PURDUE UNIVERSITY COLLEGE OF ENGINEERING

Why and How to Become a PE

for Purdue Mechanical Engineering Students

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Disclaimer

The information provided by this lecture is that of Prof. Drnevich as an individual and does not represent an official position of the Indiana Registration Board for Professional Engineers or the Indiana Society of Professional Engineers.

Topics:

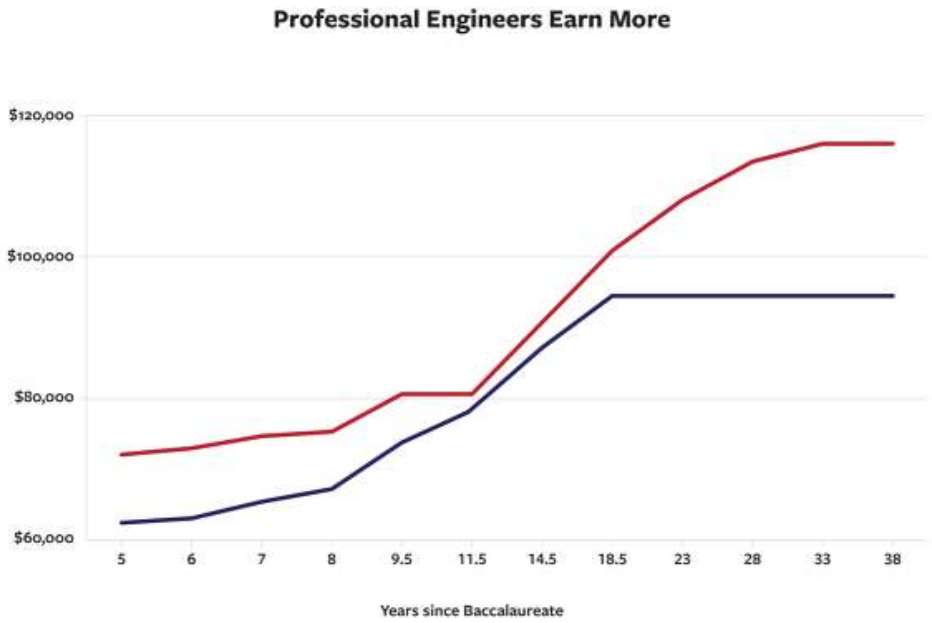
- Why become a Professional Engineer?
- Engineers in the profession
- Law on the Practice of Engineering
- How to become a PE
- Professional/Technical Societies
- Concluding Thoughts
- Address questions

Why Become a Professional Engineer (PE)?

- Mark of a professional
- Required for practice engineering involving health, welfare, and safety of the public
- Ethics requirements
- Career development and growth
- Continuing Education
- Prestige and respect
- Flexibility
- Salary

PE's Earn More

https://ncees.org/education/ncees-speakers-link-and-speakers-kit/

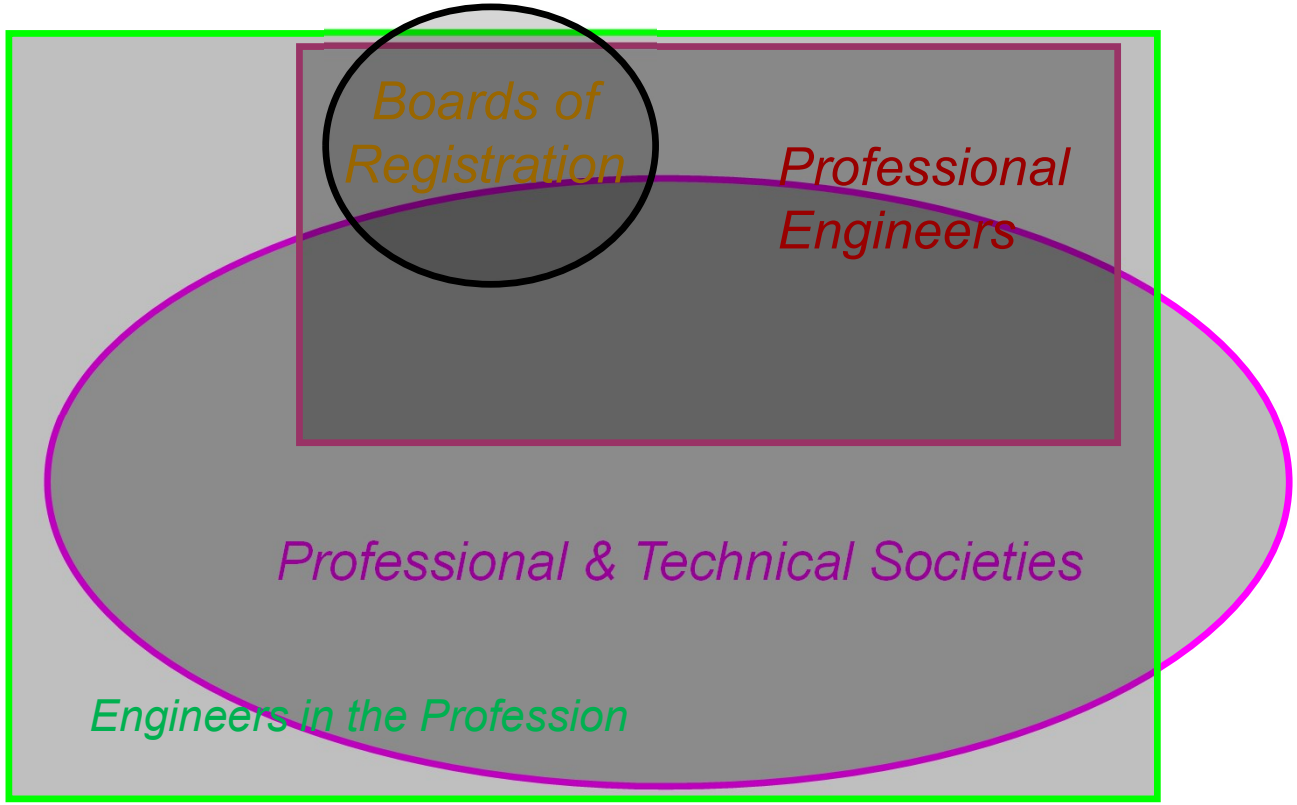


*Figures based on the most recent 'Engineering Salary Survey' by the *American Association of Engineering Societies (AAES)*. Throughout the course of a career, the median salary of a professionally licensed engineer earns a higher salary than an unlicensed engineer. *

Benefits of PE License

https://youtu.be/kXg8uzPbyEg

Engineers in the profession



Professional Engineer
Indiana Law: IC 25-31-1-2 (b)

- "Professional engineer" means an individual who, by reason of that individual's special knowledge of the mathematical and physical sciences and the principles and methods of engineering analysis and design which are acquired by education and practical experience, is qualified to engage in the practice of engineering as attested by that individual's registration as a professional engineer.

