MINUTES

STATE BOARD OF EDUCATION

APRIL 2025

STATE BOARD OF EDUCATION

(January 2025)

(State Board for Career and Technology Education)

AARON KINSEY, Midland
Chair of the State Board of Education
District 15

PAM LITTLE
Vice Chair of the State Board of Education
District 12

WILL HICKMAN
Secretary of the State Board of Education
District 6

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GUSTAVO REVELES, El Paso
District 1

LJ FRANCIS, Corpus Christi
District 2

MARISA PEREZ-DIAZ, San Antonio
District 3

STACI CHILDS, Houston
District 4

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San Marcos, District 5

JULIE PICKREN, Pearland
District 7

AUDREY YOUNG, Trinity
District 8

KEVEN ELLIS, Lufkin
District 9

TOM MAYNARD, Florence
District 10

BRANDON HALL, Aledo
District 11

TIFFANY CLARK, DeSoto
District 13

EVELYN BROOKS, Frisco
District 14

Committees of the State Board of Education
(updated January 2025)

INSTRUCTION

Audrey Young-Chair
Evelyn Brooks-Vice Chair
Rebecca Bell-Metereau
Pam Little
Gustavo Reveles

SCHOOL FINANCE/PERMANENT SCHOOL FUND

Tom Maynard-Chair
Marisa Perez-Diaz-Vice Chair
Keven Ellis
Will Hickman
Aaron Kinsey

SCHOOL INITIATIVES

LJ Francis-Chair
Julie Pickren-Vice Chair
Staci Childs
Tiffany Clark
Brandon Hall

Minutes

State Board of Education

April 11, 2025

Minutes
State Board of Education
Friday, April 11, 2025

The State Board of Education met at 8:47 a.m. on Friday, April 11, 2025, in room, #2.035 of the Barbara Jordan Building, 1601 N. Congress Avenue, Austin, Texas.

Student Performance

Mrs. Perez-Diaz introduced a student performance by the Conjunto Los Dorado Thomas Edison High School in the San Antonio Independent School District.

The Invocation, Pledge of Allegiance to the Flag of the United States of America, and Salute to the Texas Flag were led by Mrs. Little. Staff called the roll.

Present: Aaron Kinsey, chair; Gustavo Reveles; LJ Francis; Marisa B. Perez-Diaz; Staci Childs; Rebecca Bell-Metereau; Will Hickman; Julie Pickren; Audrey Young; Keven Ellis; Tom Maynard; Pam Little; Brandon Hall; Tiffany Clark; Evelyn Brooks

NOTE: The Board took up items in the following order:

1, 2, Consent (3), 3, 4, 5, 6, 7, 8, 9, 10, Consent (1), 11, 12, Consent (2), 14, 15, 16, Consent (7), Consent (6), 13, Consent (4), Consent (5)

Approval of Minutes

State Board of Education, January 28 and 31, 2025

MOTION AND VOTE: *Without objection, the State Board of Education approved the minutes of the January 28 and 31, 2025, meetings of the State Board of Education, as printed.*

1. Resolutions and Presentation

No resolutions were considered.

Public Testimony

Public Testimony was provided by the following individual:

NAME	AFFILIATION
Julia Brookins	American Historical Association

2. Approval of Consent Agenda

Any agenda item may be placed on the consent agenda by any State Board of Education committee. The State Board of Education may elect to take separate action on any item on the consent agenda.

Items 1, 2, 4, 5, 6, and 7 were removed from the Consent Agenda by individual members. *Without objection, the State Board of Education approved the following items on the consent agenda.*

Consent (3)

Proposed Amendments to 19 TAC Chapter 74, Curriculum Requirements, Subchapter B, Graduation Requirements, §74.12, Foundation High School Program, and §74.13, Endorsements
(Second Reading and Final Adoption)
(Board agenda page I-1)
[Official agenda item #8]

ADOPTED RECOMMENDATION: That the State Board of Education approve for second reading and final adoption proposed amendments to 19 TAC Chapter 74, Curriculum Requirements, Subchapter B, Graduation Requirements, §74.12, Foundation High School Program, and §74.13, Endorsements; and

Make an affirmative finding that immediate adoption of proposed amendments to 19 TAC Chapter 74, Curriculum Requirements, Subchapter B, Graduation Requirements, §74.12, Foundation High School Program, and §74.13, Endorsements, is necessary and shall have an effective date of August 1, 2025.

(ATTACHMENT 1, page 12)

COMMITTEE OF THE FULL BOARD

3. **Proposed New 19 TAC Chapter 127, Texas Essential Knowledge and Skills in Career Development and Career and Technical Education, Subchapter B, High School, §127.15, Career and Technical Education Employability Skills**
(First Reading and Filing Authorization)
(Board agenda page I-1)
[Official agenda item #3]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve for first reading and filing authorization proposed new 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and Technical Education, Subchapter B, High School, §127.15, Career and Technical Education Employability Skills, Adopted 2025, *as amended*.

AMENDMENT: *It was moved by Dr. Bell-Metereau and seconded by Mr. Francis, to amend §127.15, Career and Technical Education Employability Skills, (2) (E) to read* "describe and demonstrate the importance of ~~and demonstrate~~ punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed." The amendment was defeated 6-6.

ADOPTED RECOMMENDATION: The recommendation was adopted as presented, 12-1.

4. **Adoption of Review of 19 TAC Chapter 101, Assessment, Subchapter A, General Provisions, Subchapter B, Implementation of Assessments, and Subchapter C, Local Option**
(Adoption of Review)
(Board agenda page I-7)
[Official agenda item #4]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they postpone the item for further consideration at the June 2025 meeting.

ADOPTED RECOMMENDATION: The recommendation was adopted.

5. Proposed New 19 TAC Chapter 111, Texas Essential Knowledge and Skills for Mathematics, Subchapter B, Middle School, §§111.29-111.31
(Second Reading and Final Adoption)
(Board agenda page I-12)
[Official agenda item #5]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve for second reading and final adoption proposed new 19 TAC Chapter 111, Texas Essential Knowledge and Skills for Mathematics, Subchapter B, Middle School, §§111.29-111.31; and

Make an affirmative finding that immediate adoption of proposed new 19 TAC Chapter 111, Texas Essential Knowledge and Skills for Mathematics, Subchapter B, Middle School, §§111.29-111.31, is necessary and shall have an effective date of 20 days after filing as adopted with the Texas Register.

AMENDMENT: *It was moved by Mr. Hickman and seconded by Ms. Childs to amend the title of §111.31 Grade 8, Middle School Advanced Mathematics, Algebra by adding a Roman numeral "I" in the title.* The motion was adopted.

AMENDMENT*: It was moved by Mr. Hickman and seconded by Mr. Maynard to amend the course §111.31 Grade 8, Middle School Advanced Mathematics, Algebra I by amending paragraph (b) General requirements, to read:* "~~Students shall be awarded one credit that satisfies the Algebra I requirement for high school graduation.~~ This course is recommended for students in Grade 8. Prerequisite: Middle School Advanced Mathematics, Grade 7 or Mathematics, Grade 8. Students shall be awarded one credit that satisfies the Algebra I requirement for high school graduation. This course satisfies the requirement for any course that identifies Algebra I as a prerequisite." The motion was adopted.

AMENDMENT: *It was moved by Mr. Hickman and seconded by Mr. Maynard to amend the course §111.31 Grade 8, Middle School Advanced Mathematics, Algebra I by amending paragraph (b) General requirements, to read:* "~~Students shall be awarded one credit that satisfies the Algebra I requirement for high school graduation.~~ This course is recommended for students in Grade 8. Prerequisite: Middle School Advanced Mathematics, Grade 7 or Mathematics, Grade 8. Students shall be awarded one credit that satisfies the Algebra I requirement for high school graduation. This course satisfies the requirement for any course that identifies Algebra I as a prerequisite." The motion was adopted.

AMENDMENT: *It was moved by Mr. Hickman and seconded by Mrs. Little to amend the course §111.31 Grade 8, Middle School Advanced Mathematics, Algebra I by amending paragraph (c) Knowledge and skills, item 8 (C), to read:* "identify examples of proportional and non-proportional ~~functions~~ relationships that arise from mathematical and real-world problems." The motion was adopted.

ADOPTED RECOMMENDATION: The recommendation was adopted with a 2/3 vote, as amended.

(ATTACHMENT 2, page 15)

6. Consideration of the Committee of Education's Generation 30 High-Performing Entity Charter School Proposals
(Board agenda page I-32)
[Official agenda item #6]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they take no action on the proposed Generation 30, High-Performing Entity charter school, Mater Academy San Antonio, scheduled to open in the 2026-2027 school year.

ADOPTED RECOMMENDATION: A roll call vote was taken on the recommendation, which was adopted 11-3.

District 1: Gustavo Reveles	NO	District 9: Keven Ellis	YES
District 2: L. J. Francis	YES	District 10: Tom Maynard	YES
District 3: Marisa Perez-Diaz	YES	District 11: Brandon Hall	YES
District 4: Staci Childs	YES	District 12: Pam Little	YES
District 5: Rebecca Bell-Metereau	YES	District 13: Tiffany Clark	NO
District 6: Will Hickman	YES	District 14: Evelyn Brooks	NO
District 7: Julie Pickren	YES	District 15: Aaron Kinsey	
District 8: Audrey Young	YES		

7. Proposed New 19 TAC Chapter 67, <u>State Review and Approval of Instructional Materials</u>, Subchapter C, <u>Local Operations</u>, §67.69, <u>Local Review of Classroom Instructional Materials</u> (Second Reading and Final Adoption)
(Board agenda page I-34)
[Official agenda item #7]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve for second reading and final adoption proposed new 19 TAC Chapter 67, State Review and Approval of Instructional Materials, Subchapter C, Local Operations, §67.69, Local Review of Classroom Instructional Materials; and

Make an affirmative finding that immediate adoption of proposed new 19 TAC Chapter 67, State Review and Approval of Instructional Materials, Subchapter C, Local Operations, §67.69, Local Review of Classroom Instructional Materials, is necessary and shall have an effective date of 20 days after filing as adopted with the Texas Register.

ADOPTED RECOMMENDATION: The recommendation was adopted with a 2/3 vote.

(ATTACHMENT 3, page 30)

8. Approval of Local Classroom Review Rubrics
(Board agenda page I-39)
[Official agenda item #8]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve Mathematics K–12, ELAR K–3 Reading Comprehension, and ELAR 4–8 Reading Comprehension rubrics related to classroom reviews.

ADOPTED RECOMMENDATION: The recommendation was adopted.

MOTION: *Mrs. Little moved and Mr. Hickman seconded a motion to approve the ELAR K–3 Foundational Literacy Skills rubric related to classroom reviews.*

ADOPTED MOTION: The motion was adopted.

9. Proposed New 19 TAC Chapter 127, Texas Essential Knowledge and Skills in Career Development and Career and Technical Education, Subchapter I, Engineering, §§127.402-419, 127.452, and 127.453
(Second Reading and Final Adoption)
(Board agenda page I-49)
[Official agenda item #9]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve for second reading and final adoption proposed new 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and Technical Education, Subchapter I, Engineering, §§127.402-127.419, 127.452, and 127.453; and

Make an affirmative finding that immediate adoption of proposed new 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and Technical Education, Subchapter I, Engineering, §§127.402-127.419, 127.452, and 127.453 is necessary and shall have an effective date of August 1, 2025.

AMENDMENT: *It was moved by Mr. Maynard and seconded by Mrs. Little to amend §127.407. Environmental Engineering (d)(9)(H)* "research and describe emerging contaminants in water such as microplastics and pharmaceuticals, including methods of detection, measurement techniques, degradation, assessment of risk, and strategies for mitigation and removal [in water]." Following amendment, the item read "research and describe contaminants in water and demonstrate understanding of methods of detection, measurement techniques, degradation, assessment of risk, and strategies for mitigation and removal of contaminants." The motion was adopted.

AMENDMENT: *It was moved by Mr. Maynard and seconded by Mrs. Pickren to amend §127.407. Environmental Engineering (d)(10)(A)* "explain the differences between and costs [cost] of renewable and non-renewable energy sources , providing [of energy and provide] examples of each and discuss factors, including energy density, subsidies, raw materials, the impact on land and animal life, and the environmental and resource demands of mining for renewable and non-renewable energy sources." Following amendment, the item was divided into (A) and (B) and read "(A) explain the differences between and costs [cost] of renewable and non-renewable energy sources, providing [of energy and provide] examples of each;

(B) describe energy density, subsidies, raw materials, the impact of energy production on land and animal life, and the environmental and resource demands of mining in relation to renewable and non-renewable energy sources." The motion was adopted.

AMENDMENT*: It was moved by Mr. Hickman and seconded by Dr. Clark to amend §127.406. Engineering Design and Problem Solving (b) "General requirements.* This course is a Level 4 course and is recommended for students in Grade 12. Prerequisites: Algebra I, Geometry, and at least one credit in a Level 2 or higher course in the Engineering Career Cluster. Recommended prerequisites or corequisites: Engineering Science, Chemistry, Physics, or Physics for Engineering. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course." Following amendment, the item read "General requirements. This course is a Level 4 course and is recommended for students in Grade 12. Prerequisites: Algebra I, Geometry, and at least one credit in a Level 2 or higher course in the Engineering Career Cluster. Recommended prerequisites or corequisites: Engineering Science, chemistry, or physics. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course." The motion was adopted.

AMENDMENT: *It was moved by Mr. Maynard and seconded by Mrs. Little to amend §127.407. Environmental Engineering (d)(9)(H)* "research and describe emerging contaminants in water such as microplastics and pharmaceuticals, including methods of detection, measurement techniques, degradation, assessment of risk, and strategies for mitigation and removal [in water]." Following amendment, the item read "research and describe contaminants in water and demonstrate understanding of methods of detection, measurement techniques, degradation, assessment of risk, and strategies for mitigation and removal of contaminants." The motion was adopted.

ADOPTED RECOMMENDATION: The recommendation was adopted as amended with a 2/3 vote.

RECONSIDER: *Following adoption, Mr. Maynard moved to reconsider the vote on the recommendation. The motion was seconded by Mrs. Little and adopted.*

AMENDMENT: *It was moved by Mrs. Little and seconded by Mr. Maynard to strike the Levels from each Engineering course. The motion was adopted.*

ADOPTED RECOMMENDATION: The recommendation was adopted as further amended with a 2/3 vote.

(ATTACHMENT 4, page 31)

10. Proposed new 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and Technical Education, Subchapter C, Agriculture, Food, and Natural Resources, §127.59 and §127.61; Subchapter F, Business, Marketing, and Finance, §127.262 and §127.263; Subchapter J, Health Science, §127.510 and §127.511; Subchapter K, Hospitality and Tourism, §§127.569, 127.571, and 127.604; Subchapter M, Information Technology, §§127.689-127.691 and 127.695-127.699; and Subchapter N, Law and Public Service, §127.773
(Second Reading and Final Adoption)
(Board agenda page I-148)
[Official agenda item #10]

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve for second reading and final adoption proposed new 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and

Technical Education, Subchapter C, Agriculture, Food, and Natural Resources,§127.59 and §127.61; Subchapter F, Business, Marketing, and Finance, §127.262 and §127.263; Subchapter J, Health Science, §127.510 and §127.511; Subchapter K, Hospitality and Tourism, §§127.569, 127.571, and 127.604; Subchapter M, Information Technology, §§127.689-127.691 and 127.695-127.699, and Subchapter N, Law and Public Service, §127.773; and

Make an affirmative finding that immediate adoption of proposed new TEKS in 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and Technical Education, Subchapter C, Agriculture, Food, and Natural Resources,§127.59 and §127.61; Subchapter F, Business, Marketing, and Finance, §127.262 and §127.263; Subchapter J, Health Science, §127.510 and §127.511; Subchapter K, Hospitality and Tourism, §§127.569, 127.571, and 127.604; Subchapter M, Information Technology, §§127.689-127.691 and 127.695-127.699, and Subchapter N, Law and Public Service, §127.773, is necessary and shall have an effective date of August 1, 2025.

AMENDMENT: *It was moved by Mrs. Little and seconded by Mr. Maynard to strike the Levels from each of the mentioned courses. The motion was adopted.*

ADOPTED RECOMMENDATION: The recommendation was adopted as amended with a 2/3 vote.

(ATTACHMENT 5, page 132)

Consent (1)

Proposed Amendment to 19 TAC Chapter 74, Curriculum Requirements, Subchapter A, Required Curriculum, §74.3 Description of a Required Secondary Curriculum
(Second Reading and Final Adoption)
(Board agenda page I-214)

RECOMMENDATION: On behalf of the Committee of the Full Board, Mrs. Little recommended to the State Board of Education that they approve for second reading and final adoption the proposed amendment to 19 TAC Chapter 74, Curriculum Requirements, Subchapter A, Required Curriculum, §74.3, Description of a Required Secondary Curriculum; and

Make an affirmative finding that immediate adoption of the proposed amendment to 19 TAC Chapter 74, Curriculum Requirements, Subchapter A, Required Curriculum, §74.3, Description of a Required Secondary Curriculum, is necessary and shall have an effective date of August 1, 2025.

AMENDMENT: *It was moved by Mr. Hickman and seconded by Ms. Childs to adopt the staff recommendations as provided. The motion was adopted.*

ADOPTED RECOMMENDATION: The recommendation was adopted as amended with a 2/3 vote.

(ATTACHMENT 6, page 195)

COMMITTEE ON INSTRUCTION

11. Consideration of Renewal of Currently Approved Innovative Courses
(Board agenda page II-25)
[Official agenda item # 11]

No business related to this item was brought forward to the State Board of Education.

12. Approval of Updates and Substitutions to Approved Instructional Materials
(Board agenda page II-29)
[Official agenda item 12]

RECOMMENDATION: On behalf of the Committee on Instruction, Dr. Young recommended to the State Board of Education that they approve requests from Texas Education Agency to update the following content in its English language arts and reading materials:

- Kindergarten Unit 7: Serving Our Neighbors;
- Grade 2 Unit 2: Ancient Greeks;
- Grade 4 Unit 7 Poetry: Wonderous Words;
- Grade 4: Anthology;
- Grade 5 Unit 5 Poetry: Collage of Words;
- Grade 5 Unit 5: World War II;
- Grade 5 Anthology.

AMENDMENT: *It was moved by Dr. Young and seconded by Ms. Childs to amend the items by adding*

- Kindergarten Unit 11: Exploring Art;
- Grade 4 Unit 9: Innovations and Industry in Energy;
- Grade 5 Unit 9: Beyond Juneteenth.

The motion to amend was adopted.

ADOPTED RECOMMENDATION: The recommendation was adopted as amended.

Consent (2)

Proposed Repeal of 19 TAC Chapter 130, Texas Essential Knowledge and Skills for Career and Technical Education, and Proposed Revisions to 19 TAC Chapter 127, Texas Essential Knowledge and Skills for Career Development and Career and Technical Education (Second Reading and Final Adoption)
(Board agenda page II-1)
No business related to this item was brought forward to the State Board of Education.

COMMITTEE ON SCHOOL INITIATIVES

14. Review of Adoption of Proposed Amendment to 19 TAC Chapter 249, Disciplinary Proceedings, Sanctions, and Contested Cases
(Board agenda page IV-8)
[Official agenda item #14]

RECOMMENDATION: On behalf of the Committee on School Initiatives, Mr. Francis recommended to the State Board of Education that they take no action on the Adoption of Proposed Amendment to 19 TAC Chapter 249, Disciplinary Proceedings, Sanctions, and Contested Cases.

ADOPTED RECOMMENDATION: The recommendation was adopted.

15. **Review of Adoption of Proposed Revisions to Amendment to 19 TAC Chapter 235, Classroom Teacher Certification Standards, Subchapter A, General Provisions, Subchapter B, Elementary School Certificate Standards, Subchapter C, Middle School Certificate Standards, and Subchapter D, Secondary School Certificate Standards**
(Board agenda page IV-37)
[Official agenda item #15]

RECOMMENDATION: On behalf of the Committee on School Initiatives, Mr. Francis recommended to the State Board of Education that they take no action on the Proposed Revisions to Amendment to 19 TAC Chapter 235, Classroom Teacher Certification Standards, Subchapter A, General Provisions, Subchapter B, Elementary School Certificate Standards, Subchapter C, Middle School Certificate Standards, and Subchapter D, Secondary School Certificate Standards.

ADOPTED RECOMMENDATION: The recommendation was adopted.

16. **Review of Adoption of Proposed Revisions to 19 TAC Chapter 231, Requirements for Public School Personnel Assignments, Subchapter F, Special Education-Related Services Personnel Assignments**
(Board agenda page IV-74)
[Official agenda item #16]

RECOMMENDATION: On behalf of the Committee on School Initiatives, Mr. Francis recommended to the State Board of Education that they veto the Adoption of Proposed Revisions to 19 TAC Chapter 231, Requirements for Public School Personnel Assignments, Subchapter F, Special Education-Related Services Personnel Assignments.

DEFEATED RECOMMENDATION: The recommendation was defeated 4-9.

MOTION: *It was moved by Dr. Ellis and seconded by Ms. Perez-Diaz that the State Board of Education take on action on the Adoption of Proposed Revisions to 19 TAC Chapter 231, Requirements for Public School Personnel Assignments, Subchapter F, Special Education-Related Services Personnel Assignments.*

ADOPTED MOTION: The motion was adopted 9-4.

Consent (7)

Proposed Amendments to the "Framework for Governance Leadership" Required to be Adopted under Texas Education Code (TEC) §11.159, Member Training and Orientation, and 19 Texas Administrative Code (TAC) Chapter 61, School Districts, Subchapter A, Board of Trustees Relationship, §61.1, Continuing Education for School Board Members
(Board agenda page IV-97)

RECOMMENDATION: On behalf of the Committee on School Initiatives, Mr. Francis recommended to the State Board of Education that they adopt the substitute "Framework for Governance Leadership" as adopted and amended by the Committee on School Initiatives.

POSTPONE: *It was moved by Mr. Francis and seconded by Mr. Hall that the State Board of Education postpone further consideration of the "Framework for Governance Leadership" to the next Board meeting.*

ADOPTED POSTPONEMENT: The motion to postpone was adopted 8-4.

Consent (6)

Approval of 2025-2029 Rule Review Plan for State Board of Education Rules
(Board agenda page IV-2)

RECOMMENDATION: On behalf of the Committee on School Initiatives, Mr. Francis recommended to the State Board of Education that they approve the Proposed 2025-2029 Rule Review Plan for State Board of Education Rules.

ADOPTED RECOMMENDATION: The recommendation was adopted.

COMMITTEE ON SCHOOL FINANCE/PERMANENT SCHOOL FUND

13. Adoption of Review of 19 TAC Chapter 109, Budgeting, Accounting, and Auditing, Subchapter A, Budgeting, Accounting, Financial Reporting, and Auditing for School Districts, Subchapter B, Texas Education Agency Audit Functions, Subchapter C, Adoptions by Reference, and Subchapter D, Uniform Bank Bid or Request for Proposal and Depository Contract (Adoption of Review)
(Board agenda page III-1)
[Official agenda item #13]

RECOMMENDATION: On behalf of the Committee on School Finance/Permanent School Fund, Mr. Maynard recommended to the State Board of Education that they approve the review of 19 Texas Administrative Code (TAC) Chapter 109, Budgeting, Accounting, and Auditing, Subchapter A, Budgeting, Accounting, Financial Reporting, and Auditing for School Districts, Subchapter B, Texas Education Agency Audit Functions, Subchapter C, Adoptions by Reference, and Subchapter D, Uniform Bank Bid or Request for Proposal and Depository Contract

ADOPTED RECOMMENDATION: The recommendation was adopted.

Consent (4)

Adoption of an Annual Report on the Status of the Bond Guarantee Program
(Board agenda page III-66)

RECOMMENDATION: On behalf of the Committee on School Finance/Permanent School Fund, Mr. Maynard recommended to the State Board of Education that they adopt the annual report on the status of the Bond Guarantee Program.

ADOPTED RECOMMENDATION: The recommendation was adopted.

Consent (5)

Review the Process for Consideration of Board Member Nominees for State Board Positions
(Board agenda page III-67)

RECOMMENDATION: On behalf of the Committee on School Finance/Permanent School Fund, Mr. Maynard recommended to the State Board of Education that they adopt the procedures for selecting nominees to be sent to the Governor for appointment to the School Land Board and the Texas Teacher Retirement System Board of Trustees.

ADOPTED RECOMMENDATION: The recommendation was adopted.

REGARDING AGENDA ITEMS POSTED FOR DISCUSSION ON COMMITTEE AGENDAS

Committee on Instruction

Dr. Young did not report on the Committee on Instruction.

Committee on School Finance/Permanent School Fund

Mr. Maynard asked that Jerry Stout give a brief overview of the Permanent School Fund. Mr. Stout reported on the PSF, noting that he was distributing a list of assets under management of the largest endowments in the country, and their annual returns. The PSF has about $53.7B, with a return of 10.1%, which is one of the largest funds and has among the best returns in the US. He noted that over time, the returns were over 6%, and explained the PSF Corporation Board's Asset Allocation Policy and steps taken to avoid losses in the Fund.

Committee on School Initiatives

Mr. Francis did not report on the Committee on School Initiatives.

REPORTS OF OTHER STATE BOARD OF EDUCATION MEMBERS REGARDING AGENDA ITEMS AND EDUCATIONAL ACTIVITIES AND CONCERNS IN INDIVIDUAL DISTRICTS

No further reports were given.

The meeting adjourned at 2:30 p.m.

Will Hickman, Secretary

ATTACHMENT
Text of Proposed Amendments to 19 TAC

Chapter 74. Curriculum Requirements

Subchapter B. Graduation Requirements

§74.12. Foundation High School Program.

(a) (No change.)

(b) Core courses. A student must demonstrate proficiency in the following.

(1)-(2) (No change.)

(3) Science--three credits. One credit must consist of Biology or a comparable AP or IB biology course.

(A) One credit must be selected from the following laboratory-based courses:

(i) Integrated Physics and Chemistry;

(ii) Chemistry;

(iii) Physics;

(iv) Physics for Engineering [~~Principles of Technology~~] ; and

(v) a comparable AP or IB chemistry or physics course that does not count toward another credit required for graduation.

(B) The additional credit may be selected from one full credit or a combination of two half credits from two different courses, subject to prerequisite requirements, from the following laboratory-based courses:

(i)-(xvii) (No change.)

(xviii) Physics for Engineering [~~Principles of Technology~~] ;

(xix)-(xxiv) (No change.)

(C) Credit may not be earned for both physics and Physics for Engineering [~~Principles of Technology~~] to satisfy science credit requirements.

(4)-(7) (No change.)

(c)-(d) (No change.)

§74.13. Endorsements.

(a)-(d) (No change.)

(e) To earn an endorsement a student must demonstrate proficiency in the following.

(1)-(5) (No change.)

(6) An additional credit in science that may be selected from one full credit or a combination of two half credits from two different courses, subject to prerequisite requirements, from the following courses:

(A)-(Q) (No change.)

(R) Physics for Engineering [~~Principles of Technology~~] ;

(S)-(X) (No change.)

(Y) credit may not be earned for both physics and Physics for Engineering [~~Principles of Technology~~] to satisfy science credit requirements.

(Z) (No change.)

(7) (No change.)

(f) A student may earn any of the following endorsements.

(1) Science, technology, engineering, and mathematics (STEM). Students who entered high school prior to the 2022-2023 school year may earn a STEM endorsement by completing the requirements specified in subsection (e) of this section, including Algebra II, chemistry, and physics or Physics for Engineering [~~Principles of Technology~~] and:

(A) a coherent sequence of courses for four or more credits in career and technical education (CTE) that consists of at least two courses in the same career cluster and at least one advanced CTE course. The courses may be selected from [~~Chapter 130 of this title (relating to Texas Essential Knowledge and Skills for Career and Technical Education),~~] Chapter 127 of this title (relating to Texas Essential Knowledge and Skills for Career Development and Career and Technical Education) [~~,~~] or CTE innovative courses. The final course in the sequence must be selected from Chapter 127, Subchapter O, of this title (relating to Science, Technology, Engineering, and Mathematics) as it existed prior to August 1, 2025, or Career Preparation I or II (Career Preparation General or Career Preparation for Programs of Study) and Project-Based Research (Career and Technical Education Project-Based Capstone) in Chapter 127, Subchapter B, of this title (relating to High School), if the course addresses a STEM-related field;

(B)-(E) (No change.)

(2) Business and industry. Students who entered high school prior to the 2022-2023 school year may earn a business and industry endorsement by completing the requirements specified in subsection (e) of this section and:

(A) a coherent sequence of courses for four or more credits in CTE that consists of at least two courses in the same career cluster and at least one advanced CTE course. The courses may be selected from [~~Chapter 130 of this title,~~] Chapter 127 of this title [~~,~~] or CTE innovative courses. The final course in the sequence must be selected from one of the following:

(i) Chapter 127, Subchapter C, of this title (related to Agriculture, Food, and Natural Resources);

(ii) Chapter 127, Subchapter D, of this title (relating to Architecture and Construction;

(iii) Chapter 127, Subchapter E, of this title (relating to Arts, Audio/Video Technology, and Communications);

[~~(ii) Chapter 130, Subchapter A, of this title (relating to Agriculture, Food, and Natural Resources)~~] ;

[~~(iii) Chapter 130, Subchapter B, of this title (relating to Architecture and Construction)~~] ;

[~~(iv) Chapter 130, Subchapter C, of this title (relating to Arts, Audio/Video Technology, and Communications);~~]

(iv) [~~(v)~~] Chapter 127, Subchapter F, of this title (relating to Business, Marketing, and Finance);

(v) Chapter 127, Subchapter H, of this title (relating to Energy);

[~~(vi) Chapter 130, Subchapter D, of this title (relating to Business Management and Administration);~~]

[~~(vii) Chapter 130, Subchapter F, of this title (relating to Finance);~~]

(vi) [~~(viii)~~] Chapter 127, Subchapter K [~~I~~] , of this title (relating to Hospitality and Tourism);

(vii) Chapter 127, Subchapter M, of this title (relating to Information Technology);

(viii) Chapter 127, Subchapter O, of this title (relating to Manufacturing);

[~~(ix) Chapter 130, Subchapter K, of this title (relating to Information Technology);~~]

[~~(x) Chapter 130, Subchapter M, of this title (relating to Manufacturing);~~]

[~~(xi) Chapter 130, Subchapter N, of this title (relating to Marketing);~~]

(ix) [~~(xii)~~] Chapter 127, Subchapter P, of this title (relating to Transportation, Distribution, and Logistics); or

[~~(xiii) Chapter 130, Subchapter P, of this title (relating to Transportation, Distribution, and Logistics);~~]

[~~(xiv) Chapter 130, Subchapter Q, of this title (relating to Energy); or~~]

(x) [~~(xv)~~] Career Preparation I or II (Career Preparation General or Career Preparation for Programs of Study) and Project-Based Research (Career and Technical Education Project-Based Capstone) in Chapter 127, Subchapter B, of this title if the course addresses a career from a field listed in clauses (i)-(ix) [~~(i)-(xiv)~~] of this subparagraph;

(B)-(D) (No change.)

(3) Public services. Students who entered high school prior to the 2022-2023 school year may earn a public services endorsement by completing the requirements specified in subsection (e) of this section and:

(A) a coherent sequence of courses for four or more credits in CTE that consists of at least two courses in the same career cluster and at least one advanced CTE course. The courses may be selected from [~~Chapter 130 of this title,~~] Chapter 127 of this title [~~;~~] or CTE innovative courses. The final course in the sequence must be selected from one of the following:

(i) Chapter 127, Subchapter G, of this title (relating to Education and Training);

(ii) Chapter 127, Subchapter J [~~I~~] , of this title (relating to Health Science);

(iii) Chapter 127 [~~130~~] , Subchapter L [~~J~~] , of this title (relating to Human Services);

(iv) Chapter 127, Subchapter N [~~M~~] , of this title (relating to Law and Public Service); or

(v) Career Preparation I or II (Career Preparation General or Career Preparation for Programs of Study) and Project-Based Research (Career and Technical Education Project-Based Capstone) in Chapter 127, Subchapter B, of this title if the course addresses a field from a cluster listed in clauses (i)-(iv) [~~(i)-(v)~~] of this subparagraph;

(B)-(C) (No change.)

(4)-(5) (No change.)

(6) STEM. Students who entered high school in the 2022-2023 school year or later may earn a STEM endorsement by completing the requirements specified in subsection (e) of this section, including Algebra II, chemistry, and physics or Physics for Engineering [~~Principles of Technology~~] and:

(A)-(D) (No change.)

(7)-(8) (No change.)

(g) (No change.)

Approved by the State Board of Education for second reading and final adoption on April 11, 2025.
Not yet filed as adopted with the Texas Register; subject to edits by Texas Register editors.

Text of Adopted New 19 TAC

Chapter 111. Texas Essential Knowledge and Skills for Mathematics

Subchapter B. Middle School

§111.29. Grade 6, Middle School Advanced Mathematics, Adopted 2025.

(a) Implementation. The provisions of this section may be implemented by school districts beginning with the 2025-2026 school year.

(b) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking, mathematical fluency, and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) To increase the number of students who complete advanced mathematics courses in high school, the middle school advanced mathematics courses are designed to enable students to complete Algebra I by the end of Grade 8.

