

**FE EXAM PERFORMANCE  
CIVIL ENGINEERING PROGRAM**

Department of Civil, Environmental & Construction  
Engineering  
Texas Tech University

William D. Lawson, P.E., Ph.D. <sup>TM</sup>  
7 Feb 2022

SPR 2022 Semester 1

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## Overview

- FE Exam Interpretive Context
- TTU Civil Engineering Performance (pre-2014)
  - OVERALL
  - AM – subject content
  - PM – subject content
- TTU Civil Engineering Performance (2014-2021)
- Observations and Recommendations

SPR 2022 Semester 2

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# FE Exam Interpretive Context

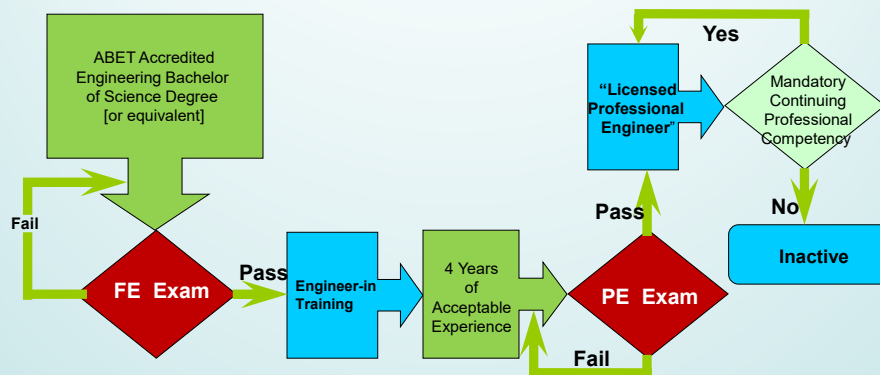


SPR 2022 Semester

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# Idealized Engineering Licensure Model



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# What is the FE, really?

The FE Exam is designed to provide evidence of technical competency for the purpose of engineering licensure.

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**NCEES**  
advancing licensure for  
engineers and surveyors

**Fundamentals of Engineering (FE)  
CIVIL CBT Exam Specifications**

Effective Beginning with the July 2020 Examinations

- 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 questions. The 6-hour time also includes a tutorial and an optional scheduled break.
- The FE exam uses both the International System of Units (SI) and the U.S. Customary System (USCS).

Knowledge	Number of Questions
<b>1. Mathematics and Statistics</b>	<b>4-6</b>
A. Analytic geometry	
B. Single-variable calculus	
C. Vector operations	
D. Statistics (e.g., distributions, mean, mode, standard deviation, confidence interval, regression and curve fitting)	
<b>2. Ethics and Professional Practice</b>	<b>5-8</b>
A. Codes of ethics (professional and technical societies)	
B. Professional liability	
C. Licensure	
D. Contracts and contract law	
<b>3. Engineering Economics</b>	<b>8-12</b>
A. Time value of money (e.g., equivalence, present worth, equivalent annual worth, future worth, rate of return)	
B. Cost (e.g., fixed, variable, direct and indirect labor, incremental, average, sunk)	
C. Values (e.g., break-even, benefit-cost, life cycle, sustainability, renewable resources and risk)	

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## FE Exam Data... herein

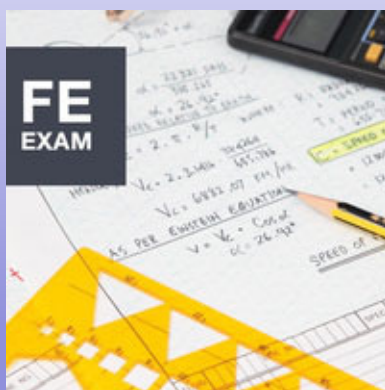
1940	1950	1960	1970	1980	1990	2000	2010	2020	2030
		<b>1956</b>	Pencil & Paper, 8.0 hrs, General Engr Content, 180 Questions, Open Book						
					<b>1993</b>	Supplied Reference, Ed. 1- Discipline Specific			
					<b>1996</b>	4.0 hrs Gen. / 4.0 hrs 180 Questions, Discipline-Specific			
							<b>2014</b>	CBT, 5.3 hrs, 18 topics, 110 questions	
							<b>2020</b>	14 Topics, 110 questions	

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## TTU CIVIL Program Performance OVERALL

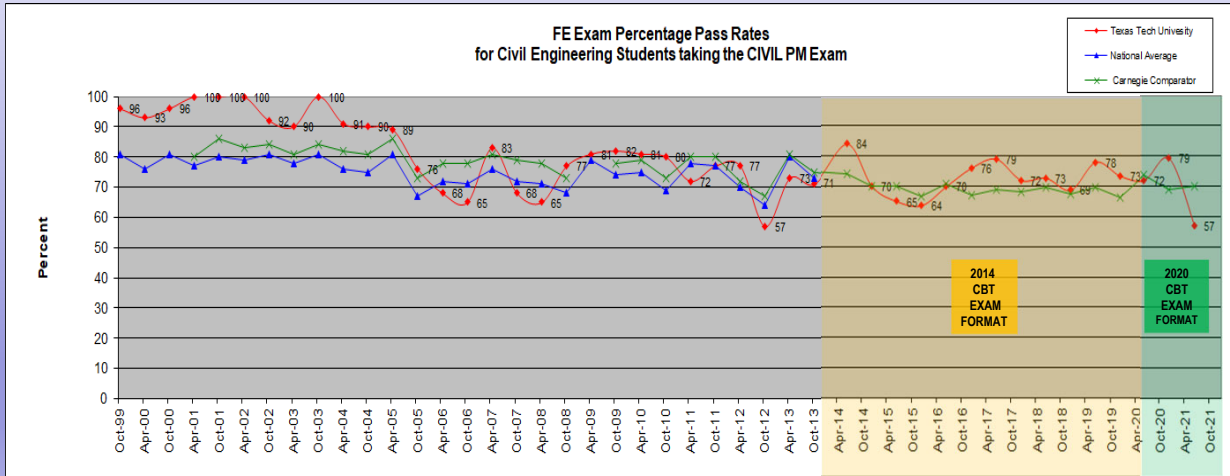


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## 20+ YEARS FE PASS RATE DATA TTU Civil Engineering Program Performance



Spring 2022

FE Exam Discussion

SLIDE 9

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## TTU Carnegie Comparators Carnegie Classification: Prof+A&S/HGC

Professions plus arts & sciences, high graduate coexistence

"60–79 percent of bachelor's degree majors were in professional fields, and graduate degrees were observed in at least half of the fields corresponding to undergraduate majors."

Institution	Location	Control	Institution	Location	Control
Auburn University Main Campus	Auburn University, Alabama	Public	Lehigh University	Bethlehem, Pennsylvania	Private not-for-profit
Botolph College	New York, New York	Private not-for-profit	Long Island University-Brooklyn Campus	Brooklyn, New York	Private not-for-profit
California State University-Los Angeles	Los Angeles, California	Public	Long Island University-C W Post Campus	Brookville, New York	Private not-for-profit
Capella University	Minneapolis, Minnesota	Private for-profit	Marywood University	Scranton, Pennsylvania	Private not-for-profit
Clemson University	Clemson, South Carolina	Public	Mississippi College	Clinton, Mississippi	Private not-for-profit
Cooper Union for the Advancement of Science and Art	New York, New York	Private not-for-profit	Mississippi State University	Mississippi State, Mississippi	Public
Drexel University	Philadelphia, Pennsylvania	Private not-for-profit	Montana State University	Bozeman, Montana	Public
Duquesne University	Pittsburgh, Pennsylvania	Private not-for-profit	New Jersey Institute of Technology	Newark, New Jersey	Public
East Carolina University	Greenville, North Carolina	Public	New Mexico State University-Main Campus	Las Cruces, New Mexico	Public
Eastern Michigan University	Ypsilanti, Michigan	Public	Northcentral University	Prescott Valley, Arizona	Private for-profit
Emerson College	Boston, Massachusetts	Private not-for-profit	Ohio University-Main Campus	Athens, Ohio	Public
Florida Atlantic University	Boca Raton, Florida	Public	Oklahoma State University-Main Campus	Stillwater, Oklahoma	Public
Florida Institute of Technology	Melbourne, Florida	Private not-for-profit	Oregon State University	Corvallis, Oregon	Public
Florida International University	Miami, Florida	Public	Pennsylvania State University-Main Campus	University Park, Pennsylvania	Public
Georgia Institute of Technology-Main Campus	Atlanta, Georgia	Public	Polytechnic Institute of New York University	Brooklyn, New York	Private not-for-profit
Howard University	Washington, District of Columbia	Private not-for-profit	Pratt Institute-Main	Brooklyn, New York	Private not-for-profit
Illinois Institute of Technology	Chicago, Illinois	Private not-for-profit	Purdue University-Main Campus	West Lafayette, Indiana	Public
Illinois State University	Normal, Illinois	Public	Rensselaer Polytechnic Institute	Troy, New York	Private not-for-profit
Indiana University-Purdue University-Indianapolis	Indianapolis, Indiana	Public	Rochester Institute of Technology	Rochester, New York	Private not-for-profit
Inter American University of Puerto Rico-Metro	San Juan, Puerto Rico	Private not-for-profit	Saint Louis University-Main Campus	Saint Louis, Missouri	Private not-for-profit
Iowa State University	Ames, Iowa	Public	San Jose State University	San Jose, California	Public
Kansas State University	Manhattan, Kansas	Public	Silicon Valley University	San Jose, California	Private not-for-profit
Kent State University Kent Campus	Kent, Ohio	Public	Southern Illinois University Carbondale	Carbondale, Illinois	Public

Carnegie Foundation identifies 72 universities, 47 public and 25 private, for the Prof+A&S/HGC classification. Comparators such as Texas A&M University, The University of Texas at Austin, are "Bal/HGC", "Balanced arts & sciences/professions, high graduate coexistence." Classification is based on data from 2008 and 2010. Note: this differs from the previous NCEES comparator classification, "Carnegie Research/Doctoral Extensive".