Who can practice engineering?

- According to the law, only licensed professional engineers can practice engineering

Practice of Engineering

Indiana Law: IC 25-31-1-2 (d)

"Practice of engineering" means any service or creative work that the adequate performance of requires engineering education, training, and experience in the application of special knowledge of the mathematical, physical, and engineering sciences to services or creative work that includes the following:

(1) Consultation.

(2) Investigation.

(3) Evaluation.

(4) Planning, including planning the use of land and water.

(5) The design of or the supervision of the design of engineering works and systems.

(6) Engineering surveys and studies or the supervision of engineering surveys and studies, ...

(7) Evaluation of construction for the purpose of assuring compliance with specifications, plans, and designs, in connection with any public or private utilities, structures, buildings, machines, equipment, processes, work systems, or projects.

Industrial Exemption

Indiana Law: IC 25-31-1-20

Exempt persons

(a) An employee or a subordinate of any person who holds a certificate of registration under the provisions of this chapter is exempt from the provisions of this chapter if the practice of the employee or subordinate does not include responsible charge of design or supervision.

(b) This chapter does not require registration for the purpose of practicing engineering by an individual or a business:

(1) on property owned or leased by that individual or business unless the engineering practice involves the public health or safety, or the health or safety of the employees of that individual or business;

*(2) **for the performance of engineering which relates solely to the design or fabrication of manufactured products**; or*

(3) that is registered as a landscape architect under IC 25-4-2 and while the individual or business is engaged in the practice of landscape architecture planning the use of land or water.

Professional Registration

- Required by law for the professional practice of engineering
- Each state and territory has a "registration law"
- Implemented by a Board of Registration http://www.in.gov/pla/engineer.htm
- National Council of Examiners for Engineering and Surveying (NCEES) generate and grade the FE and PE exams used by boards of registration http://www.ncees.org

Steps to Professional Licensure

1. Graduation from program in engineering acceptable to the Board* (EAC ABET accredited)

2. Passing the Fundamentals of Engineering (FE) Exam

3. Four years of engineering practice experience
   - One year granted for MS degree in engineering
   - Two years granted for PhD degree in engineering

4. Passing the Principles and Practice (PE) Exam

* Special Previsions Exist for persons without EAC ABET accredited degrees. Refs.: http://iac.iga.in.gov/iac//iac_title?iact=864; *864 IAC 1.1-2.1-2 Definitions*; *864 IAC 1.1-2.1-3 Education and work experience*

Computer-Based FE Exam

- Started in January 2014
- Is taken at Pearson-Vue Testing Centers
- Available over four, three-month-long testing windows each year
  - Window 1: Jan-Mar
  - Window 2: April-June
  - Window 3: July-Sept
  - Window 4: Oct-Dec

Computer-Based FE Exam, Cont'd.

- Apply to NCEES to register for FE and FS exams (http://ncees.org/engineering/fe/)
  - Provide information
  - Pay $175 fee
- Schedule Exam with Pearson-Vue
  - Choose location (Purdue is among 7 in Indiana; many in every state to choose from)
  - Choose from dates available.

Computer-Based FE Exam, Cont'd.

- The FE exam is a computer-based test (CBT). It is closed book with an electronic reference.
- Examinees have 6 hours to complete the exam, which contains 110 multiple-choice questions.
  - The 6-hour time also includes a tutorial, a break, and a brief survey at the conclusion.
- The FE exam uses both the International System of Units (SI) and the US Customary System (USCS).

Alternative item types

- CBT exams include traditional multiple-choice questions as well as alternative item types (AITs):
  - **Multiple correct**—allows examinees to select multiple answers
  - **Point and click**—requires examinees to click on part of a graphic to answer
  - **Drag and drop**—requires examinees to click on and drag items to match, sort, rank, or label
  - **Fill in the blank**—provides a space for examinees to enter a response to the question

Computer-Based FE Exam, Cont'd.

- Seven separate exams:
  - Chemical CBT Exam Specifications
  - Civil CBT Exam Specifications
  - Electrical and Computer CBT Exam Specifications
  - Environmental CBT Exam Specifications
  - Industrial CBT Exam Specifications
  - Mechanical CBT Exam Specifications
  - Other Disciplines CBT Exam Specifications
- Get exam day testing details at:
  - ***www.youtube.com****/watch?v=5YbpV48rNK4*

Mechanical CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Mec-CBT-specs.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*6-9*
2. Probability and Statistics	*4–6*
3. Computational Tools	*3–5*
4. Ethics and Professional Practice	*3–5*
5. Engineering Economics	*3–5*
6. Electricity and Magnetism	*3-5*
7. Statics	*8-12*
8. Dynamics, Kinematics, and Vibrations	*9–14*
9. Mechanics of Materials	*4–6*

Mechanical CBT FE Exam, Cont'd.

Knowledge Area	*Number of Questions*
10. Material Properties and Processing	*8-12*
11. Fluid Mechanics	*9-14*
12. Thermodynamics	*13-20*
13. Heat Transfer	*9-14*
14. Meas., Instrumentation, and Controls	*5-8*
15. Mechanical Design and Analysis	*9-14*

OTHER DISCIPLINES
CBT Exam Specifications

https://ncees.org/wp-content/uploads/FE-Other-CBT-specs-1.pdf

Knowledge	***Number of Questions***
1. Mathematics and Adv. Engineering Mathematics	*12–18*
2. Probability and Statistics	*6–9*
3. Chemistry	*7–11*
4. Instrumentation and Data Acquisition	*4–6*
5. Ethics and Professional Practice	*3–5*
6. Safety, Health, and Environment	*4–6*
7. Engineering Economics	*7–11*

OTHER DISCIPLINES
CBT Exam Specifications, Cont'd.