(4) The primary focal areas in Grade 6, Middle School Advanced Mathematics are numeracy; proportionality; expressions, equations, and relationships; and data science. Students use concepts, algorithms, and properties of rational numbers to explore mathematical relationships and to describe increasingly complex situations. Students use concepts of proportionality to explore, develop, and communicate mathematical relationships, including number, geometry and measurement, and statistics. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other. Students connect verbal, numeric, graphic, and symbolic representations of relationships, including equations and inequalities. Students begin to develop a foundational understanding of functions. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, and reasoning to draw conclusions, evaluate arguments, and make recommendations. The use of technology, including graphing tools, is essential in middle school advanced mathematics courses to master algebra readiness skills by bridging conceptual understanding and procedural fluency.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(2) Numeracy--foundations of rational numbers. The student applies mathematical process standards to represent and use rational numbers in a variety of forms. The student is expected to:

(A) classify sets and subsets using a visual representation such as a Venn diagram or a hierarchy to describe relationships between sets of rational numbers;

(B) identify a number, its opposite, and its absolute value;

(C) represent benchmark fractions and percents such as 1%, 10%, 25%, 33 1/3%, and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers as proportional relationships;

(D) generate equivalent forms of fractions, decimals, and percents using real-world problems as proportional relationships, including problems that involve money;

(E) use equivalent fractions, decimals, and percents to show equal parts of the same whole as proportional relationships;

(F) locate, compare, and order integers and rational numbers using a number line;

(G) order a set of rational numbers arising from mathematical and real-world contexts; and

(H) use coordinate geometry to identify locations on a plane, including graphing points in all four quadrants using ordered pairs of rational numbers.

(3) Numeracy--operations with rational numbers. The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions. The student is expected to:

(A) recognize that dividing by a rational number and multiplying by its reciprocal result in equivalent values;

(B) determine, with and without computation, whether a quantity is increased or decreased when multiplied by a fraction, including values greater than or less than one;

(C) extend representations for division to include fraction notation such as a/b represents the same number as $a \div b$ where $b \neq 0$;

(D) represent integer operations with concrete models and connect the actions with the models to standardized algorithms;

(E) add, subtract, multiply, and divide integers fluently;

(F) add, subtract, multiply, and divide rational numbers;

(G) generate equivalent numerical expressions using order of operations, including whole number exponents and prime factorization;

(H) balance a check register that includes deposits, withdrawals, and transfers; and

(I) create and organize a financial assets and liabilities record and construct a net worth statement.

(4) Numeracy--applications of percents. The student applies mathematical process standards to solve problems involving percents as proportional relationships. The student is expected to:

(A) solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models; and

(B) calculate the sales tax for a given purchase and calculate income tax for earned wages.

(5) Proportionality--foundations of ratios and rates. The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations. The student is expected to:

(A) give examples of ratios as multiplicative comparisons of two quantities describing the same attribute;

(B) give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients;

(C) represent ratios and percents with concrete models, fractions, and decimals; and

(D) represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions.

(6) Proportionality--applications of ratios and rates. The student applies mathematical process standards to solve problems involving proportional relationships. The student is expected to:

(A) apply qualitative and quantitative reasoning to solve prediction and comparison of real-world problems involving ratios and rates;

(B) calculate unit rates from rates in mathematical and real-world problems; and

(C) convert within and between measurement systems, including the use of proportions and the use of unit rates.

(7) One-variable expressions, equations, and relationships--foundations of one-variable relationships. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

(A) distinguish between expressions and equations verbally, numerically, and algebraically;

(B) determine if two expressions are equivalent using concrete models, pictorial models, and algebraic representations; and

(C) generate equivalent expressions using the properties of operations: inverse, identity, commutative, associative, and distributive properties.

(8) One-variable expressions, equations, and relationships--applications of one-variable relationships. The student applies mathematical process standards to use equations and inequalities to represent situations and solve problems. The student is expected to:

(A) write one-variable, one- and two-step equations and inequalities to represent constraints or conditions within problems;

(B) write corresponding real-world problems given one-variable, one- and two-step equations or inequalities;

(C) represent solutions for one-variable, one- and two-step equations and inequalities on number lines;

(D) model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts;

(E) model and solve one-variable, two-step equations and inequalities; and

(F) determine if the given value(s) make(s) one-variable, one- and two-step equations and inequalities true.

(9) Two-variable equations and relationships--foundations of linear relationships. The student applies mathematical process standards to use multiple representations to describe algebraic relationships. The student is expected to:

(A) identify independent and dependent quantities from tables and graphs;

(B) write an equation that represents the relationship between independent and dependent quantities from a table;

(C) represent a given situation using verbal descriptions, tables, graphs, and equations in the form $y = kx$ or $y = x + b$; and

(D) compare two rules verbally, numerically, graphically, and symbolically in the form of $y = ax$ or $y = x + a$ in order to differentiate between additive and multiplicative relationships.

(10) Two-variable equations and relationships--applications of proportional relationships. The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical, and algebraic representations, including $d = rt$.

(11) Geometric expressions, equations, and relationships--foundations of geometric concepts equations. The student applies mathematical process standards to use geometry to represent relationships. The student is expected to:

(A) model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes; and

(B) write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers.

(12) Geometric expressions, equations, and relationships--applications of geometric concepts. The student applies mathematical process standards to use geometry to represent relationships and solve problems. The student is expected to:

(A) extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle;

(B) determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles where dimensions are positive rational numbers;

(C) solve problems involving the volume of right rectangular prisms and triangular prisms; and

(D) write and solve equations using geometry concepts, including the sum of the angles in a triangle, and angle relationships.

(13) Data science--foundations of measurement and data. The student applies mathematical process standards to represent and analyze data. The student is expected to:

(A) distinguish between situations that yield data with and without variability; and

(B) represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots.

(14) Data science--applications of measurement and data. The student applies mathematical process standards to use numerical or graphical representations to analyze and solve problems. The student is expected to:

(A) use the graphical representation of numeric data to describe the center, spread, and shape of the data distribution;

(B) summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range (IQR) (measures of spread), and use these summaries to describe the center, spread, and shape of the data distribution;

(C) interpret numeric data summarized in dot plots, stem-and-leaf plots, histograms, and box plots;

(D) solve problems using data represented in bar graphs, dot plots, and circle graphs, including part-to-whole and part-to-part comparisons and equivalents;

(E) compare two groups of numeric data using comparative dot plots or box plots by comparing their shapes, centers, and spreads; and

(F) summarize categorical data with numerical and graphical summaries, including the mode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution.

(15) Personal financial literacy--money management. The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A) compare the features and costs of a checking account and a debit card offered by different local financial institutions;

(B) identify and explain the advantages and disadvantages of different payment methods, including distinguishing between debit cards and credit cards;

(C) explain why it is important to establish a positive credit history;

(D) describe the information in a credit report and how long it is retained;

(E) describe the value of credit reports to borrowers and to lenders;

(F) explain various methods to pay for college, including through savings, grants, scholarships, student loans, and work-study; and

(G) compare the annual salary of several occupations requiring various levels of post-secondary education or vocational training and calculate the effects of the different annual salaries on lifetime income.

§111.30. Grade 7, Middle School Advanced Mathematics, Adopted 2025.

(a) Implementation. The provisions of this section may be implemented by school districts beginning with the 2025-2026 school year.

(b) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on computational thinking,

mathematical fluency, and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, algorithms, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, computer programs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) To increase the number of students who complete advanced mathematics courses in high school, the middle school advanced mathematics courses are designed to enable students to complete Algebra I by the end of Grade 8.

(4) The primary focal areas in Grade 7, Middle School Advanced Mathematics are numeracy; proportionality; expressions, equations, and relationships; and data science. Students use concepts, algorithms, and properties of real numbers to explore mathematical relationships and to describe increasingly complex situations. Students use concepts of proportionality to explore, develop, and communicate mathematical relationships, including number, geometry and measurement, and statistics and probability. Students use algebraic thinking to describe how a change in one quantity in a relationship results in a change in the other. Students connect verbal, numeric, graphic, and symbolic representations of relationships, including equations and inequalities. Students continue to develop a foundational understanding of functions. Students use geometric properties and relationships, as well as spatial reasoning, to model and analyze situations and solve problems. Students communicate information about geometric figures or situations by quantifying attributes, generalize procedures from measurement experiences, and use the procedures to solve problems. Students use appropriate statistics, representations of data, and reasoning to draw conclusions, evaluate arguments, and make recommendations. The use of technology, including graphing tools, is essential in middle school advanced mathematics courses to master algebra readiness skills by bridging conceptual understanding and procedural fluency.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(2) Numeracy--foundations of real numbers. The student applies mathematical process standards to represent and use real numbers in a variety of forms. The student is expected to:

(A) extend previous knowledge of sets and subsets using a visual representation to describe relationships between sets of real numbers;

(B) approximate the value of an irrational number, including π and square roots of numbers less than 225, and locate that rational number approximation on a number line;

(C) convert between standard decimal notation and scientific notation; and

(D) order a set of real numbers arising from mathematical and real-world contexts.

(3) Numeracy--operations with rational numbers. The student applies mathematical process standards to add, subtract, multiply, and divide while solving problems and justifying solutions. The student is expected to:

(A) add, subtract, multiply, and divide rational numbers fluently; and

(B) apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers.

(4) Numeracy--applications of percents. The student applies mathematical process standards to represent and solve problems involving percents as proportional relationships. The student is expected to:

(A) solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems;

(B) calculate and compare simple interest and compound interest earnings;

(C) analyze and compare monetary incentives, including sales, rebates, and coupons;

(D) solve real-world problems comparing how interest rate and loan length affect the cost of credit;

(E) calculate the total cost of repaying a loan, including credit cards and easy access loans, under various rates of interest and over different periods using an online calculator;

(F) explain how small amounts of money invested regularly, including money saved for college and retirement, grow over time; and

(G) estimate the cost of a two-year and four-year college education, including family contribution, and devise a periodic savings plan for accumulating the money needed to contribute to the total cost of attendance for at least the first year of college.

(5) Proportionality--geometric ratios. The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships such as dilations. The student is expected to:

(A) describe π as the ratio of the circumference of a circle to its diameter;

(B) generalize the critical attributes of similarity, including ratios within and between similar shapes;

(C) solve mathematical and real-world problems involving similar shape and scale drawings;

(D) compare and contrast the attributes of a shape and its dilation(s) on a coordinate plane; and

(E) use an algebraic representation to explain the effect of a given positive rational scale factor applied to two-dimensional figures on a coordinate plane with the origin as the center of dilation.

(6) Proportionality--probability. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(A) represent sample spaces for simple and compound events using lists and tree diagrams;

(B) select and use different simulations to represent simple and compound events with and without technology;

(C) make predictions and determine solutions using experimental data for simple and compound events;

(D) make predictions and determine solutions using theoretical probability for simple and compound events;

(E) find the probabilities of a simple event and its complement and describe the relationship between the two;

(F) solve problems using qualitative and quantitative predictions and comparisons from simple experiments; and

(G) determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces.

(7) One-variable expressions, equations, and relationships--applications of one-variable relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

(A) represent solutions for one-variable, two-step inequalities on number lines;

(B) model and solve one-variable, two-step inequalities;

(C) write one-variable equations or inequalities with variables on both sides that represent problems using rational number coefficients and constants;

(D) write a corresponding real-world problem when given a one-variable equation or inequality with variables on both sides of the equal sign using rational number coefficients and constants; and

(E) model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants.

(8) Two-variable equations and relationships--foundations of linear relationships. The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

(A) determine the constant of proportionality ($k = y/x$) within mathematical and real-world problems;

(B) distinguish between proportional and non-proportional situations using tables, graphs, and equations in the form $y = kx$ or $y = mx + b$, where $b \neq 0$; and

(C) identify examples of proportional and non-proportional relationships [~~functions~~] that arise from mathematical and real-world problems.

(9) Two-variable equations and relationships--applications of linear relationships. The student applies mathematical process standards to represent linear relationships using multiple representations.

The student is expected to represent linear proportional and non-proportional relationships using verbal descriptions, tables, graphs, and equations that simplify to the form $y = mx + b$.

(10) Geometric expressions, equations, and relationships--foundations of geometric concepts. The student applies mathematical process standards to develop geometric relationships and solve problems. The student is expected to:

(A) use models to determine the approximate formulas for the circumference and area of a circle and connect the models to the actual formulas;

(B) solve problems involving the lateral and total surface area of a rectangular prism, rectangular pyramid, triangular prism, and triangular pyramid by determining the area of the shape's net;

(C) describe the volume formula $V = Bh$ of a cylinder in terms of its base area and its height;

(D) model the relationship between the volume of a rectangular prism and a rectangular pyramid having both congruent bases and heights and connect that relationship to the formulas;

(E) explain verbally and symbolically the relationship between the volume of a triangular prism and a triangular pyramid having both congruent bases and heights and connect that relationship to the formulas;

(F) model the relationship between the volume of a cylinder and a cone having both congruent bases and heights and connect that relationship to the formulas;

(G) use models and diagrams to explain the Pythagorean theorem; and

(H) use informal arguments to establish facts about the angle sum and exterior angle of triangles, the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

(11) Geometric expressions, equations, and relationships--applications of geometric concepts. The student applies mathematical process standards to solve geometric problems. The student is expected to:

(A) determine the circumference and area of circles;

(B) determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles;

(C) use previous knowledge of surface area to make connections to the formulas for lateral and total surface area and determine solutions for problems involving rectangular prisms, triangular prisms, and cylinders;

(D) solve problems involving the volume of rectangular pyramids and triangular pyramids;

(E) solve problems involving the volume of cylinders, cones, and spheres;

(F) use the Pythagorean theorem and its converse to solve problems; and

(G) determine the distance between two points on a coordinate plane using the Pythagorean theorem.

(12) Geometric expressions, equations, and relationships--transformations. The student applies mathematical process standards to develop transformational geometry concepts. The student is expected to:

(A) generalize the properties of orientation and congruence of rotations, reflections, translations, and dilations of two-dimensional shapes on a coordinate plane;

(B) differentiate between transformations that preserve congruence and those that do not;

(C) explain the effect of translations, reflections over the *x*- or *y*-axis, and rotations limited to 90°, 180°, 270°, and 360° as applied to two-dimensional shapes on a coordinate plane using an algebraic representation; and

(D) model the effect on linear and area measurements of dilated two-dimensional shapes.

(13) Data science--applications of measurement and data. The student applies mathematical process standards to use statistical representations and procedures to analyze and describe data. The student is expected to:

(A) use data from a random sample to make inferences about a population;

(B) compare two populations based on data in random samples from these populations, including informal comparative inferences about differences between the two populations;

(C) simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected; and

(D) determine the mean absolute deviation and use this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points.

(14) Personal financial literacy--money management. The student applies mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. The student is expected to:

(A) identify the components of a personal budget, including income; planned savings for college, retirement, and emergencies; taxes; and fixed and variable expenses, and calculate what percentage each category comprises of the total budget;

(B) use a family budget estimator to determine the minimum household budget and average hourly wage needed for a family to meet its basic needs in the student's city or another large city nearby; and

(C) analyze situations to determine if they represent financially responsible decisions and identify the benefits of financial responsibility and the costs of financial irresponsibility.

§111.31. Grade 8, Middle School Advanced Mathematics, Algebra I (One Credit), Adopted 2025.

(a) Implementation. The provisions of this section may be implemented by school districts beginning with the 2025-2026 school year.

(b) General requirements. [~~Students shall be awarded one credit that satisfies the Algebra I requirement for high school graduation.~~] This course is recommended for students in Grade 8. Prerequisite: Middle School Advanced Mathematics, Grade 7 or Mathematics, Grade 8. Students shall be awarded one credit that satisfies the Algebra I requirement for high school graduation. This course satisfies the requirement for any course which identifies Algebra I as a prerequisite.

(c) Introduction.

(1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on fluency and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

(2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and

the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, number sense, and generalization and abstraction to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) To increase the number of students who complete advanced mathematics courses in high school, the middle school advanced mathematics courses are designed to enable students to complete Algebra I by the end of Grade 8.

(4) In Grade 8, Middle School Advanced Mathematics, Algebra I , students will build on the knowledge and skills for mathematics in Middle School Advanced Mathematics, Grades 6 and 7, which provide a foundation in linear relationships, number and operations, and proportionality. Students will study linear, quadratic, and exponential functions and their related transformations, equations, and associated solutions. Students will connect functions and their associated solutions in both mathematical and real-world situations. Students will use technology to collect and explore data and analyze statistical relationships. In addition, students will study polynomials of degree one and two, radical expressions, sequences, and laws of exponents. Students will generate and solve linear systems with two equations and two variables and will create new functions through transformations. The use of technology, including graphing tools, is essential in Grade 8, Middle School Advanced Mathematics, Algebra I, to bridge conceptual understanding and procedural fluency.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(2) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using properties of linear functions to write and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations. The student is expected to:

(A) determine the domain and range of a linear function in mathematical problems; determine reasonable domain and range values for real-world situations, both continuous and discrete; and represent domain and range using inequalities;

(B) write linear equations in two variables in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$, given one point and the slope and given two points;

(C) write linear equations in two variables given a table of values, a graph, and a verbal description;

(D) write and solve equations involving direct variation;

(E) write the equation of a line that contains a given point and is parallel to a given line;

(F) write the equation of a line that contains a given point and is perpendicular to a given line;

(G) write an equation of a line that is parallel or perpendicular to the *x*- or *y*- axis and determine whether the slope of the line is zero or undefined;

(H) write linear inequalities in two variables given a table of values, a graph, and a verbal description; and

(I) write systems of two linear equations given a table of values, a graph, and a verbal description.

(3) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations. The student is expected to:

(A) use similar right triangles to develop an understanding that slope, *m*, given as the rate comparing the change in *y*-values to the change in *x*-values, $(y2 - y1)/ (x2 - x1)$, is the same for any two points $(x1, y1)$ and $(x2, y2)$ on the same line;

(B) graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship;

(C) determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$;

(D) calculate the rate of change of a linear function represented tabularly, graphically, or algebraically in context of mathematical and real-world problems;

(E) use data from a table or graph to determine the rate of change or slope and *y*-intercept in mathematical and real-world problems;

(F) graph linear functions on the coordinate plane and identify key features, including *x*-intercept, *y*-intercept, zeros, and slope, in mathematical and real-world problems;

(G) graph the solution set of linear inequalities in two variables on the coordinate plane;

(H) determine the effects on the graph of the parent function $f(x) = x$ when $f(x)$ is replaced by $af(x)$, $f(x) + d$, $f(x - c)$, and $f(bx)$ for specific values of a, b, c, and d;

(I) graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist;

(J) estimate graphically the solutions to systems of two linear equations with two variables in real-world problems; and

(K) graph the solution set of systems of two linear inequalities in two variables on the coordinate plane.

(4) Linear functions, equations, and inequalities. The student applies the mathematical process standards to formulate statistical relationships and evaluate their reasonableness based on real-world data. The student is expected to:

(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data;

(B) contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation;

(C) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions;

(D) calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity as a measure of the strength of the linear association;

(E) compare and contrast association and causation in real-world problems; and

(F) write, with and without technology, linear functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems.

(5) Linear functions, equations, and inequalities. The student applies the mathematical process standards to solve, with and without technology, linear equations and evaluate the reasonableness of their solutions. The student is expected to:

(A) solve linear equations in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides;

(B) solve linear inequalities in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides; and

(C) solve systems of two linear equations with two variables for mathematical and real-world problems.

(6) Quadratic functions and equations. The student applies the mathematical process standards when using properties of quadratic functions to write and represent in multiple ways, with and without technology, quadratic equations. The student is expected to:

(A) determine the domain and range of quadratic functions and represent the domain and range using inequalities;

(B) write equations of quadratic functions given the vertex and another point on the graph, write the equation in vertex form ($f(x) = a(x - h)^2 + k$), and rewrite the equation from vertex form to standard form ($f(x) = ax^2 + bx + c$); and

(C) write quadratic functions when given real solutions and graphs of their related equations.

(7) Quadratic functions and equations. The student applies the mathematical process standards when using graphs of quadratic functions and their related transformations to represent in multiple ways and determine, with and without technology, the solutions to equations. The student is expected to:

(A) graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercept, y-intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry;

(B) describe the relationship between the linear factors of quadratic expressions and the zeros of their associated quadratic functions; and

(C) determine the effects on the graph of the parent function $f(x) = x^2$ when $f(x)$ is replaced by $af(x)$, $f(x) + d$, $f(x - c)$, and $f(bx)$ for specific values of a, b, c, and d.

(8) Quadratic functions and equations. The student applies the mathematical process standards to solve, with and without technology, quadratic equations and evaluate the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

(A) solve quadratic equations having real solutions by factoring, taking square roots, completing the square, and applying the quadratic formula; and

(B) write, using technology, quadratic functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems.

(9) Exponential functions and equations. The student applies the mathematical process standards when using properties of exponential functions and their related transformations to write, graph, and represent in multiple ways exponential equations and evaluate, with and without technology, the reasonableness of their solutions. The student formulates statistical relationships and evaluates their reasonableness based on real-world data. The student is expected to:

(A) determine the domain and range of exponential functions of the form $f(x) = ab^x$ and represent the domain and range using inequalities;

(B) interpret the meaning of the values of a and b in exponential functions of the form $f(x) = ab^x$ in real-world problems;

(C) write exponential functions in the form $f(x) = ab^x$ (where b is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay;

(D) graph exponential functions that model growth and decay and identify key features, including y-intercept and asymptote, in mathematical and real-world problems; and

(E) write, using technology, exponential functions that provide a reasonable fit to data and make predictions for real-world problems.

(10) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to rewrite in equivalent forms and perform operations on polynomial expressions. The student is expected to:

(A) add and subtract polynomials of degree one and degree two;

(B) multiply polynomials of degree one and degree two;

(C) determine the quotient of a polynomial of degree one and polynomial of degree two when divided by a polynomial of degree one and polynomial of degree two when the degree of the divisor does not exceed the degree of the dividend;

(D) rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property;

(E) factor, if possible, trinomials with real factors in the form $ax^2 + bx + c$, including perfect square trinomials of degree two; and

(F) decide if a binomial can be written as the difference of two squares and, if possible, use the structure of a difference of two squares to rewrite the binomial.

(11) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to rewrite algebraic expressions into equivalent forms. The student is expected to:

(A) simplify numerical radical expressions involving square roots; and

(B) simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents.

(12) Number and algebraic methods. The student applies the mathematical process standards and algebraic methods to write, solve, analyze, and evaluate equations, relations, and functions. The student is expected to:

(A) identify functions using sets of ordered pairs and mappings;

(B) decide whether relations represented verbally, tabularly, graphically, and symbolically define a function;

(C) evaluate functions, expressed in function notation, given one or more elements in their domains;

(D) identify terms of arithmetic and geometric sequences when the sequences are given in function form using recursive processes;

(E) write a formula for the n^{th} term of arithmetic and geometric sequences, given the value of several of their terms; and

(F) solve mathematic and scientific formulas, and other literal equations, for a specified variable.

ATTACHMENT
Text of Proposed New 19 TAC

Chapter 67. State Review and Approval of Instructional Materials

Subchapter C. Local Operations

§67.69. Local Review of Classroom Instructional Materials.

(a) School districts and open-enrollment charter schools must establish a process by which a parent of a student may request an instructional material review under Texas Education Code, §31.0252, for a subject area in the grade level in which the student is enrolled. This process shall:

(1) establish minimum requirements for a parent's petition to the school district board of trustees for a local review of classroom instructional materials, including submission guidelines and timelines for the petition. The process must align to the statewide submission window of September 1 through the last instructional day for students. The process must require that the board consider such petitions at the regular board meeting that allows proper posting immediately following submission of the petition provided that it is submitted by the prescribed submission deadline;

(2) require parent petitions to include the student assignment, grade level, content area, campus name, and teacher name to complete the local review process; and

(3) establish an appeal process for parents if a petition for a local review is denied by the school district board of trustees, detailing steps for submitting an appeal, the criteria for reviewing the appeal, and the timelines for a final decision.

(b) A school district or open-enrollment charter school is requested to notify the State Board of Education member(s) representing the district or charter school, at the member's state email address as listed on the SBOE.Texas.gov website, within one week of a decision to approve a parent request for local classroom review and one week after receiving the final report.

ATTACHMENT
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter I. Engineering [~~Health Science~~]

§127.402. Engineering Design Process (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 9 and 10. Prerequisite: Algebra I. Recommended prerequisite: Principles of Applied Engineering. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Engineering Design Process is an engineering course applicable to all engineering fields. Students use an iterative engineering design process to solve problems, make decisions, and manage a project. Professional practices are addressed, including development of a problem statement, maintenance of documentation, use of an engineering notebook, research, project management, internal and external communication, and creation of technical drawings and prototypes. The student delivers a professional presentation detailing the experience of working through each step of the engineering design process.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student discusses ethics pertaining to engineering. The student is expected to identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) explain the importance of dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) describe teamwork, group dynamics, and conflict resolution and how they can impact the collective outcome;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences;~~]

[~~(D) identify time management skills such as prioritizing tasks, following schedules, and tending to goal-relevant activities and how these practices optimize efficiency and results;~~]

[~~(E) define work ethic and discuss the characteristics of a positive work ethic, including punctuality, dependability, reliability, and responsibility for reporting for duty and performing assigned tasks;~~]

[~~(F) identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) discuss the importance of safety in the workplace and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(K) describe the roles and responsibilities of managers.~~]

(2) The student understands there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:

(A) explain the importance of defining an engineering problem as an initial step in the engineering design process;

(B) describe the research stage of the engineering design process;

(C) define and discuss the roles of ideation and conceptualization in innovation and problem solving;

(D) explain the criteria for selecting an idea or concept for detailed prototype design, development, and testing;

(E) explain the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;

(F) describe the relevance of experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;

(G) explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and

(H) explain the purpose of effective communication throughout the entirety of the engineering design process to various audiences.

(3) The student explores and develops skills to solve problems, make decisions, and manage a project. The student is expected to:

(A) discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;

(B) identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;

(C) define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;

(D) identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and

(E) identify strategies to solve problems and describe how problem solving is utilized to accomplish personal and team objectives.

(4) The student understands the foundations of occupational safety and health. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;

(B) explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(C) identify and explain the appropriate use of types of personal protective equipment used in industry;

(D) demonstrate safe practices for preventing or reducing slips, trips, and falls in the workplace;

(E) describe types of risks of and control methods to prevent electrical hazards in the workplace; and

(F) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace.

(5) The student understands the value of maintaining documentation using an engineering notebook. The student is expected to:

(A) explain the purpose and legal value of maintaining an engineering notebook as intellectual property;

(B) describe the proper implementation of an engineering notebook, including notebook type, documentation, signatures, adding external materials, sealing, and dating;

(C) create and maintain an engineering notebook by recording ideas, notes, decisions, findings, deficiencies, and corrections throughout the entire design process; and

(D) communicate progress during the engineering design process at regular intervals using various methods such as written reports, informal presentations, and formal presentations.

(6) The student understands how to conduct research in the engineering design process. The student is expected to:

(A) describe the advantages and disadvantages of emerging technologies and practices in the research process;

(B) explain the importance of identifying and synthesizing information from a variety of sources in the research process;

(C) explain the ethical acquisition and use of digital information;

(D) demonstrate use and citation of source material ethically and appropriately;

(E) define and discuss intellectual property laws such as patent, copyright, and trade secret law and their role in protecting proprietary information in the research process; and

(F) identify limitations in information and research such as outdated, conflicting, proprietary, or limited access.

(7) The student understands the process of creating and refining a problem statement in the engineering design process. The student is expected to:

(A) explain the essential components of a problem statement such as who the problem affects, when it is a problem, where the problem happens, and the magnitude of the problem;

(B) describe different methods for creating and refining a problem statement such as questioning, observation, and client needs;

(C) create a problem statement that is concise, specific, and measurable;

(D) collect, analyze, and interpret information relevant to a problem statement;

(E) modify a problem statement based on information acquired from using processes or various analysis tools such as fishbone charts, root-cause analysis, 80-20 rule, heat maps, survey results, and end-user input;

(F) explain the purpose of a technical document such as a design brief or design basis that compiles the objectives, constraints, data, alternatives, and design solutions in the engineering design process; and

(G) compile a technical document that includes a problem statement, constraints, resources, budget, timeline, deliverables, and solution criteria such as quality, risk, and extent to which problem is solved.

(8) The student understands the importance of conceptualizing a solution in the engineering design process. The student is expected to:

(A) discuss the importance of creativity in engineering, innovation, and problem solving;

(B) explain and use various techniques for idea generation such as brainstorming, mapping, storyboarding, sketching, questioning, reverse engineering, and natural solutions to create solution concepts;

(C) explain the similarities and differences between designing a solution in the classroom versus designing a solution in the real world;

(D) analyze and evaluate solutions using [~~the~~] established criteria such as structured techniques, design matrix, or cost-benefit analysis ;

(E) explain the importance of capturing client feedback to refine solution concepts; and

(F) explain and use various techniques for gathering end-user input such as focus groups, interviews, and surveys to refine solution concepts.

(9) The student creates technical drawings in the engineering design process. The student is expected to:

(A) explain the role of freehand sketching, freehand modeling, technical drawing, and technical modeling in the development of a prototype or solution;

(B) create nontechnical representations such as sketches, drawings, or models of a solution with relevant annotations;

(C) develop a technical model of the solution using a nontechnical representation of a solution; and

(D) create technical drawings, including single-view projections, multi-view projections, and orthographic views, using industry standards.

(10) The student creates prototypes in the engineering design process. The student is expected to:

(A) identify different types of prototypes and explain the role of a prototype in the development of a solution;

(B) identify and describe the steps needed to produce a prototype;

(C) identify and use appropriate tools, equipment, machines, and materials to produce a prototype; and

(D) present a prototype using presentation software.

(11) The student tests and evaluates a prototype or solution using experiments, data, and end-user feedback. The student is expected to:

(A) explain the purpose of conducting tests on a prototype or solution;

(B) design appropriate protocols for testing a prototype or solution;

(C) analyze, evaluate, and critique a prototype or solution by using observational testing, experimental testing, empirical evidence, and statistical analysis;

(D) collect end-user feedback using appropriate protocols such as focus groups, interviews, and surveys to evaluate a prototype or solution; and

(E) identify the successes and failures of a prototype or solution based on the criteria established in the testing protocols and technical document to determine next steps in the engineering design process.

(12) The student understands the iterative nature of the engineering design process to develop a solution. The student is expected to:

(A) analyze design flaws of a prototype or solution using various tools such as fishbone charts, root-cause analysis, 80-20 rule, heat maps, survey results, and end-user feedback;

(B) iterate steps of the design process, as necessary, to improve and optimize a solution; and

(C) evaluate the potential impact of a solution on the original problem identified during the design process.

(13) The student prepares and delivers a professional presentation detailing the experience of working through each step of the engineering design process to create a viable solution. The student is expected to:

(A) prepare and deliver a presentation detailing the experience of working through each step of the engineering design process to create a viable solution;

(B) solicit and evaluate feedback on implementation of the design process and the presentation; and

(C) present learning experiences such as essential skills gained, areas of personal growth, and challenges encountered throughout the design process.

§127.403. Programming for Engineers (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. Prerequisite: Algebra I and Principles of Applied Engineering, Physics for Engineering, Introduction to Computer-Aided Design and Drafting, or Introduction to Engineering Design. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Programming for Engineers focus on understanding, writing, evaluating, and troubleshooting code to solve engineering problems. Students use the engineering process and computational thinking to write computer programs for real-world solutions. Students explore autonomous systems, sensors, and careers to integrate computational thinking within their engineering mindset. Students spend at least 40% of the instructional time completing hands-on, real-world projects.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(4) Computational thinking--foundations. The student explores the core concepts of computational thinking related to engineering solutions, a set of problem-solving processes that involve decomposition, pattern recognition, abstraction, and algorithms. The student is expected to:

(A) decompose real-world engineering problems into structured parts by using visual representation;

(B) analyze and use industry-specific symbols, patterns, and sequences found in visual representations such as flow-charts, pseudocode, concept maps, or other representations of data;

(C) define and practice abstraction in the context of writing a program to solve an engineering problem;

(D) design a plan using visual representation to document a problem, possible solutions, and an expected timeline for the development of a coded engineering solution;

(E) analyze different techniques used in debugging and apply them to an algorithm;

(F) analyze the benefits of using iteration such as code and sequence repetition in algorithms, including loops and functions;

(G) define and analyze Boolean expressions;

(H) define and analyze conditional statements;

(I) write code that uses conditional statements such as (if), (then), (while), and (else);

(J) compare the differences between scripting and programming languages such as interpretation versus compiling; and

(K) identify and demonstrate when to use a compiler and editor for programming design.

(5) Computational thinking--applications. The student applies the fundamentals of programming within the context of engineering. The student is expected to:

(A) analyze how programming parallels iterative design within the engineering design process such as problem solving and critical thinking illustrated in an engineering notebook;

(B) modify previously written code and implement the modified code to develop improved programs;

(C) solve an engineering problem by creating block-based or text-based programs that include sequences, functions, loops, conditionals, and events;

(D) identify and label variables that relate to a program or algorithm;

(E) manipulate and rename variables and describe different data types;

(F) write comments while coding programs for engineering solutions to enhance readability and functionality such as descriptive identifiers, internal comments, white space, spacing, punctuation, indentation, and standardized programming style;

(G) write code that uses comparison operators such as greater than, less than, equal to, and modulus to perform mathematical computations;

(H) write code that uses strings to sort different data types such as Boolean operators, floats, and integers; and

(I) perform user testing on code to assess and improve a program.