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## TTU Carnegie Comparators, cont'd Carnegie Classification: Prof+A&S/HGC

Professions plus arts & sciences, high graduate coexistence

"60–79 percent of bachelor's degree majors were in professional fields, and graduate degrees were observed in at least half of the fields corresponding to undergraduate majors."

Institution	Location	Control	Institution	Location	Control
Temple University	Philadelphia, Pennsylvania	Public	University of Nevada-Las Vegas	Las Vegas, Nevada	Public
Texas A & M International University	Laredo, Texas	Public	University of North Dakota	Grand Forks, North Dakota	Public
Texas Tech University	Lubbock, Texas	Public	University of South Carolina-Columbia	Columbia, South Carolina	Public
The University of Alabama	Tuscaloosa, Alabama	Public	University of Southern Mississippi	Hattiesburg, Mississippi	Public
The University of Texas at El Paso	El Paso, Texas	Public	University of the West	Rosemead, California	Private not-for-profit
University of Akron Main Campus	Akron, Ohio	Public	University of Toledo	Toledo, Ohio	Public
University of Alabama in Huntsville	Huntsville, Alabama	Public	University of Wyoming	Laramie, Wyoming	Public
University of Arkansas	Fayetteville, Arkansas	Public	Utah State University	Logan, Utah	Public
University of Central Florida	Orlando, Florida	Public	Western Illinois University	Macomb, Illinois	Public
University of Cincinnati-Main Campus	Cincinnati, Ohio	Public	Western Michigan University	Kalamazoo, Michigan	Public
University of Idaho	Moscow, Idaho	Public	Wheelock College	Boston, Massachusetts	Private not-for-profit
University of Maine	Orono, Maine	Public	Wichita State University	Wichita, Kansas	Public
University of Nebraska-Lincoln	Lincoln, Nebraska	Public	Worcester Polytechnic Institute	Worcester, Massachusetts	Private not-for-profit

Carnegie Foundation identifies 72 universities, 47 public and 25 private, for the Prof+A&S/HGC classification. Comparators such as Texas A&M University, The University of Texas at Austin, are "Bal/HGC", "Balanced arts & sciences/professions, high graduate coexistence." Classification is based on data from 2008 and 2010. Note: this differs from the previous NCEES comparator classification, "Carnegie Research/Doctoral Extensive".

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## TTU CIVIL Program Performance pre-2014 (AM & PM) data



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# CIVIL Program Performance AM-Portion

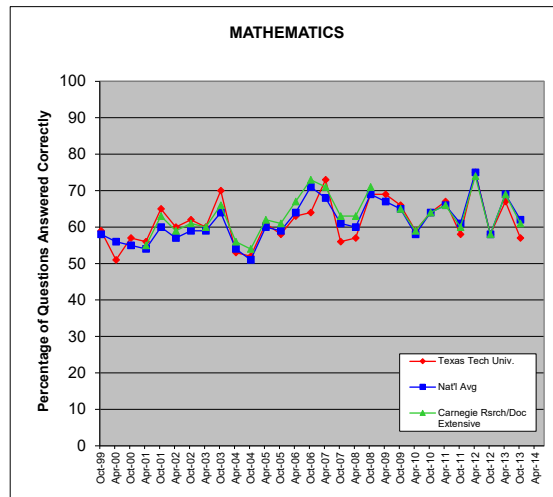


SPR 2022 Semester

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## Civil Engineering Program AM Portion



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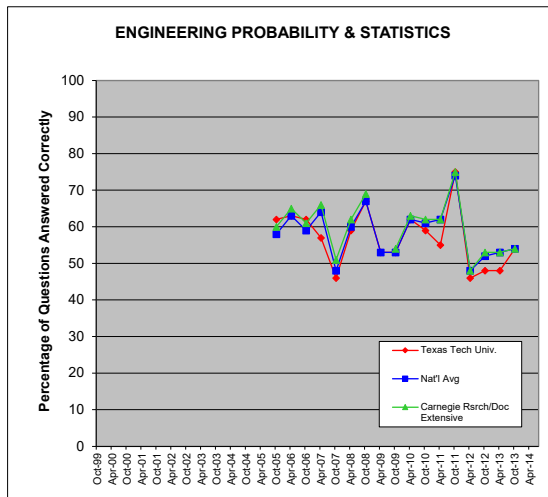
SPR 2022 Semester

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Civil Engineering Program  
AM Portion

7%



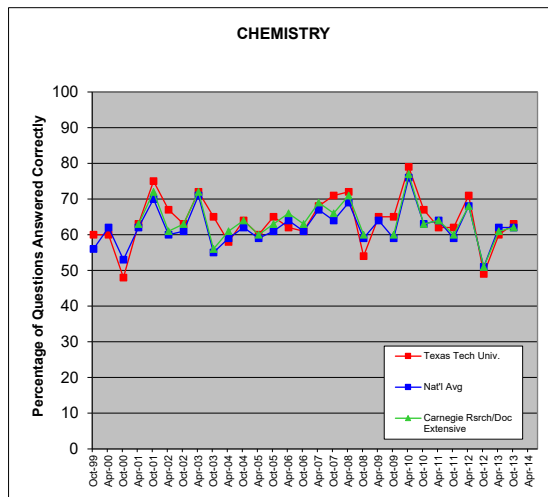
SPR 2022 Semester

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Civil Engineering Program  
AM Portion

9%



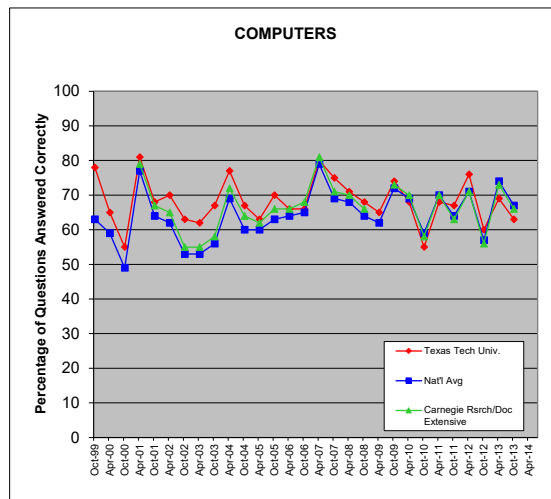
SPR 2022 Semester

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Civil Engineering Program  
AM Portion



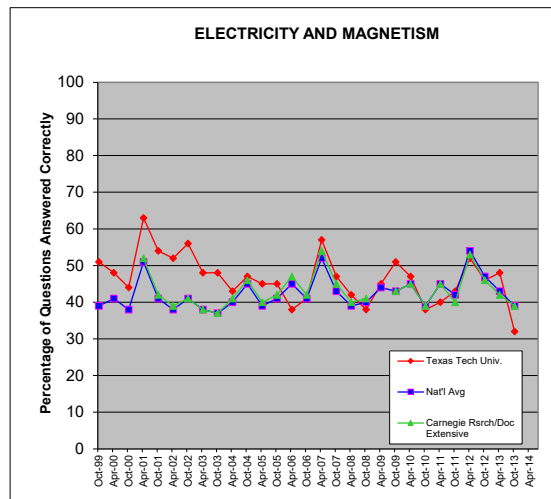
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SPR 2022 Semester

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Civil Engineering Program  
AM Portion



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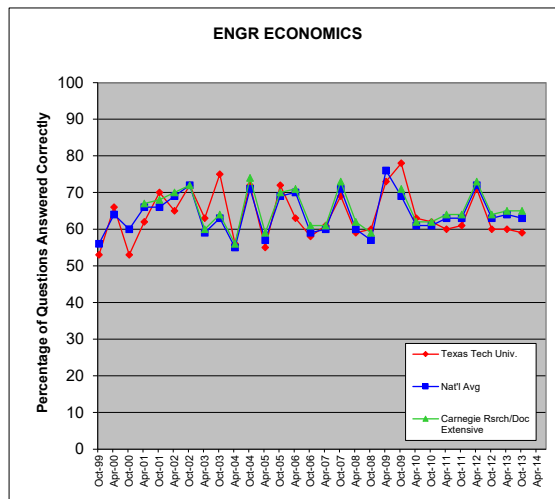
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Civil Engineering Program  
AM Portion

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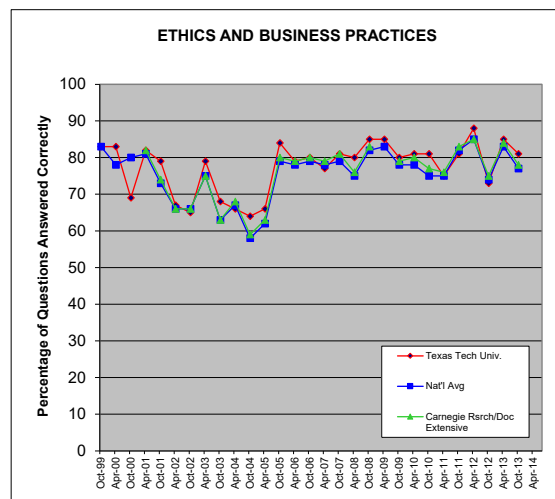
SPR 2022 Semester

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Civil Engineering Program  
AM Portion

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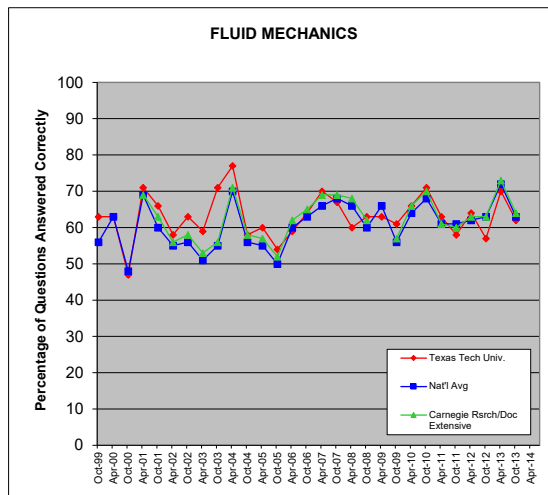
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Civil Engineering Program  
AM Portion