Knowledge	***Number of Questions***
8. Statics	*8–12*
9. Dynamics	*7–11*
10. Strength of Materials	*8–12*
11. Materials Science	*6–9*
12. Fluid Mechanics and Dynamics of Liquids	*8–12*
13. Fluid Mechanics and Dynamics of Gases	*4–6*
14. Electricity, Power, and Magnetism	*7–11*
15. Heat, Mass, and Energy Transfer	*9–14*

Comparison of Knowledge Areas

FE Exam Disciplines

Chem.	Civil	Elec & Comp	Environmental	Industrial	Mechanical	Other Disciplines
Mathematics	Mathematics	Mathematics	Mathematics	Mathematics	Mathematics	Mathematics
Probability and Statistics	Probability and Statistics	Probability and Statistics	Probability and Statistics	Probability and Statistics	Probability and Statistics	Probability and Statistics
Ethics and Prof.l Prac.	Ethics and Professional Prac.	Ethics and Prof.Pract.	Ethics and Professional F	Ethics and Professionalism	Ethics and Prof. Pract.	Ethics and Professional Pract.
Process Des. and Econ.	Engineering Economics	Engineering Economics	Engineering Economics	Engineering Economics	Engineering Economics	Engineering Economics
Engineering Sciences	Statics	Engineering Sciences		Engineering Sciences	Statics	Statics
Materials Science	Mechanics of Materials	Prop. of Electrical Mat'ls.			Mechanics of Materials	Strength of Materials
	Dynamics				Dyn., Kinemat., and Vibr.	Dynamics
Fluid Mechanics/Dyn.	Fluid Mechanics		Fluid Mechanics		Fluid Mechanics	Fluid Mech. and Dyn.of Liq.
Safety, Health, and Envir.	Environmental Engineering		Envir. Sci. and Chem.			Safety, Health, and Environ.
	Materials		Materials Science		Material Prop. and Proc.	Materials Science
Computational Tools	Computational Tools			Modeling and Computations	Computational Tools	
Chemistry						Chemistry
Thermodynamics			Thermodynamics		Thermodynamics	Heat, Mass, and Energy Trans.
		Circuit Analysis			Electricity and Magnetism	Electricity, Power, and Magn.
Disciipline Specific Courses						
Materials/Energy Bal.	Hydraulics and Hydrol. Sys.	Linear Systems	Risk Assessment	Industrial Management	Heat Transfer	Fluid Mech. and Dyn. of Gases
Heat Transfer	Structural Analysis	Signal Processing	Water Resources	Manufact., Prod., & Serv. Sys.	Meas., Instrum., and Cont.	Instrument. and Data Acquisit.
Mass Transfer and Sep.	Structural Design	Electronics	Water and Wastewater	Facilities and Logistics	Mech. Design and Anal.	
Chemical Reaction	Geotechnical Engineering	Power	Air Quality	Hum. Fact., Ergonom., & Saf'ty		
Process Control	Transportation Engineering	Electromagnetics	Solid and Haz. Waste	Work Design		
	Construction	Control Systems	Groundwater and Soils	Quality		
	Surveying	Communications		Systems Engineering		
		Computer Networks				
		Digital Systems				
		Computer Systems				
		Software Development				

Engineer-in-Training (EIT)

- Once the required education is completed and the FE exam is passed, must apply to State Board for certification as an EIT.
  - Submit transcripts and other info. (https://www.in.gov/pla/files/EIT_online(4).pdf)
  - Must be certified as EIT before taking PE exam.
  - All state boards accept passed FE exam
  - FE exam does not expire
  - Indiana Board information available at: http://www.in.gov/pla/engineer.htm

2020 FE Exam Takers and Pass Rates

	Overall takers			
	First time		Repeat	
	Volume	Pass rate	Volume	Pass rate
Chemical	1,738	73%	200	32%
Civil	11,455	66%	5,643	33%
Electrical and Computer	3,613	65%	1,145	35%
Environmental	1,639	75%	395	41%
Industrial and Systems	351	66%	50	44%
Mechanical	8,114	75%	1,002	42%
Other Disciplines	2,290	70%	761	30%

FE Exam Pass Rates

- Nationwide – Approximately 70%
- Purdue – Greater than 90%

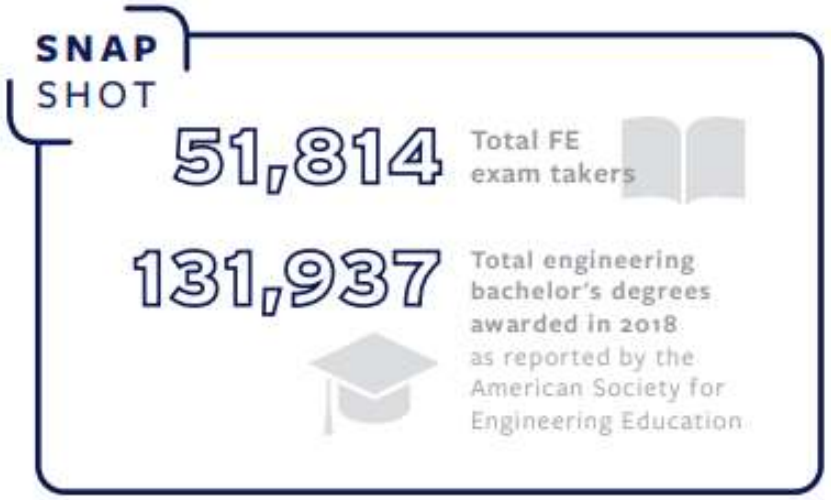
	National Pass Rate	Purdue Pass Rate
All Major National Exams	84%	96%
Speech, Language Pathology	85%	100%
Registered Nurse	86%	95%
Doctor of Audiology	70%	100%
Fundamentals of Engineering	76%	95.1%
# of exams Purdue beat the national pass rate: 11 of 11		

Ref.: Mitch Daniels Open Letter, Jan. 2017

BS Engineers who take FE exam

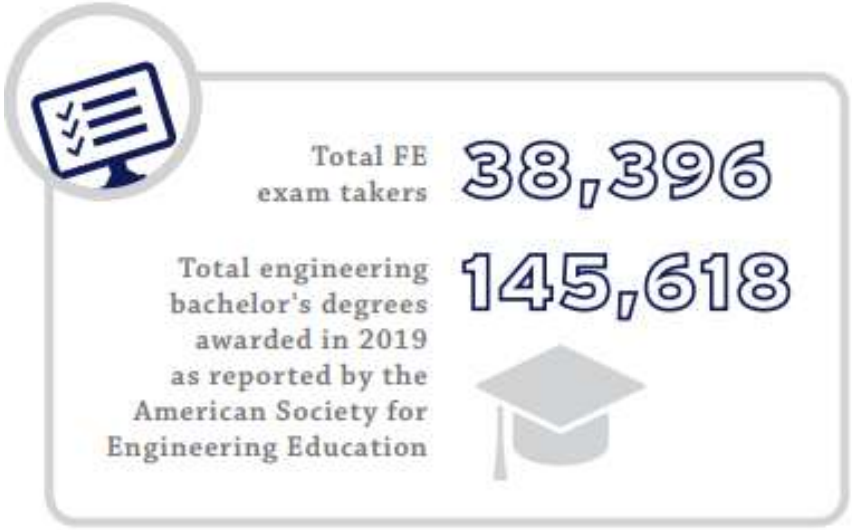
https://ncees.org/wp-content/uploads/Squared-2020_spreads_web.pdf

2019



39% of Engrg. Grads to FE exam

2020



26% of Engrg. Grads to FE exam

COVID-19

Register for Exams at NCEES, LLC.