(6) The student understands physical computing systems to integrate input and output functions in engineering concepts. The student is expected to:

(A) write programming to process data and control physical devices for efficient and optimized solutions;

(B) apply coding to demonstrate the correct operation of the output device such as motors, video displays, speakers, rapid prototype machines, and lights;

(C) apply coding to demonstrate the correct operation of the input device such as buttons, sensors, and switches;

(D) apply critical problem-solving skills to troubleshoot any errors and miscommunication such as wiring, code, and physical hardware;

(E) apply basic circuit theory as it pertains to ground and power systems for diagramming input and output devices and use tools such as a multimeters, microcontrollers, sensors, and LEDs; and

(F) use script writing to develop engineering solutions such as automatic data collecting, data analysis, programmable logic controllers, power system programming, robotics, and scripting for commercial engineering related software.

(7) The student understands the roles of sensors and programming sensors in engineering. The student is expected to:

(A) describe how sensors were used in the past and are used currently in real-world engineered products, including innovative applications for sensors;

(B) identify the proper input sensors to measure light, distance, sound, and color such as photoresistors, thermistors, sonar, switches, and buttons;

(C) identify the specifications of sensors and other input devices used in engineering problems, including units of measurement, upper limits, lower limits, and errors;

(D) select the proper sensor and defend the choice in developing a solution to an engineering problem;

(E) write code that will control sensors and accurately collect relevant information pertaining to the function of sensors;

(F) debug, asses, and test code to evaluate and improve sensor performance; and

(G) document the steps of sensor integration in an engineering notebook using flowcharts or technical drawings.

(8) The student understands how automation plays a role in engineering and manufacturing. The student is excepted to:

(A) research and explain how automated machines are used in engineering and manufacturing;

(B) research and explain different job roles and required level of education in the field of automation;

(C) compare the roles of engineers, technicians, and technologists in automation;

(D) describe the role of safety and ethics related to the use of automation within engineering; and

(E) convert a manual mechanical system to an automated system using code and hardware.

(9) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:

(A) demonstrate lab safety as prescribed by the instructor in compliance with local, state, and federal regulations;

(B) recognize the classification of hazardous materials and wastes;

(C) dispose of hazardous materials and wastes appropriately;

(D) describe the implications of negligent or improper maintenance of tools in engineering solutions;

(E) demonstrate the use of precision measuring instruments;

(F) analyze a circuit design and identify specific areas where quality, reliability, and safety features can be implemented; and

(G) identify governmental and organizational regulations for health and safety in the workplace related to electronics.

§127.404. Engineering Design and Presentation [~~I~~] (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I and at least one credit in a course from the Engineering Career Cluster. Recommended prerequisite:

Principles of Applied Engineering. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Engineering Design and Presentation [~~I~~] demonstrate knowledge and skills of the design process as it applies to engineering fields and project management using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Through implementation of the design process, students transfer advanced academic skills to component designs. Additionally, students explore career opportunities in engineering, technology, and drafting and learn what is required to gain and maintain employment in these areas.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(3) The student understands the value of maintaining documentation using an engineering notebook. The student is expected to:

(A) explain the legal value of maintaining an engineering notebook as intellectual property;

(B) describe the proper implementation of an engineering notebook, including notebook type, documentation, signatures, adding external materials, sealing, and dating; and

(C) create and maintain an engineering notebook by recording ideas, notes, decisions, findings, and corrections.

(4) The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(5) The student gains knowledge of and demonstrates the skills necessary for success in the engineering workplace. The student is expected to:

(A) describe and compare the roles of an industry technician, engineering technologist, and engineer;

(B) identify educational requirements and career opportunities for engineers, engineering technologists, and industry technicians;

(C) research and describe various engineering disciplines such as mechanical, civil, aerospace, biomedical, chemical civil, computer, electrical, petroleum, and other related and emerging fields;

(D) investigate and describe the requirements of engineering licensure and industry-based certifications;

(E) investigate and describe elements of teamwork critical for success in the engineering and technology industries such as communication, active listening, and time management;

(F) research and describe industry standards and governmental regulations such as health and safety and environmental regulations applicable to a design problem; and

(G) analyze and discuss ethical issues related to engineering and technology.

(6) The student understands the roles and responsibilities of individual team members, how successful teams function, and how to constructively contribute to the team. The student is expected to:

(A) describe the various roles and responsibilities of a project team;

(B) identify the strengths of individual team members to assign roles and distribute tasks within a team; and

(C) describe and demonstrate appropriate behaviors such as active listening and clear communication while serving as a team leader and member on projects.

(7) The student practices safe and proper work habits. The student is expected to:

(A) identify and explain the appropriate use of types of personal protective equipment used in industry;

(B) explain and comply with safety guidelines and procedures as described in relevant manuals, instructions, and regulations;

(C) discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(D) describe the various types of electrical hazards in the workplace and the risks associated with electrical hazards;

(E) describe the various control methods to prevent electrical hazards in the workplace;

(F) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and explain how emergency plans and Safety Data Sheets are used to make decisions in the workplace;

(G) describe the appropriate disposal of selected hazardous materials and wastes;

(H) perform routine maintenance on selected tools, equipment, and machines;

(I) demonstrate proper handling, use, and storage of tools and materials; and

(J) research and describe the consequences of negligent or improper equipment maintenance.

(8) The student understands how visual and spatial reasoning applies to engineering design. The student is expected to:

(A) describe and compare characteristics and dimensional changes of two-dimensional (2D) and three-dimensional (3D) figures;

(B) draw and manipulate geometric shapes in three dimensions;

(C) create 2D views of a 3D object; and

(D) explain the symmetry of figures through the proportionate transformation of objects.

(9) The student uses sketching and computer-aided design and drafting (CADD) to represent 3D objects in a 2D format needed for manufacturing an object. The student is expected to:

(A) use single and multi-view projections to represent 3D objects in a 2D format;

(B) use appropriate line types in engineering drawings to represent 3D objects in a 2D format;

(C) use orthographic and pictorial views to represent 3D objects in a 2D format;

(D) use auxiliary views to represent 3D objects in a 2D format;

(E) use section views to represent 3D objects in a 2D format;

(F) prepare and revise annotated multi-dimensional production drawings in computer-aided design and drafting to industry standards;

(G) apply best practices for file structure and management to efficiently retrieve and edit files;

(H) use advanced dimensioning techniques, including annotation scale; and

(I) construct and use CADD drawings to develop a model or prototype for presentation.

(10) The student designs products using appropriate engineering design processes and techniques. The student is expected to:

(A) design product components using a variety of technologies;

(B) research and analyze the applications of different types of CADD software for various engineering problems;

(C) create and interpret engineering drawings using industry standards;

(D) describe how quality, reliability, and safety can be designed into specific products;

(E) identify specific requirements of users with special needs and modify a product design to accommodate users with special needs;

(F) research and explain the patenting process and analyze opportunities for potential patents related to a project; and

(G) use multiple software applications for concept presentations.

(11) The student builds a prototype(s) using the appropriate tools, materials, and techniques. The student is expected to:

(A) identify and describe the steps needed to produce a prototype;

(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype;

(C) present the prototype and explain how the prototype meets the project requirements; and

(D) evaluate the successes and failures of the prototype(s) in the context of an iterative design process.

(12) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:

(A) identify and define an engineering problem;

(B) formulate goals, objectives, and requirements to solve an engineering problem;

(C) investigate and select appropriate materials for a particular product to be designed;

(D) explain the importance of manufacturability and maintainability when designing a product;

(E) determine design constraints such as personnel, resources, funding, feasibility, and time associated with an engineering problem;

(F) identify requirements, including health, safety, social, environmental, ethical, regulatory, and legal constraints, defining an engineering problem;

(G) identify alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;

(H) test and evaluate proposed solutions using engineering practices such as experiments, simulations, statistical analysis, and critical design review; and

(I) select and justify a preferred solution to a problem using structured techniques such as a decision tree, design matrix, or cost-benefit analysis.

(13) The student presents a solution derived through the engineering design process. The student is expected to:

(A) present the solution in a professional manner;

(B) solicit and evaluate feedback on the solution and presentation; and

(C) present learning experiences, including essential skills gained, areas of personal growth, challenges, and solutions, encountered throughout the design process.

§127.405. Advanced Engineering Design and Presentation [~~H~~] (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Algebra I, Geometry, and [~~Principles of Applied Engineering or~~] Engineering Design and Presentation [~~I~~] . Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Advanced Engineering Design and Presentation [~~H~~] is a continuation of knowledge and skills learned in Engineering Design and Presentation [~~I~~] . Students enrolled in this course demonstrate advanced knowledge and skills of a system design process as it applies to engineering fields and project management using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Students expand on the use of a variety of computer hardware and software applications to complete assignments and projects. Through implementation of a system design process, students transfer advanced academic skills to component designs and engineering systems. Emphasis is placed on transdisciplinary and integrative approaches using skills from ideation, prototyping, and project management methods.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how interested parties impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule, influence an engineering design, and are influenced by an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(4) The student practices safe and proper work habits. The student is expected to:

(A) identify and explain the appropriate use of types of personal protective equipment used in industry;

(B) explain and comply with safety guidelines and procedures as described in relevant manuals, instructions, and regulations;

(C) explain the importance of lock out tag out (LOTO) procedures in preventing the release of hazardous energy;

(D) explain the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(E) describe the various types of electrical hazards in the workplace and the risks associated with electrical hazards;

(F) describe the various control methods to prevent electrical hazards in the workplace;

(G) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and explain how health and safety resources are used to make decisions in the workplace;

(H) describe the appropriate disposal of selected hazardous materials and wastes;

(I) perform routine maintenance on selected tools, equipment, and machines;

(J) handle, use, and store tools and materials correctly; and

(K) research and describe the consequences of negligent or improper equipment maintenance.

(5) The student demonstrates the roles and responsibilities of individual team members, how successful teams function, and how to constructively contribute to the team. The student is expected to:

(A) demonstrate the various roles and responsibilities of a project team;

(B) create a plan to improve team member's skillsets based on strengths of individual team members;

(C) demonstrate appropriate behaviors of a successful team such as active listening, development of consensus, and clear communication while serving as a team leader and member on projects; and

(D) describe and demonstrate the roles and responsibilities specific to team leaders such as assigning roles and responsibilities, facilitating decision making, tracking progress, and soliciting and providing timely feedback to team members.

(6) The student uses and documents engineering design processes. The student is expected to:

(A) use idea generation techniques such as brainstorming, sketching, rapid prototyping, and mind mapping during conceptual stages and for resolving problems of an engineering project;

(B) analyze and evaluate solution constraints;

(C) develop or improve a solution using evidence-based decision-making;

(D) compare solutions using analysis tools such as a decision matrix or paired comparison analysis;

(E) create and maintain an organized engineering notebook to record findings and corrections, including deficiencies in the design process and decisions throughout the entire design process; and

(F) develop an engineering notebook or portfolio to record and justify the final design, construction, and manipulation of finished projects.

(7) The student understands how systems impact the design, integration, and management of engineering solutions. The student is expected to:

(A) analyze and document systems such as electrical, mechanical, or information processes within a product or design concept in engineering;

(B) explain ethical reverse engineering;

(C) reverse engineer a multi-system product and explain how the systems work together; and

(D) modify a system design to meet a newly identified need or to improve performance.

(8) The student demonstrates proficiency using computer-aided design and drafting (CADD) software as part of the engineering design process. The student is expected to:

(A) research and explain the features and benefits of different types of CADD software applications for use in design systems and problem solving;

(B) identify and describe industry graphic standards such as American National Standards Institute (ANSI) and International Organization for Standardization (ISO) standards;

(C) create drawings that meet industry standards using CADD software;

(D) customize CADD software user interface options such as buttons, tabs, and ribbons to match different digital work environments;

(E) prepare and use advanced views such as auxiliary, section, and break-away using CADD software;

(F) draw detailed parts, assembly diagrams, and sub-assembly diagrams using CADD software;

(G) indicate tolerances and standard fittings using appropriate library functions within CADD software;

(H) setup and apply annotation styles by defining fonts, dimension styles, and leader lines using CADD software;

(I) identify and incorporate the use of advanced layout techniques and viewports using paper-space and modeling areas using CADD software;

(J) create and use layers to organize objects in drawings using CADD software;

(K) create and use custom templates using CADD software for advanced project management;

(L) use advanced polar tracking and blocking techniques using CADD software to increase drawing efficiency;

(M) create drawings that incorporate external referencing using CADD software;

(N) create and render objects using parametric modeling tools within CADD software; and

(O) model individual parts or assemblies and produce rendered or animated output using CADD software.

(9) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:

(A) delineate and implement the steps such as defining the problem and generating concepts needed to produce a prototype;

(B) develop a prototype safely using tools, equipment, machines, or precision measuring instruments;

(C) select and justify the use of materials for prototyping and manufacturing;

(D) describe how design quality concepts, including performance, usability, accessibility, reliability, and safe use, affect prototype development;

(E) document quality-control requirements in the design and production of a prototype;

(F) evaluate prototype quality and performance to meet design criteria;

(G) fabricate a prototype using a systems engineering approach to compare the actual prototype performance to the required performance; and

(H) present a prototype and explain how the prototype meets the project requirements.

(10) The student creates justifiable solutions to open-ended real-world problems within a multitude of engineering disciplines using engineering design practices and processes. The student is expected to:

(A) identify and define a multi-system engineering problem requiring a complex solution from different engineering disciplines such as aerospace, biomedical, chemical, civil, electrical, industrial, mechanical, petroleum, robotics, or structural engineering;

(B) formulate and document goals, objectives, and requirements to solve a multi-system engineering problem;

(C) determine the design constraints such as materials, personnel, resources, funding, manufacturability, feasibility, and time associated with a multi-system engineering problem;

(D) identify parameters, including health, safety, social, environmental, ethical, regulatory, and legal constraints, defining a multi-system engineering problem;

(E) identify or create alternative solutions to a multi-system engineering problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;

(F) test and evaluate proposed multi-system engineering solutions using tools such as models, prototypes, and mockups and methods such as simulations, critical design review, statistical analysis, and experiments; and

(G) select and justify a preferred solution to a multi-system engineering problem using a structured technique such as a decision tree, design matrix, or cost-benefit analysis.

(11) The student presents a solution derived through the engineering design process. The student is expected to:

(A) develop and deliver a presentation describing the solution to a multi-system engineering problem in a professional manner to an appropriate audience such as peers, educators, potential clients, potential employers, community members, or engineering professionals;

(B) solicit and evaluate feedback from the audience on the multi-system engineering solution and presentation; and

(C) present learning experiences, including essential skills gained, areas of personal growth, challenges, and solutions encountered throughout the design process for a multi-system engineering solution.

§127.406. Engineering Design and Problem Solving (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grade 12. Prerequisites: Algebra I, Geometry, and at least one credit in a Level 2 or higher course in the Engineering Career Cluster. Recommended prerequisites or corequisites: Engineering Science, chemistry, or physics [~~Chemistry, Physics, or Physics for Engineering~~] . This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) The Engineering Design and Problem Solving course extends students' problem solving skills by identifying needs and then devising solutions using scientific and engineering practices. Students apply prior knowledge to develop a multi-system product or solution for a complex problem. Students demonstrate project management skills by collaborating as part of a team, conducting research, and analyzing data that culminates in a comprehensive report and presentation. Technical drawings, models, and prototypes are created using the appropriate tools, materials, and techniques. Structured decision-making processes are used to select and justify a preferred, multi-system solution to an authentic problem. Students develop, implement, and document repeated trials of experiments and tests using scientific and engineering practices to determine whether a prototype meets design requirements.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are

well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as dial caliper, micrometer, protractor, compass, scale rulers, multimeter, and circuit components;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of various scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field.

(6) The student understands how to implement an engineering design process to develop a multi-system product or solution for a complex problem. The student is expected to:

(A) implement the stages of an engineering design process to construct a model of a multi-system product or solution;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, affect stages of the engineering design process;

(C) explain how interested parties affect an engineering design process; and

(D) discuss how lessons learned from failure is often an essential component of the engineering design process.

(7) The student explores and implements the methods and aspects of project management for complex, multi-phase, multi-system projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) create a resource-loaded project schedule for an engineering project;

(D) maintain a resource-loaded project schedule for the life of an engineering project;

(E) develop and implement a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(F) describe how project requirements, constraints, and deliverables affect the project schedule and influence and are influenced by an engineering design;

(G) create a budget that includes materials, equipment, and labor for an engineering project;

(H) describe the importance of management of change (MOC) and how MOC applies throughout the life of an engineering project;

(I) create and implement a project management plan for an engineering project; and

(J) describe how techniques such as Monte Carlo simulation, risk matrices, and tornado diagrams are used to evaluate risk.

(8) The student conducts research and analyzes data to create a problem statement in the engineering design process. The student is expected to:

(A) create an organized engineering notebook to record research and findings for an engineering project;

(B) select an open-ended real-world problem that can be solved using scientific and engineering practices and the engineering design process;

(C) collect, organize, analyze, and summarize scientific and technical articles, data, and information to support the development of a problem statement;

(D) define and use relevant scientific and engineering vocabulary as it relates to the problem statement;

(E) evaluate information from sources for quality, accuracy, completeness, and reliability and conduct additional research as appropriate in the context of an iterative design process; and

(F) create a problem statement that is concise, specific, and measurable.

(9) The student identifies potential solutions and uses structured techniques to select and justify a preferred solution using scientific and engineering practices and the engineering design process. The student is expected to:

(A) identify or create alternative solutions to a problem using a variety of techniques such as sketching, brainstorming, reverse engineering, and researching engineered and natural solutions;

(B) select a preferred solution to a problem by applying structured techniques such as a decision tree, design matrix, or cost-benefit analysis;

(C) evaluate whether the preferred solution meets the requirements of the problem statement in the context of an iterative design process;

(D) identify material properties that are important to the solution design such as physical, mechanical, chemical, electrical, and magnetic properties and explain how material properties affect material selection;

(E) explain how different engineering solutions can have significantly different effects on individuals, society, and the natural world; and

(F) document concepts, solutions, findings, and structured decision-making techniques in the engineering notebook.

(10) The student creates technical drawings, models, and prototypes using the appropriate tools, materials, and techniques. The student is expected to:

(A) determine and explain the type of technical drawing that best represents the solution;

(B) create a technical drawing(s) that includes dimensions, scale, views, annotations, tolerances, legends, symbols, and material specifications;

(C) create a mathematical or physical model(s) to make predictions, identify limitations, and optimize design criteria;

(D) create a prototype for testing;

(E) evaluate the successes and failures of the prototype(s) in the context of an iterative design process; and

(F) revise technical drawings, models, and prototype(s) as the solution evolves to better meet objectives.

(11) The student develops, implements, and documents repeated trials of experiments and tests using scientific and engineering practices to determine whether a prototype meets design requirements. The student is expected to:

(A) design and conduct experiments and tests to determine whether the prototype meets the requirements of the problem statement;

(B) document and evaluate quantitative and qualitative data obtained through experiments and tests of the prototype in the engineering notebook;

(C) create and analyze charts, data tables, or graphs to organize information collected during experiments on the prototype;

(D) determine acceptable limits of error in data from experiments and tests of the prototype;

(E) explain the purpose of regression analysis as a method to model and investigate relationships between independent and dependent variables from experiments and tests of the prototype;

(F) identify linear and nonlinear relationships in data and situations where regression is appropriate;

(G) identify sources of random error and systematic error and differentiate between both types of error from experiments and tests of the prototype; and

(H) evaluate and determine whether the prototype meets the requirements of the problem statement by analysis of data collected in the context of an iterative design process.

(12) The student develops and presents a comprehensive report that describes the problem, research and information collected and analyzed, concepts and solutions considered, prototypes developed and tested, and final results. The student is expected to:

(A) create and present the comprehensive report in a professional manner to an appropriate audience such as peers, educators, potential clients, potential employers, community members, or engineering professionals;

(B) solicit and evaluate feedback from the audience on the comprehensive report and presentation;

(C) present learning experiences such as essential skills gained, areas of personal growth, and challenges and solutions encountered throughout the design process; and

(D) predict the local and global impacts or risks of an engineering solution to segments of the society such as the economy or the environment.

§127.407. Environmental Engineering (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: At least one credit in a course from the Engineering or Energy Career Cluster. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) In Environmental Engineering, students research, develop, and design solutions related to water, land, and energy problems, with consideration to ethics and regulations. Using technology and the engineering design process, students devise innovative solutions to address current and future engineering challenges.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations, organizations that foster leadership and career development in the profession such as student chapters of related professional associations, and work-based experiences.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(1) [~~(2)~~] The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(2) [~~(3)~~] The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(3) [~~(4)~~] Engineering ethics. The student applies ethical consideration to analyze resilient engineered systems. The student is expected to:

(A) analyze [~~compare~~] the Texas Engineering Practices Act and [~~to the code of ethics of other engineering societies such as the American Society of Civil Engineers and the National Society of Professional Engineers to~~] explain how engineers demonstrate the responsibility they have to serve the public interest, their clients, and the profession with a high degree of honesty, integrity, and accountability;

(B) research the New London school explosion and explain how this event led to the development of the Texas Engineering Practice Act and other regulations such as odorization of natural gas;

(C) evaluate and explain an engineering ethical dilemma between environmental considerations and the needs and wants of society; and

(D) explain how engineering solutions can have significantly different impacts on an individual, society, and the natural world.

(4) [~~(5)~~] Models. The student builds a model using the appropriate tools, materials, and techniques. The student is expected to:

(A) identify and describe the steps needed to produce a model of a system such as hydrological, watershed management, or geospatial analysis models;

(B) identify advantages and limitations of models such as size, scale, properties, and materials;

(C) identify and use appropriate tools, equipment, and materials to produce a model;

(D) describe the use of a model to accurately represent the key aspects of a physical system, including the identification of constraints such as cost, time, or expertise, that may influence the selection of a model;

(E) develop a design proposal using a variety of media to produce a model; and

(F) evaluate the successes and failures of a model in the context of an iterative design process.

(5) [~~(6)~~] Critical and creative problem-solving. The student examines environmental challenges and gathers assumptions to synthesize a meaningful, well-defined problem and ideates multiple solutions. The student is expected to:

(A) collect, analyze, and interpret information relevant to an environmental engineering problem;

(B) document a design process according to best practices in an engineering notebook;

(C) identify and define visual, functional, and design requirements with realistic constraints against which solution alternatives can be evaluated;

(D) list potential appropriate criteria for a defined problem that may impact the success of a design solution such as economic, environmental, ethical, health and safety, technical feasibility, and design;

(E) represent concepts using a variety of visual tools such as sketches, graphs, and charts to communicate the details of an idea;

(F) develop, design, and test alternatives to generate valid quantitative data to inform decision making and demonstrate solutions; and

(G) explain why there are often multiple viable solutions.

(6) [~~(7)~~] Critical and creative problem-solving. The student selects the optimal design solution for real-world environmental problems based on engineering judgement. The student is expected to:

(A) evaluate competing solutions paths using a decision matrix to compare solutions based on design criteria;

(B) formulate a risk analysis matrix using a spreadsheet to evaluate threats and opportunities, including cost, time, and environmental impacts;

(C) identify data needed to address an environmental engineering research question and the appropriate tools necessary to collect, record, analyze, and evaluate the data; and

(D) evaluate evidence and arguments to identify deficiencies, limitations, and biases for appropriate next steps in the pursuit of a better solution.

(7) [~~(8)~~] Engineering tools and technology. The student uses a variety of techniques to measure and report quantities appropriate for an environmental analysis. The student is expected to:

(A) research and determine appropriate units of measure, including acres, miles, and hectares, for environmental analysis;

(B) measure and estimate a large-scale area such as a wetland, streamline, or floodplain using maps or digital resources;

(C) perform dimensional analysis and unit conversions to transform data to units appropriate for a particular purpose or model; and

(D) select and effectively use appropriate tools for accurately measuring specific volumes.

(8) [~~(9)~~] Water resources. The student analyzes environmental factors related to safe drinking water. The student is expected to:

(A) research and describe the Texas State Water Plan, including the sources of water, floodplain management, and recycling;

(B) analyze the relationship between population growth and water resources;

(C) describe how human health is affected by the quality of drinking water sources;

(D) describe and compare the most common sources of drinking water such as desalination, aquifers, surface water, and reclaimed water in developed and developing countries;

(E) explain the characteristics of potable water;

(F) describe common sources of drinking water contamination, including stormwater runoff;

(G) explain contaminant cycling through an ecosystem; and

(H) describe the infrastructure components of private wells and public drinking water systems.

(9) [~~(10)~~] Water quality. The student evaluates water quality and uses a variety of chemical and biological assays to describe water quality. The student is expected to:

(A) research and describe Environmental Protection Agency (EPA) and Texas Commission on Environmental Quality (TCEQ) surface water quality standards for rivers, lakes, and estuaries;

(B) research and describe annual water quality compliance reports and compare water quality between the different reports;

(C) explain how water quality is quantitatively measured using chemical and biologically based testing processes;

(D) perform and analyze a culture assay to detect coliform in water;

(E) collect a water sample and determine water turbidity and pH;

(F) outline the stages of treatment that a typical septic system and modern sewage treatment plant use to treat sewage water;

(G) explain the role of bacteria in wastewater treatment;

(H) research and describe emerging contaminants in water and demonstrate understanding of methods of detection, measurement techniques, degradation, assessment of risk, and strategies for mitigation and removal of contaminants [~~such as microplastics and pharmaceuticals in water~~] ;

(I) describe the interacting roles of bacteria, protozoa, and rotifers in a wastewater treatment ecosystem;

(J) describe and provide examples of how physical, chemical, and biological processes work in the process of purifying contaminated water;

(K) explain how plants remove nitrates from contaminated water;

(L) use the engineering design process to design, build, and test a water filtration system;

(M) design and perform an experiment to use phytoremediation to remove contaminants from water; and

(N) design and conduct a scientific experiment to test a variable affecting the bacteria's ability to decompose oil.

(10) [~~(11)~~] Energy. The student demonstrates a working knowledge of various sources of energy and their environmental and economic impact. The student is expected to:

(A) explain the differences between and costs [~~cost~~] of renewable and non-renewable energy sources , providing [~~of energy and provide~~] examples of each;

(B) describe energy density, subsidies, raw materials, the impact of energy production on land and animal life, and the environmental and resource demands of mining in relation to renewable and non-renewable energy sources;

(C) [~~(B)~~]identify and measure the amount and types of energy that students use in their daily lives;

(D) [~~(C)~~] compare the fuel efficiency of various fuel sources;

(E) [~~(D)~~] analyze the results of software simulations and models that vary the amounts and types of energy used to predict future energy needs;

(F) define and identify types of intermittent and on-demand energy;

(G) [~~(E)~~] perform a full life cycle assessment (LCA) of material and energy sources; and

(H) [~~(F)~~] identify the variables and the methods for completing an LCA.

(11) [~~(12)~~] Engineering resilient systems. The student understands the environmental impacts to infrastructure systems and the need to support system performance with resilient solutions. The student is expected to:

(A) identify innovations and laws which have improved air quality in the United States, including bag houses, water suppression at mines, the catalytic converter, industrial scrubbers, and the Clean Air Act;

[~~(A) describe mitigation techniques and their associated costs for air pollutants and greenhouse gas emissions;~~]

(B) analyze the impact on human habitat and access to energy of climate and [~~humans of naturally occurring~~] extreme weather events such as flooding, freezing temperatures, hurricanes, tornadoes, and thunderstorms;

(C) research and explain how engineering design can be more resilient to environmental impacts to limit additional impacts to the natural environment; [~~and~~]

(D) research and explain elements of natural environmental resilience ; and [~~.~~]

(E) compare and analyze air quality data from different countries around the world, evaluating factors that influence air quality such as laws and use of different types of energy.

(12) [~~(13)~~] Land management. The student understands land management and land management practices. The student is expected to:

(A) explain the value of a healthy ecosystem and the impact of biodiversity on the environment;

(B) research and explain ecological value of the land such as direct products and provisioning, regulating, supporting, and cultural services;

(C) identify and evaluate land conservation , [~~and~~] preservation , and restorative measures using industry practice standards , including [~~such as~~] the United States Department of Agriculture (USDA) National Resources Conservation Services (NRCS) Conservation Practice Standards and the Texas Railroad Commission (TRC) environmental regulations [~~for a given land area~~] ;

(D) research changes in land use and land cover over time using geospatial tools;

(E) analyze and report positive and negative environmental impacts due to changes in land use , including [~~such as~~] urbanization over time , mining of rare earth minerals, and precision farming ; and

(F) explain the role of protected areas and lands to safeguard natural ecosystems.

(13) [~~(14)~~] Waste management. The student understands the role and importance of waste management. The student is expected to:

(A) analyze the impacts of reduction, reuse, and recycling in waste management;

(B) explain the impact of individual practices of waste reduction on resource management;

(C) explain how landfills manage waste decomposition, including the capture and potential use of gases, including methane;

[~~(C) explain the capture and use of methane gas from landfills;~~]

(D) analyze the waste breakdown cycle of various waste products that enter landfills; and

(E) research and describe hazardous waste products and impacts on the environment, including long-term storage needs and pollution.

(14) [~~(15)~~] Regulations. The student understands the role of national and local standards and regulations in environmental design. The student is expected to:

(A) research and describe the functions of the EPA and U.S. Fish and Wildlife Service;

(B) research and describe the functions of the TCEQ and the Texas Parks and Wildlife Department; [~~and~~]

(C) describe the relationship between the National Environmental Policy Act, the EPA, and TCEQ ; and [~~.~~]

(D) explain the role of the TRC in facilitating the restoration of mined land to its original condition.

(15) [~~(16)~~] Future challenges in environmental engineering. The student discusses and analyzes some of the persistent environmental engineering challenges to sustain growing populations and the natural environment and improve quality of life. The student is expected to:

(A) explain why some environmental engineering challenges are persistent such as providing access to clean water, energy, sanitation, and health to growing populations;

(B) create a solution to a current challenge to meet the needs of society without compromising the ability to meet the needs of the future;

(C) identify principles that guide the development of resilient solutions that enhance quality of life, support a high standard of living, and conserve resources;

[~~C) identify principles that help guide development of solutions with considerations for sustainable development to include people and the planet; and~~]

(D) describe the life cycle of a product or service and identify energy consumption, wastes, and emissions that are produced in the process.

§127.408. Fluid Mechanics (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: at least one credit in a course from the Engineering Career Cluster and physics or chemistry [~~Physics or Chemistry~~] . Recommended prerequisite or corequisite: Algebra II. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Fluid Mechanics investigate the behavior and properties of fluids, including liquids and gasses. Through hands-on experiments, simulations, and real-world examples, students learn about concepts such as viscosity, pressure, buoyancy, and flow dynamics. Students explore how fluids interact with solid objects, understanding phenomena like lift and drag, which are critical to the operation of ships, airplanes, and vehicles. Students engage in case studies and problem-solving activities to gain insights into how fluid mechanics shape our everyday lives, technological advancements, and industrial applications. This course prepares students to progress in careers in engineering and scientific disciplines such as aerospace, mechanical, civil, chemical, materials, and physics.

(4) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(5) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide tools for understanding the ideas presented. Students should analyze a system in terms of its

components and how these components relate to each other, to the whole, and to the external environment.

(9) [~~(4)~~] Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(10) [~~(5)~~] Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time-management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as dial calipers, protractors, scale rulers, tape measures, load cells, micrometers, scales, tensiometer, multimeter, and thermometers;

(E) collect quantitative data using the System International (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of various scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field.

(6) The student explains the application of fluids in historical and modern applications. The student is expected to:

(A) describe the efficient storage and transportation of fluids, including gravity flow and natural phenomena such as aqueducts, water towers, winds, and currents;

(B) explain the use of fluids in power generation and power transmission such as hydraulics, pneumatics, pumps, compressors, and turbomachinery; and

(C) explain the impact of lift and drag on a moving object.

(7) The student describes basic concepts of fluid mechanics. The student is expected to:

(A) differentiate and compare the properties that distinguish a solid from a fluid;

(B) define the characteristics of a fluid and identify different types of fluids, including gasses, liquids, Newtonian, and non-Newtonian;

(C) define and list examples of compressible and incompressible fluids;

(D) explain the properties of fluids, including density, specific weight, specific gravity, viscosity, and compressibility;

(E) describe methods to measure and calculate the density, specific weight, specific gravity, viscosity, and compressibility of a Newtonian fluid;

(F) calculate density, specific weight, and specific gravity for a variety of fluids from measured data;

(G) explain the appropriate use of material reference frames and spatial reference frames, including boundary conditions, control surfaces, and control volumes;

(H) identify and explain the variables in the ideal gas law and apply the ideal gas law to constructed problems;

(I) explain the laws of conservation of energy and conservation of mass, including the algebraic version of Reynold's Transport theorem; and

(J) identify appropriate boundary conditions, including no-slip and ambient pressure boundary conditions in fluid flow.

(8) The student demonstrates an understanding of pressure and hydrostatics and calculates values in a variety of systems. The student is expected to:

(A) describe the relationship between force, area, and pressure;

(B) calculate force proportionalities in hydraulic and pneumatic cylinders using Pascal's law and explain the impact of the cylinders' diameter on the resultant force;

(C) differentiate between atmospheric pressure, gauge pressure, and absolute pressure;

(D) describe the working principles of a pressure gauge and measure fluid pressure using dial gauges and manometers;

(E) calculate the buoyant force of floating and submerged objects according to Archimedes' principle; and

(F) define and calculate hydrostatic pressure.