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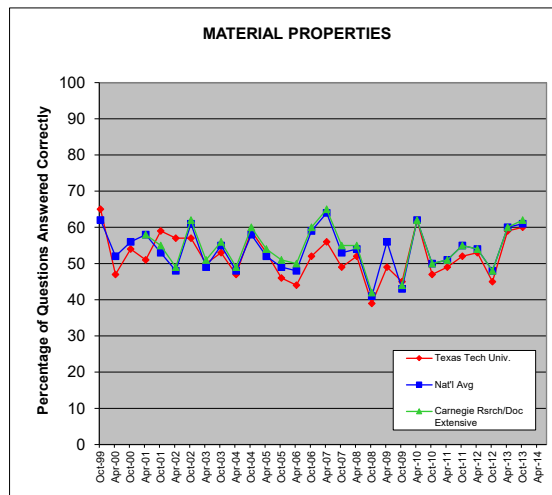
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Civil Engineering Program  
AM Portion

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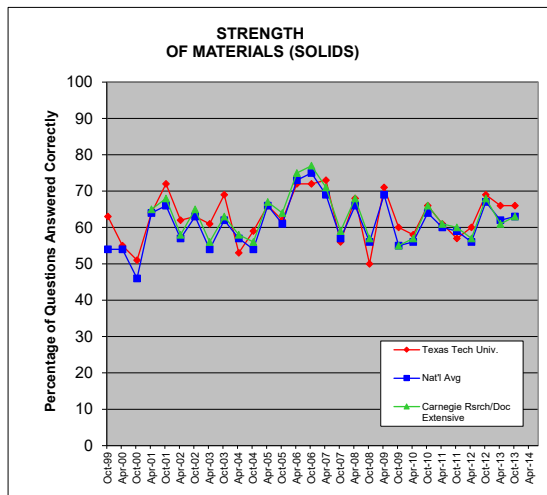
SPR 2022 Semester

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Civil Engineering Program  
AM Portion

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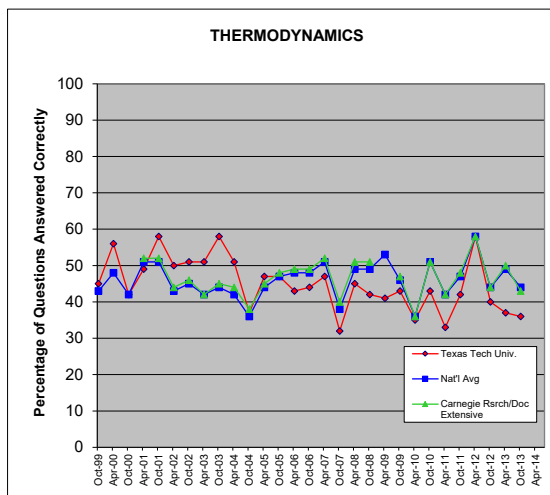
SPR 2022 Semester

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Civil Engineering Program  
AM Portion

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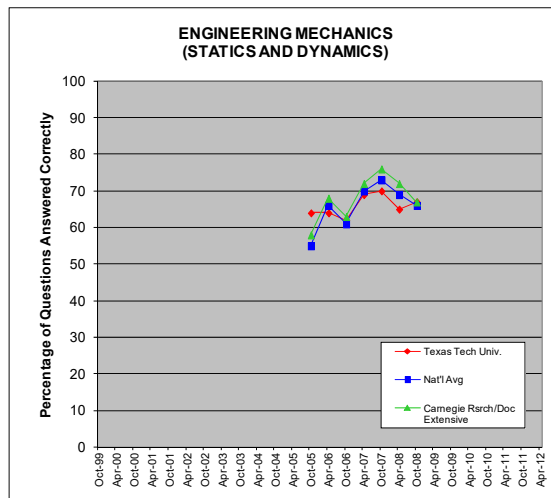


SPR 2022 Semester

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Civil Engineering Program  
AM Portion



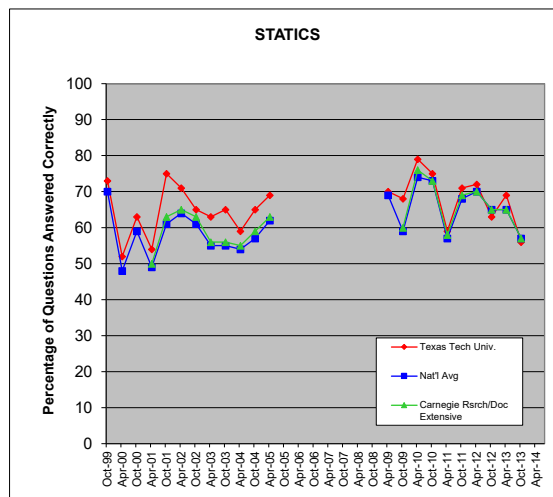
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SPR 2022 Semester

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Civil Engineering Program  
AM Portion



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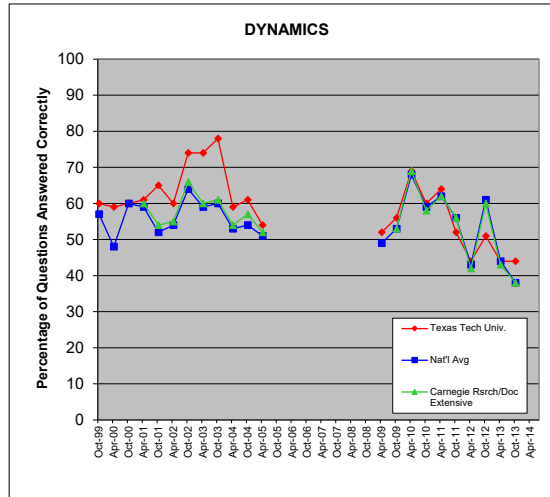
SPR 2022 Semester

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Civil Engineering Program  
AM Portion

1/2\*10%

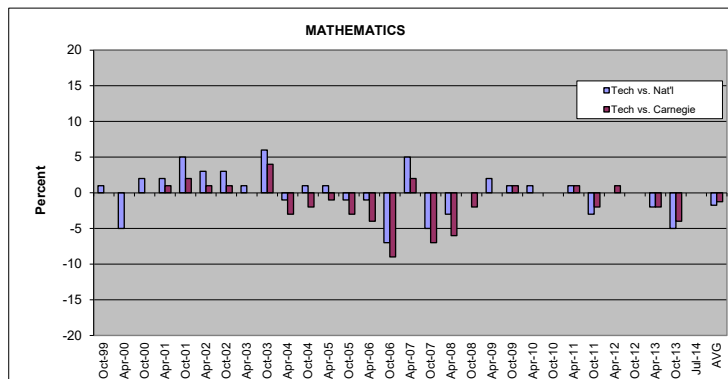


SPR 2022 Semester

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Civil Engineering Program  
AM Comparison



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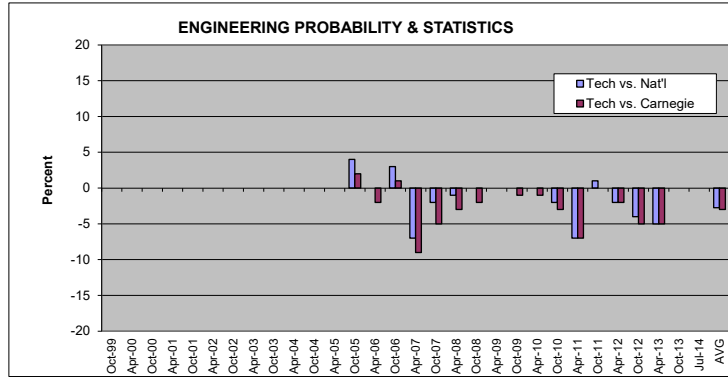
MATHEMATICS	
Tech vs. Nat'l	-1.8
Tech vs. Carnegie	-1.3

SPR 2022 Semester

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## Civil Engineering Program AM Comparison



7%

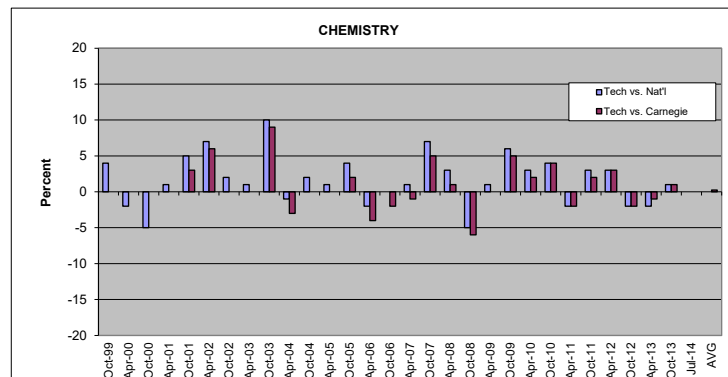
ENGINEERING PROBABILITY & STATISTICS  
Tech vs. Nat'l -2.8  
Tech vs. Carnegie -3.0

SPR 2022 Semester

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## Civil Engineering Program AM Comparison



7%

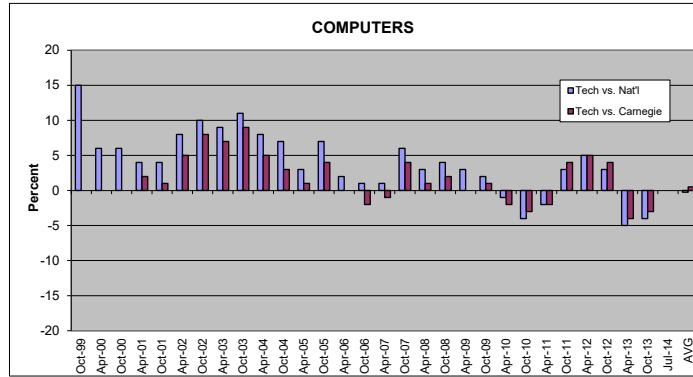
CHEMISTRY  
Tech vs. Nat'l 0.0  
Tech vs. Carnegie 0.3

