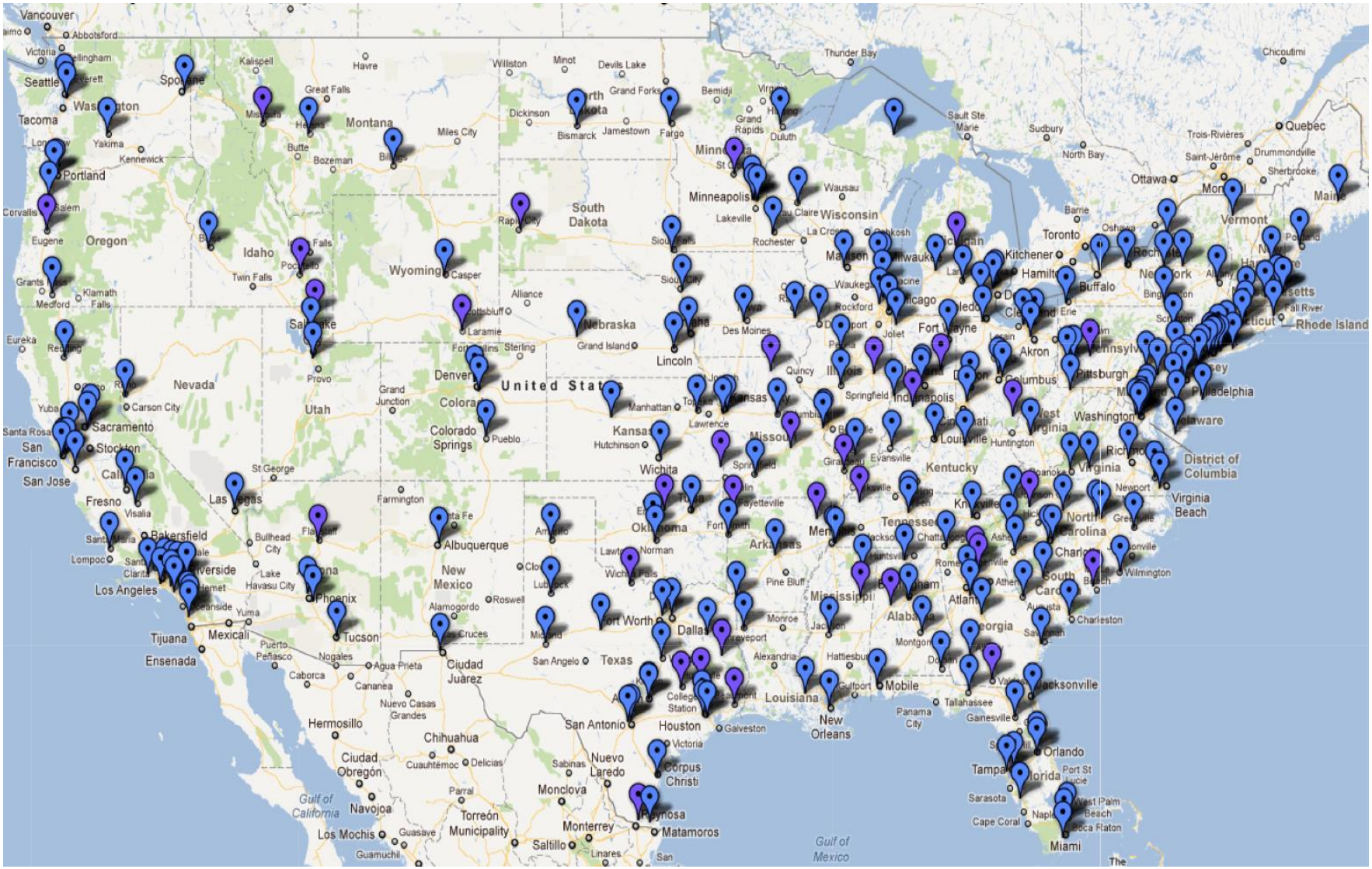
Will there be any changes?

- Price
  - TBD in August
- Registration process
  - Candidates will be required to pay all exam-related fees directly to NCEES.
  - Online
  - Require payment with MasterCard or Visa

Will there be any changes?

- Testing opportunities
  - Testing windows
    - January–February
    - April–May
    - July–August
    - October–November
- Test center locations
  - Pearson VUE testing centers

Test center locations



Will there be any changes?

- FE Reference Handbook
  - Closed-book exam
  - Electronic

FE exam—supplied reference

NCEES Demo: FE Reference Handbook - Candidate Name

I A 2^3 factorial experiment is run using the following levels. For X_1: 10 and 20; for X_2: 5 and 10; and for X_3: 20 and 30. The low level for each factor is represented by 1 and the high level is represented by 2. The table shows the results obtained at random for the eight experimental conditions of the design. Which of the individual choices would be most effective in increasing the value of the response in the region of the experimental conditions given?

X_1	X_2	X_3	Response
1	1	1	20
2	1	1	11
1	2	1	12
2	2	1	22
1	1	2	10
2	1	2	9
1	2	2	21
2	2	2	10

A. Increase X_3

B. Increase X_2

C. Decrease X_1

D. Decrease X_2

m_f = mass of liquid.