(9) The student demonstrates an understanding of fluid flows in steady-state pipes, channels, and free jets. The student is expected to:

(A) compare developing, fully developed, and steady-state Newtonian fluid flows in pipes and channels;

(B) compare fluid flow profiles, including uniform and parabolic;

(C) describe experimental measurements of fluid flow field lines, including stream, streak, and pathlines;

(D) calculate volumetric flow rate in a steady state system using the continuity equation and conservation of mass;

(E) explain how Bernoulli's equation relates to the total energy of a steady-state system;

(F) calculate unknown variables in varying conditions, including changes in height, velocity, and cross-sectional area of a steady state system using Bernoulli's equation and the conservation of energy;

(G) derive Torricelli's equation from Bernoulli's equation and calculate the exit velocity and mass flow rates of free jets;

(H) calculate fluid flows in pipes, channels, and free jets using the Reynolds Transport theorem and conservation of mass; and

(I) calculate the resultant force of a free jet at the outlet based on the density of the fluid, cross-sectional area, pressure, and velocity of the fluid.

(10) The student demonstrates an understanding of the effects of an object moving through a fluid. The student is expected to:

(A) differentiate turbulent and laminar flows;

(B) calculate the Reynolds number of given flows to determine if the flows are turbulent or laminar;

(C) define lift and drag as applied to fluid flows;

(D) explain the relationship between viscosity and shear force in a fluid flow;

(E) explain the variables of lift and drag formulas and how the variables relate to fluid flow; and

(F) design an experiment to measure the drag coefficient for a solid body in a fluid flow.

(11) The student understands compressible flow and the relationship between sound transmission through a fluid and fluid compression. The student is expected to:

(A) differentiate between compressible and incompressible fluids and explain the effect of compressibility on the speed of sound through a fluid;

(B) explain how density impacts the speed of sound through a fluid;

(C) calculate and use the Mach number to model a fluid as compressible or incompressible; and

(D) explain the effects on fluid, including shock waves, when the sound barrier is broken.

(12) The student designs and analyzes fluid systems. The student is expected to:

(A) explain the function of weirs in an open channel and describe an application of weirs such as flow control or flow measurement;

(B) calculate the fluid flow in open channels with different shapes, slopes, and weirs;

(C) design an application of hydrostatics using the principle of buoyancy such as a boat, submarine, floating dock, or hot air balloon;

(D) analyze and design a fluid device such as a clepsydra, water tower, pressure regulator, or nozzle using the principles of fluid dynamics;

(E) describe applications and processes of different types of pumps, including centrifugal pumps, peristaltic pumps, gear pumps, and positive displacement pumps;

(F) describe the operation of a centrifugal pump and explain the data presented in a pump curve, including head, flow rate, efficiency, and power;

(G) design a hydraulics system with components, including hydraulic fluid, pump, reservoir, motor, cylinders, valves, and flow controllers;

(H) identify and compare different types of turbomachines, including pumps and turbines;

(I) describe and differentiate the applications of turbomachines, including pumps and turbines; and

(J) explain the concept of tribology and identify the associated variables of tribology such as film thicknesses and pressures.

§127.409. Mechanics of Materials (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: at least one credit from the Engineering Career Cluster and physics [~~Physics~~] . Prerequisite or corequisite: Algebra II. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for the successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Mechanics of Materials describe the mechanical behavior of engineering materials, including metals, ceramics, polymers, composites, welds, and adhesives, and the applications of load, deformation, stress and strain relationships for deformable bodies, and mechanical elements relevant to engineers. The course includes axially loaded members, buckling of columns, torsional members, beams, and failure.

(4) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(5) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making

comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide tools for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time-management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as dial calipers, protractors, scale rulers, tape measures, load cells, micrometers, scales, tensometers, multimeters, and thermometers;

(E) collect quantitative data using the System International (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of various scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field.

(6) The student examines the historical developments that led to the field of mechanics of materials and material science. The student is expected to:

(A) describe the contribution to the field of mechanics by historical scientists such as Pascal, Galileo, Euler, Navier, Lame, Poisson, Hooke, and Young;

(B) describe key historical advancements related to the development of different materials such as bronze, iron, steel, Damascus steel, and Roman concrete;

(C) explain how materials have influenced historical events and products such as the steel in the Titanic, the space race, and smartphones;

(D) evaluate and explain the impact of modern development of materials to manufacturing such as composites, nanotechnology, semi-conductors, and alloys and the effects of processes on materials such as subtractive manufacturing, additive manufacturing, and welding; and

(E) describe the development of shapes in architectural structures such as columns, arches, domes, keystones, and suspension bridges.

(7) The student identifies and measures different properties of an object. The student is expected to:

(A) classify properties of an object as geometric, structural, or material;

(B) identify and describe the application of tools, including rulers, calipers, micrometers, weighing scales, tensile testers (tensometers), and thermometers;

(C) measure common properties of materials, including length, width, height, and mass;

(D) measure and observe intrinsic properties of materials such as hardness, thermal conductivity, and impact resistance;

(E) calculate density, cross-sectional area, specific gravity, thermal expansion, modulus of elasticity, Poisson's ratio, bulk modulus, yield, and ultimate stress using data from a table or graph;

(F) differentiate material properties, including ductility, malleability, resilience, toughness, and reflectivity;

(G) classify material properties as geometric (extrinsic), material (intrinsic), or structural; and

(H) classify types of materials, including metals and alloys, polymers, ceramics, biomaterials, composites, and semiconductors.

(8) The student understands various manifestations of forces acting on solids. The student is expected to:

(A) illustrate forces, including axial, radial, normal, torsional, and shear and identify different units such as newtons, pounds, and kips used in force measurement;

(B) explain force intensity of distributed forces, including forces distributed over a line, area, and volume;

(C) calculate and simplify multiple loads to a single combined load;

(D) distinguish between normal forces and shear forces; and

(E) identify and calculate different types of stress, including axial stress, shear stress, and bending stress.

(9) The student evaluates the effect of temperature on the properties of a material. The student is expected to:

(A) describe engineering applications of thermo-mechanical properties such as thermometers, thermocouples, thermistors, thermostatic valves and controllers, and fuses;

(B) explain the atomic origin of thermal expansion resulting in measurable effects such as building height change and material distortion;

(C) describe potential failure modes due to thermal expansion for kinematically constrained structures;

(D) explain how to accommodate thermal expansion in construction such as buckling of railroad rails, U-runs in piping, and expansion joints; and

(E) explain the effect of temperature on the mechanical properties of materials, including modulus of elasticity, yield strength, ductility, and toughness.

(10) The student determines the material properties from different mechanical material tests and how they are graphically represented. The student is expected to:

(A) describe a tensile test, the various possible shapes of tensile testing specimens, and tensile test measurements, including force, elongation, and change in thickness;

(B) analyze data from a tensile test to calculate engineering stress and strain for various materials such as aluminum, brass, cast iron, steel, and nylon at significantly different temperatures;

(C) plot engineering stress and strain on a two-dimensional graph;

(D) identify regions of a stress-strain curve, including elastic deformation, plastic deformation, resilience, strain hardening, fracture, and tension toughness;

(E) estimate the values from a stress-strain curve, including 0.2% offset, modulus of elasticity, yield stress, ultimate stress, resilience, and tension toughness;

(F) compare and explain differences in testing plots based on differences in specimen geometry and material;

(G) compare different types of material testing, including compression tests, tensile tests, and three-point bending tests;

(H) analyze testing results from compression and three-point bending tests with different specimen geometries, including length, cross-sectional shape, and cross-sectional area; and

(I) describe modern mechanical testing such as digital image correlation, thermography, acoustic emission, and x-ray diffraction.

(11) The student analyzes the impact of the cross-sectional geometry on the second moment of area for beams and shafts. The student is expected to:

(A) calculate the area and the second moment of area for primitive shapes, including rectangles, triangles, circles, and semi-circles;

(B) explain the parallel-axis theorem and use the parallel axis theorem to calculate the second moment of area for complex shapes;

(C) calculate area, centroid, and second moment of area for complex shapes composed of primitive shapes such as an H-beam, square tubes, round tubes, and angle iron; and

(D) hypothesize the best cross-sectional shape for different types of loads such as tension, compression, torsion, bending, and combinations of these loads.

(12) The student represents point and distributed forces on a sketch and calculates the maximum deflection and factor of safety of bars, cables, columns, beams, and shafts using algebraic equations. The student is expected to:

(A) describe the consequences of stresses such as elastic deformation, plastic deformation, and fracture on solid objects with mass;

(B) calculate the maximum deflection of various homogenous prismatic beams, including simply supported, cantilever, and overhang beams, using algebraic formulas;

(C) calculate the factor of safety of various homogenous prismatic beams, including simply supported, cantilever, overhang beams, and columns, using algebraic formulas;

(D) analyze the impact of cross-sectional area and length on the potential for various homogenous prismatic columns to buckle under load;

(E) explain the impact of and the reason for using a tapered object in structural applications; and

(F) describe why pre-stress is used in applications such as shot-peening, tempered glass, wheel spokes, flatbed trailers, and bridges.

(13) Students demonstrate an understanding of stress, strain, and displacement fields throughout a structure, including bars and beams. The student is expected to:

(A) identify compression and tension regions in a bent beam;

(B) describe the kinematics of a bent member, including elongation due to tension, shortening due to compression, the neutral axis, and the linear displacement profile; and

(C) identify regions of compression and tension in digital image correlation data.

(14) The student understands that the mechanics of materials are required to analyze a multi-member structure for strength and stability in real-world applications. The student is expected to:

(A) compare permanent and non-permanent joints, including welding, brazing, soldering, adhesives, bolting, screwing, and riveting joints;

(B) analyze a bolted connection for pre-stress, load, factor of safety, grade, size, yield stress, and applied torque; and

(C) design a structure to support a specified load with materials of adequate properties, size, and geometry and with an appropriate factor of safety.

§127.410. Statics (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: at least one credit in a course from the Engineering Career Cluster and physics [~~Physics~~] . Prerequisite or corequisite: Algebra II.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Statics is a gateway course into most engineering majors such as aerospace, mechanical, civil, and biomedical engineering. Students learn the elements of statics that include the forces in structures that are in equilibrium and usually not moving. This includes forces calculated in two dimensions, free-body diagrams, distributed loads, centroids, and friction as applied to cables, trusses, beams, machines, gears, and mechanisms. Students explore scenarios where objects remain stationary, emphasizing the importance of balance and stability in engineering design. This course not only equips students with theoretical knowledge but also empowers them with practical skills that are indispensable in real-world engineering scenarios.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student describes milestones in structural design and construction throughout history. The student is expected to:

(A) research and evaluate the significance of pioneering structures such as the Eiffel Tower, pyramids, Roman aqueducts, ferris wheel, Sydney Opera House, and St. Louis Bridge to the field of structural design;

(B) analyze how locally available materials and technology have impacted the construction of structures through time;

(C) identify the contributions of structural design pioneers such as Archimedes, Leonardo DaVinci, Galileo, René Descartes, and Albert of Saxony; and

(D) identify careers that use the field of statics and predict the future application of statics.

(3) The student measures and converts units in the System International (SI) units and United States (US) customary systems of measurement. The student is expected to:

(A) measure objects using different units of measurement such as feet, inches, centimeters, meters, pounds force, Newtons, slugs, and kilograms in decimal and fractional measurements;

(B) apply prefixes to units of measure and convert between units in U.S. customary and SI systems such as kilograms and kips; and

(C) identify physical examples of different units of measurement, including one Newton, one pound, and one kip.

(4) The student develops an understanding of point and distributed forces and moments, including torque and couples and their respective units. The student is expected to:

(A) explain how Newton's third law of motion applies to static systems;

(B) explain the purpose and operation of mechanical components, including gears, sprockets, pulleys, and simple machines;

(C) explain how mechanical components, including gears, sprockets, pulley systems, and simple machines, are used in mechanisms;

(D) explain distributed loads and simplify distributed loads to point loads;

(E) compare a two-dimensional distributed load applied over a line to a distributed load applied over an area and a volume;

(F) calculate and use applicable units for forces, torque, distances, and mechanical advantages related to levers, gears, and pulleys;

(G) define and calculate the efficiency of mechanical systems; and

(H) identify and explain couples in a static system.

(5) The student applies vector algebra to calculate the equivalent force and moment vectors. The student is expected to:

(A) differentiate between scalar and vector quantities;

(B) identify properties of a vector, including magnitude and direction;

(C) convert forces represented graphically to vector notation;

(D) represent a force vector in its horizontal and vertical components;

(E) calculate resultant vectors from multiple vectors using a strategy, including vector addition and the parallelogram rule;

(F) simplify free-body diagrams by using strategies, including the principle of transmissibility, couples, and the summation of moments;

(G) calculate moments of a rigid body system using strategies, including multiplying force by the perpendicular distance to a specified axis and the right-hand rule;

(H) calculate moments from component forces using Varignon's principle; and

(I) apply equivalent transformation to simplify external loads in a structural system.

(6) The student locates and applies the geometric centroid and the center of mass of homogenous and heterogeneous objects. The student is expected to:

(A) explain the difference between geometric centroid and center of mass;

(B) locate the geometric centroid of simple and complex shapes using the composite parts method; and

(C) locate the center of mass for two-dimensional and three-dimensional homogeneous and heterogeneous objects.

(7) The student determines the stability of simple and complex objects with a variety of applied forces. The student is expected to:

(A) identify potential pivot points at which objects could potentially rotate leading to a tip-over;

(B) determine the stability of simple and complex objects with only frictional force using the relative location of the center of mass and the object pivot point;

(C) calculate the stability of simple and complex objects with external forces applied at different locations on the object and a reaction force caused by friction; and

(D) describe how the friction reaction forces when combined with applied forces at different locations affect the stability of an object and how to stabilize systems subject to tipping.

(8) The student differentiates supports, including fixed, pin, and roller supports, for structures. The student is expected to:

(A) define and compare the applications of different structural supports, including fixed, pin, and roller supports, and describe which support is utilized in a cantilevered beam;

(B) explain the degrees of freedom for fixed, pin, and roller supports;

(C) describe how fixed, pin, and roller supports affect a structural system; and

(D) describe and sketch the different reaction forces and moments for structural supports, including fixed, pin, and roller supports.

(9) The student constructs free-body diagrams of particles and rigid bodies around various supports and determines the reaction forces of the static body. The student is expected to:

(A) sketch a complete free-body diagram that includes applied and reaction forces for a structure;

(B) define static equilibrium;

(C) formulate translational and rotational static equilibrium equations into a system of algebraic equations; and

(D) solve for unknown forces in a structure using equations of equilibrium.

(10) The student analyzes statically determinant plane trusses. The student is expected to:

(A) test if a plane truss is statically determinant;

(B) apply the method of sections and method of joints to calculate the internal forces of a statically determinant plane truss;

(C) explain the difference between tension and compression forces;

(D) describe capabilities of members, including beams, cables, ropes, bars, and columns, to bear tension, compression, or both tension and compression;

(E) identify internal members as being in tension or compression, the members bearing the maximum loads, and the member most likely to fail; and

(F) design structures such as bridges, tensegrity structures, or trusses to support external loads.

(11) The student recognizes the limitations of a two-dimensional model. The student is expected to:

(A) identify the differences between a two-dimensional and three-dimensional system;

(B) explain the implications of adding a third dimension to a structure and how a two-dimensional analysis is insufficient to model a three-dimensional structure; and

(C) describe how a third dimension can cause instability in a structure.

§127.411. Mechanical Design I (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I [~~and at least one credit in a course from the Engineering Career Cluster~~] . Recommended corequisite: Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Mechanical Design I demonstrate knowledge and skills associated with design and manufacture of mechanical systems. Fundamental mechanisms are introduced such as gears, belts, threaded elements, and four-bar mechanisms. Basic manufacturing processes such as stamping, injection molding, casting, machining, and assembly are explored through reverse engineering. The mechanisms encountered through reverse engineering enable the exploration of product functionality. Students compare engineering choices made for components, materials, and manufacturing processes. Emphasis is placed on team collaboration and professional documentation.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student discusses ethics pertaining to engineering. The student is expected to identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying.

(2) The student understands that there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:

(A) explain the importance of defining an engineering problem as an initial step in the engineering design process;

(B) describe the research stage of the engineering design process;

(C) define ideation and conceptualization and discuss the role these processes play in innovation and problem solving;

(D) explain the processes of selecting an idea or concept for detailed prototype design, development, and testing;

(E) describe the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;

(F) describe the process of relevant experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;

(G) explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and

(H) describe the purpose of effective communication of the engineering solution as obtained through the engineering design process to various audiences.

(3) The student explores and develops skills to solve problems, make decisions, and manage a project. The student is expected to:

(A) discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;

(B) identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;

(C) define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;

(D) identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and

(E) identify strategies to solve problems and describe how problem solving is utilized to accomplish personal and team objectives.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

[~~(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:~~]

[~~(A) describe and implement the stages of an engineering design process to construct a model;~~]

[~~(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;~~]

[~~(C) explain how stakeholders impact an engineering design process; and~~]

[~~(D) analyze how failure is often an essential component of the engineering design process.~~]

[~~(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:~~]

[~~(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;~~]

[~~(B) explain the roles and responsibilities of team members, including project managers and leads;~~]

[~~(C) research and evaluate methods and tools available for managing a project;~~]

[~~(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;~~]

[~~(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;~~]

[~~(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and~~]

[~~(G) describe the importance of management of change (MOC) and how MOC applies to project planning.~~]

(4) Collaboration. The student develops teamwork skills. The student is expected to:

(A) discuss principles of critique such as describing, analyzing, interpreting, and evaluating;

(B) identify and demonstrate teamwork skills such as sensemaking where a team member recognizes another team member who requires additional clarity and then addresses the team member by providing clarity;

(C) identify methods for structuring projects such as Gantt charts, work breakdown structure, Agile, and critical path method; and

(D) discuss the importance of contributing to positive and productive group dynamics to enhance teamwork.

(5) Documentation. The student documents information gathered and interpretation developed throughout engineering processes. The student is expected to:

(A) create documents such as executive summaries, reverse engineering forms, test reports, failure documents, system black box models, engineering notebooks, and drawing packages aligned with professional industry standards;

(B) select the document format to communicate essential information to identified stakeholders; and

(C) explain and justify the structure and sequence of how information is presented in engineering documents.

(6) Applications for mechanical design. The student examines domestic, commercial, and industrial applications of mechanical design. The student is expected to:

(A) explain applications of mechanical design in various industries, including medical, aeronautical, automotive, naval, and robotics industries;

(B) research and identify commercial applications for mechanical design such as heating and cooling systems and robotics; and

(C) identify and discuss household items that are impacted by mechanical design such as environmental controls, refrigerators, washing machines, and clothes dryers.

(7) Mechanisms. The student investigates and understands mechanisms that convert motion such as gears, belts, threaded elements, linkages, or linear actuators. The student is expected to:

(A) create virtual models of physical mechanisms using appropriate tools;

(B) predict how different inputs affect the motion of a mechanism such as gears and linkages and compare the predictions with physical models;

(C) classify mechanisms into different types such as gears, belts, threaded elements, linkages, or linear actuators; and

(D) explain how changes in the dimensions of a mechanism influence the relationship between input and output.

(8) Reverse engineering. The student systematically disassembles and analyzes a system to identify the concepts involved in function and manufacture. The student is expected to:

(A) use appropriate simple tools and methods to disassemble consumer products such as can openers, mixers, or drills;

(B) document the reverse engineering process using appropriate documentation tools and methods;

(C) identify mechanisms of a product such as drive systems and gears and how their function contributes to the overall function of the product;

(D) identify elements of a product such as housings, covers, and controls and how their attributes contribute to the product;

(E) use appropriate measurement tools and methods to capture and document information about the sub-assemblies and components in a product;

(F) identify and evaluate the choice of particular materials in the elements of a product;

(G) identify and evaluate the choice of the process used to manufacture the element of a product; and

(H) identify and evaluate the choice of the process to assemble a product.

(9) Manufacturing. The student identifies different manufacturing processes such as stamping, injection molding, casting, sintering, and machining and assembly. The student is expected to:

(A) explain and compare common manufacturing processes such as stamping, casting, injection molding, and machining;

(B) identify and describe stamping manufacturing process elements such as press, tool, and blank and process steps such as shearing, bending, and perforating;

(C) identify and describe injection molding elements such as hopper, heater, platen, and mold and process steps such as heating and injecting;

(D) identify and describe casting elements such as mold, furnace, parting plane, sprue, and gate and process steps such as heating, pouring, cooling, and removal;

(E) identify and describe sintering elements such as mold, furnace, binder, and powder and process steps such as heating, pressing, cooling, and post-processing;

(F) identify and describe material removal elements such as workpiece, tool, jigs, and fixtures; the machine used such as mill, lathe, or drill; and process steps such as holding, locating, and cutting;

(G) identify and describe assembly process elements such as jigs and fixtures, tolerances, fasteners, and tools and related process steps such as locating, holding, joining, and automating; and

(H) identify and explain which material types are appropriate for manufacturing processes such as stamping, injection molding, casting, sintering, material removal, and assembly.

(10) Assembly. The student explores the assembly process. The student is expected to:

(A) explain the purposes of joining methods such as welding, adhesive bonding, fastening, riveting, and snap fitting;

(B) evaluate the choice of joining methods found in a consumer product and generate requirements based on the evaluation; and

(C) compare different assembly strategies such as assembly line, automation versus manual, or batch versus pull.

(11) Design. The student applies appropriate professional design tools. The student is expected to:

(A) define industry relevant terminology, including Failure Modes Effects Analysis (FMEA), Design for Manufacturing (DFM), Design for Assembly (DFA), Lean Manufacturing, Design of Experiments (DOE), benchmarking, reverse engineering, and Life Cycle Analysis (LCA);

(B) use design tools such as FMEA, Quality Functional Deployment (QFD), root cause analysis, five whys, or decision matrices to extract information about a reverse engineered product;

(C) develop an engineering requirements list to justify the selection of materials, processes, parts, and features from a reverse engineered product;

(D) identify opportunities for manufacturing and assembly improvement from a reverse engineered consumer product; and

(E) design and conduct tests to collect information needed to understand the engineers' design decisions, including material, manufacturing process, and mechanism choices, during a reverse engineering project.

(12) Key concepts. The student understands key concepts of mechanical engineering. The student is expected to:

(A) define heat transfer concepts such as conduction, convection, or radiation;

(B) define thermodynamic concepts such as systems boundary, conservation, or entropy;

(C) define mechanics of materials concepts such as strain, stress, elasticity, brittleness, or fatigue;

(D) define dynamics concepts such as vibrations, dampening, or spring coefficients;

(E) define material concepts such as strength, hardness, metallics, polymers, or ceramics;

(F) define fluids concepts such as mass flow rate, viscosity, compressibility, turbulence, or boundary layer;

(G) define statics concepts such as free body diagrams, force, torque, moment, or equilibrium;

(H) define controls concepts such as open loop, closed loop, or systems modeling; and

(I) identify and explain the use of engineering computational tools such as computer-aided design (CAD), finite element analysis (FEA), or computational fluid dynamics (CFD).

§127.412. Mechanical Design II (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Mechanical Design I. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Mechanical Design II demonstrate knowledge and skills associated with the design development and validation of a prototype solution to meet a given set of requirements.

Students identify project stakeholders; manage projects; evolve requirements; model system solutions; develop, test, and refine prototypes; and validate project solutions. Emphasis is placed on budget management, professional documentation, conducting project status updates, critiquing design reviews, and team collaboration.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(4) Collaboration. The student develops teamwork skills. The student is expected to:

(A) explain and apply sensemaking skills such as recognizing team members who require additional clarity and addressing team members to provide clarity;

(B) apply methods such as Gantt charts, work breakdown structure, Agile, and critical path method to structure a project;

(C) apply principles of critique within the team such as describing, analyzing, interpreting, and evaluating;

(D) develop and present action plans to positively support the team's work relationships;

(E) explain and model how to provide an effective critique of team members on topics such as team performance, test performance, project development, or presentation;

(F) explain and model how to provide an effective critique of other teams on topics such as presentation, problem definition, schedule, and solution justification;

(G) analyze and evaluate critique received from team members and other teams; and

(H) develop a design review presentation to provide status and solicit feedback on the design problem and solution.

(5) Documentation. The student documents information gathered and interpretations developed throughout the applied engineering process. The student is expected to:

(A) generate documents such as executive summaries, reverse engineering forms, test reports, failure documents, system black box models, engineering notebooks, and drawing packages by applying professional standards and templates;

(B) select the appropriate document format for the information being communicated based on the audience;

(C) explain and justify the structure and sequence of how the information is presented in the engineering documents;

(D) create assembly and user manuals for peer review; and

(E) generate a final design report that focuses on the project scope and solution with appendices to capture all relevant design information such as the design process used, requirements compliance matrix, concept reports, and test reports.

(6) Project management. The student reviews and applies basic project management strategies following a proposal-justification-approval process for each significant model considered. The student is expected to:

(A) generate a project management plan that includes time and deliverable estimates;

(B) review and update periodically the project management plan based on appropriate industry standard practices such as stage-gate and Agile Project Management; team structure and formation; and project modeling such as flow charts, Gantt charts, Program Evaluation Review Technique (PERT), critical path method, and work breakdown structures;

(C) create model or test proposals for review; and

(D) compare project management approaches such as stage-gate and Agile.

(7) Stakeholder. The student understands how to engage stakeholders, including end user, consumer, fabricator, maintenance, the design team, and other engineers. The student is expected to:

(A) describe how an engineer's professional responsibility applies to stakeholders;

(B) develop a journey map or equivalent tool to model how the stakeholder interacts with the product; and

(C) explain the importance of maintaining engagement with the stakeholder throughout the project.

(8) Design requirements. The student understands the importance of the role of requirements in the mechanical engineering design process. The student is expected to:

(A) identify and solicit stakeholder requirements;

(B) generate, refine, and document product and project requirements throughout the project;

(C) document requirements in correct format with appropriate standards such as National Aeronautics and Space Administration (NASA), military, and International Council on Systems Engineering (INCOSE);

(D) verify that each requirement can be associated to at least one stakeholder;

(E) verify that each stakeholder can be associated to at least one requirement;

(F) discuss the importance of the relation between requirements and respective stakeholders;

(G) analyze how key mechanical design concepts such as heat transfer, mechanics of materials, statics, or fluids impact the design process, design requirements, and design decisions; and

(H) explain how requirements drive the project.

(9) System modeling. The student generates multiple abstract models of mechanical systems using representations such as schematic diagramming and function structure modeling. The student is expected to:

(A) create models of various mechanical system concepts;

(B) compare different models against the appropriate requirements;

(C) extract new system requirements from the models;

(D) create models to communicate engineering design solutions to stakeholders for a project;

(E) discuss conservation principles of energy, matter, and motion; and

(F) apply conservation principles throughout the system model.

(10) Design space modeling. The student models conceptual design spaces using morphological matrices. The student is expected to:

(A) select the key requirements for the problem;

(B) generate multiple means to address each key requirement to populate a morphological matrix;

(C) generate multiple integrated solutions by selecting means from each requirement for further modeling and refinement; and

(D) calculate the total number of possible solutions captured in the generated morphological matrix.

(11) Concept generation. The student generates multiple systematic concepts using appropriate ideation tools. The student is expected to:

(A) explain the rules of ideation tools such as brainstorming, 6-3-5, Gallery Method, C-Sketch, and concept mapping;

(B) apply ideation tools to generate multiple concepts for a problem; and

(C) compare the ideation tools based on the rules, number of people, representation, and purpose.

(12) Concept pruning. The student prunes sets of concepts using design tools such as decision matrices, pair-wise comparison, and pro-con lists. The student is expected to:

(A) use and explain absolute or relative decision matrices to prune a set of concepts;

(B) use and explain pair-wise comparisons to prune a set of concepts;

(C) use and explain pro-con lists to prune a set of concepts;

(D) explain why it is important to use multiple pruning tools in design; and

(E) explain why the pruning tools are not for selecting concepts.

(13) Prototyping and testing. The student fabricates multiple physical prototypes ranging from parts to subsystems to final integrated prototypes to gather information needed to support mechanical engineering design decision making. The student is expected to:

(A) develop prototyping proposals that include cost, time, and effort estimates; desired information; and testing plans;

(B) use appropriate tools and materials to fabricate prototypes;

(C) evaluate and execute testing plans for each prototype to gather information or check requirement satisfaction;

(D) extract and document new requirements from prototyping and testing; and

(E) justify the purpose for each physical or virtual model constructed against the cost of making the model.

(14) Embodiment and refinement. The student refines design solutions by selecting and sizing components appropriately. Students justify material choices based on the requirements defined. The student is expected to:

(A) construct geometric models and drawings to represent designed system;

(B) justify and use appropriate analytical and simulation tools to correlate the changes in parameters of the models with changes in the performance of the modeled system;

(C) justify design decisions using requirements such as functionality, cost, performance, or time;

(D) use appropriate tools and materials to fabricate a final prototype;

(E) develop final product documents such as bill of materials, assembly models, user manual, and assembly instructions; and

(F) explain the evolution of requirements between earlier and final prototypes.

(15) Solution validation. The student tests and verifies requirements throughout the project. The student understands the importance of discovering new requirements through testing and simulation. The student is expected to:

(A) analyze information gained from testing and simulation to document new or refined requirements;

(B) document simulations or tests using an appropriate report template;

(C) design and execute simulations or tests to validate functional requirements are met;

(D) explain why engineering design processes are iterative; and

(E) discuss how continuous improvement and design iteration are related.

(16) Budget. The student plans, monitors, and updates project budgets throughout the design project. The student is expected to:

(A) create budgets for initial project costs such as raw materials, purchased parts, salvaged parts, hardware, taxes, shipping, and handling categories;

(B) create a Bill of Materials cost report for the final build;

(C) compare and explain any differences between the final product build cost and the project budget;

(D) monitor and update the project budget throughout the duration of the project;

(E) prepare budget status reports that include explanations of spenddown rates and changes to the budget; and

(F) explain the importance of budget tracking in design projects.

§127.413. Aerospace Design I (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I [~~and at least one credit in a course from the Engineering Career Cluster~~] . Recommended corequisite: Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Aerospace Design I demonstrate knowledge and skills associated with the design evolution and emerging trends of aircraft and aerospace systems. Fundamental concepts such as forces of flight, structures, aerodynamics, propulsion, stability and control, and orbital mechanics are introduced as related to design decisions for atmospheric and space flight. These concepts are related to mission requirements and solution approaches.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student discusses ethics pertaining to engineering. The student is expected to identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying.

(2) The student understands that there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:

(A) explain the importance of defining an engineering problem as an initial step in the engineering design process;

(B) describe the research stage of the engineering design process;

(C) define ideation and conceptualization and discuss the role these processes play in innovation and problem solving;

(D) explain the processes of selecting an idea or concept for detailed prototype design, development, and testing;

(E) describe the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;

(F) describe the process of relevant experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;

(G) explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and

(H) describe the purpose of effective communication of the engineering solution as obtained through the engineering design process to various audiences.

(3) The student explores and develops skills to solve problems, make decisions, and manage a project. The student is expected to:

(A) discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;

(B) identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;

(C) define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;

(D) identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and

(E) identify strategies to solve problems and describe how problem solving is utilized to accomplish personal and team objectives.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

[~~(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:~~]

[~~(A) describe and implement the stages of an engineering design process to construct a model;~~]

[~~(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;~~]

[~~(C) explain how stakeholders impact an engineering design process; and~~]

[~~(D) analyze how failure is often an essential component of the engineering design process.~~]

[~~(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:~~]

[~~(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;~~]

[~~(B) explain the roles and responsibilities of team members, including project managers and leads;~~]

[~~(C) research and evaluate methods and tools available for managing a project;~~]

[~~(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;~~]

[~~(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;~~]

[~~(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and~~]

[~~(G) describe the importance of management of change (MOC) and how MOC applies to project planning~~.]

(4) Collaboration. The student engages in multiple team projects and activities. The student is expected to:

(A) discuss principles of critique such as describing, analyzing, interpreting, and evaluating;

(B) identify and demonstrate teamwork skills such as sensemaking where a team member recognizes another team member who requires additional clarity and then addresses the team member by providing clarity;

(C) identify methods for structuring projects such as Gantt charts, work breakdown structure, Agile, and critical path method; and

(D) discuss the importance of contributing to positive and productive group dynamics to enhance teamwork.

(5) Documentation. The student documents information and interpretation developed throughout engineering processes. The student is expected to:

(A) use professional standards and templates to generate documents such as executive summaries, test reports, failure documents, system black box models, engineering notebooks, and drawing packages;

(B) select the document format to communicate essential information for identified stakeholders; and

(C) explain and justify the structure and sequence of how the information is presented in the engineering documents.

(6) History of flight. The student understands the history and evolution of human flight, including flight within and outside the Earth's atmosphere. The student is expected to:

(A) identify and discuss successes and failures in human efforts to fly prior to powered flight;

(B) research and discuss innovations in aircraft prior to the jet age and explain how world events impacted these innovations;

(C) research and discuss innovations in aircraft after the beginning of the jet age and explain how world events impacted these innovations;

(D) research and discuss innovations in rockets prior to human spaceflight and explain how world events impacted these innovations;

(E) research and discuss innovations in rockets after the first human spaceflight and explain how world events impacted these innovations; and

(F) discuss the history of regulation of aircraft and the role of the Federal Aviation Administration (FAA).