SPR 2022 Semester

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## Civil Engineering Program AM Comparison



7%

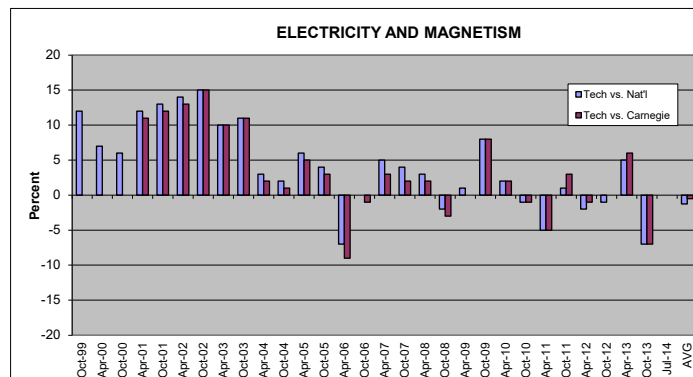
COMPUTERS  
Tech vs. Nat'l -0.3  
Tech vs. Carnegie 0.5

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## Civil Engineering Program AM Comparison



9%

ELECTRICITY AND MAGNETISM  
Tech vs. Nat'l -1.3  
Tech vs. Carnegie -0.5

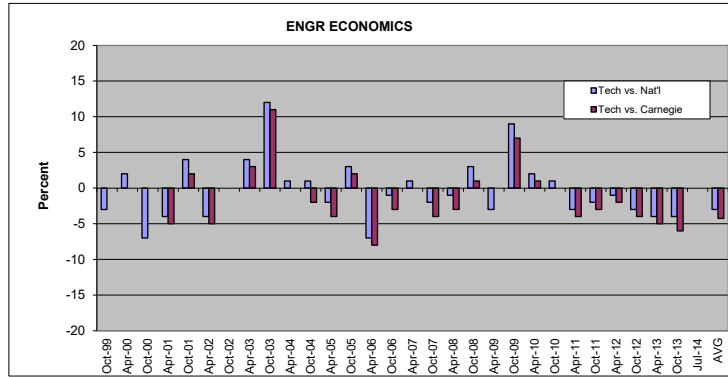
SPR 2022 Semester

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## Civil Engineering Program AM Comparison



**8%**

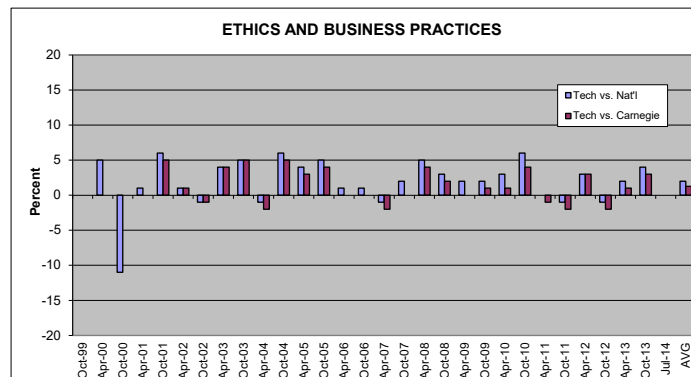
ENGINEERING ECON  
Tech vs. Nat'l -3.0  
Tech vs. Carnegie -4.3

SPR 2022 Semester

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## Civil Engineering Program AM Comparison



**7%**

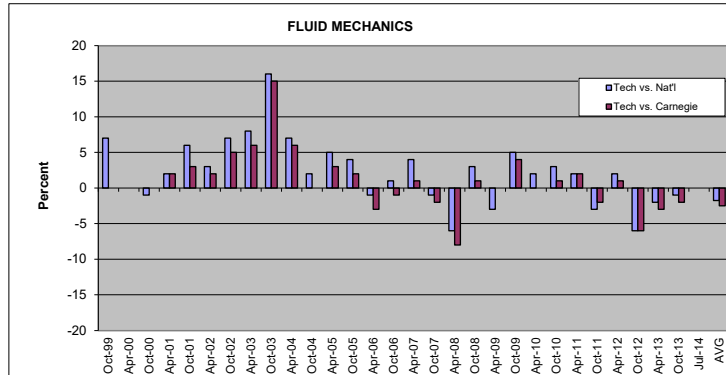
ETHICS AND BUSINESS PRACTICES  
Tech vs. Nat'l 2.0  
Tech vs. Carnegie 1.3

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



7%

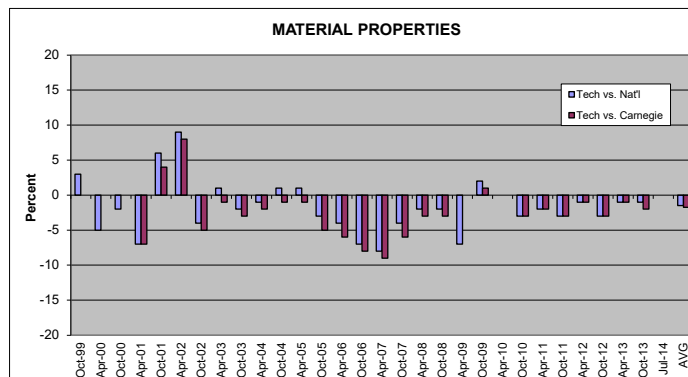
FLUID MECHANICS  
Tech vs. Nat'l -1.8  
Tech vs. Carnegie -2.5

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



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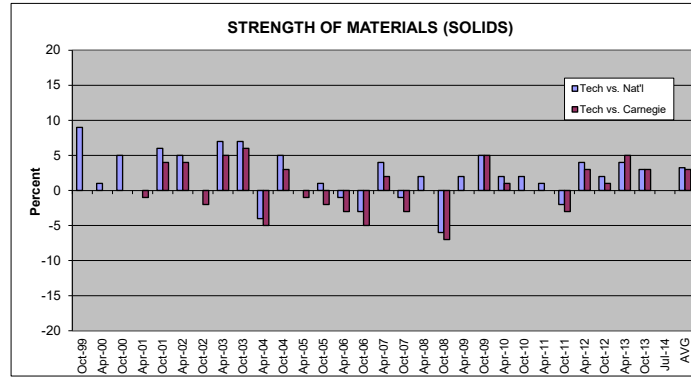
MATERIAL PROPERTIES  
Tech vs. Nat'l -1.5  
Tech vs. Carnegie -1.8

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



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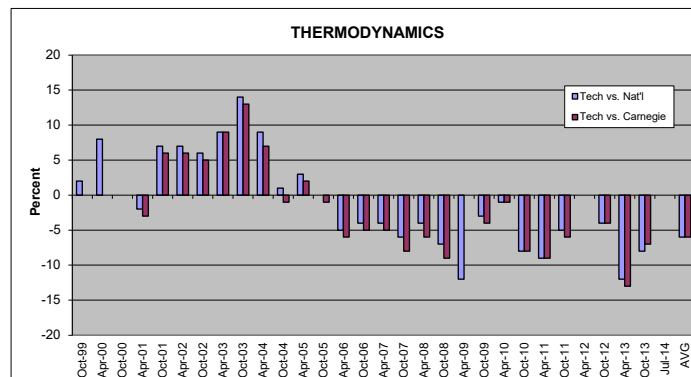
STRENGTH OF MATERIALS  
Tech vs. Nat'l 3.3  
Tech vs. Carnegie 3.0

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



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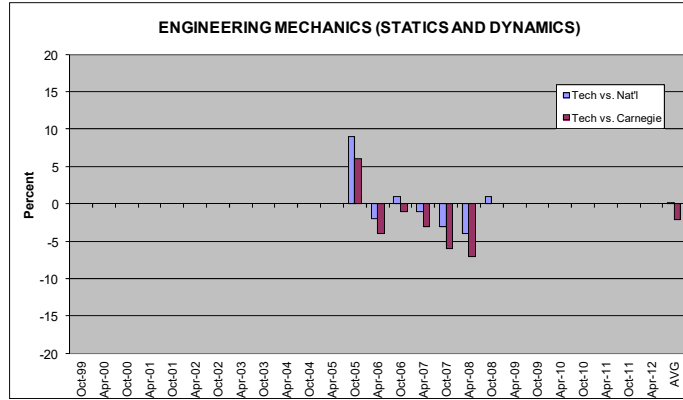
THERMODYNAMICS  
Tech vs. Nat'l -6.0  
Tech vs. Carnegie -6.0

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



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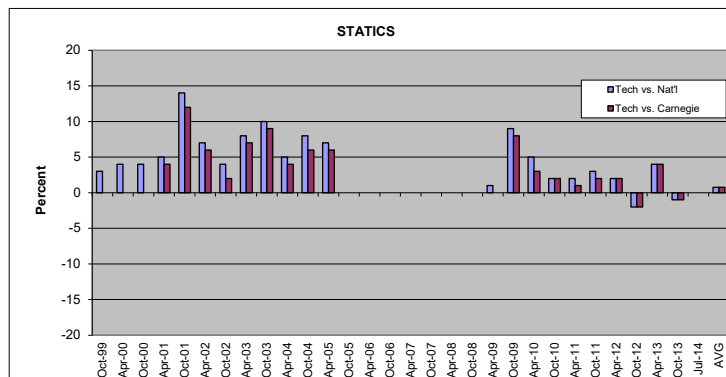
ENGINEERING MECHANICS (STATICS & DYNAMICS)  
Tech vs. Nat'l 0.1  
Tech vs. Carnegie -2.1

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



1/2\*10%

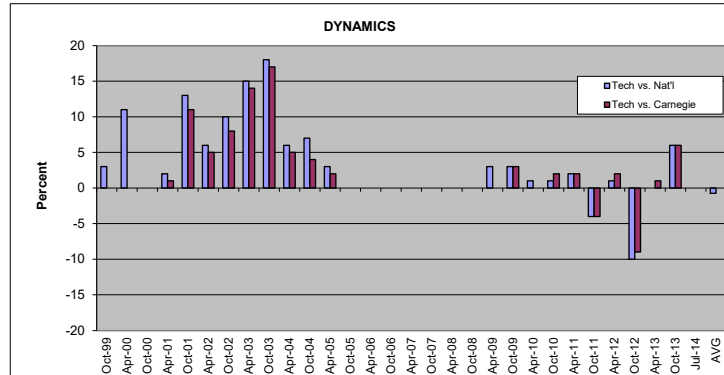
ENGINEERING MECHANICS (STATICS)  
Tech vs. Nat'l 0.8  
Tech vs. Carnegie 0.8