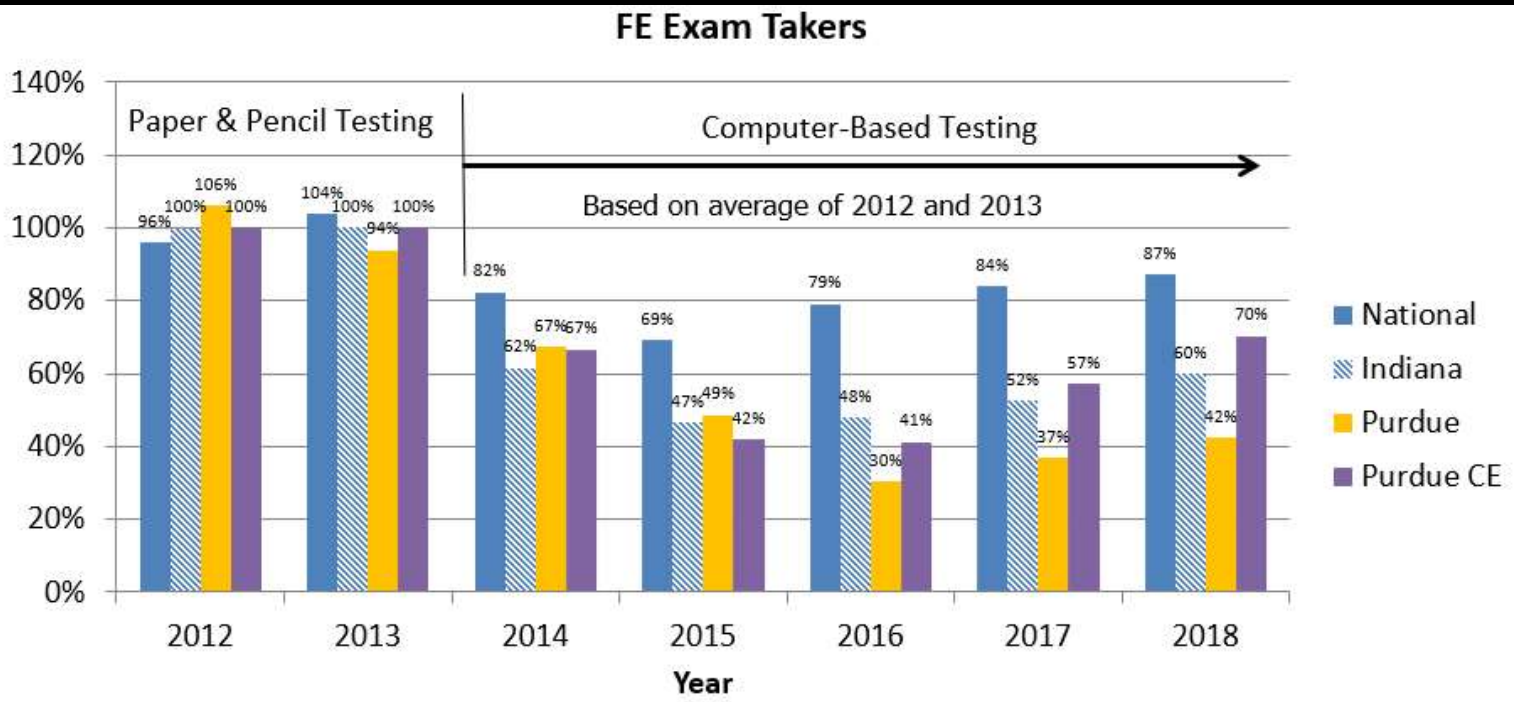
- Handles registration and administration of exams
  https://ncees.org/engineering/
- NCEES Examinee Guide
  https://ncees.org/exams/examinee-guide/
  - Very strict rules and security
  - Closed book; on-line booklet provided

- Preparation Materials

https://ncees.org/exams/exam-preparation-materials/

http://pearsonvue.com/demo/

Effects of CBT on taking FE Exams



Source: https://institutions.ncees.org/360

Principles and Practice (PE) Exams

(Taken after 4 years of engineering practice experience*)

- PE Agricultural & Biological
- PE Architectural
- PE Chemical
- PE Civil
- PE Control Systems
- PE Electrical and Computer
- PE Environmental
- PE Fire Protection
- PE Industrial
- PE Mechanical
- PE Metallurgical and Materials
- PE Mining and Mineral Processing
- PE Naval Architecture and Marine Engineering
- PE Nuclear
- PE Petroleum
- PE Structural I
- PE Structural II
- PS Surveying

** Some states now do not require any waiting time after passing the FE exam to take the PE exam.*

COVID-19 Impacts

https://home.pearsonvue.com/coronavirus-update

Important test delivery information pertaining to COVID-19

Face masks are now required while testing at Pearson VUE-owned test centers.

Updated: October 9, 2020

COVID-19 Impacts – Purdue Testing Center

https://tinyurl.com/yyuf242z

COVID-19 Information

All clients visiting the Purdue Testing Center must comply with safety guidelines outlined in the Protect Purdue Plan.

To acknowledge that you have read and will abide by the Protect Purdue Plan, you are required to complete the Purdue Testing Center COVID Compliance Form. Failure to complete this form in its entirety may result in the delay or cancellation of your scheduled exam.

Please stay home if you are exhibiting any symptoms of COVID-19. Please visit the Pearson VUE COVID-19 Update Page for information about rescheduling your exam. **To ensure the safety of all Purdue staff, students, and visitors, your temperature may be taken using a touchless infrared thermometer prior to admission.**

COVID-19 Impacts – Purdue Testing Center, Cont'd.

https://tinyurl.com/yyuf242z

Clients are requested to call the PTC at (765) 494-7690 before entering Schleman Hall to ensure that the check-in area is clear. Due to social distancing requirements, there is no seating/waiting area in the testing center or hallway.

Testing workstations are thoroughly cleaned and sanitized after use. Hand sanitizer is available in the PTC check-in area and throughout Schleman Hall.