(7) Introduction to aircraft. The student explains the FAA categories for aircraft and categorizes the different types of aircraft such as airplanes, rotorcraft, lighter-than-air or aerostats, glider, powered-lift, powered parachutes, weight-shift aircraft, ground-effect vehicles (GEV), air-cushion vehicles (ACV), and rockets. The student is expected to:

(A) identify and describe classes of aircraft such as single-engine land (SEL), gyroplane, powered-lift, and glider using the FAA categories;

(B) categorize aircraft by attributes such as piston engine, turboprop, powered or unpowered, and drones or piloted;

(C) compare aircraft categories and use cases for each category; and

(D) research and discuss emerging trends in aircraft such as airships, rotary powered aircraft, and alternative energy powered aircraft.

(8) Atmospheric flight. The student identifies and relates the three axes of an aircraft, the four forces of flight, and the components used for stability and control of the aircraft. The student is expected to:

(A) explain the relationships between atmospheric temperature, pressure, density, and altitude;

(B) identify and describe the motion about the three axes of an aircraft, including yaw, pitch, and roll;

(C) identify and describe ways to control motion about the three axes;

(D) identify and explain the four forces acting on aerospace vehicles in flight, including lift, drag, thrust, and weight;

(E) explain the relationship between weight, mass, gravity, and acceleration and identify their corresponding units such as pounds-force, pound-mass, kilogram, and Newton;

(F) discuss the difference between g-force and weight;

(G) draw the forces of flight for a straight and level flight and a level banked turn;

(H) identify different ways to control the forces that change the pitch, roll, and yaw of an aircraft;

(I) identify and explain the major fixed and movable components of various aircraft to enable stability and control within the atmosphere; and

(J) define and discuss aerodynamics as a subset of aerospace.

(9) Lift and drag. The student explains how lift and drag are generated by an aircraft and how they change during flight. The student is expected to:

(A) explain how an airfoil generates lift;

(B) explain how the angle of attack (AoA) influences lift;

(C) explain how to interpret a "Lift Coefficient (CL) versus AoA" chart;

(D) define and discuss stall for an airfoil;

(E) explain the types of drag, including profile/form, skin friction, interference, trim, and induced;

(F) explain how the AoA influences drag;

(G) explain how to interpret a "Drag Coefficient (CD) versus AoA" chart;

(H) explain how changes in drag during flight impact performance such as range, altitude, and power requirements;

(I) define and discuss Lift-to-Drag (L/D) ratio;

(J) explain how to interpret an L/D chart;

(K) identify the maximum L/D ratio from a chart to determine the optimal glide speed for maximum range;

(L) research and discuss other systems that use airfoils such as windmills, fans, and propelling aircraft; and

(M) explain how a plane can fly without engine power and in some cases can gain altitude to stay aloft for extended time and distance.

(10) Weight and balance. The student recognizes that components have mass, weight, and location resulting in moments that are balanced by control surfaces. The student is expected to:

(A) identify and calculate moments created by the forces of flight;

(B) define and discuss center of gravity (CG);

(C) define and discuss center of pressure (CP);

(D) explain how the locations of the CP and CG influence the stability of an aircraft; and

(E) create a model of an aircraft with variable configurations for CG and CP to determine stability of an aircraft.

(11) Computerized design tools. The student understands that computerized technology is available for design and analysis. The student is expected to:

(A) identify engineering computational tools such as computer-aided design (CAD), finite element analysis (FEA), or computational fluid dynamics (CFD); and

(B) explain the applications of engineering computational tools used in aerospace [~~mechanical~~] design.

(12) Mission requirements. The student understands how mission requirements influence the type and form of aircraft. The student is expected to:

(A) analyze a mission to generate a list of atmospheric mission requirements such as payload, range, cruise, take-off length, landing length, climb gradient, altitude, and land or sea;

(B) analyze a mission to generate a list of space mission requirements such as payload, altitude, vibration sensitivity, launch conditions, environmental conditions, and recovery;

(C) explain how the mission requirements are interrelated;

(D) discuss how the mission requirements relate to the aircraft and spacecraft categories;

(E) discuss how mission requirements relate to the overall aircraft design; and

(F) interpret a mission profile and explain how it impacts mission requirements.

(13) Propulsion. The student explains and evaluates different types of propulsion systems such as piston engine, turboprop, jet, and rocket. The student is expected to:

(A) identify and explain how a piston powered aircraft delivers thrust with respect to altitude limits and speed limitations;

(B) identify and explain how a turboprop powered aircraft delivers thrust with respect to design requirements such as cost, operation cost, reliability, power, altitude limits, and speed limitations;

(C) identify and explain how a jet powered aircraft delivers thrust with respect to design requirements such as cost, operation cost, reliability, power, altitude limits, and speed limitations;

(D) explore and explain how a rocket engine is different from a jet engine;

(E) research and discuss the applications for solid-fuel rockets; and

(F) research and discuss the applications for liquid-fuel rockets.

(14) Material selection. The student explains why a particular material is used in an aircraft application, taking into account cost, density, strength, and mission requirements. The student is expected to:

(A) research and discuss material classes used in aerospace design such as woods, composites, metals, and plastics;

(B) explain why specific materials might have been chosen for components on different aircraft;

(C) discuss methods for manufacturing aircraft components such as landing gears, wings, fuselage, or canopies;

(D) explain the impact of material and manufacturing costs on design decisions; and

(E) explain how material requirements relate to mission requirements.

(15) Aerospace structures. The student explains and compares and contrasts types of structures such as truss, semi-monocoque, monocoque. The student is expected to:

(A) identify and discuss truss, semi-monocoque, and monocoque structures;

(B) explain why different structure types are used in various aircraft categories;

(C) discuss how mission requirements impact the selection of the structural types for an aircraft;

(D) identify structural components in the fuselage such as stringers, bulkheads, and skin;

(E) identify structural components in the wings and empennage such as ribs, spars, stringers, and skin; and

(F) compare structures used in atmospheric flight and space flight.

(16) Space flight and orbital mechanics. The student knows properties of orbital mechanics as they relate to space flight and the impact of the space environment on design. The student is expected to:

(A) identify and describe orbits based on the six Keplerian Elements;

(B) explain how changes in Keplerian Elements change the orbit;

(C) explain how mission requirements determine specific orbit types;

(D) describe the unique environmental conditions of operating in space for human or autonomous missions;

(E) research and discuss methods to reach and recover a spacecraft from space; and

(F) research and discuss emerging trends in space flight.

(17) Alternate applications for aerospace design. The student examines alternate applications for aerospace design in various industries, including the automotive, naval, and other commercial industries. The student is expected to:

(A) research and discuss how aerospace engineers contribute to automotive and naval applications to improve performance;

(B) research and identify commercial applications for aerospace design such as heating and cooling systems, building design, and wind turbines; and

(C) identify and discuss items at home that are impacted by aerodynamics such as fans, convection ovens, and heating and cooling systems.

(18) Aircraft systems. The student explores and discusses other aircraft systems such as navigation, communication, entertainment, flight control, actuation, energy storage and management, and propulsion. The student is expected to:

(A) explain basic functionality for aircraft systems such as navigation, communication, entertainment, flight control, and propulsion; and

(B) research and discuss different implementations for aircraft systems such as navigation, communication, entertainment, flight control, and propulsion.

§127.414. Aerospace Design II (Two Credits) [~~Credit~~] , Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Geometry and Aerospace Design I. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Aerospace Design II demonstrate knowledge and skills associated with the design and prototyping of aerospace systems. Through aerospace projects, students apply fundamental concepts such as managing an engineering project to meet mission requirements, prototyping, testing, and validating requirements. Students explore choices made for propulsion, material, and structural design as well as various ways aircraft can navigate. Emphasis is placed on team collaboration and professional documentation.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(4) Collaboration. The student engages in multiple team projects and activities. The student is expected to:

(A) explain and apply sensemaking skills such as recognizing team members who require additional clarity and addressing team members to provide clarity;

(B) apply methods such as Gantt charts, work breakdown structure, Agile, and critical path method to structure a project;

(C) apply principles of critique within the team such as describing, analyzing, interpreting, and evaluating;

(D) develop and present action plans to positively support the team's work relationships;

(E) explain and model how to provide an effective critique of team members on topics such as team performance, test performance, project development, or presentation;

(F) explain and model how to provide an effective critique of other teams on topics such as presentation, problem definition, schedule, and solution justification;

(G) analyze and evaluate critique received from team members and other teams; and

(H) develop a design review presentation to provide status and solicit feedback on the design problem and solution.

(5) Documentation. The student documents information and interpretation developed throughout engineering processes. The student is expected to:

(A) generate documents such as executive summaries, reverse engineering forms, test reports, failure documents, system black box models, engineering notebooks, and drawing packages by applying professional standards and templates;

(B) select the appropriate document format for the information being communicated based on the audience;

(C) explain and justify the structure and sequence of how the information is presented in the engineering documents;

(D) create assembly and user manuals for peer review; and

(E) generate a final design report that focuses on the project scope and solution with appendices to capture all relevant design information such as the design process used, requirements compliance matrix, concept reports, and test reports.

(6) Designing to mission requirements. The student generates conceptual aircraft solutions to meet a set of given requirements. The student is expected to:

(A) analyze given mission requirements such as altitude, speed, and payload to derive sub-requirements;

(B) generate and document additional sub-requirements for the mission considering various factors such as maintainability, producibility, operational cost, and safety;

(C) generate and document conceptual aircraft solutions to address mission and sub-requirements;

(D) classify the generated conceptual aircraft solutions into appropriate categories such as single-engine land (SEL), gyroplane, powered-lift, and glider using the Federal Aviation Agency (FAA) classification system;

(E) select, justify, and document a conceptual solution that addresses the mission and sub-requirements; and

(F) create a model such as a graph or matrix that displays the relationships between the documented requirements.

(7) Managing aerospace engineering projects. The student applies project management techniques to aerospace projects. The student is expected to:

(A) generate a project plan that includes time, deliverable, and cost estimates;

(B) review and update periodically a project plan according to a stage gate process;

(C) document and execute test plans to evaluate prototypes against requirements;

(D) justify and present design choices through periodic design reviews; and

(E) generate a final design report with an executive summary, a body with problem and solution descriptions, and appendices with additional relevant information such as the design process used, requirements compliance matrix, concept reports, and test reports.

(8) Prototyping aerospace vehicles. The student creates a prototype to address a set of mission requirements. The student is expected to:

(A) generate a list of design parameters based on the mission and sub-requirements;

(B) generate and document design concepts to address design parameters;

(C) use appropriate tools such as decision matrices, pro-con lists, and pair-wise comparison to evaluate, downselect, and justify design concepts to prototype;

(D) create and document prototypes to test, validate, and modify design concepts;

(E) use appropriate tools such as decision matrices, pro-con lists, and pair-wise comparison to evaluate, downselect, and justify a prototype to develop as the solution;

(F) evaluate a prototype to identify areas of improvement for iteration;

(G) test, evaluate, and document performance of the revised prototype in meeting project requirements; and

(H) compose and present a project debrief, including lessons learned.

(9) Atmospheric flight. The student relates the three axes of an aircraft, the four forces of flight, and the components used for stability and control. The student is expected to:

(A) research and discuss ways to control motion about the three axes;

(B) calculate and explain changes in motion due to the four forces acting on aircraft during flight;

(C) explain why loads acting on aircraft change during different flight scenarios;

(D) draw and calculate the forces of flight for a straight and level flight and a level banked turn; and

(E) describe which aircraft components control and provide stability with respect to the six degrees of freedom.

(10) Lift and drag. The student explains how lift and drag are generated by an aircraft and how they change during flight. The student is expected to:

(A) explain the lift equation and illustrate the relationships between its variables;

(B) explain the drag equation and illustrate the relationships between its variables;

(C) calculate the changes to lift and drag based on changes to atmospheric conditions such as temperature, density, and pressure;

(D) describe how aircraft control surfaces, including leading edge flaps, trailing edge flaps, ailerons, and spoilers, influence lift;

(E) describe how aircraft control surfaces, including leading edge flaps, trailing edge flaps, ailerons, and spoilers, influence drag;

(F) define and discuss how the stall angle and stall speed can be changed; and

(G) research and present contemporary developments reducing drag such as winglets, boundary layer control, and surface effects.

(11) Weight and balance. The student recognizes that components have mass, weight, and location resulting in moments that are balanced by control surfaces. The student is expected to:

(A) calculate an aircraft's estimated center of gravity throughout a mission profile considering factors such as fuel consumption, payload, and passengers;

(B) estimate the location of an aircraft's center of pressure;

(C) calculate the static margin throughout a flight profile to verify positive stability margin;

(D) generate and document solutions to improve positive static stability in the event of a negative stability margin; and

(E) revise and document static margin calculations reflecting proposed solutions.

(12) Propulsion. The student evaluates various propulsion solutions to downselect the solutions to meet mission requirements. The student is expected to:

(A) evaluate and select a propulsion solution that meets requirements such as piston, jet, turboprop, and rocket;

(B) evaluate and select the number of engines to meet mission and sub-requirements; and

(C) calculate propulsion weight of the selected solution to meet mission and sub-requirements.

(13) Material selection. The student evaluates various materials to meet mission and sub-requirements. The student is expected to:

(A) analyze component material requirements to select materials that meets mission and sub-requirements; and

(B) document the justification for the materials selected to meet component requirements.

(14) Aerospace structures. The student evaluates and selects structure types to meet mission and sub-requirements. The student is expected to:

(A) analyze structural requirements to select structure types that meets mission and sub-requirements; and

(B) document the justification for the structure types selected to meet structural requirements.

(15) Navigation. The student defines and explains types of navigation used for flight. The student is expected to:

(A) explain dead reckoning navigation using an aeronautical chart, compass, clock, and airspeed indicator;

(B) explain navigation using radio radials such as Automatic Direction Finder (ADF) and VHF Omnidirectional Range (VOR);

(C) explain navigation using an Inertial Navigation System (INS); and

(D) explain navigation using Global Positioning Systems (GPS).

§127.415. Civil Engineering I (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. Prerequisite: Algebra I and Introduction to Computer-Aided Design and Drafting or Principles of Applied Engineering. Recommended prerequisite: Geometry. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students in Civil Engineering I are introduced to the basic principles and practices essential to the field of civil engineering. Throughout this course students investigate different career paths in civil engineering, explore the various specializations within the field, and understand the phases and life cycle of civil engineering projects. They also delve into the functional mathematics crucial to the profession. Additionally, the course emphasizes the importance of effective project document structure and project management, ethical considerations, and the impact of civil engineering on the natural and built environment.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) explain the importance of dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) describe teamwork, group dynamics, and conflict resolution and how they can impact the collective outcome;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences;~~]

[~~(D) identify time management skills such as prioritizing tasks, following schedules, and tending to goal relevant activities and how these practices optimize efficiency and results;~~]

[~~(E) define work ethic and discuss the characteristics of a positive work ethic, including punctuality, dependability, reliability, and responsibility for reporting for duty and performing assigned tasks;~~]

[~~(F) identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) discuss the importance of safety in the workplace and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(K) describe the roles and responsibilities of managers.~~]

(1) [~~(2)~~] The student understands that there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:

(A) explain the importance of defining an engineering problem as an initial step in the engineering design process;

(B) describe the research stage of the engineering design process;

(C) define ideation and conceptualization and discuss the role these processes play in innovation and problem solving;

(D) explain the processes of selecting an idea or concept for detailed prototype design, development, and testing;

(E) describe the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;

(F) describe the process of relevant experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;

(G) explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and

(H) describe the purpose of effective communication of the engineering solution as obtained through the engineering design process to various audiences.

(2) [~~(3)~~] Students explore and develop skills to solve problems, make decisions, and manage a project. The student is expected to:

(A) discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;

(B) identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;

(C) define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;

(D) identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and

(E) identify strategies to solve problems and describe how problem solving is utilized to accomplish personal and team objectives.

(3) [~~(4)~~] The student understands the foundations of occupational safety and health. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations, how OSHA inspections are conducted, and the role of national and state regulatory entities;

(C) explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(D) identify and explain the appropriate use of types of personal protective equipment used in industry;

(E) discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(F) describe types of electrical hazards in the workplace and the risks associated with these hazards and describe control methods to prevent electrical hazards in the workplace;

(G) analyze the hazards of handling, storing, using, and transporting hazardous materials and identify and discuss ways to reduce exposure to hazardous materials in the workplace;

(H) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace;

(I) describe the elements of a safety and health program, including management leadership, worker participation, and education and training;

(J) explain the purpose and importance of written emergency action plans and fire protection plans and describe key components of each such as evacuation plans and emergency exit routes, list of fire hazards, and identification of emergency personnel;

(K) explain the components of a hazard communication program; and

(L) explain and give examples of safety and health training requirements specified by standard setting organizations.

(4) [~~(5)~~] The student investigates different career paths in civil engineering. The student is expected to:

(A) explain the licensing requirements for an engineer in training and a professional engineer;

(B) identify various career options related to civil engineering such as surveyors, architects, construction contractors, urban and regional planners, inspectors, and regulators;

(C) identify and explain the requirements to obtain professional credentials such as certified flood plain manager (CFM), project management professional (PMP), professional engineer (PE), Autodesk certifications, SolidWorks certifications, certified surveying technician (CST), registered professional land surveyor (RPLS), certified quality engineer (CQE), and certified quality inspector (CQI) associated with civil engineering; and

(D) describe sub-disciplines within civil engineering, including water resources, environmental, geotechnical, structural, transportation, material sciences, coastal, land development, urban development, and infrastructure.

(5) [~~(6)~~] The student examines the functional mathematics used in civil engineering. The student is expected to:

(A) calculate the mean, median, and mode of a given data set;

(B) calculate the standard deviation of a given data set;

(C) identify parts of a normal distribution curve;

(D) define the Empirical Rule and analyze the distribution of a data set using the Empirical Rule;

(E) define systematic, gross, and random error;

(F) define accuracy and precision in a data set;

(G) analyze the accuracy and precision of a data set;

(H) identify the types and properties of various polygons;

(I) solve for the parts of a triangle using the Pythagorean theorem, the law of sines, and the law of cosines;

(J) identify the properties of circles;

(K) solve for the measurements of a circle, including diameter, radius, circumference, area, chord, arclength, delta, and tangent;

(L) solve linear functions on a Cartesian Coordinate System using standard form, slope-intercept form, point-slope form, and the distance between two points; and

(M) calculate the volumes of three-dimensional shapes such as cylinders, spheres, and trapezoidal and triangular prisms.

(6) [~~(7)~~] The student understands methods of measurement and associated errors. The student is expected to:

(A) define units of linear measurement, including U.S. survey feet, international feet, chains, rods, miles, fathoms, furlongs, varas, and other metric units commonly used in the surveying and civil engineering industry;

(B) define the different units of angular measurement, including vertical angles, horizontal angles, bearings, azimuths, degrees-minutes-seconds, decimal degrees, seconds of arc, and gradians;

(C) define the different units of volumetric measurement, including cubic feet, cubic yards, tons, and acre-feet;

(D) calculate and define area measurements such as acre, hectare, square feet, square mile, league, or sitio;

(E) convert linear, angular, and area measurements between different units;

(F) determine a change in elevation between two or more points by performing a differential level loop;

(G) measure the distance between two points on a plane using methods such as taping, electronic distance meter, total station, pacing, odometer, tacheometry, and stadia;

(H) compare the errors from two or more methods of calculating distance between two points such as comparing pacing and taping; and

(I) identify and analyze various types of errors associated with survey data.

(7) [~~(8)~~] The student researches civil engineering throughout history. The student is expected to:

(A) describe the significance and development of historic civil engineering projects such as the Panama Canal, Roman aqueducts, and Hadrian's wall;

(B) describe the significance and development of a major Texas civil engineering project; and

(C) describe the significance and development of a major U.S. civil engineering project.

(8) [~~(9)~~] The student understands a civil engineering project life cycle. The student is expected to:

(A) explain the civil engineering project conception, scope, proposal, contract, design planning and development, construction documents, bid and specifications, construction, and closeout phase; and

(B) identify and sequence the phases of a project life cycle.

(9) [~~(10)~~] The student understands and develops a civil engineering project scope of work and proposal. The student is expected to:

(A) identify and describe the importance of potential components in a feasibility report, including soil analysis, existing land entitlements, existing topography, federal

emergency management agency (FEMA) floodplain location and elevation, existing utility and locations, environmental studies, and adjacent rights-of-way;

(B) identify and quantify costs and benefits associated with a proposed civil engineering project, including initial investments, operational expenses, and anticipated returns;

(C) conduct a cost-benefit analysis for a small civil engineering project;

(D) identify common risks associated with civil engineering projects, including technical, financial, environmental, and regulatory risks;

(E) describe methodologies for conducting risk analysis such as probability assessment, impact analysis, and risk prioritization;

(F) develop a feasibility report for a small civil engineering project;

(G) explain the purpose of a request for qualifications (RFQ);

(H) evaluate RFQs based on a project's scope;

(I) identify relevant codes and regulations impacting civil engineering projects;

(J) define the fundamental components of a scope of work document, including project description, stakeholders, objectives, deliverables, scope exclusions, milestones, schedule, and signature block; and

(K) develop a scope of work document for a small civil engineering project.

(10) [~~(11)~~] The student understands and develops the components of civil engineering designs. The student is expected to:

(A) identify various conceptual schematic design drawings, sketches, and diagrams that explore design solutions and communicate design concepts;

(B) generate a conceptual schematic design drawing, sketch, or diagram that effectively communicates a design concept;

(C) explain the purpose and application of common civil engineering calculations such as superelevation, flow line, beam analysis, cost amortization, materials testing, plasticity index, and differential leveling;

(D) evaluate engineering plans and specifications using quality control and quality assurance (QCQA) processes; and

(E) prepare a design quantity take-off and estimate of probable construction cost.

(11) [~~(12)~~] The student researches the use and application of technology in civil engineering. The student is expected to:

(A) identify the tools and technology used in civil engineering throughout history such as abacus, compass, scale, measuring tape, slide rule, calculator, computer-aided drafting and design, level, auto-level, grade rod, plumb bob, transit, theodolite, total station, GPS, lidar, and drones;

(B) explain the evolution of technology used in civil engineering; and

(C) explain the uses of design analysis and computer-aided drafting software.

(12) [~~(13)~~] The student understands and researches the components of project closeout processes. The student is expected to:

(A) identify the main stakeholders involved in final inspections such as owner, utility provider(s), designer(s), contractors, municipalities, and regulatory agencies;

(B) develop a punch list that is organized by trade, area, or priority and identifies deficiencies in a substantially completed project; and

(C) evaluate the completed project to identify project successes and deficiencies.

(13) [~~(14)~~] The student understands and navigates civil engineering construction documents. The student is expected to:

(A) identify the sections of a construction document set, including plat, existing conditions, site plan, fire protection plan, dimensional control plan, grading plan, drainage plan, utility plan, paving plan, erosion control plan, and project detail sheets;

(B) research and describe the purpose of a fire protection plan;

(C) describe the components of a paving plan, including pavement sections, material types, and design details;

(D) identify and locate construction specification documents relevant to a given project;

(E) explain and locate the fundamental components of a construction document's legend, including symbols, line types, and typical abbreviations;

(F) explain the process of drafting a construction document to scale;

(G) determine and demonstrate which scale best fits a standard size drawing sheet;

(H) explain the relationship between a construction document's specifications, plans, legend, and scale; and

(I) identify and explain the differences between design drawings and record drawings.

(14) [~~(15)~~] The student applies best practices for effective project document structure and management. The student is expected to:

(A) explain the significance of systematic organizational structure for project documents;

(B) develop a systematic organizational structure for project documents that considers factors such as project phase, discipline, and document type;

(C) develop a consistent naming convention for project documents; and

(D) implement and maintain a uniform naming convention for project documents.

(15) [~~(16)~~] The student describes and exhibits characteristics that lead to a successful civil engineering team. The student is expected to:

(A) research and describe time management techniques such as using Gantt charts, schedules, critical paths, and man-power projections for project management;

(B) demonstrate effective communication skills in written and oral formats to facilitate collaboration in a project team; and

(C) explain how project team dynamics impact project outcomes and member morale.

(16) [~~(17)~~] The student researches and describes ethics pertaining to civil engineering. The student is expected to:

(A) research and identify the fundamental engineering ethics established by the Texas Board of Professional Engineers and Land Surveyors [~~and other professional organizations such as American Society of Civil Engineers, the National Society of Professional Engineers, the National Council of Examiners for Engineering and Surveying, and the National Institute of Engineering Ethics~~] ; and

(B) analyze root causes and lessons learned from historical examples or case studies involving ethical misconduct in civil engineering projects.

(17) [~~(18)~~] The student explores the impact of engineering in the natural world and built environment. The student is expected to:

(A) describe the potential impacts, costs, and benefits of sustainable practices on local and global communities, environments, and economies;

(B) apply cost-benefit analysis to [~~describe~~] sustainability standards used throughout the project life cycle to evaluate their economic, environmental, and social trade-offs ;

(C) describe governmental agencies that regulate environmental impact at the federal, state, and local level;

(D) describe the potential impacts of construction on the natural world, including flora, fauna, groundwater, surface water, soil, Earth's atmosphere, air quality, and waterways; and

(E) describe methods used by engineers to mitigate and remediate the effects of construction on the natural world.

(18) [~~(19)~~] The student understands the methods environmental engineers use to supply water, dispose of waste, and control pollution. The student is expected to:

(A) describe methods of population projection for sizing water and wastewater facilities;

(B) describe water quality standards using prescribed units of measure;

(C) research and explain regulations for water quantity design requirements by jurisdiction;

(D) research and explain regulations for wastewater quantity design requirements by jurisdiction;

(E) research and describe methods of water and wastewater treatment;

(F) research and describe methods of solid waste management;

(G) research and describe methods of controlling hazardous waste; and

(H) research and describe methods of measuring and managing air quality.

§127.416. Civil Engineering II (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Geometry and Civil Engineering I. Recommended prerequisite: Introduction to Computer-Aided Design and Drafting. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students in Civil Engineering II apply the principles and practices essential to various subdisciplines within civil engineering. Throughout this course, students develop knowledge and skills essential to the design development and construction of a civil engineering project. The students explore the impacts and constraints on the design of a project. They also delve into the functional mathematics crucial to the profession. Additionally, the course emphasizes the

importance of effective project document structure and project management, ethical considerations, and the impact of civil engineering on the natural and built environment.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers;~~]

[~~(K) identify the components of a safety plan and why a safety plan is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(1) [~~(2)~~] The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(2) [~~(3)~~] The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(3) [~~(4)~~] The student recognizes project stakeholders and industry organizations in civil engineering. The student is expected to:

(A) describe the roles and objectives of project stakeholders, including engineer, owner, architect, contractor, subcontractors, project manager, end users, regulatory agencies, and the public; and

(B) describe the mission and membership benefits of industry organizations such as the American Society of Civil Engineers, the National Society of Professional Engineers, and the Society of Women Engineers.

(4) [~~(5)~~] The student explores various disciplines within civil engineering. The student is expected to:

(A) describe the essential technical knowledge and functions in a variety of civil engineering subdisciplines, including environmental, geotechnical, transportation, structural, water resources, and construction;

(B) explain how different types of projects within civil engineering subdisciplines, including public works, transportation, urban development, water resources, and utility projects, impact the built environment; and

(C) identify and describe types of civil engineering projects.

(5) [~~(6)~~] The student explores how codes, regulations, and plats impact a civil engineering project. The student is expected to:

(A) research and describe regulations established by the American Disabilities Act relevant to site design;

(B) identify local codes and regulations for a civil engineering project;

(C) describe the potential impacts of local codes and regulations on civil engineering projects; and

(D) describe the purpose of a plat and easements for a civil engineering project.

(6) [~~(7)~~] The student develops a proposal for a civil engineering project such as a park, a parking lot, or a storm drain. The student is expected to:

(A) analyze or develop a feasibility report for a civil engineering project;

(B) develop and analyze the scope of work document for a civil engineering project;

(C) calculate monetary value for engineering efforts on a given project;

(D) revise and archive the draft project proposal for scope of work changes;

(E) develop a client deliverable package that contains a fee proposal, project schedule, organizational chart, exclusions, and an engineering contract;

(F) communicate effectively a final proposal for a civil engineering project; and

(G) identify and evaluate lessons learned from the project proposal process.

(7) [~~(8)~~] The student develops a civil engineering project schedule. The student is expected to:

(A) identify and prioritize project tasks to determine the critical path of a project;

(B) create a project critical path diagram;

(C) evaluate project tasks and the critical path to develop a project schedule;

(D) create a Gantt chart for all the project activities in a project; and

(E) assess a project schedule for opportunities to improve project efficiencies.

(8) [~~(9)~~] The student develops a civil engineering design for a project site. The student is expected to:

(A) create a concept site plan using existing schematics, survey data, and regulatory design manuals;

(B) identify existing and proposed utility providers, including electric, water, sewer, gas, and telecommunications providers, at a project site;

(C) research and identify existing plats and easements for a project site; and

(D) revise and finalize a project site plan to reflect analyzed site data, including utilities, geotechnical, right-of-way, water resources, environmental, survey, and transportation data.

(9) [~~(10)~~] The student explores concepts and calculations for storm water events used by water resources engineers. The student is expected to:

(A) describe storm event probability based on historical models;

(B) describe methods used, including Rational method, Natural Resources Conservation Service (NRCS), Soil Conservation Service (SCS), and unit hydrograph, to calculate flow rate;

(C) analyze existing topography at the project site to determine drainage patterns;

(D) delineate existing and proposed drainage areas impacting a project site to determine the change in stormwater runoff generated by a project design;

(E) research and describe methods of stormwater mitigation and water quality treatment;

(F) calculate the existing flow rates for a 5-year and a 100-year storm event for a project site using the Rational method;

(G) analyze and calculate the proposed flow rates for a 5-year and a 100-year storm event for a project design;

(H) determine the required stormwater remediation techniques for a 100-year storm event by comparing existing and proposed runoff quantities;

(I) describe methods of stormwater conveyance, including channel, culvert, and pipe;

(J) calculate the hydraulics of a stormwater conveyance using the continuity equation, energy equation, and Bernoulli's equation;

(K) design a conveyance system such as a pipe, culvert, or open channel to convey stormwater runoff for a 100-year storm event using the calculated data;

(L) create a plan and profile sheet of a drainage system, including surface elevations, slopes, conveyance system dimensions, material, and pipe invert elevations; and

(M) describe potential impacts of a drainage analysis for a project.

(10) [~~(11)~~] The student explores concepts and calculations used by geotechnical engineers. The student is expected to:

(A) identify and explain the components of a geotechnical report, including boring samples and logs, soil types and classifications, pavement recommendations, foundations recommendations, and soil preparations;

(B) identify and determine the soil classifications at a project site using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS);

(C) calculate the plasticity index of soil from a project site;

(D) research and describe methods of soil preparation;

(E) research and explain how geotechnical results impact pavement recommendations used in civil engineering projects;

(F) research and select the most effective pavement section for a project; and

(G) describe the impact of a geotechnical analysis for a project.

(11) [~~(12)~~] The student explores concepts and calculations used by structural engineers. The student is expected to:

(A) identify and analyze the various types of building foundations, including raft, monolithic slab, slab on grade, pier and beam, spread footing, mat footing, drilled piers, pylons, waffle slab, and post-tension slab;

(B) describe the forces common to structural engineering calculations, including gravity, tension, compression, flexure, and torsion;

(C) describe the loads common to structural engineering calculations, including dead load, live load, environmental loads, and other loads such as lateral and concentrated loads;

(D) diagram and explain how applied loads and forces are resisted in a structure and transferred to the Earth;

(E) diagram a simply supported beam subjected to loading conditions to determine reaction forces;

(F) sketch diagrams to determine the maximum shear and moment resulting in the beam;

(G) identify the different types of trusses, including simple, planar, and space frame trusses;

(H) diagram a truss subjected to loading conditions to determine reaction forces and identify the zero force members;

(I) explain why design loads are dictated by building codes; and

(J) describe potential impacts of a structural analysis for a project.

(12) [~~(13)~~] The student explores concepts and calculations used by transportation engineers. The student is expected to:

(A) identify and describe various types of transportation engineering specializations such as rail, aviation, roadway, highway, and marine;

(B) research and explain the benefits of having a professional transportation engineering certification;

(C) research and explain the benefits of membership in a transportation engineering organization such as Institute for Transportation Engineers (ITE), American Society of Highway Engineers (ASHE), American Association of State Highway and Transportation Officials (AASHTO), and WTS International;

(D) determine stopping sight distance of a roadway given the design speed and grade;

(E) research and describe the impacts of transportation design elements, including grades, superelevation, design speed, friction factor, lane widths, vertical curves, horizontal curves, roadway classification, acceleration, and deceleration;

(F) analyze the level of service of a roadway to determine if operating conditions are adequate;

(G) identify and explain the components of a traffic impact analysis (TIA), including data collection summary, trip analysis, turn lane analysis, project phasing, and sight visibility analysis;

(H) research and identify methods of traffic data collection;

(I) collect and calculate traffic count data at a project site and analyze the results of the traffic count to determine peak hour trips and traffic mitigation;

(J) determine the peak hour trips generated by a given land use from a ITE Trip Generation Manual;

(K) research and describe traffic level of service for various roadways;

(L) determine if a turn lane is warranted based on peak hour trips and traffic volume; and

(M) describe potential impacts of a transportation analysis for a project.