SPR 2022 Semester

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# Civil Engineering Program AM Comparison



$\frac{1}{2} * 10\%$

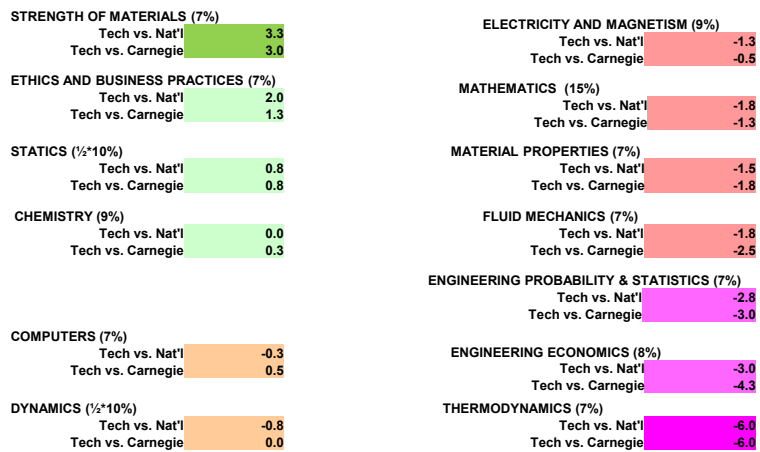
ENGINEERING MECHANICS (DYNAMICS)  
Tech vs. Nat'l -0.8  
Tech vs. Carnegie 0.0

SPR 2022 Semester

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## CIVIL Program Performance AM-Challenges (PRE-2014) (Averages April 2012– October 2013)



SPR 2022 Semester

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# CIVIL Program Performance PM-Portion

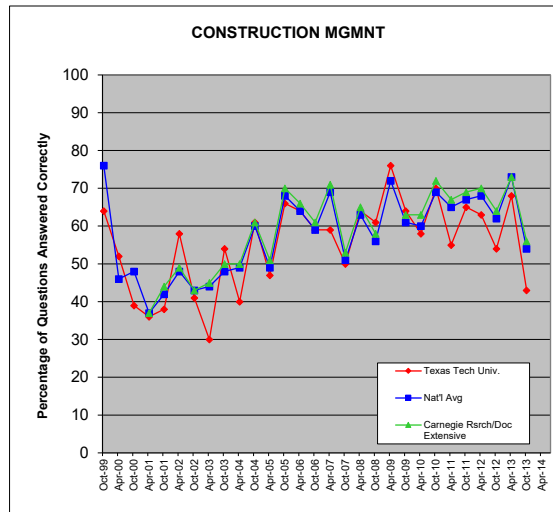


SPR 2022 Semester

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## Civil Engineering Program PM Portion



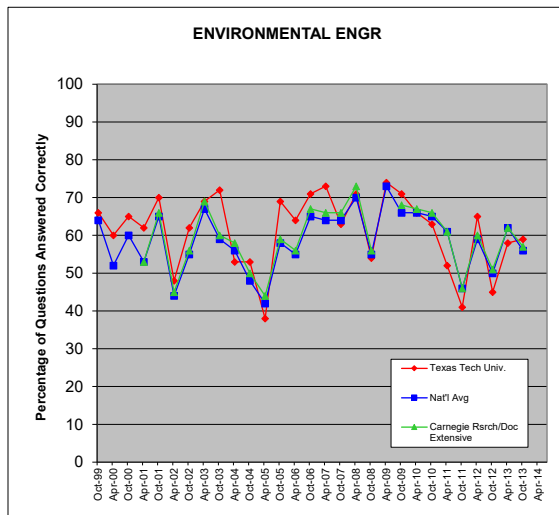
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



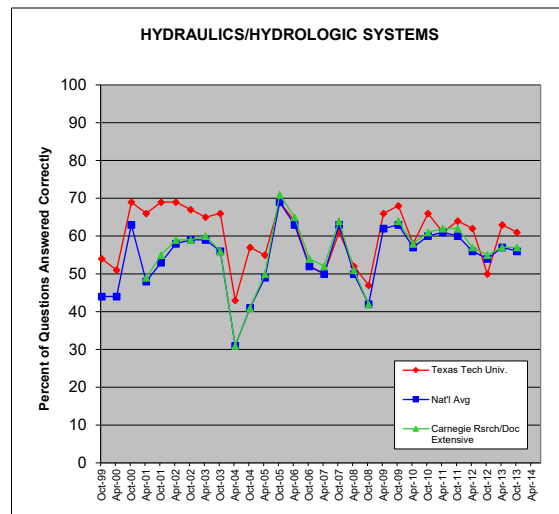
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



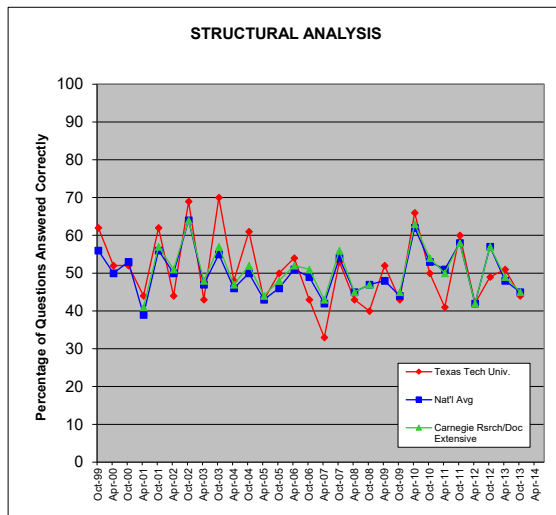
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



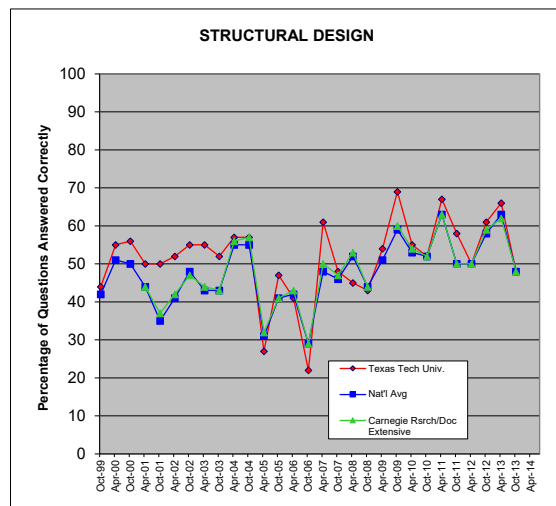
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



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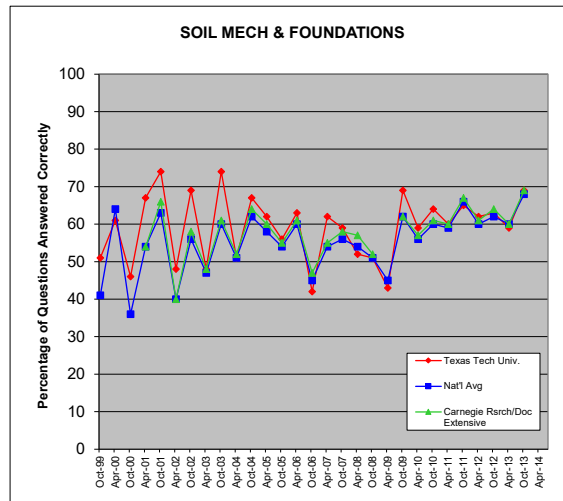
SPR 2022 Semester

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Civil Engineering Program  
PM Portion



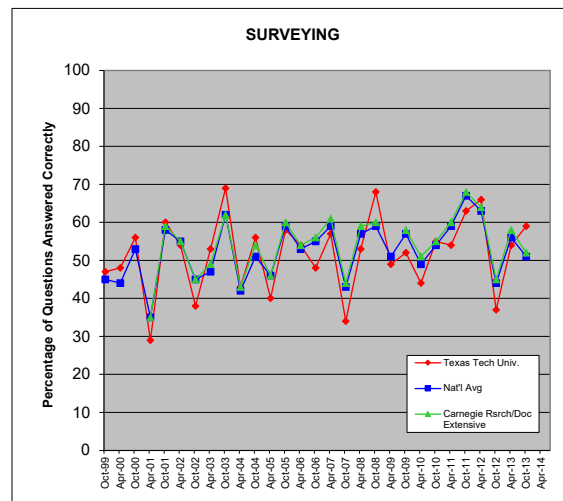
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



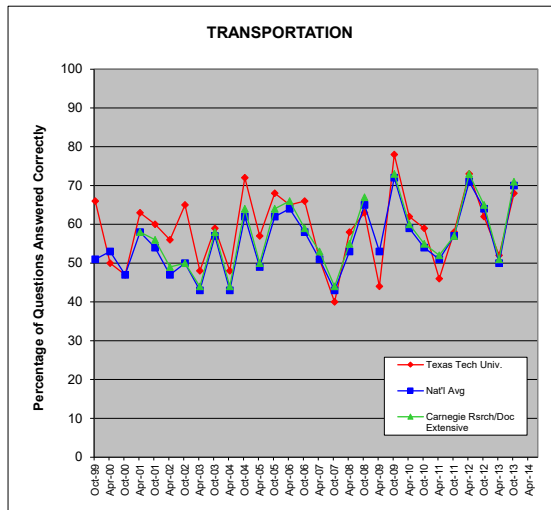
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