COVID-19 Impacts – Purdue Testing Center, Cont'd.

https://tinyurl.com/yyuf242z

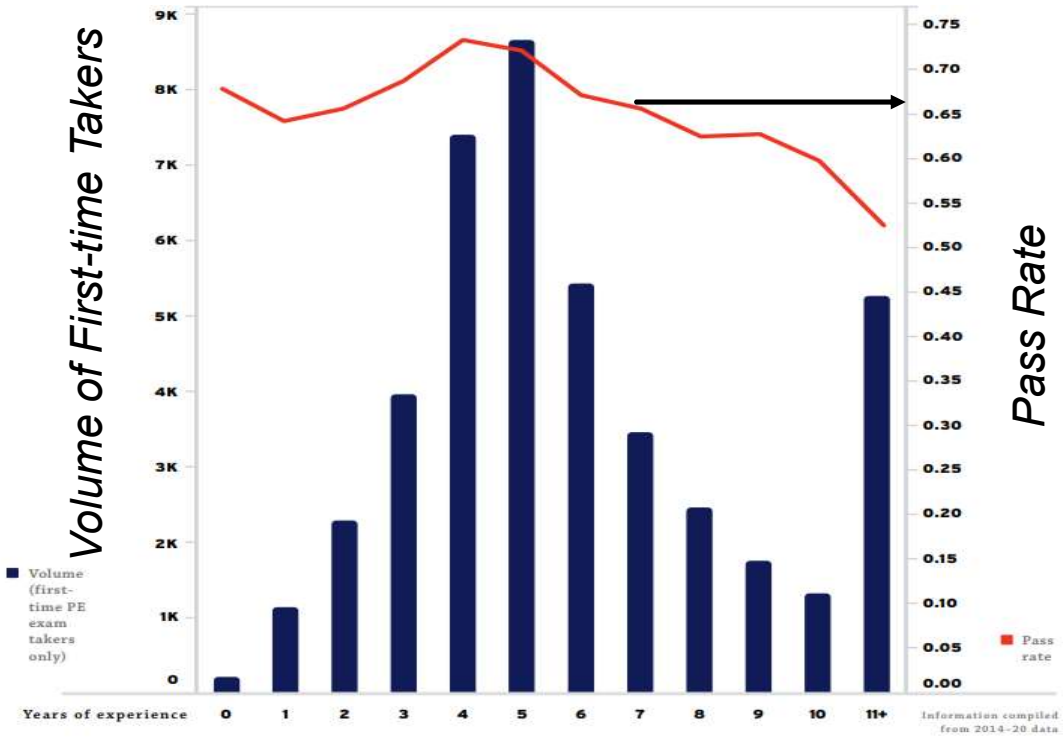
Outerwear is not allowed in the testing room and must be stored in a locker prior to admission. Outerwear includes coats, jackets, vests, scarves, **hooded sweatshirts**, and other shirts/sweatshirts/sweaters with hoods, pockets, and/or pouches.

Please check the identification requirements for your exam. You will not be admitted to test if you do not have the required form(s) of identification.

Please also note that **your report time is 30 minutes before your scheduled appointment time**. This is an allowance for storing personal items and completing the admission process so that you can begin your exam by the scheduled time.

Time after Graduation & PE Exam

https://ncees.org/wp-content/uploads/Squared-2020_spreads_web.pdf



PE Exam Pass Rates

Exam	First-time takers		Repeat takers	
	Volume	Pass Rate	Volume	Pass Rate
PE Agricultural and Biological	13	69%	5	60%
PE Architectural	92	72%	29	48%
PE Chemical	209	68%	22	32%
PE Civil: Construction	817	57%	744	35%
PE Civil: Geotechnical	515	63%	401	33%
PE Civil: Structural	1438	65%	843	44%
PE Civil: Transportation	1674	65%	1153	44%
PE Civil: Wat. Res. and	1711	67%	846	43%
PE Control Systems	224	75%	61	48%
PE Elec. & Comp., Computer	12	58%	4	0%
PE Electr., Cont., & Comm.	108	69%	55	27%
PE Elect. & Comp.: Power	1041	58%	745	39%

PE Exam Pass Rates

Exam	First-time takers		Repeat takers	
	Volume	Pass Rate	Volume	Pass Rate
PE Environmental	248	65%	0	0%
PE Fire Protection	165	56%	76	28%
PE Industrial and Systems	60	95%	25	60%
PE Mech.: HVAC and Refr.	660	77%	270	60%
PE Mech.: Mach. Des. and Mat.	490	75%	142	39%
PE Mech.: Therm. &Fluid Sys.	498	69%	211	48%
PE Metallurgical and Materials	44	77%	12	25%
PE Mining and Min. Process.	70	60%	12	25%
PE Naval Arch. & Marine Engrg	41	56%	15	27%
PE Nuclear	32	56%	0	0%
PE Petroleum	183	66%	59	37%
PE Software	16	50%	1	100%

Study and Review Help

- See NCEES Information:
  - http://ncees.org/exams/fe-exam/
- PSPE Information
  - https://purduepspe.com/fe/
- Review Sessions sponsored by Chi Epsilon
  - https://engineering.purdue.edu/~xe/FEReview.html
- Free online FE Review Course from Georgia Tech.
  - https://www.coursera.org/learn/fe-exam/
- Marshall University 2018 FE Exam Review (Civil Engineering) Gregory Michaelson (michaelson@marshall.edu)
  - https://www.youtube.com/playlist?list=PLCV9OyAY5K-V-bki_dxxq_uVpyIoyIJ8P

NEW!

PSPE FE Exam Study Room

Purdue Society of Professional Engineers

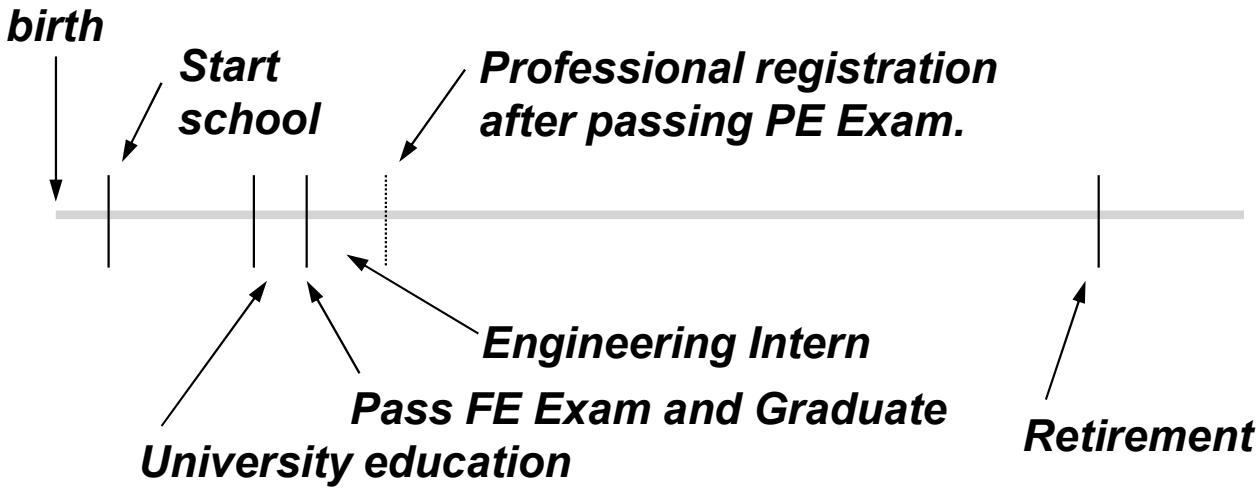
PSPE will be hosting a 24/7 FE Exam Discord study room starting in February 2021.