(13) [~~(14)~~] The student develops construction documents for a civil engineering project. The student is expected to:

(A) develop project construction documents that includes design plans, specifications, and a cost estimate for a civil engineering project;

(B) develop the analysis reports for a civil engineering project;

(C) generate a demolition sheet that contains existing topography, property lines, easements, utilities, rights-of-way, drainage infrastructure, and structures, and identifies items to be demolished;

(D) develop a fire protection plan for a project;

(E) generate a paving plan that shows the limits and types of pavement necessary for a project;

(F) generate a site plan that labels proposed improvements for a project;

(G) generate a site dimensional control plan containing measurements for all site improvements for a project;

(H) generate a grading plan that documents proposed elevations and topography in comparison to existing topography for a project;

(I) generate drainage plans that document the existing drainage patterns, proposed drainage plan, and drainage infrastructure for a project;

(J) generate a utility plan that documents existing and proposed utility types, locations, and materials for a project;

(K) generate an erosion control plan that identifies erosion control best management practices (BMP) defined by the Texas Commission on Environmental Quality (TCEQ) for a project; and

(L) explain the importance of a quality control review and complete a quality control review of the construction documents of the project.

(14) [~~(15)~~] The student develops documents for support of the construction bid. The student is expected to:

(A) identify components of a bid tabulation, including item description, material quantity, unit measure, unit price, and total price;

(B) compare a project bid tabulation with corresponding construction documents to verify all items are included;

(C) create a project bid tabulation; and

(D) identify and compile the parts of civil engineering project manual.

(15) [~~(16)~~] The student works as an individual and a team member to complete projects. The student is expected to:

(A) track team goals to verify completion of project milestones;

(B) explain various methods to resolve conflict within a project team;

(C) explain how leadership impacts project outcomes and team members; and

(D) evaluate team member performance and effectiveness in a project.

(16) [~~(17)~~] The student researches and understands the code of ethics pertaining to civil engineering. The student is expected to:

(A) research and describe the impact of the State of Texas Engineering Practice Act [~~and Rules~~] ; and

(B) analyze and discuss ethical case studies using Texas Administrative Code, Title 22, Part 6, Chapter 137, Subchapter C (relating to Professional Conduct and Ethics).

(17) [~~(18)~~] The student understands the fundamental sustainable design approaches and practices in civil engineering projects. The student is expected to:

(A) research and describe sustainable building materials and methods;

(B) identify and explain the programs and certifications that establish design criteria for engineering projects such as Leadership in Energy and Environmental Design (LEED);

(C) explain how sustainable programs and certifications potentially impact the design elements and costs of a project;

(D) explain how design choices potentially impact human health, the environment, and the cost of a project; and

(E) explain how elements of the construction process potentially impact human health and the environment.

§127.417. Engineering Project Management (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I. Recommended prerequisite: English II. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Engineering Project Management develop cursory knowledge and essential skills to lead an engineering team through the development and construction of a project. Students assess project documentation for compliance with best management practices. They engage in project planning, risk management, team management, and stakeholder communication to ensure project completion, adherence to safety guidelines, and continuous improvement.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student discusses ethics pertaining to engineering. The student is expected to identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) explain the importance of dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) describe teamwork, group dynamics, and conflict resolution and how they can impact the collective outcome;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences;~~]

[~~(D) identify time management skills such as prioritizing tasks, following schedules, and tending to goal-relevant activities and how these practices optimize efficiency and results;~~]

[~~(E) define work ethic and discuss the characteristics of a positive work ethic, including punctuality, dependability, reliability, and responsibility for reporting for duty and performing assigned tasks;~~]

[~~(F) identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) discuss the importance of safety in the workplace and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(K) describe the roles and responsibilities of managers.~~]

(2) The student understands that there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:

(A) explain the importance of defining an engineering problem as an initial step in the engineering design process;

(B) describe the research stage of the engineering design process;

(C) define ideation and conceptualization and discuss the role these processes play in innovation and problem solving;

(D) explain the processes of selecting an idea or concept for detailed prototype design, development, and testing;

(E) describe the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;

(F) describe the process of relevant experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;

(G) explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and

(H) describe the purpose of effective communication of the engineering solution as obtained through the engineering design process to various audiences.

(3) The student explores and develops skills to solve problems, make decisions, and manage a project. The student is expected to:

(A) discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;

(B) identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;

(C) define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;

(D) identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and

(E) identify strategies to solve problems and describe how problem solving is utilized to accomplish personal and team objectives.

(4) The student understands the foundations of occupational safety and health. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations, how OSHA inspections are conducted, and the role of national and state regulatory entities;

(C) explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(D) identify and explain the appropriate use of types of personal protective equipment used in industry;

(E) discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(F) describe types of electrical hazards in the workplace and the risks associated with these hazards and describe control methods to prevent electrical hazards in the workplace;

(G) analyze the hazards of handling, storing, using, and transporting hazardous materials and identify and discuss ways to reduce exposure to hazardous materials in the workplace;

(H) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace;

(I) describe the elements of a safety and health program, including management leadership, worker participation, and education and training;

(J) explain the purpose and importance of written emergency action plans and fire protection plans and describe key components of each such as evacuation plans and emergency exit routes, list of fire hazards, and identification of emergency personnel;

(K) explain the components of a hazard communication program; and

(L) explain and give examples of safety and health training requirements specified by standard setting organizations.

(5) The student explores the methods and aspects of project management in relation to engineering projects. The student is expected to:

(A) identify and prioritize engineering tasks for an engineering project plan;

(B) identify and outline the critical path of a set of tasks in an engineering project;

(C) develop a project budget based on billable hours and engineering tasks in a project;

(D) track and maintain time spent on engineering tasks for a given project;

(E) generate a Gantt chart for an engineering project, including project tasks, time to complete tasks, critical path, and schedule of tasks;

(F) develop and implement a systematic folder structure for organizing project documents considering factors such as project phase, discipline, and document type;

(G) apply naming conventions consistently to all project documents to facilitate efficient identification and retrieval;

(H) research and describe best management practices such as quality control and quality assurance, risk management, and project management plan for an engineering project;

(I) evaluate an engineering project for adherence to local, state, and federal regulations;

(J) evaluate an engineering project for adherence to best management practices; and

(K) evaluate an engineering project for implementation of sustainable practices.

(6) The student explores processes involved in the construction phase of an engineering project. The student is expected to:

(A) identify parts of an engineering project manual associated with a construction bid, including bid schedule, bid tabulation, construction plan set, and material specifications;

(B) explain the bid process for a project, including timeline, value engineering, request for information (RFI), request for qualifications (RFQ), request for price (RFP), interview process, bid opening, bid evaluations, and bid award;

(C) develop a quantity take-off for an engineering project; and

(D) identify applicable materials based on the engineering project specifications to conduct a material quantity take-off.

(7) The student researches and identifies methods and divisions of project documentation. The student is expected to:

(A) compare shop drawings and construction documents to identify and rectify variances;

(B) identify and justify applicable material specifications for a given project;

(C) compile and organize material specifications to create a submittal log;

(D) analyze a construction drawing to develop applicable design questions and create an RFI document;

(E) identify and explain the permitting process for an engineering project;

(F) identify permitting stakeholders and explain stakeholder roles in the permitting process;

(G) identify permitting entities and create a permit request;

(H) identify and explain the purpose and parts of a change order for a project;

(I) develop a method of documentation to track project changes, including field changes, design changes, and change orders, and analyze cost and schedule impacts of project changes; and

(J) identify and draft applicable completion documents, including certificate of occupancy, temporary certificate of occupancy, field changes, as-built or plan of record documents, and engineer's certification of substantial completion.

(8) The student explores applicable federal, state, and local regulations as they pertain to engineering projects. The student is expected to:

(A) research federal regulatory agencies and describe the role federal regulatory agencies serve in relation to engineering projects such as the Environmental Protection Agency (EPA), Federal Aviation Administration (FAA), and Army Corps of Engineers;

(B) research state regulatory agencies such as the Texas Department of Transportation (TxDOT), Texas Commission on Environmental Quality (TCEQ), and the Texas Railroad Commission (TRC) and describe the role these agencies serve in relation to engineering projects;

(C) research local regulatory agencies such as cities and counties and describe the role local regulatory agencies serve in relation to engineering projects; and

(D) describe local codes and ordinances affecting construction and development activities.

(9) The student explores methods of risk management and the effects on engineering projects. The student is expected to:

(A) identify and describe various methods of risk management related to engineering projects;

(B) identify and analyze the potential risks in a project with respect to the project stakeholders;

(C) develop and communicate a job hazard analysis (JHA) for a given project task;

(D) identify factors of contingency related to an engineering project;

(E) create a contingency estimate analyzing events that can cause potential losses to a project; and

(F) present a risk management plan for a given project.

(10) The student examines components of value engineering practices in relation to an engineering project. The student is expected to:

(A) describe value engineering;

(B) identify and analyze common areas of engineering projects that are susceptible to value engineering;

(C) analyze an existing project design and cost estimate to identify potential cost saving areas;

(D) describe an opinion of probable cost (OPC) associated with an engineering project;

(E) generate an OPC for an engineering project, including construction mobilization, material cost, material quantities, waste disposal, contingency, and total price; and

(F) create a cost-benefit analysis of an engineering project that compares the monetary cost of the project to the benefit to end user.

(11) The student demonstrates effective leadership and communications skills necessary to manage engineering projects. The student is expected to:

(A) identify and describe the various team roles for an engineering project;

(B) research and describe various project management methodologies;

(C) create a schedule of roles for team members in an engineering project;

(D) conduct an effective kick-off meeting to communicate the project management plan for a given engineering project;

(E) evaluate how project team dynamics impact the successful completion of a project;

(F) prepare and document effective meeting agendas;

(G) record, prepare, and distribute clear and accurate meeting minutes;

(H) research and describe effective leadership qualities;

(I) research and identify examples of effective leadership styles;

(J) identify and describe personal leadership styles and strengths; and

(K) evaluate how student leadership styles impact the success of the project team.

§127.418. Architectural Engineering (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Civil Engineering I. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Architectural Engineering use principles of engineering and design tools to create innovative, functional, and sustainable buildings. Students develop cursory knowledge and essential skills to understand the design of buildings, including the mechanical, electrical, plumbing, and structural systems, while also planning the construction process. They engage in project planning, building and system analysis, site investigation, and the integration of sustainable design and construction practices for an architectural engineering project.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how to implement an engineering design process to develop a product or solution. The student is expected to:

(A) describe and implement the stages of an engineering design process to construct a model;

(B) explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process;

(C) explain how stakeholders impact an engineering design process; and

(D) analyze how failure is often an essential component of the engineering design process.

(3) The student explores the methods and aspects of project management in relation to projects. The student is expected to:

(A) research and explain the process and phases of project management, including initiating, planning, executing, and closing;

(B) explain the roles and responsibilities of team members, including project managers and leads;

(C) research and evaluate methods and tools available for managing a project;

(D) discuss the importance of developing and implementing a system for the organization of project documentation such as file naming conventions, document release control, and version control;

(E) describe how project requirements, constraints, and deliverables impact the project schedule and influence and are influenced by an engineering design;

(F) explain how a project budget, including materials, equipment, and labor, is developed and maintained; and

(G) describe the importance of management of change (MOC) and how MOC applies to project planning.

(4) The student explores the origin and application of basic building types. The student is expected to:

(A) identify and describe the fundamental parts of a building, including foundations, floors, walls, roof, and utility systems;

(B) identify and describe the visual design elements of various building types, including residential, commercial, institutional, and industrial buildings; and

(C) research and describe the evolution of the built space and development of building forms.

(5) The student understands the properties of common building materials and construction methods. The student is expected to:

(A) identify and describe common building materials such as wood, masonry, concrete, metal, glass, aggregate, and plastic;

(B) identify and describe common roofing materials such as thatch, wood, metal, sod, and asphalt;

(C) describe traditional construction methods such as wood framing, tilt-wall, masonry, and steel;

(D) describe contemporary construction methods such as prefabricated, modular, and additive construction (3D printing);

(E) identify and describe standard building methods such as casting, cutting, drilling, driving, and fastening for the construction of buildings;

(F) research and describe resilient [~~sustainable~~] building materials, methods, and costs; and

(G) describe how building material selection is impacted influenced by certifications such as Leadership in Energy and Environmental Design (LEED) or Energy Star.

(6) The student understands the application of codes and regulations to building projects. The student is expected to:

(A) explain the purpose of local building codes, including public health and safety, structural, and utility codes;

(B) describe land use regulations to identify zoning ordinances and allowable uses of real property;

(C) describe how zoning regulations are used to control land use and development;

(D) identify standard accessibility features such as ramps, elevators, parking, handrails, and fire alarm horn strobe as specified in codes and regulations such as the American Disability Act (ADA) and the Texas Accessibility Standards (TAS);

(E) explain how codes and building regulations constrain aspects of building design, including the structure, site design, utilities, and building usage;

(F) explain how codes and building regulations constrain aspects of building construction, including the structure, site construction, utilities, and building usage; and

(G) classify a building according to its use type, occupancy, and construction type using the International Building Code.

(7) The student explores the various building systems. The student is expected to:

(A) identify and describe various building envelopes such as tilt-wall, glazing, brick, and Exterior Insulation Finishing System (EIFS);

(B) describe the components of building envelopes, including foundation, walls, wall openings, roofs, roof penetrations, insulation, and building membranes;

(C) research and describe different types of insulating materials;

(D) describe different types of windows and doors;

(E) identify the main components and describe the purpose of mechanical systems within a building, including heating ventilation and air conditioning (HVAC), air handler, boiler, fire protection and suppression, lift, chilled water equipment, and emergency power systems;

(F) describe how programs and certifications such as LEED potentially impact the selection of building systems;

(G) identify the main components and describe the purpose of electrical systems within a building, including meters, panels, lighting, receptacles, transformers, generators, and low-voltage systems; and

(H) identify the main components and describe the purpose of plumbing systems within a building, including meters, main supply lines, branch lines, sewer lines, traps, risers, fire suppression, appurtenances, and fixtures.

(8) The student examines building foundations and structures. The student is expected to:

(A) identify and analyze the various types of building foundations, including slab on grade, pier and beam, spread footing, mat footing, drilled piers, pylons, waffle slab, and post-tension slab;

(B) classify a soil sample according to grain size and plasticity;

(C) calculate the plasticity index of a soil sample;

(D) determine the united soil classification system designation from a site soil sample analysis;

(E) describe the forces common to structural engineering calculations, including gravity, tension, compression, flexure, and torsion;

(F) describe the loads common to structural engineering calculations, including dead load, live load, environmental, and other load paths such as lateral and concentrated;

(G) diagram and explain how applied loads and forces are resisted in a structure and transferred to the Earth;

(H) diagram a simply supported beam subjected to loading conditions to determine reaction forces;

(I) sketch diagrams to determine the maximum shear and moment resulting in the beam;

(J) identify the different types of trusses, including simple, planar, and space frame trusses;

(K) diagram a truss subjected to loading conditions to determine reaction forces and identify the zero force members;

(L) explain why design loads are dictated by building codes;

(M) identify the composition and describe the ratios of ingredients in different concrete mixtures;

(N) describe the purpose of various concrete admixtures, including air entrainer, reducer, retarder, and accelerator;

(O) explain why various admixtures are selected for a project such as curing time, ambient climate, and permeability;

(P) conduct concrete compression and splitting-tension tests and compare strength and failures in a concrete mixture; and

(Q) analyze a concrete mixture by performing a slump test.

(9) The student designs and develops plans for the building systems. The student is expected to:

(A) develop a stormwater management system for a building that includes roof drainage calculations, roof drain design, and downspout sizing and location;

(B) design ingress and egress for a building that complies with local, state, and federal codes and regulations;

(C) develop building design and engineering plans that incorporate energy conservation techniques;

(D) recommend and defend an appropriate foundation design for a building type;

(E) design, modify, and plan structures using 3D software;

(F) construct building drawings using advanced computer-aided design drafting skills;

(G) create three-dimensional views of a building design;

(H) create three-dimensional solid models of the building;

(I) design and present a final effective building design for critique;

(J) develop preliminary drawings of a building or structural design;

(K) develop a site plan using maximum orientation of the building relative to views, sun, and wind direction;

(L) draw schematic site plans, floor plans, roof plans, building elevations, sections, and perspectives using design development techniques;

(M) draw scaled wall thickness plans, interior elevations, and sections;

(N) develop details, floor and wall sections, ceiling and roof sections, door and window sections, and other sections as required within a building design;

(O) review and revise draft construction documents to incorporate results from structural analysis such as beam, truss, and foundation calculations conducted for the project; and

(P) review and revise draft construction documents to incorporate results from building system analysis such as mechanical, electrical, and plumbing calculations conducted for the project.

(10) The student designs and develops plans for the building site. The student is expected to:

(A) identify and describe various site constraints, including utilities, grading, drainage, transportation access, environmental, regulatory requirement, and rights-of-way constraints;

(B) explain the purpose of low impact development techniques in site development such as to reduce the impact on stormwater runoff quantity and quality;

(C) develop preliminary drawings of a building site design;

(D) develop building site design and engineering plans that integrate solutions to site constraints as appropriate;

(E) describe how soil characteristics impact building design;

(F) determine the type, sizing, and placement of site features, including parking lots, entrance and exits road, pedestrian and handicap access, and storm water facilities, that comply with local codes and regulations;

(G) evaluate a site to appropriately locate and orient a building or structure;

(H) develop site drawings using advanced computer-aided design drafting skills; and

(I) design and present a final effective site design for critique.

(11) The student explores construction phase processes for a building design project. The student is expected to:

(A) calculate quantities of building components such as the total square units of wall covering, the total cubic units of concrete, linear units of wire, and doors and windows;

(B) develop a material quantity take-off for a building project;

(C) develop an Opinion of Probable Cost (OPC) for a building project;

(D) document elements of the building construction that comply with design criteria such as those outlined in LEED;

(E) identify components of a bid tabulation, including item description, material quantity, unit measure, unit price, and total price;

(F) compare a project bid tabulation with corresponding construction documents to verify all items are included;

(G) create a project bid tabulation;

(H) identify and describe the parts of a construction project manual, including invitation to bidders, instruction for bidders, project information, construction contracts, bid tabulation, maintenance bonds, performance bonds, payment bonds, specifications, insurance certificates, and legal requirements; and

(I) develop an organizational chart and Gantt chart for the construction of a project.

§127.419. Surveying and Geomatics (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I. Recommended prerequisites: Geometry and Introduction to Computer-Aided Design and Drafting. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Students enrolled in Surveying and Geomatics are introduced to the principles and practices essential to the field of surveying. Throughout this course students investigate different tools, applications, and techniques used to capture and process geospatial data. They also use functional mathematics crucial to the profession. Additionally, the course emphasizes the importance of visual representations of data in multiple mediums, ethical considerations, and the legal or regulatory impact of surveying on the community and society.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) explain the importance of dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) describe teamwork, group dynamics, and conflict resolution and how they can impact the collective outcome;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences;~~]

[~~(D) identify time management skills such as prioritizing tasks, following schedules, and tending to goal-relevant activities and how these practices optimize efficiency and results;~~]

[~~(E) define work ethic and discuss the characteristics of a positive work ethic, including punctuality, dependability, reliability, and responsibility for reporting for duty and performing assigned tasks;~~]

[~~(F) identify and discuss the importance of professionalism, standards of conduct, and ethics as defined by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) discuss the importance of safety in the workplace and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(K) describe the roles and responsibilities of managers.~~]

(1) [~~(2)~~] The student understands that there are different stages of the engineering design process and the importance of working through each stage as part of an iterative process. The student is expected to:

(A) explain the importance of defining an engineering problem as an initial step in the engineering design process;

(B) describe the research stage of the engineering design process;

(C) define ideation and conceptualization and discuss the role these processes play in innovation and problem solving;

(D) explain the processes of selecting an idea or concept for detailed prototype design, development, and testing;

(E) describe the purpose of non-technical drawings, technical drawings, models, and prototypes in designing a solution to an engineering problem;

(F) describe the process of relevant experimental design, conducting tests, collecting data, and analyzing data to evaluate potential solutions;

(G) explain how the engineering design process is iterative and the role reflection plays in developing an optimized engineering solution; and

(H) describe the purpose of effective communication of the engineering solution as obtained through the engineering design process to various audiences.

(2) [~~(3)~~] The student explores and develops skills to solve problems, make decisions, and manage a project. The student is expected to:

(A) discuss strategies for managing time, setting deadlines, and prioritizing to accomplish goals;

(B) identify constraints and describe the importance of planning around constraints, including budgets, resources, and materials;

(C) define milestones and deliverables and explain the advantages of dividing a large project into smaller milestones and deliverables;

(D) identify different types of communication and explain how different types of communication lead to successful teamwork on a shared project in a professional setting; and

(E) identify strategies to solve problems and describe how problem solving is utilized to accomplish personal and team objectives.

(3) [~~(4)~~] The student understands the foundations of occupational safety and health. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations, how OSHA inspections are conducted, and the role of national and state regulatory entities;

(C) explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(D) identify and explain the appropriate use of types of personal protective equipment used in industry;

(E) discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(F) describe types of electrical hazards in the workplace and the risks associated with these hazards and describe control methods to prevent electrical hazards in the workplace;

(G) analyze the hazards of handling, storing, using, and transporting hazardous materials and identify and discuss ways to reduce exposure to hazardous materials in the workplace;

(H) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace;

(I) describe the elements of a safety and health program, including management leadership, worker participation, and education and training;

(J) explain the purpose and importance of written emergency action plans and fire protection plans and describe key components of each such as evacuation plans and emergency exit routes, list of fire hazards, and identification of emergency personnel;

(K) explain the components of a hazard communication program; and

(L) explain and give examples of safety and health training requirements specified by standard setting organizations.

(4) [~~(5)~~] The student examines the functional mathematics of surveying. The student is expected to:

(A) calculate central tendencies of a given data set, including mean, median, and mode;

(B) calculate standard deviation of a given data set;

(C) identify parts of a normal distribution curve;

(D) define the Empirical Rule and analyze the distribution of a data set using the Empirical Rule;

(E) define systematic and random error;

(F) identify and describe the relationship between accuracy and precision;

(G) identify the types and properties of various polygons;

(H) solve for the parts of a triangle, including Pythagorean theorem, sine, cosine, tangent, arcsine, arccosine, and arctangent;

(I) identify the properties of circles;

(J) solve for the parts of a unit circle, including diameter, radius, circumference, area, chord, arclength, delta, and tangent;

(K) identify and solve for linear functions, including standard form, slope-intercept form, point-slope form, and the distance between two points, on a Cartesian Coordinate System; and

(L) identify and solve for volumetric calculations of three-dimensional shapes, including a cylinder, sphere, rectangular prisms, trapezoidal prisms, and triangular prisms.

(5) [~~(6)~~] The student researches and understands global positioning systems (GPS) used in surveying. The student is expected to:

(A) identify and explain data terminology related to GPS such as latitude, longitude, datum, ellipsoid, geoid, orthometric height, World Geodetic System 1984, Earth Centered Earth Fixed (ECEF), 3D coordinate geometry, and state plane coordinate system;

(B) explain the different types and applications of GPS surveying, including static, differential, and real-time kinematic (RTK);

(C) tie down a point and derive a geographic latitude and longitude coordinate using GPS;

(D) identify and explain GPS components, including the space segment, control segment, and the user segment;

(E) describe the functions of a GPS satellite;

(F) describe the functions of GPS ground stations;

(G) describe the functions of GPS receivers; and

(H) generate a map using geodetic coordinates.

(6) [~~(7)~~] The student researches and understands the industry standard methods and means of collecting various topographical data used in the civil engineering and construction professions. The student is expected to:

(A) research and explain the components of optomechanical equipment, including vertical and horizontal plates and optics;

(B) explain the types of optomechanical equipment, including theodolite, level, and total station, and their application;

(C) explain methods of remote sensing, including unmanned aerial vehicle (UAV), light detection and ranging (LiDAR), sonar, ground penetrating radar, underwater remotely operated vehicle (ROV), photogrammetry, and gravity satellite;

(D) identify the tools used to make distance measurements, including steel tape, electric distance meter, pacing, odometer, stadia, and estimating;

(E) explain the various methods to measure the distance between two points on the surface of the Earth;

(F) measure the distance between two points on the surface of the Earth using different methods and tools;

(G) compare the data collected from different methods used to measure the distance between two points on the surface of the Earth for accuracy;

(H) identify the tools used to make angular measurements, including protractor, compass, theodolite, total station, and estimating;

(I) explain the various methods to measure the angle between two vectors;

(J) measure the angle between two vectors using different methods and tools;

(K) compare the data collected from different methods used to measure the angles between two vectors for accuracy;

(L) describe the use of control points and National Geodetic Survey (NGS) monuments;

(M) identify the tools used to measure elevation, including level, theodolite, total station, barometer, and estimating;

(N) measure and calculate the height of an object using a theodolite;

(O) establish the elevation of a point assuming the elevation of a relative point is zero using various methods and tools;

(P) compare the data collected from different methods used to measure elevation between two points for accuracy;

(Q) identify and adhere to regulations of UAV piloting and control specified by the Federal Aviation Administration Small UAS Rule (Part A107); and

(R) explain the purposes of specialized surveys used in engineering, including engineering topographic, control, construction, boundary, hydrographic, optical tooling, American Land Title Association (ALTA), photogrammetric, and as-built survey.

(7) [~~(8)~~] The student records meta-data associated with surveying measurements and data collection. The student is expected to:

(A) create and maintain field notes within a comprehensive field book that includes a cover page and field data;

(B) describe the necessary components of a field book cover page, including weather data, project site data, personnel data, equipment data, and type of survey conducted; and

(C) record surveying information in a field book, including differential level notes, collected horizontal and vertical angles, site sketches, and topographic data.

(8) [~~(9)~~] The student researches and understands the industry standard methods and means of analyzing various topographical data used in the civil engineering and construction professions. The student is expected to:

(A) explain the process to generate a control survey;

(B) identify and explain symbols found on survey drawings; and

(C) identify and describe software used to create drawings and analyze survey data.

(9) [~~(10)~~] The student develops and communicates visual representations of topographical data used in civil engineering and construction documentation and presentations. The student is expected to:

(A) explain the process of drafting a construction document to scale;

(B) determine and demonstrate which scale best fits a standard size drawing sheet;

(C) explain the relationship between a construction document's specifications, plans, legend, and scale;

(D) explain the difference between grid and surface distances;

(E) identify the local scale factor that transforms collected grid distances to surface distances for a given survey;

(F) generate a scaled topography map using collected field data;

(G) create a surface profile from a baseline drawn on a topographic map; and

(H) stake out points from design files, maps, or real-property descriptions.

(10) [~~(11)~~] The student explores how a practicing surveyor follows in the footsteps of the original surveyor. The student is expected to:

(A) explain why and how surveyors defer to the work of existing surveys;

(B) define boundary monumentation;

(C) research and explain natural and artificial monuments;

(D) explain the methods to adjust real-property boundaries for the change in natural monuments over time, including riparian and littoral boundaries;

(E) interpret a legal description of a real property;

(F) identify an original survey boundary by conducting land record research using the Texas General Land Office (GLO);

(G) explain the historical significance of land grants in Texas;

(H) explain how a boundary survey protects the public;

(I) create a property boundary drawing using collected field data; and

(J) explain the dignity of calls, including natural objects, artificial objects, courses, distances, and acreage, as specified in Texas Administrative Code, Title 31, Part 1, Chapter 7, §7.5 (relating to Dignity of Calls).

(11) [~~(12)~~] The student understands the different methods of measurements and associated errors. The student expected to:

(A) define the different units of linear measurement, including U.S. feet, international feet, chains, rod, mile, fathom, furlong, varas, and metric units, commonly used in the surveying and civil engineering industry;

(B) define the different units of angular measurement, including vertical angles, horizontal angles, bearings, azimuths, degrees-minutes-seconds, decimal degrees, seconds of arc, and gradians;

(C) define the different units of volumetric measurement, including cubic feet, cubic yards, tons, and acre-feet;

(D) calculate and define area measurements such as acre, hectare, square feet, square mile, league, or sitio;

(E) convert linear, angular, and area measurements between different units;

(F) determine a change in elevation between two or more points by performing a differential level loop;

(G) measure the distance between two or more points using industry acceptable methods such as taping, electronic distance meter, total station, pacing, odometer, tacheometry, GPS, and stadia;

(H) compare the errors from two or more methods of calculating the distance between two or more points; and

(I) calculates various types of errors associated with survey data.

(12) [~~(13)~~] The student researches and understands surveying and geomatics throughout history. The student is expected to:

(A) explain how Eratosthenes first derived the circumference of the Earth;

(B) research and describe the change in methods and precision used to calculate the circumference of the Earth; and

(C) describe the surveying that contributed to great works of civil engineering before and after the Age of Exploration.

(13) [~~(14)~~] The student researches and understands the code of ethics pertaining to civil engineering and surveyors. The student is expected to:

(A) research and identify the legal definitions and descriptions surveyors use to delineate and report survey data; and

(B) research and identify engineering ethics established by the Texas Engineering Practice Act and rules concerning the practice of engineering and surveying [~~organizations such as the American Society of Civil Engineers, the National Society of Professional Engineers, the Texas Board of Professional Engineers and Land Surveyors, the National Council of Examiners for Engineering and Surveying, and the National Institute of Engineering Ethics~~] .

§127.452. Practicum in Engineering (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grade 12. Prerequisites: Algebra I and Geometry and a minimum of two credits with at least one course in a Level 2 or higher course from the Engineering Career Cluster.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Practicum in Engineering is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experiences such as employment, independent study, internships, assistantships, mentorships, or laboratories. To prepare for careers in engineering, students must attain academic knowledge and skills, acquire technical knowledge and skills related to the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how a professional engineer serves the local and global community. The student is expected to:

(A) research and identify student and professional engineering organizations and the benefits of membership such as networking platforms, training and educational opportunities, and participating in community initiatives;

(B) explain an engineer's role and how various engineering roles serve the organization, community, and society; and

(C) evaluate how the work of student or professional engineering organizations impact the local or global community such as recommended practices and issuing standards.

(3) The student uses critical thinking and problem solving in the work-based learning experience. The student is expected to:

(A) conduct technical research to gather information, identify gaps, and make decisions in the work-based learning experience;

(B) develop creative and innovative solutions to problems in the work-based learning experience;

(C) analyze and compare alternative designs for an effective solution to a problem in the work-based learning experience; and

(D) evaluate and present solutions to problems in the work-based learning experience.

(4) The student understands and demonstrates how effective leadership and teamwork skills enable the accomplishment of goals and objectives. The student is expected to:

(A) analyze leadership characteristics such as trustworthiness, positive attitude, integrity, and work ethic;

(B) explain and demonstrate effective characteristics of teamwork;

(C) explain and demonstrate responsibility for shared group and individual work tasks in the work-based learning experience;

(D) describe and analyze how strategies such as meeting deadlines, showing respect for all individuals, and communicating clearly and timely contribute to effective working relationships and accomplishing objectives; and

(E) research and identify opportunities to participate in extracurricular engineering activities.

(5) The student demonstrates oral and written communication skills in delivering and receiving information and ideas. The student is expected to:

(A) apply appropriate content knowledge, technical concepts, and vocabulary to analyze information and follow directions;

(B) use professional communication skills such as using technical terminology, email etiquette, and following the organization or team communication plan and hierarchy when delivering and receiving information in the work-based learning experience;

(C) identify and analyze information contained in informational texts, internet sites, or technical materials in the work-based learning experience;

(D) describe and analyze verbal and nonverbal cues and behaviors such as body language, tone, and interrupting to enhance communication in the work-based learning experience; and

(E) apply active listening skills to receive and clarify information in the work-based learning experience.

(6) The student reflects on the work-based learning experience to prepare for postsecondary and employment success. The student is expected to:

(A) assess and evaluate personal strengths and weaknesses in knowledge and skill proficiency and contributions to a project related to the work-based learning experience;

(B) develop and maintain a professional portfolio to include:

(i) attainment of technical skill competencies;

(ii) licensures or certifications;

(iii) recognitions, awards, and scholarships;

(iv) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;

(v) abstract of key points of the practicum;

(vi) resume;

(vii) samples of work; and

(viii) evaluation from the practicum supervisor; and

(C) present the professional portfolio to interested stakeholders.

(7) The student develops a presentation describing the culmination of skills and knowledge gained from the work-based learning experience. The student is expected to:

(A) develop a professional presentation to display and communicate the work-based learning experience, including goals and objectives, levels of achievement, skills and knowledge gained, areas for improvement and personal growth, challenges encountered throughout the experience, and a plan for future goals;

(B) identify an appropriate audience and coordinate the presentation of findings related to the work-based learning experience;

(C) present findings in a professional manner using concise language, engaging content, relevant media, and clear speech; and

(D) analyze feedback received from a presentation.

§127.453. Extended Practicum in Engineering (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Engineering Career Cluster. Prerequisites: Algebra I and Geometry and a minimum of two credits with at least one course in a Level 2 or higher course from the Engineering Career Cluster. This course must be taken concurrently with Practicum in Engineering and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Engineering Career Cluster focuses on planning, designing, testing, building, and maintaining machines, structures, materials, systems, and processes using empirical evidence and science, technology, and math principles. This career cluster includes occupations ranging from mechanical engineer and drafter to electrical engineer and mapping technician.