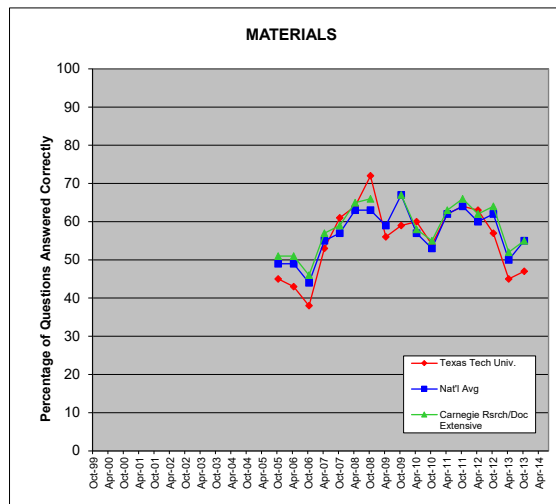
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SPR 2022 Semester

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Civil Engineering Program  
PM Portion



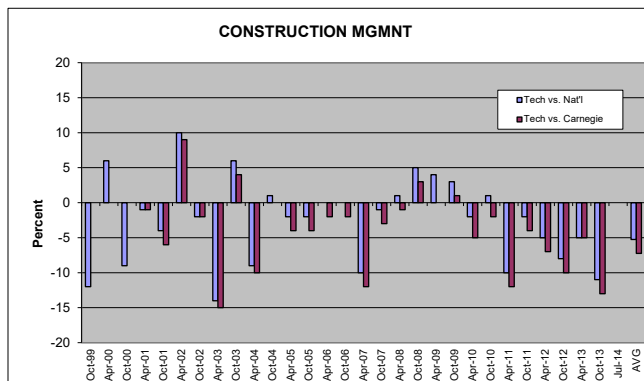
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SPR 2022 Semester

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## Civil Engineering Program PM Comparison



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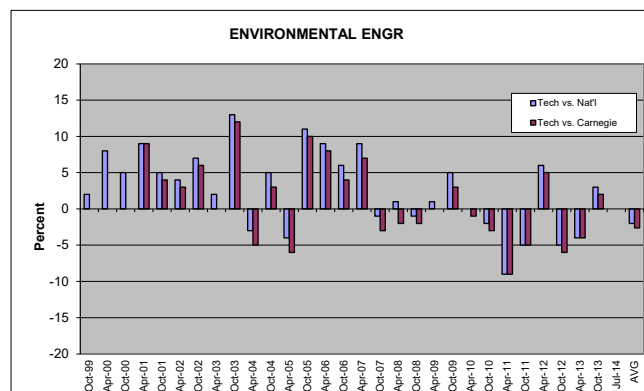
CONSTRUCTION MGMNT  
 Tech vs. Nat'l **-5.3**  
 Tech vs. Carnegie **-7.3**

SPR 2022 Semester

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## Civil Engineering Program PM Comparison



**12%**

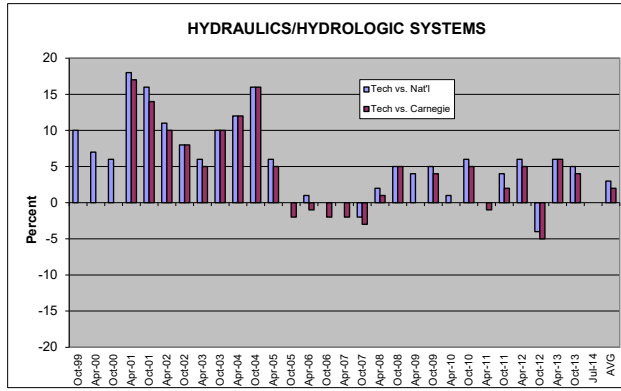
ENVIRONMENTAL ENGR  
 Tech vs. Nat'l **-2.0**  
 Tech vs. Carnegie **-2.6**

SPR 2022 Semester

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## Civil Engineering Program PM Comparison



12%

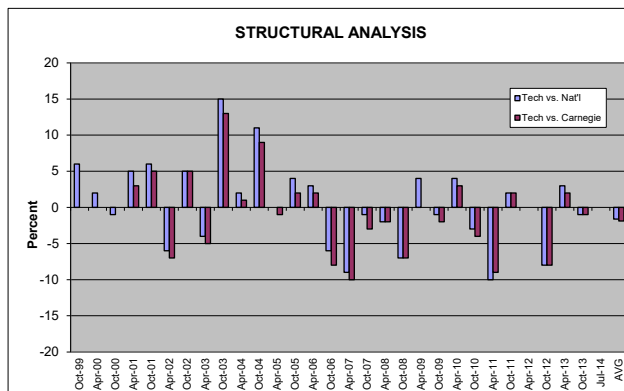
HYDRAUL/HYDROLOG SYS  
Tech vs. Nat'l 3.0  
Tech vs. Carnegie 2.0

SPR 2022 Semester

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## Civil Engineering Program PM Comparison



10%

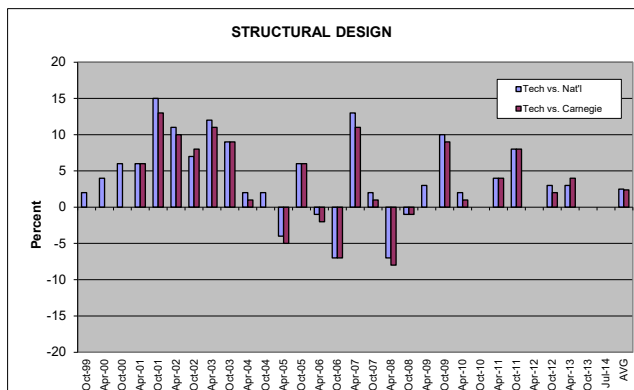
STRUCTURAL ANALYSIS  
Tech vs. Nat'l -1.6  
Tech vs. Carnegie -1.9

SPR 2022 Semester

56

56

## Civil Engineering Program PM Comparison



10%

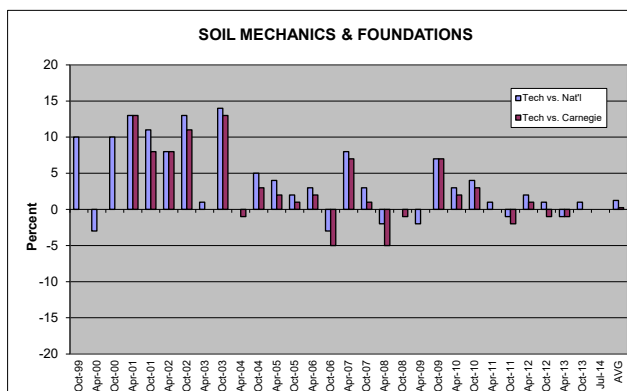
STRUCTURAL DESIGN  
Tech vs. Nat'l 2.5  
Tech vs. Carnegie 2.4

SPR 2022 Semester

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## Civil Engineering Program PM Comparison



15%

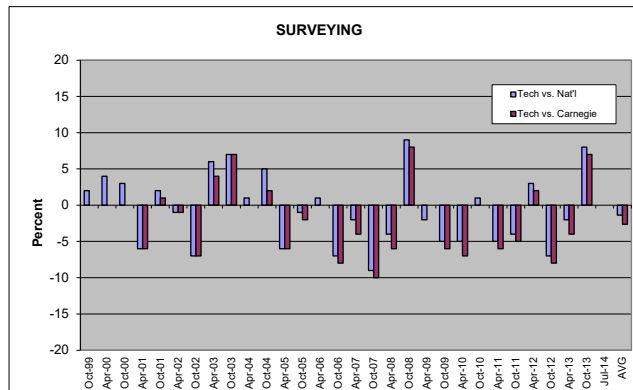
SOIL MECH & FOUNDAT  
Tech vs. Nat'l 1.3  
Tech vs. Carnegie 0.3

SPR 2022 Semester

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## Civil Engineering Program PM Comparison



11%

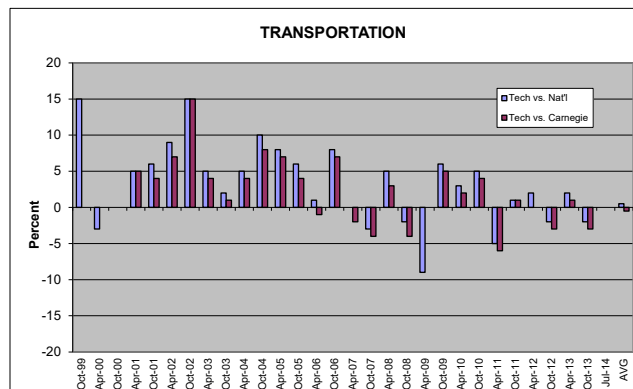
SURVEYING  
Tech vs. Nat'l -1.4  
Tech vs. Carnegie -2.6

SPR 2022 Semester

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## Civil Engineering Program PM Comparison



12%

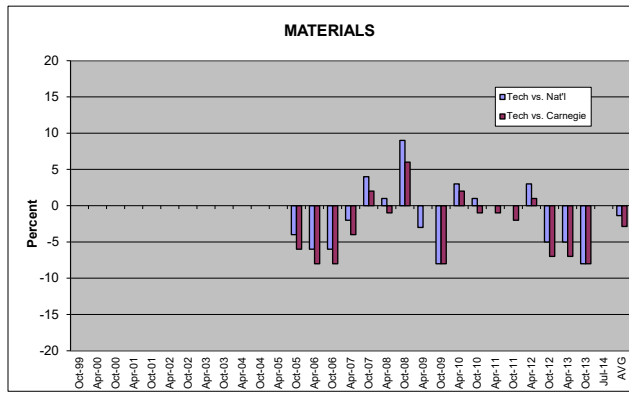
TRANSPORTATION  
Tech vs. Nat'l 0.5  
Tech vs. Carnegie -0.5

SPR 2022 Semester

60

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## Civil Engineering Program PM Comparison