- *Meet with other students who are preparing for the FE exam*
- *Exchange study resources and tips*
- *Will include moderators & access to NCEES study materials in the near future*

PSPE Website: https://purduepspe.com/

For more info, contact Lucas Allegrette at: lallegre@purdue.edu

Time line for Engineers



Note: For surveyors, the corresponding exams are the FS and PS exams.

Continuing Education

- 40 of the states now have Continuing Education requirements for maintaining licenses.
  - Typically require 24 to 30 hours per biennium for renewal of license
  - Approved activities vary, but always include courses and short courses related to the practice of engineering
  - Rules for Indiana were established in 2010 and updated in 2014

Continuing Education Question

- How does a professional acquire new knowledge and keep up with developments in the field?
- Answer: By continuing your education by formal and self study and by becoming involved with professional and technical societies.

Professional and Technical Societies

- Source of new knowledge and technologies – Continuing Education
- Sense of identity to the professional
- Represents the profession to government and society
- Codes of Ethics
- Develop leadership skills
- Networking
- Other

Gallup Poll

Dec. 2019

- Honesty and Ethics in the Professions
- https://news.gallup.com/poll/1654/Honesty-Ethics-Professions.aspx

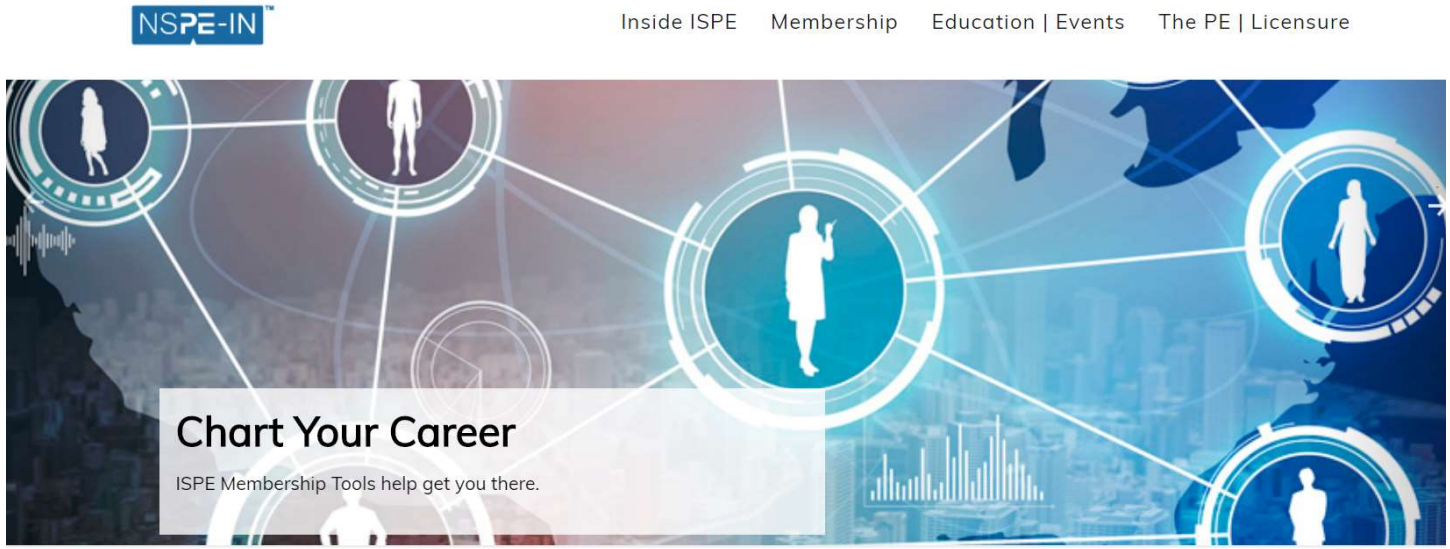
	Very high %	High %	Average %	Low %	Very low %	No opinion %
Nurses	31	54	14	*	1	*
Engineers	17	49	31	2	1	1
Medical doctors	20	45	28	4	2	*
Pharmacists	15	49	28	5	3	*
Dentists	13	48	33	4	2	*
Police officers	17	37	31	9	5	*
College teachers	12	37	34	10	7	1
Psychiatrists	10	33	43	10	2	2
Chiropractors	6	35	47	9	2	1
Clergy	10	30	42	10	5	4
Journalists	5	23	34	20	17	1
Bankers	3	25	52	15	5	*
Labor union leaders	4	20	48	20	7	1
Lawyers	4	18	49	19	9	*
Business executives	2	18	50	22	8	1
State governors	4	16	52	21	6	*
Stockbrokers	2	12	55	22	8	2
Advertising practitioners	2	11	44	30	10	2
Insurance salespeople	2	11	52	26	9	*
Senators	2	11	42	32	13	1
Members of Congress	3	9	33	34	21	1
Car salespeople	1	8	47	30	13	*

Recommended Prof./Tech. Orgs.

- Professional Org.
  - NSPE/ISPE with local chapters and student chapters (PSPE at Purdue)
  - SWE, NSBE, SHPE, EWB, etc.
- Technical Orgs.
  - Basic Founder Societies, e.g. ASABE, ASCE, ASME, IEEE, IIE, etc.
  - Specialty Societies, e.g. ACI, PAWMA , ITE, etc.

Indiana Society of Professional Engineers (ISPE)

http://www.indspe.org



Indiana Professional Engineer Journal

https://mcusercontent.com/94873d42dd224736b3b354622/files/e001a048-c5b8-4da7-ab32-4c23ee0ff9bb/IndSPE_March_April_2021_1_003_.pdf

Indiana Professional Engineer Journal

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BY JAMES E. ALLEMAN, P.E., PHD

FURTHER UPDATES AND REFLECTIONS ON FE EXAM ACTIVITIES WITHIN INDIANA

This article is intended as a sequel to Professor Vince Drnevich's article within the Nov/Dec 2020 'IPEJ' issue [i.e., Drnevich, V.P. (2020). "Professional Engineering Licensing Exams with Computer-Based Testing and Covid-19." NSPE-IN Indiana Society of Professional Engineers Journal, 86, 6, 11-12]For those who may have missed his critical insights, Professor Drnevich highlighted the fact that Indiana is experiencing an extraordinary and prolonged problem with its drop in the percentage of Indiana engineering FE exam takers, where our statewide numbers have significantly lagged behind the national average by ~30% over the past several years. Given that Vince's data effectively represents an acute 'call-to-action', this follow-up publication consequently offers a constructive set of five further updates and reflections.