(3) Extended Practicum in Engineering is designed to give students supervised practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student researches and describes ethics pertaining to engineering. The student is expected to explain how engineering ethics as defined by the Texas Board of Professional Engineers and Land Surveyors apply to engineering practice.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession and work site;~~]

[~~(B) analyze how teams can produce better outcomes through cooperation, contribution, and collaboration from members of the team;~~]

[~~(C) present written and oral technical communication in a clear, concise, and effective manner for a variety of purposes and audiences, including explaining and justifying decisions in the design process;~~]

[~~(D) use time management skills independently and in groups to prioritize tasks, follow schedules, and tend to goal-relevant activities in a way that optimizes efficiency and results;~~]

[~~(E) describe the importance of and demonstrate punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain how engineering ethics as defined by professional organizations such as the National Society of Professional Engineers apply to engineering practice;~~]

[~~(G) demonstrate respect for differences in the workplace;~~]

[~~(H) identify the importance and benefits of meritocracy, a hard work ethic, and equal opportunity in the workplace;~~]

[~~(I) identify consequences relating to discrimination and harassment;~~]

[~~(J) analyze elements of professional codes of conduct or creeds in engineering such as the National Society of Professional Engineers Code of Ethics for Engineers and how they apply to the knowledge and skills of the course and the engineering profession;~~]

[~~(K) identify the components of a safety plan and why it is critical for employees and employers to maintain a safe work environment; and~~]

[~~(L) compare skills and characteristics of managers and leaders in the workplace.~~]

(2) The student understands how a professional engineer serves the local and global community. The student is expected to:

(A) research and identify student and professional engineering organizations and the benefits of membership such as networking platforms, training and educational opportunities, and participating in community initiatives;

(B) explain an engineer's role and how various engineering roles serve the organization, community, and society; and

(C) evaluate how the work of student or professional engineering organizations impact the local or global community such as recommended practices and issuing standards.

(3) The student uses critical thinking and problem solving in the work-based learning experience. The student is expected to:

(A) conduct technical research to gather information, identify gaps, and make decisions in the work-based learning experience;

(B) develop creative and innovative solutions to problems in the work-based learning experience;

(C) analyze and compare alternative designs for an effective solution to a problem in the work-based learning experience; and

(D) evaluate and present solutions to problems in the work-based learning experience.

(4) The student understands and demonstrates how effective leadership and teamwork skills enable the accomplishment of goals and objectives. The student is expected to**:**

(A) analyze leadership characteristics such as trustworthiness, positive attitude, integrity, and work ethic;

(B) explain and demonstrate effective characteristics of teamwork;

(C) explain and demonstrate responsibility for shared group and individual work tasks in the work-based learning experience;

(D) describe and analyze how strategies such as meeting deadlines, showing respect for all individuals, and communicating clearly and timely contribute to effective working relationships and accomplishing objectives; and

(E) research and identify opportunities to participate in extracurricular engineering activities.

(5) The student demonstrates oral and written communication skills in delivering and receiving information and ideas. The student is expected to:

(A) apply appropriate content knowledge, technical concepts, and vocabulary to analyze information and follow directions;

(B) use professional communication skills such as using technical terminology, email etiquette, and following the organization or team communication plan and hierarchy when delivering and receiving information in the work-based learning experience;

(C) identify and analyze information contained in informational texts, internet sites, or technical materials in the work-based learning experience;

(D) describe and analyze verbal and nonverbal cues and behaviors such as body language, tone, and interrupting to enhance communication in the work-based learning experience; and

(E) apply active listening skills to receive and clarify information in the work-based learning experience.

(6) The student reflects on the work-based learning experience to prepare for postsecondary and employment success. The student is expected to:

(A) assess and evaluate personal strengths and weaknesses in knowledge and skill proficiency and contributions to a project related to the work-based learning experience;

(B) develop and maintain a professional portfolio to include:

(i) attainment of technical skill competencies;

(ii) licensures or certifications;

(iii) recognitions, awards, and scholarships;

(iv) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;

(v) abstract of key points of the practicum;

(vi) resume;

(vii) samples of work; and

(viii) evaluation from the practicum supervisor; and

(C) present the professional portfolio to interested stakeholders.

(7) The student develops a presentation describing the culmination of skills and knowledge gained from the work-based learning experience. The student is expected to:

(A) develop a professional presentation to display and communicate the work-based learning experience, including goals and objectives, levels of achievement, skills and knowledge gained, areas for improvement and personal growth, challenges encountered throughout the experience, and a plan for future goals;

(B) identify an appropriate audience and coordinate the presentation of findings related to the work-based learning experience;

(C) present findings in a professional manner using concise language, engaging content, relevant media, and clear speech; and

(D) analyze feedback received from a presentation.

ATTACHMENT I
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter C. Agriculture, Food, and Natural Resources

§127.59. Geographic Information Systems for Agriculture (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Agriculture, Food, and Natural Resources. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources career cluster focuses on the essential elements of life, food, water, land, and air. This career cluster includes occupations ranging from farmer, rancher, and veterinarian to geologist, land conservationist, and florist.

(3) Geographic Information Systems for Agriculture is a course designed to provide students with the academic and technical knowledge and skills that are required to pursue a career as a precision agriculture specialist, a crop specialist, an independent crop consultant, a nutrient management specialist, a physical scientist, a precision agronomist, a precision farming coordinator, a research agricultural engineer, or a soil fertility specialist. Students will learn to use computers to develop or analyze maps of remote sensing to compare physical topography with data on soils, fertilizer, pests, or weather.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) identify career and entrepreneurship opportunities for a chosen occupation in the field of agriculture and develop a plan for obtaining the education, training, and certifications required for the chosen occupation;~~]

[~~(B) model professionalism by continuously exhibiting appropriate work habits, solving problems, taking initiative, communicating effectively, listening actively, and thinking critically;~~]

[~~(C) model appropriate personal and occupational safety and health practices and explain the importance of established safety and health protocols for the workplace;~~]

[~~(D) analyze and interpret the rights and responsibilities, including ethical conduct and legal responsibilities, of employers and employees; and~~]

[~~(E) analyze the importance of exhibiting good citizenship and describe the effects of good citizenship on the development of home, school, workplace, and community.~~]

(1) [~~(2)~~] The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience as an experiential learning activity;

(B) use appropriate record-keeping skills in a supervised agricultural experience;

(C) participate in youth agricultural leadership opportunities;

(D) review and participate in a local program of activities; and

(E) create or update documentation of relevant agricultural experience such as community service, professional, or classroom experiences.

(2) [~~(3)~~] The student explains the current applications of geographic information system (GIS) in agriculture, food, and natural resources and identifies the future need for GIS in precision agriculture. The student is expected to:

(A) research and compare current and emerging careers related to GIS in agriculture and natural resource fields;

(B) identify and analyze applications of GIS technologies in agriculture, food, and natural resources;

(C) explain GIS data as it pertains to agriculture; and

(D) describe the types of licensing, certification, and credentialing requirements related to GIS occupations.

(3) [~~(4)~~] The student analyzes geographic information and spatial data types in agriculture, food and natural resources. The student is expected to:

(A) identify the uses of GIS in agriculture;

(B) identify the GIS terminology used in agriculture applications, such as spatial analysis, remote sensing, georeferencing, geostatistics, and geocoding;

(C) identify GIS models and representations in precision agriculture;

(D) explain GIS representations of geographic phenomena in soil types, topography, and farming management;

(E) organize and describe spatial data in yield monitoring for crop planning; and

(F) analyze GIS data sources and ethics in agriculture.

(4) [~~(5)~~] The student uses agriculture, food, and natural resources GIS tools. The student is expected to:

(A) identify hardware and software for agriculture data management and processing;

(B) explain spatial data capture and preparation, spatial data storage and maintenance, spatial query and analysis, and spatial data presentation for agriculture; and

(C) describe remote sensing tools and technologies used in precision farming, including unmanned aerial support (UAS), unmanned aerial vehicles (UAV), and global positioning satellite (GPS).

(5) [~~(6)~~] The student integrates spatial referencing and global positioning techniques in agriculture, food, and natural resources. The student is expected to:

(A) explain spatial referencing systems and projections for capturing and displaying agricultural data; and

(B) identify uses for satellite-based positioning to increase agriculture proficiency.

(6) [~~(7)~~] The student evaluates applications for spatial data entry and preparation for agricultural analysis. The student is expected to:

(A) analyze agricultural GIS spatial data; and

(B) explain and analyze data accuracy and precision related to using GIS in agriculture.

(7) [~~(8)~~] The student performs agricultural spatial data analysis. The student is expected to:

(A) analyze GIS maps of agricultural fields to determine variables that would impact maximum crop yields;

(B) compare vector and raster-based data for agricultural analysis; and

(C) explain types of GIS analysis used in natural resource management.

(8) [~~(9)~~] The student creates spatial data visualizations and cartographic models. The student is expected to:

(A) identify types of GIS maps used in agriculture;

(B) develop GIS maps for various types of agricultural data;

(C) identify and explain the purpose of cartographic symbols used in precision farming; and

(D) analyze visual data and explain how the data is used in agricultural decision making.

§127.61. Beekeeping and Honey Processing (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Agriculture, Food, and Natural Resources. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources career cluster focuses on the essential elements of life, food, water, land, and air. This career cluster includes occupations ranging from farmer, rancher, and veterinarian to geologist, land conservationist, and florist.

(3) Beekeeping and Honey Processing is a course designed to provide students with the academic and technical knowledge and skills that are required to pursue a career related to beekeeping, apiary operations, honey harvesting, and related industries. Beekeeping and honey processing is a vital part of the United States agricultural economy. To prepare for success in Beekeeping and Honey Processing, students need opportunities to learn, reinforce, experience, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career

development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) identify career and entrepreneurship opportunities for a chosen occupation in the field of agriculture and develop a plan for obtaining the education, training, and certifications required for the chosen occupation;~~]

[~~(B) model professionalism by continuously exhibiting appropriate work habits, solving problems, taking initiative, communicating effectively, listening actively, and thinking critically;~~]

[~~(C) model appropriate personal and occupational safety and health practices and explain the importance of established safety and health protocols for the workplace;~~]

[~~(D) analyze and interpret the rights and responsibilities, including ethical conduct and legal responsibilities, of employers and employees; and~~]

[~~(E) analyze the importance of exhibiting good citizenship and describe the effects of good citizenship on the development of home, school, workplace, and community.~~]

(1) [~~(2)~~] The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience as an experiential learning activity;

(B) use appropriate record-keeping skills in a supervised agricultural experience;

(C) participate in youth agricultural leadership opportunities;

(D) review and participate in a local program of activities; and

(E) create or update documentation of relevant agricultural experience such as community service, professional, or classroom experiences.

(2) [~~(3)~~] The student explores the biology of bee behavior. The student is expected to:

(A) identify different types and life spans of bees;

(B) explain the different roles assumed by the different types of honeybees, including the queen, drones, and workers; and

(C) describe honeybee development, castes, behavior, division of labor, and the bee life cycle, including larval, pupal, and adult stages.

(3) [~~(4)~~] The student analyzes beehive design and development. The student is expected to:

(A) identify the site characteristics required for successful beehive production;

(B) analyze factors such as climatic characteristics and food sources to determine the suitability of a beehive site for honey harvesting and pollination;

(C) research and compare the conditions of successful beehives in other parts of the world with similar local conditions; and

(D) develop a beehive design and installation plan, including consideration of sunlight, access to water, wind, topography, human and animal habitation, and good neighbor policy.

(4) [~~(5)~~] The student evaluates technology and best practices for weatherizing a beehive. The student is expected to:

(A) explain the environmental conditions that lead to bee colonies adapting to extremes in climate conditions;

(B) compare seasonal strategies for proper beehive management and describe why best management practices change based on the seasons, including spring, summer, autumn, and winter; and

(C) explain practices for winterizing hives.

(5) [~~(6)~~] The student demonstrates beehive management techniques. The student is expected to:

(A) identify the tools of an apiarist and demonstrate safe and proper usage of tools;

(B) demonstrate inspection of a beehive and describe necessary equipment, including a bee suit, a smoker, and a comb replacement;

(C) explain beehive training techniques, including diagnosing the brood pattern, adding brood comb to the nest, switching colonies, feeding bees, providing water, removing old combs, extracting honey, and caging queens;

(D) identify safety precautions in the field while handling live bees, caring for the colonies in the hives, and extracting honey and honeycomb;

(E) explain the proper methods of bee handling to prevent harm to handlers and others; and

(F) describe personal protective equipment used to reduce the risk of accidents.

(6) [~~(7)~~] The student develops an integrated pest management plan for beehives. The student is expected to:

(A) identify the major insect pests and diseases of honeybees;

(B) compare the components of honeybee integrated pest management; and

(C) describe the safe usage of pesticides in honeybee hives.

(7) [~~(8)~~] The student examines honey harvesting and the use of proper equipment and tools. The student is expected to:

(A) describe the tools and equipment used in honey production, including a bee brush, fume board, honey drip tray, nectar detector, escape board, and extractor;

(B) explain the safe use of honey harvesting tools;

(C) explain the use of technology in modern honey production systems; and

(D) explain the appropriate procedures used to extract honey.

(8) [~~(9)~~] The student identifies procedures and regulations for sanitation and safety in the food industry. The student is expected to:

(A) identify food industry inspection standards, including hazard analysis and critical control points;

(B) identify the appropriate chemicals used in the food industry, specifically in honey processing;

(C) identify safety and governmental regulations involved in the processing and labeling of foods, including honey;

(D) explain the procedures relating to the safe manufacture of foods through hygienic food handling and processing;

(E) develop and maintain sanitation schedules; and

(F) identify food safety laws that impact the bee industry.

(9) [~~(10)~~] The student demonstrates an in-depth understanding of [~~a~~] beekeeping , bee hauling, and honey processing businesses [~~business~~] , including production, processing, marketing, sales, and distribution. The student is expected to:

(A) describe the roles of an entrepreneur in [~~a~~] beekeeping , bee hauling, and honey processing operations [~~operation~~] ;

(B) differentiate between small, medium, and large-sized bee and honey businesses;

(C) create a list of tools and equipment needed to start a beekeeping operation and develop a budget to start a beekeeping business; and

(D) develop a business model for beekeeping, honey production, and honey processing.

(10) [~~(11)~~] The student completes the process for development, implementation, and evaluation of a marketing plan and a financial forecast for beekeeping. The student is expected to:

(A) identify and explain the target market for honey-related products;

(B) create and conduct a customer survey;

(C) analyze the customer survey results;

(D) identify modification recommendations based on customer survey results;

(E) complete a detailed honey-related products market analysis;

(F) analyze and explain different types of marketing strategies;

(G) describe a social media marketing campaign for honey-processed products; and

(H) develop and explain a projected income statement, cash budget, balance sheet, and projected sources and uses of funds statement.

(11) [~~(12)~~] The student explains the scope and nature of distribution of honey-related products. The student is expected to:

(A) explain effective distribution activities, including transportation, storage, product handling, and inventory control;

(B) explain how distribution can add value to goods and [~~,~~] services, which can be protected by [~~and~~] intellectual property; and

(C) analyze distribution costs for honey-related products.

ATTACHMENT II
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter F. Business, Marketing, and Finance

§127.262. Marketing (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Business, Marketing, and Finance. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Business, Marketing, and Finance Career Cluster focuses on careers in planning, organizing, directing, and evaluating business functions essential to efficient and productive business operations.

(3) The Marketing course explores the seven core functions of marketing, which include marketing planning -- why target marketing and industry affect businesses; marketing-information management -- why market research is important; pricing -- how prices maximize profit and affect the perceived value; product/service management -- why products live and die; promotion -- how to inform customers about products; channel management -- how products reach the final user; and selling -- how to convince a customer that a product is the best choice. Students will demonstrate knowledge through hands-on projects that may include conducting research, creating a promotional plan, pitching a sales presentation, and introducing an idea for a new product or service.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student defines marketing and identifies the seven core functions of marketing. The student is expected to:

(A) define marketing and explain the marketing concept; and

(B) identify the seven core functions of marketing, including marketing planning, marketing-information management, pricing, product/service management, promotion, channel management, and selling.

(2) The student knows the interrelationship and purpose of the marketing mix or 4P's of marketing: product, price, promotion, and place. The student is expected to:

(A) identify and describe the four elements of the marketing mix, including product, price, place, and promotion;

(B) explain how each component of the marketing mix contributes to successful marketing;

(C) analyze the interdependence of each element of the marketing mix with the other three elements;

(D) develop and present an idea for a new product or service and the marketing mix for the new product or service; and

(E) investigate and explain how to determine the feasibility of a new product or service proposal.

(3) The student knows how a company considers internal and external factors to understand the current market. The student is expected to:

(A) explain the internal and external factors that influence marketing planning;

(B) define a marketing plan and describe each step in the plan;

(C) identify and explain market position and market share;

(D) explain how a business can use a strengths, weaknesses, opportunities, and threats (SWOT) analysis to plan for opportunities in the market;

(E) conduct a SWOT analysis; and

(F) analyze the data from a SWOT analysis to make informed business decisions.

(4) The student applies the concepts of market and market identification to make informed business decisions. The student is expected to:

(A) define the term market;

(B) identify the target market for a product or service;

(C) define niche marketing, identify examples of niche marketing, and compare niche marketing to other marketing strategies;

(D) analyze an appropriate target market within a specific industry;

(E) compare types of markets, including business to business and business to consumer; and

(F) identify real-life scenarios of effective markets and explain what makes a market effective.

(5) The student understands the concept of market segmentation. The student is expected to:

(A) define the term market segmentation;

(B) explain the commonly used types of market segmentation, including demographic segmentation, geographic segmentation, psychographic segmentation, and behavioral segmentation;

(C) analyze the impact of culture on buying decisions; and

(D) describe how market segmentation concepts apply to real-world situations.

(6) The student understands the purpose and importance of gathering and evaluating information for use in making business decisions. The student is expected to:

(A) describe marketing information and how it influences marketing decisions;

(B) use marketing-research tools to gather primary and secondary data;

(C) compare primary and secondary research data;

(D) define analytics;

(E) identify sources of data and information that can be analyzed to make business decisions;

(F) identify key business metrics that are used to make business decisions or evaluate outcomes of business decisions; and

(G) analyze data and make recommendations for improving business operations.

(7) The student explains concepts and strategies used in determining and adjusting prices to maximize return and meet customers' perceptions of value. The student is expected to:

(A) investigate and describe how businesses make pricing decisions;

(B) identify and explain goals for pricing, including profit, market share, and competition;

(C) analyze factors affecting price, including supply and demand, perceived value, costs, expenses (profit margin), and competition;

(D) explain the economic principle of break-even point;

(E) explain key pricing terms, including odd/even pricing, loss leaders, prestige pricing, penetration pricing, price bundling, price lining, and everyday low pricing; and

(F) explain how supply and demand affect price.

(8) The student explains the role of product or service management as a marketing function. The student is expected to:

(A) explain the concept of product mix, including product lines, product width, and product depth;

(B) explain the importance of generating new product ideas;

(C) analyze the product mix for a current business;

(D) identify and discuss the components of the product life cycle, including introduction, growth, maturity, and decline; and

(E) identify the impact of marketing decisions made in each stage of the product life cycle.

(9) The student knows the process and methods to communicate information about products to achieve a desired outcome. The student is expected to:

(A) explain the role of promotion as a marketing function;

(B) identify and describe elements of the promotional mix, including advertising, public relations, personal selling, and sales promotion;

(C) describe and demonstrate effective ways to communicate features and benefits of a product to a potential client; and

(D) analyze and evaluate websites for effectiveness in achieving a desired outcome.

(10) The student identifies promotional channels used to communicate with the targeted audiences. The student is expected to:

(A) create advertising examples using various media, including print media such as outdoor, newspapers, magazines, and direct mail; digital media such as email, apps, and social media; and broadcast media such as television and radio, to communicate with target audiences;

(B) describe various public-relations activities such as a press releases and publicity management;

(C) analyze and compare examples of sales promotions such as coupons, loyalty programs, rebates, samples, premiums, sponsorship, and product placement; and

(D) explain the role of marketing ethics in promotional strategies.

(11) The student explores the role of channel members and methods of product transportation. The student is expected to:

(A) define channel of distribution;

(B) describe the roles of intermediaries, including manufacturer, agent, wholesaler/industrial distributor, retailer, and consumer/industrial user, and explain how the roles may impact business decisions and the success of a business;

(C) identify and discuss the methods of transportation for products, including road, air, maritime, rail, and intermodal; and

(D) analyze and explain the impact of the distribution channel on price.

(12) The student demonstrates how to determine client needs and wants and responds through planned and personalized communication. The student is expected to:

(A) explain the role of personal selling as a marketing function;

(B) explain the role of customer service as a component of selling relationships;

(C) explain the importance of preparing for the sale, including gaining knowledge of product features and benefits, identifying the target market and their needs, and overcoming common objections; and

(D) identify and explain ways to determine needs of customers and their buying behaviors, including emotional, rational, or patronage.

(13) The student demonstrates effective sales techniques. The student is expected to:

(A) describe the steps of the selling process such as approaching the customer, determining needs, presenting the product, overcoming objections, closing the sale, and suggestive selling;

(B) explain effective strategies and techniques for various sales situations; and

(C) develop and pitch a sales presentation for a product or service using the steps of the sales process such as addressing customers' needs, wants, and objections and negotiating the sale.

(14) The student implements a marketing plan. The student is expected to:

(A) identify a key target audience;

(B) develop an appropriate message and select a medium to attract customers;

(C) create a promotional plan that includes target market, promotional objective, advertising media selection, promotional schedule, and budget;

(D) develop and present a marketing plan to an audience; and

(E) analyze various marketing plans for effectiveness.

(15) The student knows the nature and scope of project management. The student is expected to:

(A) investigate and describe the various tools available to manage a project such as a Gantt chart; and

(B) define and explain the components of a project plan, including project goals schedule, timeline, budget, human resources, quality management, risk management, monitoring, and controlling a project.

(16) The student knows the nature and scope of ethics in marketing. The student is expected to:

(A) analyze and explain the role and use of ethics in marketing;

(B) research and discuss how ethics has affected a company's profitability; and

(C) describe how marketing ethics can be effectively applied to the decision-making process.

§127.263. Retail Management (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Business, Marketing, and Finance Career Cluster. Recommended prerequisite: Principles of Business, Marketing, and Finance. Students shall be awarded one credit for the successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current professions.

(2) The Business, Marketing, and Finance Career Cluster focuses on planning, managing, and performing marketing activities to reach organizational objectives.

(3) Retail Management is designed as a comprehensive introduction to the principles and practices of retail management. The course explores the process of promoting greater sales and customer satisfaction by gaining a better understanding of the consumers of the goods and services provided by a company. The course provides an overview of the strategies involved in the retail process such as distributing finished products created by the business to consumers and determining what buyers want and require from the retail market.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student uses self-development techniques and interpersonal skills to accomplish retail management objectives. The student is expected to:

(A) describe and demonstrate effective interpersonal and team-building skills involving situations with coworkers, managers, and customers;

(B) create a self-development plan that includes improving leadership and interpersonal skills and that identifies opportunities to participate in leadership and career development activities; and

(C) identify and describe employability skills needed to be successful in the retail marketing industry.

(2) The student explores features of excellent customer service. The student is expected to:

(A) discuss the importance of and demonstrate effective communication skills such as active listening, evaluating nonverbal signals, and use of appropriate grammar, vocabulary, and tone;

(B) present written and oral communication, including email, traditional letter writing, face-to-face conversations, and phone conversation, in a clear, concise, and effective manner for a variety of purposes and audiences;

(C) discuss how company policy impacts an employee's interactions with consumers and a consumer's interactions with the retail establishment; and

(D) analyze how attitude impacts a consumer's experience with the retailer.

(3) The student creates professional documents required for employment. The student is expected to:

(A) develop a professional portfolio or resume;

(B) write appropriate business correspondence such as a letter of intent and a thank you letter;

(C) complete sample job applications accurately and effectively; and

(D) explain protocol for identifying and asking for references.

(4) The student analyzes non-store retailing modalities, including direct selling, telemarketing, online retailing, automatic vending, direct marketing, and e-tailing. The student is expected to:

(A) investigate and evaluate the effectiveness of marketing and selling through online platforms such as mobile apps and software applications;

(B) analyze and explain the disadvantages of non-store retailing such as security concerns, inability to interact with the customer, delay in customer receipt of the product, less ease of return for unwanted items, and the lack of social interaction between customers and retailers; and

(C) analyze and explain the advantages of non-store retailing such as unlimited access for customers to view the inventory, the ability for customers to purchase 24 hours per day/7 days a week, lower overhead cost, and a larger inventory of items than is housed in a brick-and-mortar facility.

(5) The student analyzes marketing research to make changes to business strategies or operations. The student is expected to:

(A) synthesize and analyze data collected through surveys, interviews, group discussions, and internal records to create data reports;

(B) explain how data reports are used to make decisions to improve a retailer's practices and improve overall operations;

(C) analyze and evaluate the effective use of surveys to gather data needed by the retailer to make effective operational decisions;

(D) disaggregate and analyze internal data such as sales data, shipping data, finance reports, inventory reports, and customer and personnel feedback collected by the retailer to make effective operational decisions;

(E) disaggregate and analyze marketing data based on indicators such as age, gender, education, employment, income, family status, and ethnicity to identify and evaluate products based on the retailers' target market; and

(F) identify and analyze how the product, price, promotion, and placement of the product impacts the retail market.

(6) The student understands the role and responsibilities of a buyer in retail management and understands the purpose of analyzing the target market to interpret consumer needs and wants based on data. The student is expected to:

(A) define and describe various merchandising categories such as staple, fashion, seasonal, and convenience;

(B) describe merchandise plans and their components, including planned sales, planned stock, planned stocked reductions, and planned retail purchases;

(C) analyze and discuss each stage of a product's life cycle, including introduction, growth, maturity, and decline, and explain how each stage relates to the target market; and

(D) develop a budget based on financial goals.

(7) The student applies inventory management strategies to effectively create and manage reliable tracking systems to schedule purchases, calculate turnover rate, and plan merchandise and marketing decisions. The student is expected to:

(A) describe the process of purchasing inventory and executing a purchase order, transporting orders, and receiving orders;

(B) explain inventory management practices, including ordering, storing, producing, and selling merchandise;

(C) differentiate between perpetual and periodic inventory tracking methods and describe how point-of-sale software, universal product codes, radio frequency identification, stock shrinkage, and loss prevention impact a retailer's inventory management; and

(D) analyze and describe how stock turnover rates impact inventory.

(8) The student evaluates retailer pricing strategies based on factors such as competition, the economy, and supply and demand to maximize sales and profit. The student is expected to:

(A) analyze how uncontrollable factors such as competition, the economy, and supply and demand impact pricing;

(B) explain how controllable factors such as company goals, operating expenses, and product life cycles impact pricing;

(C) differentiate between demand-based pricing, competition-based pricing, and cost-based pricing and explain how each pricing method is used to determine the base price for a product;

(D) identify and describe how market share impacts pricing of products; and

(E) create price points using keystone pricing, industry benchmarks, and industry surveys.

(9) The student explores effective promotional activities, including advertising, sales promotion, public relations, and personal selling, that retail managers use to inform, persuade, and remind customers of products that will meet consumer needs. The student is expected to:

(A) explain the six elements of effective communication, including source, message, channel, environment, context, and feedback;

(B) demonstrate effective written, verbal, and nonverbal communication;

(C) analyze and evaluate promotional communication techniques used to inform or motivate consumers to invest in products or services;

(D) differentiate between techniques used for advertising, public relations, personal selling, and sales promotion; and

(E) investigate and evaluate technology applications that promote items using online advertising, web presence, social media, email campaigns, and other modes of electronic promotions.

(10) The student analyzes and applies personal selling elements needed in retail management to determine how to generate sales. The student is expected to:

(A) explain sales generating techniques, including prospecting, solution development, buyer qualification, opportunity qualification and control, negotiation, and account management and follow-up;

(B) describe how ethical behaviors of a sales associate impacts the retail market;

(C) demonstrate effective selling techniques needed in the retail market;

(D) analyze and describe best practices in product training for sales associates;

(E) explain how determining the needs, presenting the product, handling objections, closing the sale, and following up with customers increases sales for the retailer; and

(F) identify effective questions and questioning techniques sales associates use with consumers to gain a competitive advantage or increase sales and discuss the importance of strategically selecting questions and techniques based on the product or service and target market.

(11) The student explores how to effectively use visual merchandising. The student is expected to:

(A) analyze and describe how a retailer's storefront, store layout, store interior, centralized visual merchandising, and interior displays impact sales and a consumer's experience with the business; and

(B) develop a visual merchandising plan using proper design elements such as mannequins, props, lighting, color, signage, and graphics.

(12) The student understands the role of the retail manager for recruiting, hiring, training, supervising, and terminating employees as well as maintaining the everyday operation of a business to ensure that it functions efficiently and meets established goals. The student is expected to:

(A) identify and describe effective methods of recruiting employees externally;

(B) explain effective methods of recruiting employees internally;

(C) describe how to recruit a diverse pool of talent for employment consideration;

(D) explain the importance of the Equal Employment Opportunity Commission guidelines on the recruitment process;

(E) explain the benefits of training employees to learn new skills and technologies and comply with new laws and regulations;

(F) develop an employee appraisal program;

(G) explain an effective employee performance evaluation system and the importance of including supervisors and managers, peers, customers or clients, and subordinates in the process; and

(H) identify leadership and career development activities such as involvement with appropriate student and local management associations and create a personal development plan that includes participation in leadership and career development activities.

(13) The student understands the importance of effective teams and how effective leaders implement group development strategies. The student is expected to:

(A) explain the process of forming, storming, norming, performing, and adjourning;

(B) analyze and discuss effective interpersonal and team-building skills involving situations with coworkers, supervisors, and subordinates;

(C) investigate and analyze personal integrity and its effects on relationships in the workplace;

(D) describe characteristics of successful working relationships such as teamwork, conflict resolution, self-control, and the ability to accept criticism;

(E) discuss the importance of showing respect to all people and explain how showing respect to all people impacts the success of a business;

(F) identify employer expectations and discuss how meeting employer expectations impacts the success of a business; and

(G) explain and demonstrate productive work habits and attitudes.

(14) The student explores the practice of risk management, including identifying, assessing, and reducing risk through proper planning. The student is expected to:

(A) differentiate between natural, human, market, economic, and market risks;

(B) differentiate between controllable and uncontrollable risks;

(C) investigate and explain effective strategies for identifying, assessing, and reducing risks; and

(D) analyze how financial losses from human, physical, and natural risk factors can be minimized through the use of insurance.

ATTACHMENT III
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter J. Health Science [~~Hospitality and Tourism~~]

§127.510. Speech and Language Development (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Recommended prerequisites: Principles of Health Science, Anatomy and Physiology, and Introduction to Speech Pathology and Audiology. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

(3) The Speech and Language Development course provides advanced knowledge and skills related to speech and language acquisition and growth of developing children. Understanding healthy development and speech, language, and communication developmental milestones is a prerequisite for studying communication disorders. This course provides students with the knowledge and skills necessary to pursue further education, possibly culminating in a bachelor's degree and subsequent master's degree in communication sciences and disorders.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) explain the importance of and demonstrate clear, concise, and effective verbal and non-verbal communication; and~~]

[~~(B) describe and demonstrate effective teamwork skills, including cooperation, contribution, and collaboration.~~]

(1) [~~(2)~~] The student understands basic human communication processes, including the biological, neurological, psychological, developmental, linguistic, and cultural processes. The student is expected to:

(A) differentiate between communication, speech, language, and hearing;

(B) summarize the structural bases of speech production and hearing;

(C) compare anatomy and physiology of the speech mechanism;

(D) examine and describe the anatomy and physiology of the auditory system;

(E) identify and describe healthy verbal and nonverbal communication development;

(F) describe the developmental building blocks and prerequisites for healthy speech and language development;

(G) identify and define terminology related to human communication such as speech sound production, fluency (stuttering), voice, language, hearing, hearing loss, breathing, swallowing, pragmatics, and cognition; and

(H) explain social-interactive and psychological bases of communication and the influences it has on interpersonal communication, including linguistic and cultural influences.

(2) [~~(3)~~] The student gains knowledge and understanding of various theoretical perspectives of healthy speech and language acquisition. The student is expected to:

(A) investigate and explain the major theories of language acquisition;

(B) compare the major theories of speech sound production; and

(C) research and explain the connections between language development and speech development as they relate to phonological awareness in learning to read.

(3) [~~(4)~~] The student understands the healthy development of speech sound production in children. The student is expected to:

(A) describe articulatory phonetics and explain how articulatory phonetics relate to the respiratory system, including the larynx, vocal tract, articulators (velopharynx, tongue, lips, and jaw), and air flow;

(B) analyze the foundation for speech acquisition in relation to auditory perception before birth and in infants;

(C) describe early vocal development in infants as a prerequisite for speech;

(D) explain how the use of vowels by infants and young children is important for the development of speech;

(E) illustrate ways to categorize or describe vowel and diphthong production;

(F) research and describe the development of consonant inventories in young English-speaking children;

(G) describe and differentiate between models for describing consonant production;

(H) summarize progression in speech development for combining sounds into syllable shapes and words; and

(I) analyze the linguistic and cultural influences of the heritage/native language on the development of speech sound production in English.

(4) [~~(5)~~] The student understands the components of a developing language system and how language skills develop in children. The student is expected to:

(A) identify and explain the components of a language system, including phonology, phonetics, morphology, syntax, semantics, and pragmatics;

(B) explain the components of a developing language system in terms of vocabulary, grammar, and social and interpersonal communication;

(C) describe the prerequisite skills for developing language;

(D) differentiate between language delay, language disorders, and language difference;

(E) outline the milestones of healthy language development from birth through age five years related to comprehension and expression;

(F) summarize healthy language development from Kindergarten (age 5) through Grade 5 (age 10 or 11) and describe factors that influence age-appropriate development of language;

(G) describe healthy continuing language development in adolescence for each component of a developing language system; and

(H) compare cultural and ethnic differences in language development.