8%

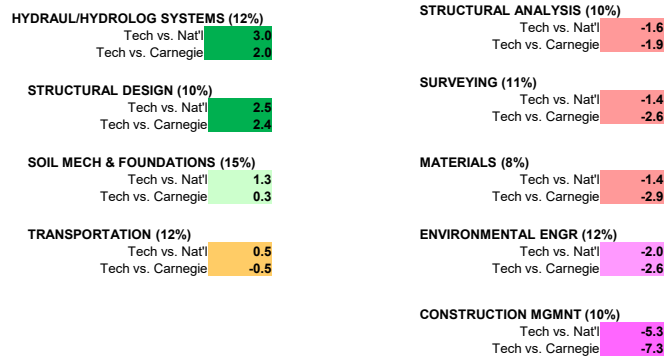
MATERIALS  
Tech vs. Nat'l -1.4  
Tech vs. Carnegie -2.9

SPR 2022 Semester

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## CIVIL Program Performance PM-Challenges (PRE 2014) (Averages Apr 2012– Oct 2013)



SPR 2022 Semester

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## TTU CIVIL Program Performance 2014-2020 data



SPR 2022 Semester

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## Ongoing Evolution of the FE Exam

1940	1950	1960	1970	1980	1990	2000	2010	2020	2030	
	1956	Pencil & Paper, 8.0 hrs, General Engr Content, 180 Questions, Open Book								
				1993	Supplied Reference, Ed. 1- Discipline Specific					
				1996	4.0 hrs Gen. / 4.0 hrs 180 Questions, Discipline-Specific					
							2014	CBT, 5.3 hrs, 18 topics, 110 questions		
							2020	14 Topics, 110 questions		

FALL' 2021

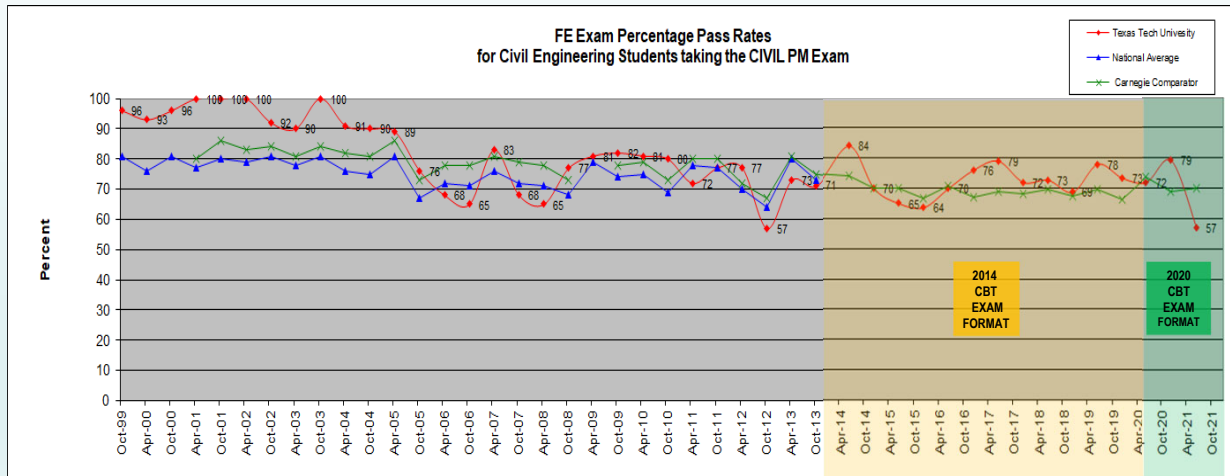
FE Exam Discussion

64

64



## 20+ YEARS FE PASS RATE DATA TTU Civil Engineering Program Performance



Spring 2022

FE Exam Discussion

SLIDE 65

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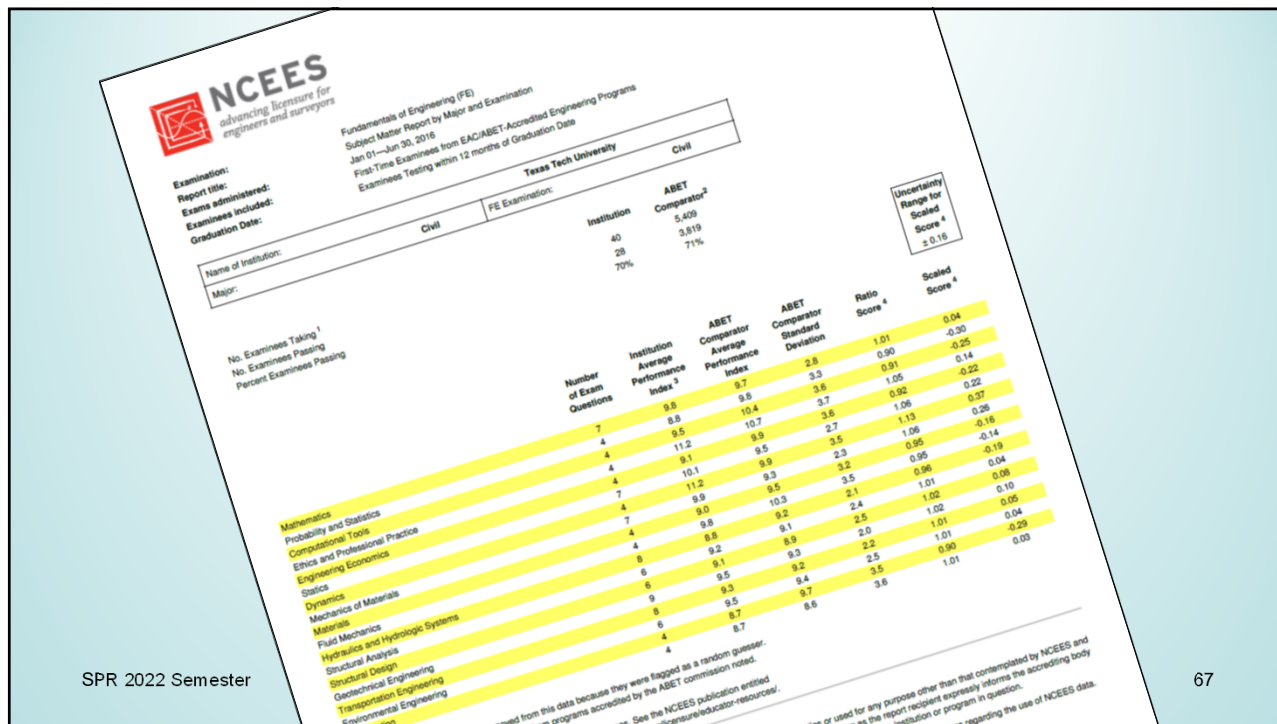
### 2020 FE Exam (CIVIL)

2014 FE EXAM SPECIFICATION				2020 FE EXAM SPECIFICATION			
No	TOPIC	Number of Questions (FE Exam)	Recmd # MFE+	No	TOPIC	Number of Questions (FE Exam)	Recmd # MFE+
1	Mathematics	7-11	4	1	Mathematics and Statistics	8-12	5
2	Probability and Statistics	4-6	3				
3	Computational Tools	4-6	3		∅	0	0
4	Ethics and Professional Practice	4-6	2	2	Ethics and Professional Practice	4-6	3
5	Engineering Economics	4-6	3	3	Engineering Economics	5-8	3
6	Statics	7-11	4	4	Statics	8-12	5
7	Dynamics	4-6	3	5	Dynamics	4-6	3
8	Mechanics of Materials	7-11	4	6	Mechanics of Materials	7-11	4
9	Materials	4-6	3	7	Materials	5-8	3
10	Fluid Mechanics	4-6	3	8	Fluid Mechanics	6-9	4
18	Surveying	4-6	3	9	Surveying	6-9	4
11	Hydraulics and Hydrologic Systems	8-12	5	10	Water Resources and Environmental Engineering	10-15	7
16	Environmental Engineering	6-9	4				
12	Structural Analysis	6-9	4	11	Structural Engineering	10-15	6
13	Structural Design	6-9	3				
14	Geotechnical Engineering	9-14	5	12	Geotechnical Engineering	10-15	6
15	Transportation Engineering	8-12	4	13	Transportation Engineering	9-14	5
17	Construction	4-6	2	14	Construction Engineering	8-12	4
	<b>averages</b>	<b>100-152</b>	<b>62</b>		<b>averages</b>	<b>100-152</b>	<b>62</b>