First and foremost, though, this assessment must start with an

Table 1. Civil Engineering Outcomes

	# Questions	ND Index	National Index
Mathematics and Statistics	8	11.5	9.5
Ethics and Professional Practice	4	11.8	10.5
Engineering Economics	5	10.1	9.9
Statics	8	11.1	9.2
Dynamics	4	10.7	9.5
Mechanics of Materials	7	11.2	9.1
Materials	5	11	9.3
Fluid Mechanics	6	10.9	9.7
Surveying	6	11.4	9.4
Water Resources and Environmen	10	10.2	9.3
Structural Engineering	10	10.7	8.9
Geotechnical Engineering	10	10.8	9.1
Transportation Engineering	9	11.1	9.3
Construction Engineering	8	11	9.2

National Society of Professional Engineers (NSPE) www.nspe.org

NSPE™ NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Student Membership

You qualify for a **FREE** NSPE national **student membership** if you are: a **student** enrolled full-time ... free

NSPE **Student Membership** and get the following:

Free Resources for **Students** Looking for a job after graduation

... **student membership** entitles you to deep discounts on a wide variety of publications including FE/PE Exam ...

https://www.nspe.org/membership/type-membership/student-membership

Active Participation in Prof/Tech Student Organizations

Purdue Society of Professional Engineers

Our History, Events, Membership, Research Roundtable, Rube Goldberg Competition, Order of the Engineer, Field Trips, MathCOUNTS, Community and Social Activities

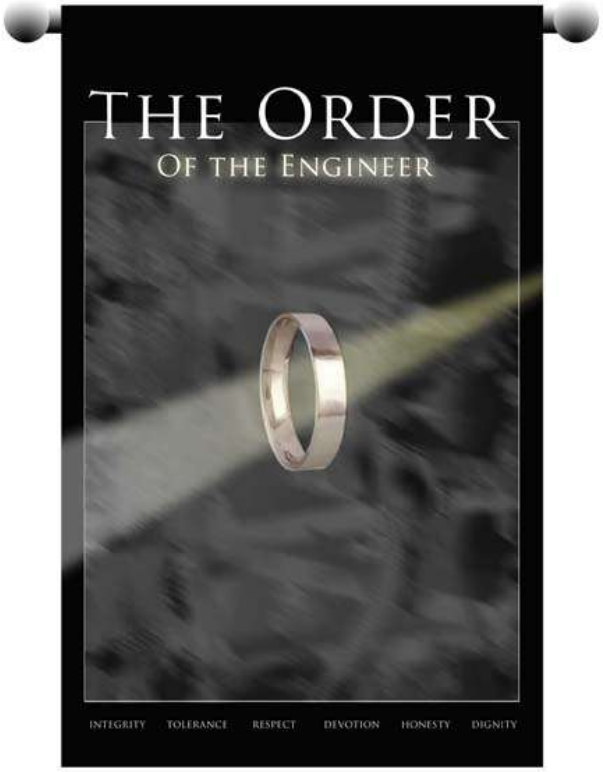
http://purduepspe.com/

https://engineering.purdue.edu/PSPE/

Purdue University 2019 Student Organization of the Year Excellence Award

Order of the Engineer

http://www.order-of-the-engineer.org/



Reprinted with permission of the Order of the Engineer

The Order of the Engineer was initiated in the United States to foster a spirit of pride and responsibility in the engineering profession, to bridge the gap between training and experience, and to present to the public a visible symbol identifying the engineer.

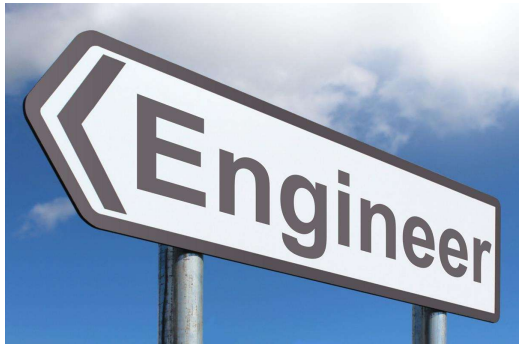
Member identified by the wearing of a stainless steel ring on the small finger of the working hand.

Ceremony at Purdue in April and December before graduations

Concluding Thoughts

- Reasons to become licensed:
  - Required by the law to practice engineering
  - Money
  - Status/Respect
  - Career Flexibility
- Licensure is a 4-step process
  1. Education from ABET accredited program
  2. Pass FE Exam (exam is changing to CBT in 2014)
  3. Four years of experience as an EIT
  4. Pass the PE Exam
- Professional and Technical Societies play an important role in the professional lives of engineers.

Things you need to do:



- Obtain a broad engineering education
  - Keep in mind the topics covered in the FE Exam
- Plan to take the FE Exam
  - Apply for it at the beginning of the last semester before graduating
- Choose a job that provides qualifying work experience for the PE Exam
- Prepare for and take the PE Exam at your earliest possible date
- Continue participating in professional and technical organizations after graduation
- Continue to learn about your profession

Questions and Discussions

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Thanks for listening!

Vince Drnevich

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Chemical CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Chem-CBT-specs-1.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*8-12*
2. Probability and Statistics	*4–6*
3. Engineering Sciences	*4-6*
4. Computational Tools	*4–6*
5. Materials Science	*4–6*
6. Chemistry	*8–12*
7. Fluid Mechanics/Dynamics	*8-12*
8. Thermodynamics	*8-12*
9. Materials/Energy Balance	*8-12*

Chemical CBT FE Exam, Cont'd.

Knowledge Area	***Number of Questions***
10. Heat Transfer	*8-12*
11. Mass Transfer and Separation	*8–12*
12. Chemical Reaction Engineering	*8-12*
13. Process Design and Economics	*8-12*
14. Process Control	*5-8*
15. Safety, Health, and Environment	*5-8*
16. Ethics and Professional Practice	*2-3*

Electrical & Computer CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Ele-CBT-specs.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*11-17*
2. Probability and Statistics	*4–6*
3. Ethics and Professional Practice	*3–5*
4. Engineering Economics	*3–5*
5. Properties of Electrical Materials	*4–6*
6. Engineering Sciences	*6–9*
7. Circuit Analysis (DC and AC Steady State)	*10-15*
8. Linear Systems	*5–8*
9. Signal Processing	*5–8*

Electrical CBT FE Exam, Cont'd.