Specific volume of a two-phase system can be written:

$v = xv_g + (1 - x)v_f$ or $v = v_f + xv_{fg}$, where

v_f = specific volume of saturated liquid,

v_g = specific volume of saturated vapor, and

v_{fg} = specific volume change upon vaporization.

$= v_g - v_f$

Similar expressions exist for u, h, and s:

$u = xu_g + (1 - x)u_f$ or $u = u_f + xu_{fg}$

$h = xh_g + (1 - x)h_f$ or $h = h_f + xh_{fg}$

$s = xs_g + (1 - x)s_f$ or $s = s_f + xs_{fg}$

For a simple substance, specification of any two intensive, independent properties is sufficient to fix all the rest.

$\bar{C}_p = \frac{\bar{c}_1 - \bar{c}_2}{T_2 - T_1}$

Also, for *constant entropy* processes:

$\frac{P_2}{P_1} = \left(\frac{v_1}{v_2}\right)^k$; $\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$

$\frac{T_2}{T_1} = \left(\frac{v_1}{v_2}\right)^{k-1}$, where $k = c_p/c_v$

For real gases, several equations of state are available; one such equation is the van der Waals equation with constants based on the critical point:

$$\left(P + \frac{a}{\bar{v}^2}\right)(\bar{v} - b) = \bar{R}T$$

where $a = \left(\frac{27}{64}\right)\left(\frac{\bar{R}^2 T_c^2}{P_c}\right)$, $b = \frac{\bar{R}T_c}{8P_c}$

where P_c and T_c are the pressure and temperature at the critical point, respectively, and $\bar{v}$ is the molar specific volume.

FIRST LAW OF THERMODYNAMICS

The *First Law of Thermodynamics* is a statement of conservation of energy in a thermodynamic system. The net energy crossing the system boundary is equal to the change in energy inside the system.

Heat Q is *energy transferred* due to temperature difference and is considered positive if it is inward or added to the system.

Closed Thermodynamic System

No mass crosses system boundary

$$Q - W = \Delta U + \Delta KE + \Delta PE$$

where

ΔKE = change in kinetic energy, and

ΔPE = change in potential energy.

Energy can cross the boundary only in the form of heat or work. Work can be boundary work, w_b, or other work forms (electrical work, etc.)

Work $W\left(w = \frac{W}{m}\right)$ is considered *positive if it is outward* or *work done* by the system.

Reversible boundary work is given by $w_b = \int P\,dv$.

Special Cases of Closed Systems

Constant Pressure (***Charles' Law***):

$w_b = P\Delta v$

(ideal gas) T/v = constant

Constant Volume:

u_s = specific internal energy of system, and

$\dot{Q}$ = rate of heat transfer (neglecting kinetic and potential energy of the system).

Special Cases of Open Systems

Constant Volume:

$w_{rev} = -v(P_2 - P_1)$

Constant Pressure:

$w_{rev} = 0$

Constant Temperature:

(ideal gas) Pv = constant

$w_{rev} = RT \ln(v_2/v_1) = RT \ln(P_1/P_2)$

Isentropic (ideal gas):

Pv^k = constant

$w_{rev} = k(P_2v_2 - P_1v_1)/(1 - k)$

$= kR(T_2 - T_1)/(1 - k)$

$$w_{rev} = \frac{k}{k-1}RT_1\left[1 - \left(\frac{P_2}{P_1}\right)^{(k-1)/k}\right]$$

Polytropic:

Pv^n = constant

$w_{rev} = n(P_2v_2 - P_1v_1)/(1 - n)$

Steady-State Systems

The system does not change state with time. This assumption is valid for steady operation of turbines, pumps, compressors, throttling valves, nozzles, and heat exchangers, including boilers and condensers.

End Exam | Previous | Next

NCEES

Will there be any changes?

- Content of the exam
  - 7 free-standing discipline-specific exams
    - Chemical, Civil, Electrical & Computer, Environmental, Industrial, Mechanical, Other Disciplines
  - No separate breadth module

The current FE Elec./Comp. exam

- Mathematics
- Probability and Statistics
- ~~Chemistry~~
- ~~Computers~~ (merged with Computer Systems)
- Ethics and Business Practices
- Engineering Economics
- ~~Engineering Mechanics (Statics and Dynamics)~~
- ~~Strength of Materials~~
- Material Properties (now Properties of Electrical Materials)
- ~~Fluid Mechanics~~
- ~~Electricity and Magnetism~~ (Engineering Sciences)
- ~~Thermodynamics~~
- Circuits
- Power
- Electromagnetics
- Control Systems
- Communications
- Signal Processing
- Electronics
- Digital Systems
- Computer Systems

The new FE Elec./Comp. exam

- Mathematics
- Probability and Statistics
- Ethics and Professional Practice
- Engineering Economics
- Properties of Electrical Materials
- Engineering Sciences
- Circuit Analysis (DC and AC Steady State)
- Linear Systems
- Signal Processing
- Electronics
- Power
- Electromagnetics
- Control Systems
- Communications
- Computer Networks
- Digital Systems
- Computer Systems
- Software Development

Other ongoing initiatives

- Opening new test centers
- Development of sample exams
- Institution reports

How can I prepare?

- Review new specifications at ncees.org/CBT
- NCEES sample exams
  - Available online after October 2013 exam administration

Institution reports

- Will be available at least twice per year
- Will change due to the exam methodology

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Questions?