FALL '2021

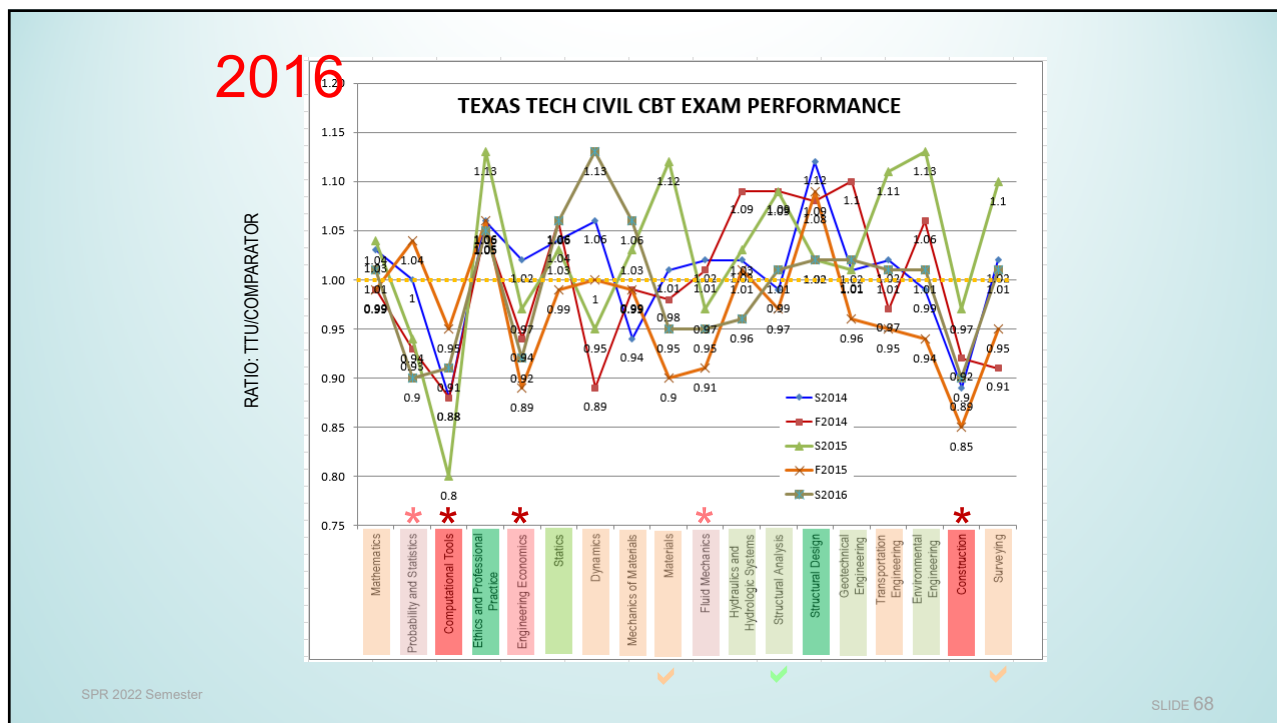
66

66



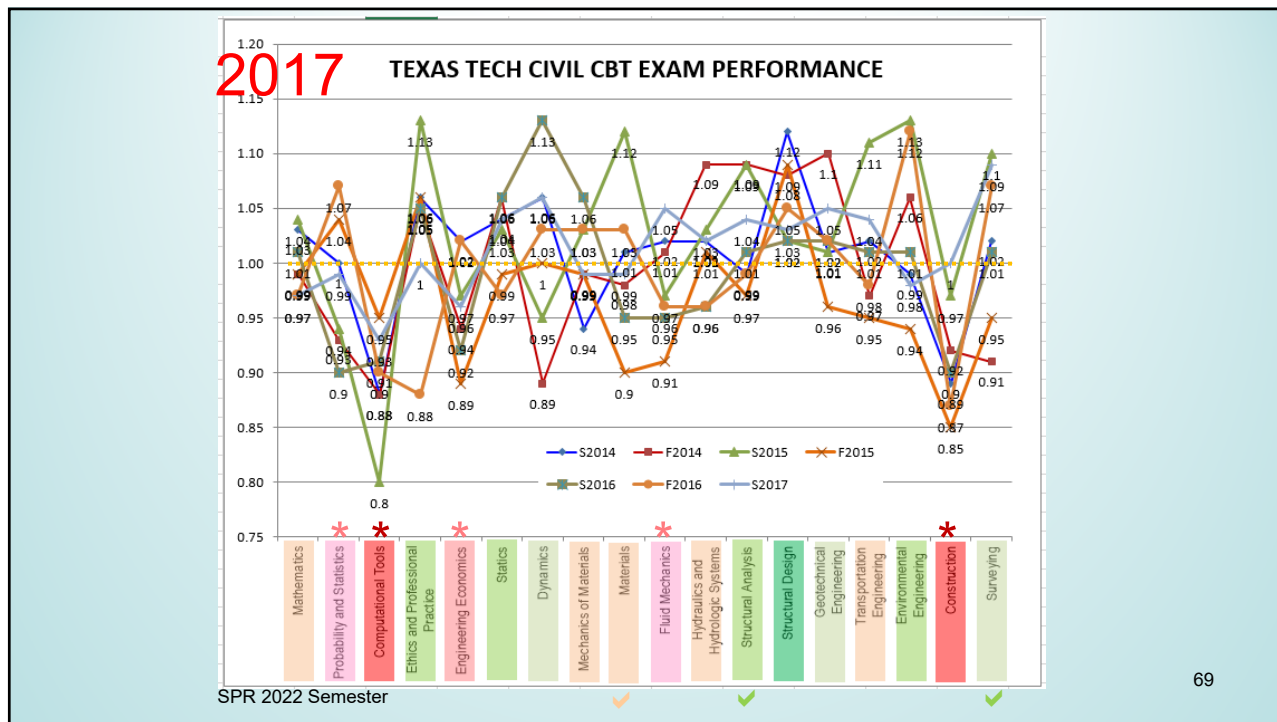
67

67

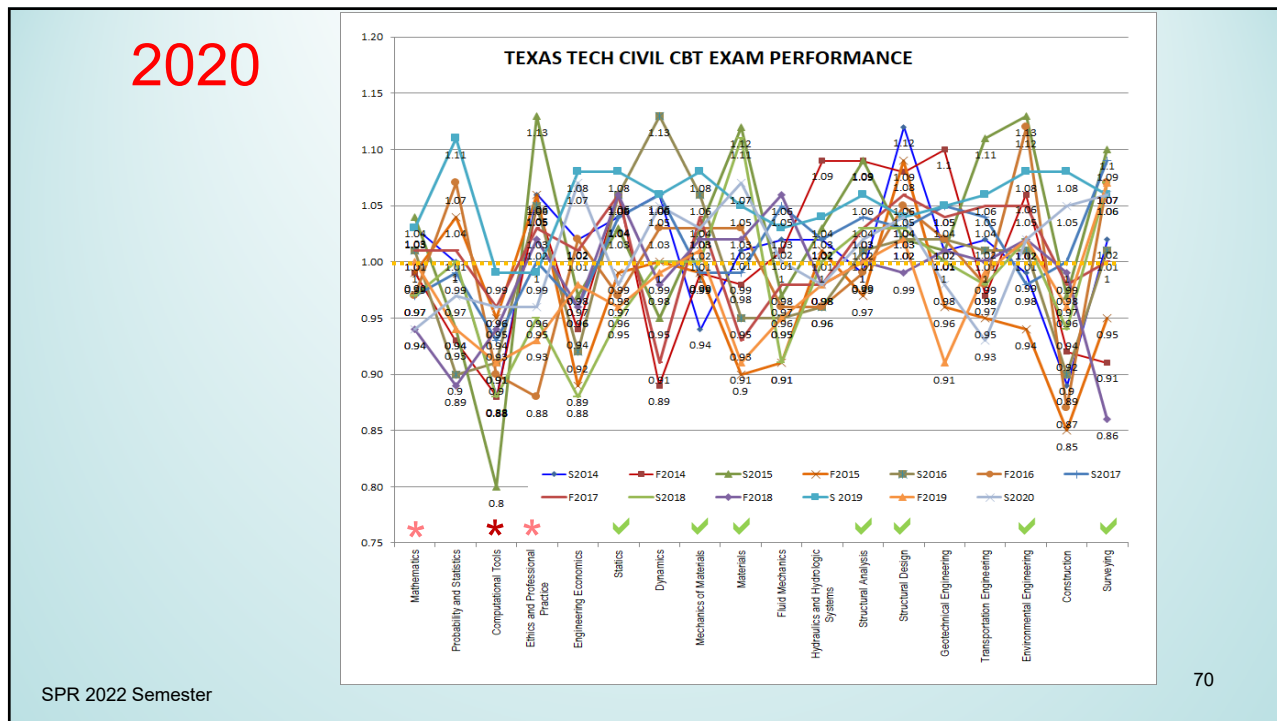


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SLIDE 68

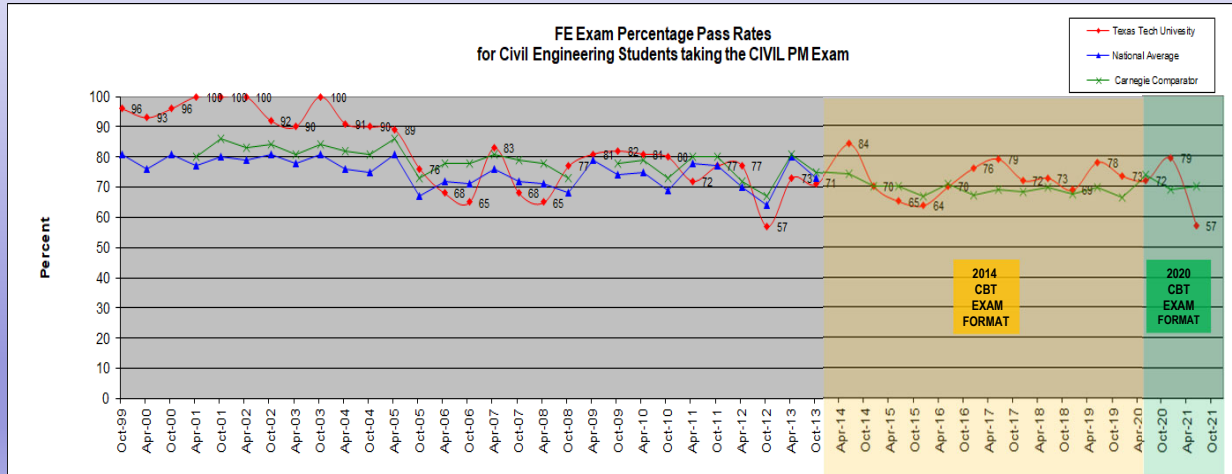


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## 20+ YEARS FE PASS RATE DATA TTU Civil Engineering Program Performance



Spring 2022

FE Exam Discussion

SLIDE 71

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## Summary Observations

1. NCEES changed the FE Exam in 2014 and again in July 2020.
2. Prior to 2014, typical performance was about 30 to 80, avg 50% correct, by topic (varies)

### FROM JAN 2014- JUN 2021

1. CIVIL Program analysis suggests that AM performance needs improvement in 4 of 10 topics.
  - Esp.; Computational Tools, Engineering Economics, Probability & Statistics, Fluid Mechanics
2. PM performance needs improvement in 1 of 8 topics.
  - Esp.; Construction

SPR 2022 Semester

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## Recommendations

- SHORT TERM
  - Encourage students NOT to take FE early
  - Take FE Exam when best prepared to pass (graduating semester)
  - FE review course: special attention to reviews in problem topics
  
- LONGER TERM
  - Faculty evaluate curriculum relative to FE topics/specification
  - Use CE 4200 to introduce, and provide diagnostic data for, student FE Exam preparation
  - Consider Scope and Focus of FE Review Course (CE 4000)
    - Review? Re-Learn? Learn?
  - Accumulate FE pass rate data for current version of Exam