Knowledge Area	*Number of Questions*
10. Electronics	*7-11*
11. Power	*8–12*
12. Electromagnetics	*5–8*
13. Control Systems	*6–9*
14. Communications	*5-8*
15. Computer Networks	*3-5*
16. Digital Systems	*7-11*
17. Computer Systems	*4–6*
18. Software Development	*4–6*

Industrial CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Ind-CBT-specs.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*6-9*
2. Engineering Sciences	*5-8*
3. Ethics and Professionalism	*5-8*
4. Engineering Economics	*10-15*
5. Probability and Statistics	*10-15*
6. Modeling and Computations	*8-12*
7. Industrial Management	*8–12*
8. Manufact., Prod., and Service Systems	*8-12*
9. Facilities and Logistics	*8-12*

Industrial CBT FE Exam, Cont'd.

Knowledge Area	***Number of Questions***
10. Human Factors, Ergonomics, and Safety	*8-12*
11. Work Design	*8–12*
12. Quality	*8-12*
13. Systems Engineering	*8-12*

Civil CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Civil-CBT-specs.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*7–11*
2. Probability and Statistics	*4–6*
3. Computational Tools	*4–6*
4. Ethics and Professional Practice	*4–6*
5. Engineering Economics	*4–6*
6. Statics	*7–11*
7. Dynamics	*4–6*
8. Mechanics of Materials	*7–11*
9. Materials	*4–6*

Civil CBT FE Exam, Cont'd.

Knowledge Area	*Number of Questions*
10. Fluid Mechanics	*4–6*
11. Hydraulics and Hydrologic Systems	*8–12*
12. Structural Analysis	*6–9*
13. Structural Design	*6–9*
14. Geotechnical Engineering	*9–14*
15. Transportation Engineering	*8–12*
16. Environmental Engineering	*6–9*
17. Construction	*4–6*
18. Surveying	*4–6*

Environmental CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Env-CBT-specs.pdf

Knowledge Area	Number of Questions
1. Mathematics	4–6
2. Probability and Statistics	3–5
3. Ethics and Professional Practice	5–8
4. Engineering Economics	4–6
5. Materials Science	3–5
6. Environmental Science and Chemistry	11–17
7. Risk Assessment	5–8
8. Fluid Mechanics	9–14
9. Thermodynamics	3–5

Environmental CBT FE Exam, Cont'd.

Knowledge Area	*Number of Questions*
10. Water Resources	*10–15*
11. Water and Wastewater	*14–21*
12. Air Quality	*10–15*
13. Solid and Hazardous Waste	*10–15*
14. Groundwater and Soils	*9–14*

Industrial CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Ind-CBT-specs.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*6-9*
2. Engineering Sciences	*5-8*
3. Ethics and Professionalism	*5-8*
4. Engineering Economics	*10-15*
5. Probability and Statistics	*10-15*
6. Modeling and Computations	*8-12*
7. Industrial Management	*8–12*
8. Manufact., Prod., and Service Systems	*8-12*
9. Facilities and Logistics	*8-12*

Industrial CBT FE Exam, Cont'd.

Knowledge Area	***Number of Questions***
10. Human Factors, Ergonomics, and Safety	*8-12*
11. Work Design	*8–12*
12. Quality	*8-12*
13. Systems Engineering	*8-12*

Mechanical CBT FE Exam

https://ncees.org/wp-content/uploads/FE-Mec-CBT-specs.pdf

Knowledge Area	***Number of Questions***
1. Mathematics	*6-9*
2. Probability and Statistics	*4–6*
3. Computational Tools	*3–5*
4. Ethics and Professional Practice	*3–5*
5. Engineering Economics	*3–5*
6. Electricity and Magnetism	*3-5*
7. Statics	*8-12*
8. Dynamics, Kinematics, and Vibrations	*9–14*
9. Mechanics of Materials	*4–6*

Mechanical CBT FE Exam, Cont'd.

Knowledge Area	*Number of Questions*
10. Material Properties and Processing	*8-12*
11. Fluid Mechanics	*9-14*
12. Thermodynamics	*13-20*
13. Heat Transfer	*9-14*
14. Meas., Instrumentation, and Controls	*5-8*
15. Mechanical Design and Analysis	*9-14*

Calculator Policy

- Only models of calculators listed below are permitted in the exam room.
  - Hewlett Packard—HP 33s and HP 35s models, but no others.
  - Casio—All fx-115 and fx-991 models. Any Casio calculator must contain fx-115 or fx-991 in its model name.
  - Texas Instruments—All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

PE Agricultural Engineering Examination (8-hour exam)

Paper & pencil; Available only in April of each year; CBT in 2021

40 multiple choice questions in five topic areas.

Agricultural Exam	
Engineering Principles and Professional Practices	20%
Facility Engineering: Plant, Animal, and Commodity Environments and Structures	15%
Machine Systems: Power, Electrical/Electronic, Machines, Controls, and Sensors	25%
Natural Resource Engineering: Soil, Water, and Plant Systems	30%
Process Engineering: Food, Feed, Fiber, and Fuel Products	10%
TOTAL	100%

PE Chemical Engineering Examination
(9-hour CBT* exam)

https://ncees.org/wp-content/uploads/PE-Che-Jan_2018_CBT-1.pdf

80 questions in five topic areas

Topic	No. Ques.
1. Mass/Energy Balances and Thermodynamics	16–24
2. Heat Transfer	11–16
3. Kinetics	8–12
4. Fluids	11–16
5. Mass Transfer	10–15
6. Plant Design and Operation	14–21

**Computer-Based Exam started in January 2018; Available year-round*

PE Civil Engineering Examination
(8-hour exam)

- *Paper & pencil; Available only in April and October;*
- *CBT in 2023; then available year-round*
- *80 multiple choice questions in five topic areas.*
- *Morning covers breadth; afternoon depth*
  - *PE Civil: Construction*
  - *PE Civil: Geotechnical*
  - *PE Civil: Structural*
  - *PE Civil: Transportation*
  - *PE Civil: Water Resources and Environmental*

PE Elec. & Computer Engineering Exam. (8-hour exam)

- *Paper & pencil; Available only in April and October;*
- *CBT in 2021*
- *80 multiple choice questions in five topic areas.*

  - Computer Engineering Single-day (date TBD)
  - Electronics, Controls, and Communications Single-day (date TBD)
  - Power Year-round

PE Indust. and SystemsEngineering Exam.
(8-hour exam)

- *Paper & pencil; Available only in April and October;*
- *CBT in 2020; then Single-day (date TBD)*
- *80 multiple choice questions in five topic areas.*

Subject	No. of Ques.
I. Systems Definition, Analysis, and Design	*16*
II. Facilities Engineering and Planning	*16*
III. Supply Chain and Logistics	*16*
IV. Work Design	*16*
V. Quality Engineering	*16*

PE Mechanical Engineering Exam.
(8-hour exam)

- *Paper & pencil; Available only in April and October;*
- *CBT in 2020; then available year-round*
- *80 multiple choice questions in five topic areas.*

  - HVAC and Refrigeration
  - Machine Design and Materials
  - Thermal and Fluids Systems