(5) [~~(6)~~] The student explores the healthy development of verbal fluency skills in children. The student is expected to:

(A) define and differentiate between verbal fluency, disfluencies, and stuttering;

(B) identify and explain common disfluencies and periods of expected disfluencies;

(C) explain the development of speech and language skills;

(D) differentiate between and discuss variables that may affect verbal fluency; and

(E) describe ways to measure verbal fluency for English language learners and evaluate the effectiveness of each method.

(6) [~~(7)~~] The student explores parameters of voice production in children and adults. The student is expected to:

(A) describe the physical and physiological parameters of voice production;

(B) describe the components of healthy voice production, including voice quality, pitch, loudness, resonance, and duration;

(C) explain causes or etiologies of variations in voice production;

(D) describe how parameters of voice production change throughout the span of life;

(E) analyze environmental variables that may affect voice production;

(F) explain the practice of speech-language pathology and allowable services; and

(G) analyze the ethical considerations for the speech-language pathologist in dealing with individuals with a possible voice disorder and the requirement for ongoing work with a physician.

(7) [~~(8)~~] The student understands the development of effective language and communication skills needed to demonstrate high levels of achievement in elementary and secondary school. The student is expected to:

(A) research and describe the milestones of communication development and literacy development;

(B) compare milestones of communication development to the milestones of literacy development;

(C) differentiate between interpersonal language used for conversational interaction and more formal, literate language used for learning academic content;

(D) define and provide examples of tier 1, tier 2, and tier 3 vocabulary as it relates to language development and meeting grade level expectations of academic vocabulary across subject areas;

(E) explain the development of language used for oral and written narratives and demonstrate how story grammar can be used as a bridge between conversational language and academic language;

(F) analyze the development of pragmatic-language skills and the types of verbal, nonverbal, and written communication skills needed to do well in school; and

(G) define emergent literacy and analyze the language base necessary for the development of reading skills.

(8) [~~(9)~~] The student explores healthy and unhealthy speech and language development. The student is expected to:

(A) describe the role of the speech-language pathologist in determining healthy speech and language development and speech sound disorders and language disorders;

(B) explain the purpose of and describe techniques for screening speech and language skills in children;

(C) explain the purpose of and describe techniques for evaluating speech and language skills in children;

(D) analyze the Response to Intervention (RtI) method for accurately identifying a speech or language disorder in school-age children; and

(E) discuss the role of the speech-language pathologist in referral, counseling, and providing basic information when there are concerns about a child's speech or language development.

(9) [~~(10)~~] The student demonstrates effective verbal and nonverbal communication skills. The student is expected to:

(A) describe and demonstrate appropriate communication skills when interacting with elementary age students, classroom teachers, speech-language pathologists, principals, and parents in various situations;

(B) identify and demonstrate verbal and nonverbal communication techniques that should be used when communicating with children who have sensory loss, language barriers, cognitive impairment, and other learning disabilities;

(C) identify and evaluate electronic communication and technology devices that may be used when interacting with children with communication disorders; and

(D) differentiate between oral interpretation and translation skills from English to a second language.

(10) [~~(11)~~] The student explores the influence of dialects of Standard American English or native language on the development of speech and language skills in English and on the production of English. The student is expected to:

(A) provide examples of how a common phrase may be expressed across Standard American English and three different dialects;

(B) describe how speech and language patterns vary as a function of language, age, socioeconomic status, and geography;

(C) analyze the characteristics of American English dialects in terms of speech sound production and language use;

(D) explain the influence of heritage language on the speech sound production and grammar development of English in emergent bilingual students; and

(E) analyze speech and language patterns of English language learners in terms of expected speech and language development.

§127.511. Speech Communication Disorders (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: at least one credit in a course from the Health Science Career Cluster. Recommended prerequisites: Principles of Health Science, Anatomy and Physiology, Introduction to Speech-Language Pathology and Audiology, Speech and Language Development, and Human Growth and Development. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

(3) The Speech Communication Disorders course is designed to provide for the development of advanced knowledge and skills related to an overview of communication disorders that occur in children and adults in the areas of speech sound production, stuttering, voice disorders, and the language areas of semantics, syntax, pragmatics, phonology, and metalinguistics. An overview of treatment for hearing loss and deafness will also be provided.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and~~]

[~~(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team.~~]

(1) [~~(2)~~] The student demonstrates knowledge of the nature of speech, language, hearing, and communication disorders and differences. The student is expected to:

(A) identify the anatomy and describe the function of the peripheral and central auditory pathways;

(B) describe the physical and psychological attributes of sound;

(C) differentiate between the different types of hearing loss and their causes;

(D) describe the impact of hearing loss on speech and language development;

(E) compare the processes of speech, language, and hearing in people of various cultures;

(F) identify and relate disorder differences in relationship to communication skills;

(G) explain the concepts of speech, language, hearing, and communication disorders across the human lifespan; and

(H) explain potential barriers and solutions that an interpreter or translator must consider when communicating with a child with a communication disorder.

(2) [~~(3)~~] The student demonstrates knowledge of the etiologies, characteristics, and anatomical/physical, acoustic, psychological, developmental, linguistic, and cultural correlates of communication disorders across the human lifespan. The student is expected to:

(A) compare common causes of hearing impairment in children and adults;

(B) analyze the causes of speech, language, and hearing disorders across the lifespan;

(C) identify common communication and hearing disorders, their typical symptoms, etiologies, characteristics, and associated correlates;

(D) evaluate the impact of communication disorders on the individual; and

(E) compare cultural variations in how communication disorders are perceived.

(3) [~~(4)~~] The student describes the types of communication disorders most commonly seen in children and the services provided by professionals in this field to provide habilitation or rehabilitation. The student is expected to:

(A) analyze speech sound disorders of the child's phonological system and describe the production of speech sounds such as place, manner, voicing, and distinctive feature analysis;

(B) describe and organize evidence-based treatment approaches for speech sound disorders;

(C) summarize fluency disorders, including secondary characteristics;

(D) analyze evidence-based treatment approaches for stuttering;

(E) identify voice disorders in terms of vocal quality, pitch, volume, resonance, and duration;

(F) develop a plan for an evidence-based treatment for voice disorders and the required interface with a physician;

(G) explain language disorders in terms of the child's use of syntax, morphology, semantics, pragmatics, phonology, and metalinguistics; and

(H) compare current evidence-based treatment approaches for language disorders in preschool and elementary-age children.

(4) [~~(5)~~] The student demonstrates effective verbal and nonverbal communication skills. The student is expected to:

(A) demonstrate communication skills appropriate to the situation when interacting with elementary age students, classroom teachers, speech-language pathologists, principals, and parents with communication disorders;

(B) demonstrate knowledge of verbal and nonverbal communication techniques that should be used when communicating with children that have sensory loss, language barriers, cognitive impairment, and other learning disabilities; and

(C) employ electronic communication and technology devices when interacting with children with communication disorders with appropriate supervision in a school setting.

(5) [~~(6)~~] The student demonstrates sensitivity and understanding of cultural and linguistic influences on an individual's communication patterns and describes how cultural and linguistic influences must be considered when working with children with communication disorders and their families. The student is expected to:

(A) analyze how speech and language patterns vary as a function of language, age, socioeconomic status, and geography;

(B) prepare a simulated interview with the parent or family member of a child referred for a hearing or communication evaluation;

(C) identify patterns of communication that are common for individuals from different cultural and linguistic backgrounds such use of eye contact, personal space, and gestures;

(D) apply design strategies for culturally sensitive family-centered practices for children with communication disorders; and

(E) explain the terms language disorder, language delay, language difference, heritage language, and dialect for describing the communication patterns of a young child.

(6) [~~(7)~~] The student identifies screening, evaluation, and diagnosis procedures that are used to identify hearing loss/deafness, speech sound production disorders, stuttering, voice impairment, and language disorders in children. The student is expected to:

(A) explain principles related to different audiometric test procedures;

(B) participate in a basic audiometric test (screening procedure) and interpret a variety of test results regarding whether the individual passed or failed the screening;

(C) interpret principles related to screening speech sound production, fluency, voice, and language skills in young children;

(D) evaluate developmental screening activities that include screening speech and language development; and

(E) synthesize the components of a comprehensive diagnostic report of findings inclusive of speech sound production, fluency (stuttering), voice production, and receptive, expressive, and social language skills to explain the test results.

(7) [~~(8)~~] The student identifies research-based and evidence-based practices in speech-language pathology and audiological service delivery. The student is expected to:

(A) define evidence-based practice (EBP) and differentiate EBP from scientifically-based research in the fields of speech-language pathology and audiology;

(B) define the set of Evidence Levels used by the American Speech-Language-Hearing Association as a protocol to evaluate research evidence;

(C) correlate research studies to the Evidence Levels used by the American Speech-Language-Hearing Association;

(D) analyze the role of expert opinion and clinical experience in evidence-based practice; and

(E) design and present an action research project in the field of communication disorders.

(8) [~~(9)~~] The student demonstrates knowledge and understanding of a variety of treatment approaches used with children with communication disorders. The student is expected to:

(A) compare two treatment approaches for speech sound disorders;

(B) compare two treatment approaches for fluency disorders;

(C) describe and practice treatment approaches for voice disorders in the areas of vocal quality, pitch, loudness, resonance, and duration;

(D) compare two treatment approaches for language disorders in preschool children;

(E) compare two treatment approaches for language disorders in elementary school-age children; and

(F) identify treatment approaches for language disorders with children with disabilities such as autism, intellectual disability, cleft palate, or cerebral palsy.

ATTACHMENT IV
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter K. Hospitality and Tourism

§127.569. Foundations of Restaurant Management (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Hospitality and Tourism. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Hospitality and Tourism Career Cluster focuses on the management, marketing, and operations of restaurants and other food/beverage services, lodging, attractions, recreation events, and travel-related services.

(3) Foundations of Restaurant Management provides students with a foundation to understand basic culinary skills and food service management, along with current food service industry topics and standards. Building on prior instruction, this course provides introductory insight into critical thinking, financial analysis, industry technology, social media, customer or client awareness, and leadership in the food service industry. Students will gain an understanding of restaurant operations and the importance of communicating effectively to diverse audiences for different purposes and situations in food service operations and management. Students will learn how the front of the house and the back of the house of restaurant management operate and collaborate and will obtain value-added certifications in the industry to help launch themselves into food service careers.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

(1) The student demonstrates professional standards as required by the food service industry. The student is expected to:

(A) explain the importance of and demonstrate effective oral and written communication;

(B) describe professional grooming, hygiene, and appropriate uniform standards for various food service positions and scenarios;

(C) describe how punctuality and time-management skills are critical to the success of employees and businesses in the food service industry;

(D) describe what demonstrating self-respect and respect for others looks like;

(E) analyze and demonstrate effective teamwork strategies and leadership styles;

(F) describe initiative, adaptability, and problem-solving techniques and discuss how each may be used in the food service industry; and

(G) identify opportunities to participate in community leadership and teamwork activities that enhance professional skills.

(2) The student develops academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within the food service industry. The student is expected to:

(A) use information management methods and tools to organize oral and written information;

(B) create a variety of written documents such as job descriptions, menus, presentations, and advertisements;

(C) calculate numerical concepts such as weights, measurements, pricing, and percentages;

(D) identify how scientific principles used in the food service industry affect customer service and profitability; and

(E) explain how to operate a profitable restaurant using mathematics and science knowledge and skills.

(3) The student uses verbal and nonverbal communication skills to create, express, and interpret information to establish a positive work environment. The student is expected to:

(A) develop and deliver business presentations;

(B) identify and create various marketing strategies used by the food service industry to increase customer or client traffic and profitability;

(C) plan and facilitate new staff member training;

(D) explain how interpersonal communications such as verbal and nonverbal cues enhance communication with coworkers, employees, managers, and customers or clients; and

(E) explain how active listening skills can affect employee morale and customer service.

(4) The student solves problems using critical thinking, innovation, and creativity independently and in teams. The student is expected to:

(A) develop ideas to increase customer service, employee morale, and profitability; and

(B) describe how employing critical-thinking and interpersonal skills can help resolve conflicts with individuals such as coworkers, customers or clients, and employers.

(5) The student uses information technology tools specific to restaurant management to access, manage, integrate, and interpret information. The student is expected to:

(A) identify information technology tools and applications used to perform workplace responsibilities and explain how the tools and applications may be used to increase productivity;

(B) describe how business financial statements may be evaluated to increase profitability;

(C) analyze customer service scenarios and make recommendations for improvements;

(D) explain how point-of-sale systems are used to evaluate business outcomes and provide customer service; and

(E) design Internet resources for business profitability.

(6) The student understands the various roles and responsibilities within teams, work units, departments, organizations, and the larger environment of the food service industry. The student is expected to:

(A) compare the roles and responsibilities of food service operations staff, including back-of-the-house, front-of-the-house, and support roles, and explain how each impact profitability of business operations;

(B) explain how developing strategic work schedules impacts effective customer service and profitability;

(C) investigate quality-control standards and practices and analyze how those standards and practices affect restaurant profitability;

(D) analyze various styles of restaurant services such as table, buffet, fast food, fast casual, and quick service for cost and level of profitability;

(E) describe how various place settings impact the customer service experience and profitability of the business; and

(F) explain how proper service techniques in food service operations contribute to the customer or client experience.

(7) The student understands the importance of health, safety, and environmental management systems in organizations and their impact on organizational performance, profitability, and regulatory compliance. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations, how OSHA inspections are conducted, and the role of national and state regulatory entities;

(C) explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(D) research and discuss sources of food-borne illness and determine ways to prevent them;

(E) identify and explain the appropriate use of types of personal protective equipment used in industry;

(F) discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(G) describe types of electrical hazards in the workplace and the risks associated with these hazards and describe control methods to prevent electrical hazards in the workplace;

(H) analyze the hazards of handling, storing, using, and transporting hazardous materials and identify and discuss ways to reduce exposure to hazardous materials in the workplace;

(I) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace;

(J) describe the elements of a safety and health program, including management leadership, worker participation, and education and training;

(K) explain the purpose and importance of written emergency action plans and fire protection plans and describe key components of each such as evacuation plans and emergency exit routes, list of fire hazards, and identification of emergency personnel;

(L) explain the components of a hazard communication program; and

(M) explain and give examples of safety and health training requirements specified by standard setting organizations.

(8) The student explores professional ethics and legal responsibilities within the food service industry. The student is expected to:

(A) research and describe laws and guidelines affecting operations in the restaurant industry; and

(B) explain the reasons for liability insurance in the restaurant industry.

(9) The student understands the importance of developing skills in time management, decision making, and prioritization. The student is expected to:

(A) identify and explain delegation of tasks related to the effective operation of a food service establishment;

(B) describe the relationships between scheduling, payroll costs, and sales forecasting; and

(C) analyze various steps in determining the priority of daily tasks to be completed in a food service establishment.

(10) The student investigates the skills, training, and educational requirements needed to successfully gain and maintain employment in the food service industry and explores local and regional opportunities in the industry. The student is expected to:

(A) describe effective strategies for seeking employment in the food service industry;

(B) identify the required training and educational requirements that lead to a career in the food service industry;

(C) select educational and work history highlights to include in a career portfolio;

(D) create and update a personal career portfolio;

(E) describe and demonstrate effective interviewing techniques for gaining employment in the food service industry;

(F) create a personal training plan for obtaining employment in a specific occupation such as Texas Alcoholic Beverage Commission training and Food Safety and Sanitation training in the food service industry;

(G) research and analyze the local and regional labor market to determine opportunities in the food service industry;

(H) investigate professional development opportunities to keep current on relevant trends and information within the food service industry; and

(I) identify and discuss entrepreneurship opportunities within the food service industry.

(11) The student explores factors that have shaped the food service industry. The student is expected to:

(A) research and describe the history and growth of the food service industry;

(B) explain how culture and globalization influence the food service industry; and

(C) analyze current trends affecting the food service industry.

(12) The student understands factors that affect the profitability of a food service business. The student is expected to:

(A) explain the importance of effectively managing inventory to maintain profitability of the food service business;

(B) describe and demonstrate effective stewarding processes and procedures such as establishing thorough cleaning schedules and proper dishwashing techniques;

(C) describe how proper food storage techniques affect the profitability of an establishment;

(D) explain how pricing and controlling costs such as labor and supplies affect the profitability of a food service business; and

(E) analyze how customer service and customer or client loyalty affect the profitability of a food service business and compare strategies for building and maintaining customer loyalty.

§127.571. [~~Introduction to~~] Event and Meeting Planning (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Hospitality and Tourism Career Cluster. Recommended prerequisite: Principles of Hospitality and Tourism, Hotel Management, or Travel and Tourism Management. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Hospitality and Tourism Career Cluster focuses on the management, marketing, and operations of restaurants and other food/beverage services, lodging, attractions, recreation events, and travel-related services.

(3) [~~Introduction to~~] Event and Meeting Planning introduces students to the concepts and topics necessary to understand the meetings, events, expositions, and conventions (MEEC) industry. The course will review the roles of the organizations and people involved in the businesses that comprise the MEEC industry.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) explain the importance of developing personal and professional skills such as punctuality, initiative, leadership, respect for all people, conflict management, work ethic, and adaptability;~~]

[~~(B) explain how critical thinking, innovation, and creativity are essential to the problem-solving process;~~]

[~~(C) describe appropriate professional grooming, hygiene, and appearance for the workplace;~~]

[~~(D) identify effective teamwork and conflict management skills and explain how using effective teamwork and conflict management skills leads to the achievement of collective goals;~~]

[~~(E) explain how planning and time management skills and tools can be used to enhance results and complete work tasks;~~]

[~~(F) identify and describe essential workplace skills necessary for obtaining employment and developing a career;~~]

[~~(G) prepare and complete employment related documents such as paper and electronic job applications and I-9 and W-4 forms;~~]

[~~(H) compare effective stress management techniques and explain the importance of using effective stress management techniques;~~]

[~~(I) explain the various steps in the decision-making process; and~~]

[~~(J) describe and demonstrate effective interview techniques for gaining employment in various positions and at various businesses in the MEEC industry.~~]

(1) [~~(2)~~] The student recognizes the importance of and uses oral and written communication skills in creating, expressing, and interpreting information and ideas. The student is expected to:

(A) explain the importance of using verbal and non-verbal communication skills effectively with customers or clients and colleagues;

(B) summarize information formally and informally;

(C) synthesize information from various sources and determine how to prioritize and convey relevant information to customers or clients and colleagues;

(D) explain how to use active listening skills to obtain and clarify information;

(E) develop and deliver different types of presentations such as informative, instructional, persuasive, and decision making;

(F) identify interpersonal skills used to maintain internal and external customer or client satisfaction and describe how effectively using those interpersonal skills impacts customer or client relationships; and

(G) identify and use technical vocabulary related to the meeting and event planning industry.

(2) [~~(3)~~] The student applies academics with career-readiness skills. The student is expected to:

(A) explain how applying mathematical skills to business transactions such as sales forecasting, service pricing, and planning for profitability are essential to operating a successful business;

(B) calculate and interpret key ratios, financial statements, and budgets related to the hospitality event and meeting planning industry;

(C) identify opportunities in the hospitality industry to use advanced reading, writing, and mathematics skills;

(D) analyze and summarize data from tables, charts, and graphs to estimate and find solutions to problems and identify opportunities for increased profitability; and

(E) identify and use industry standards for budgeting and forecasting to maximize profit and growth.

(3) [~~(4)~~] The student explores career opportunities available within the meeting and event planning segment of the hospitality industry. The student is expected to:

(A) compile a list of professional organizations that support the professionals in the convention, meeting, and event planning industry;

(B) develop a personal training plan to keep current on relevant trends and information within the meeting and event planning industry; and

(C) identify occupational opportunities for meeting and event planning for hospitality businesses and corporate businesses.

(4) [~~(5)~~] The student explores the history of and current trends and career opportunities in the meeting and event planning industry. The student is expected to:

(A) describe how the meeting and event planning industry has evolved;

(B) analyze and describe current trends in the meeting and event planning industry;

(C) describe the varied occupations related to meeting and event planning such as meeting planning and management, conference planning and management, trade show planning and management, social event planning and management, association and non-profit meeting planning and management, corporation meeting planning and management, convention and visitor bureau planning and management, and destination management planning and organization;

(D) describe how a professional mentor can be beneficial to a career and identify potential mentors in the meeting and event planning industry; and

(E) create a career plan to achieve the desired career position in the meeting and event planning industry.

(5) [~~(6)~~] The student explores how varying needs of customers or clients impact the event planning industry. The student is expected to:

(A) explain the importance of meeting the varying needs of customers or clients for the successful operation of a business;

(B) explain how a business plan and business activities may be modified to meet the varying needs of customers or clients; and

(C) describe how understanding diversity such as differences in social etiquette, dress, and behaviors may positively impact event and meeting planning.

(6) [~~(7)~~] The student uses information technology tools in event and meeting planning to access, manage, integrate, and create information. The student is expected to:

(A) research and compare event planning software and technology tools such as tools that manage attendee engagement or provide marking services that help perform workplace tasks and meet business objectives;

(B) create complex multimedia publications and presentations for clients and colleagues;

(C) explain how point-of-sale systems are used in the meeting and event planning industry;

(D) explain how Internet resources can promote industry growth;

(E) investigate and evaluate current and emerging technologies used to improve guest services; and

(F) use electronic tools to produce appropriate communication for planning and selling meetings and events.

(7) [~~(8)~~] The student understands the professional, ethical, and legal responsibilities in event and meeting planning services. The student is expected to:

(A) explain ethical conduct such as maintaining client confidentiality and privacy of sensitive content when interacting with others;

(B) identify different components of a meeting or event contract;

(C) investigate and describe applicable rules, laws, and regulations related to event and meeting planning;

(D) discuss the reasons for providing event security;

(E) compare options for event insurance; and

(F) explain the reasons for event insurance.

(8) [~~(9)~~] The student understands the importance of health, safety, and environmental management systems and their impact on organizational performance and regulatory compliance. The student is expected to:

(A) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;

(B) explain and discuss the importance of Occupational Safety and Health Administration (OSHA) standards and OSHA requirements for organizations, how OSHA inspections are conducted, and the role of national and state regulatory entities;

(C) explain the role industrial hygiene plays in occupational safety and explain various types of industrial hygiene hazards, including physical, chemical, biological, and ergonomic;

(D) research and discuss sources of food-borne illness and determine ways to prevent them;

(E) identify and explain the appropriate use of types of personal protective equipment used in industry;

(F) discuss the importance of safe walking and working surfaces in the workplace and best practices for preventing or reducing slips, trips, and falls in the workplace;

(G) describe types of electrical hazards in the workplace and the risks associated with these hazards and describe control methods to prevent electrical hazards in the workplace;

(H) analyze the hazards of handling, storing, using, and transporting hazardous materials and identify and discuss ways to reduce exposure to hazardous materials in the workplace;

(I) identify workplace health and safety resources, including emergency plans and Safety Data Sheets, and discuss how these resources are used to make decisions in the workplace;

(J) describe the elements of a safety and health program, including management leadership, worker participation, and education and training;

(K) explain the purpose and importance of written emergency action plans and fire protection plans and describe key components of each such as evacuation plans and emergency exit routes, list of fire hazards, and identification of emergency personnel;

(L) explain the components of a hazard communication program; and

(M) explain and give examples of safety and health training requirements specified by standard setting organizations.

(9) [~~(10)~~] The student explores marketing strategies and how effective marketing strategies are used in the meeting and event planning industry. The student is expected to:

(A) develop effective marketing strategies for meetings and events;

(B) create promotional packages for meetings and events;

(C) design an effective, comprehensive menu;

(D) analyze the state of the economy to plan effective meeting and event services; and

(E) develop a meeting and events business plan.

(10) [~~(11)~~] The student understands and demonstrates appropriate professional customer service skills required by the meeting and event planning industry. The student is expected to:

(A) create a detailed plan or process to provide maximum customer service;

(B) describe and demonstrate how critical-thinking and interpersonal skills are effectively used to resolve conflicts with individuals such as coworkers, employers, guests, and clients; and

(C) analyze customer or client feedback to formulate improvements in services and products.

(11) [~~(12)~~] The student explores different business segments and stakeholders within the event and meeting planning industry. The student is expected to:

(A) compare roles and responsibilities of various departments in the larger lodging environment, including food and beverage services;

(B) differentiate between meeting and event planning operations for different clients such as business, leisure, professional organizations, and students; and

(C) identify the various stakeholders in the MEEC industry.

(12) [~~(13)~~] The student understands the roles and responsibilities within teams, work units, departments, organizations, and the larger environment of the meeting and event planning industry. The student is expected to:

(A) differentiate between the roles and responsibilities of meeting and event planning staff and lodging property staff;

(B) describe the responsibilities of an event manager or planner;

(C) identify and explain how operating procedures can contribute to profitable operations; and

(D) identify and explain how inventory management systems used in the meeting and event planning industry can contribute to profitable operations.

(13) [~~(14)~~] The student knows how to create a functional and aesthetic meeting and event plan to meet the customer or client requirements. The student is expected to:

(A) describe how to conduct a pre-meeting or pre-event meeting with potential clients to identify the meeting or event requirements;

(B) discuss the importance of a meeting venue floorplan specification chart and appropriate meeting room set-up;

(C) compare various meeting room set-up options and describe the benefits of each option;

(D) describe how meeting room set-up options vary based on the venue;

(E) develop a meeting room set-up for a planned event;

(F) calculate the square footage required for an event based on the number of anticipated attendees for the event;

(G) identify and design effective traffic patterns for a specific event;

(H) explain and demonstrate proper table rotations; and

(I) develop a staffing guide to schedule various staff for a meeting or event.

(14) [~~(15)~~] The student understands the importance of collaborating with various companies to provide an all-inclusive successful meeting or event. The student is expected to:

(A) identify the various entities involved in the meeting and event planning industry such as convention and visitors' bureaus, group travel companies, entertainers, recreations,

amusements, attractions, florists, caterers, and venues and differentiate between the roles each entity plays in planning the meeting or event;

(B) differentiate between event sponsors, organizers, and producers and the events that are coordinated by each;

(C) explain and demonstrate how to effectively plan and negotiate with various entities to deliver a successful meeting or event;

(D) compare products and services from related industries; and

(E) explain how the meeting and event planning process differs based on the venue such as hotels and resorts, convention and visitors' centers, event centers, and destination venues and describe the pros and cons of convening a meeting or event at various venues.

§127.604. Practicum in Event and Meeting Planning (Two Credits), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: a minimum of two credits with at least one credit in a Level 2 or higher course from the Hospitality and Tourism Career Cluster. Recommended prerequisite: [~~Introduction to~~] Event and Meeting Planning. Students shall be awarded two credits for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Hospitality and Tourism Career Cluster focuses on the management, marketing, and operations of restaurants and other food/beverage services, lodging, attractions, recreation events, and travel-related services.

(3) The Practicum in Event and Meeting Planning course will reinforce the concepts and topics necessary for the comprehensive understanding of the meetings, events, expositions, and conventions (MEEC) industry. The central focus of this course is to integrate academic education with local MEEC businesses to prepare students for success in the work force and/or postsecondary education. Students will benefit from a combination of classroom instruction and a work- based learning experience. Students will learn employability skills, communication skills, customer service skills, and other activities related to job acquisition. The course is recommended for students who have completed the required prerequisites.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates proficiency in professional standards/employability skills as required by the meeting and event planning industry. The student is expected to:~~]

[~~(A) participate in a paid or unpaid, laboratory or work-based application of previously-studied knowledge and skills related to event meeting and planning;~~]

[~~(B) demonstrate proper interview techniques for event and meeting planning occupations;~~]

[~~(C) complete employment-related documents such as job applications (written and electronic formats), a resume, and I-9 and W-4 forms;~~]

[~~(D) exhibit suitable grooming and appearance standards appropriate for the workplace and planned events;~~]

[~~(E) demonstrate productive work habits and a positive attitude;~~]

[~~(F) model knowledge of personal and occupational safety practices in the workplace; and~~]

[~~(G) integrate verbal, nonverbal, and written communication skills in a variety of settings.~~]

(1) [~~(2)~~] The student applies professional advancement skills and strategies in the meeting and event planning industry. The student is expected to:

(A) develop strategies to enhance career advancement and promote lifelong industry learning;

(B) describe historical events that have affected the event and meeting planning industry;

(C) formulate plans to address current events that have an effect on the event and meeting planning industry;

(D) document in manual and electronic format acquired technical knowledge and skills needed for success in the meeting planning industry;

(E) produce and present a professional portfolio, including a current resume, documentation of skill attainment or technical competencies, recognitions, awards, scholarships, community service activities, student organization participation, evaluations, letters of recommendation, and cover letters;

(F) evaluate employment options by comparing salaries and benefits offered by different companies and occupations within the industry; and

(G) develop a personal budget based on career choice using effective money management and financial planning techniques.

(2) [~~(3)~~] The student demonstrates the ethics and etiquette necessary for the meeting and event planning workplace. The student is expected to:

(A) practice appropriate business and personal etiquette in the workplace;

(B) display appropriate electronic communication techniques and etiquette;

(C) exhibit the behaviors that align with the hospitality code of ethics and ethical standards; and

(D) determine the most ethical behavior or course of action in response to various situations experienced in the meeting and event planning industry.

(3) [~~(4)~~] The student develops and demonstrates the interpersonal and customer service skills needed for success in the meeting and event planning environment. The student is expected to:

(A) exhibit essential workplace characteristics such as organization, perseverance, motivation, dependability, punctuality, initiative, self-control, and the ability to accept and act on criticism;

(B) demonstrate effective team-building skills such as collaboration, planning, conflict resolution, rapport-building, decision-making, problem-solving, and persuasion and influencing techniques;

(C) identify and respond to customer or client needs, including resolving customer dissatisfaction;

(D) exercise leadership by anticipating and proactively diffusing potential event issues; and

(E) negotiate to resolve conflicts in the workplace and with customers by using strategies such as active listening, "I" messages, negotiation, and offering win-win solutions.

(4) [~~(5)~~] The student demonstrates the industry-based knowledge and skills required for a successful career in the event and meeting planning industry. The student is expected to:

(A) employ job-specific technical vocabulary with accuracy and fluency;

(B) explain event planning procedures designed to ensure client needs are met such as Banquet Event Orders, rate assignment, event organization, client relations, and determination of payment methods;

(C) assess meeting or event company structures and traits that lead to profitability and business success;

(D) determine the correct procedures for the execution of client events and contracts;

(E) identify and organize tasks for daily operation;

(F) describe societal events that have shaped the event and meeting planning industry both in the past and present; and

(G) interpret the role of the convention and visitors' bureau in the event and meeting planning industry.

(5) [~~(6)~~] The student develops and practices awareness of varying needs of customers or clients understands the impact of diversity on the industry. The student is expected to:

(A) assesses how varying needs of customers or clients impacts the event planning industry both from a planning and profitability aspect;

(B) demonstrate respect for individual differences;

(C) explain the importance of meeting the varying needs of customers or clients for the successful operation of a business;

(D) develop business plans and activities to meet the varying needs of customers or clients; and

(E) describe differences in social etiquette, dress, and behaviors and explain how differences affect the event planning process.

(6) [~~(7)~~] The student uses information technology tools in event and meeting planning to access, manage, integrate, and create information. The student is expected to:

(A) evaluate current and emerging technologies that improve client services;

(B) evaluate and incorporate event planning software and technology tools that help to perform workplace tasks and meet business objectives;

(C) create and present multi-level (complex) multimedia presentations to clients;

(D) use and problem-solve issues with point-of-sale systems;

(E) design a plan for using Internet resources to maximize company profitability; and

(F) use appropriate electronic communication tools for planning and selling meetings and events.

(7) [~~(8)~~] The student differentiates between and adapts to various roles, types of events, and functions. The student is expected to:

(A) differentiate between the types of event sponsors, organizers, and producers and their events such as trade shows, conferences, social events, and corporate meetings;

(B) identify various suppliers for different event planning needs and explain how they service different events;

(C) describe the importance of sales coordinators to events and meetings regardless of organization or type of event;

(D) evaluate and modify different types of catering options and menus based on the needs of the event or organization;

(E) evaluate and modify different types of meeting room set-ups (banquet, classroom, theater, and reception) based on the needs of the event or organization; and

(F) determine and organize staff and resources according to the specific needs of the organization and event.

(8) [~~(9)~~] The student collaborates within departments, organizations, and the larger environment of the meeting and event planning industry. The student is expected to:

(A) analyze the roles and responsibilities of each level of the management structure of a venue;

(B) identify the advantages and disadvantages of different event destinations and facilities and their effects on profitability and customer satisfaction;

(C) analyze the roles and responsibilities of an in-house event manager or planner as compared to independent professionals; and

(D) define specific roles and responsibilities when interfacing with destination venues.

(9) [~~(10)~~] The student understands and can articulate the factors that contribute to a successful and profitable event. The student is expected to:

(A) analyze the expenses associated with the planning and production of a meeting or event;

(B) analyze and evaluate how marketing techniques impact operation and profitability related to an event;

(C) calculate costs of supplies and evaluate how costs affect profitability;

(D) evaluate the impact of payroll expenses on profitability;

(E) analyze and modify operating procedures to result in more profitable or cost-effective operations;

(F) research and create a marketing plan for various markets such as weddings, government and military groups, professional and educational organizations, family or social gatherings, and geography;

(G) identify profit margins associated with various markets; and

(H) evaluate the importance of conducting pre-and post-event evaluations for continuous improvement.

(10) [~~(11)~~] The student demonstrates knowledge of potential liability situations that can affect business reputation and profitability. The student is expected to:

(A) compare and contrast different levels of insurance and liability limits for events;

(B) analyze customer-provided insurance options for events;

(C) identify and explain legal, health, and safety obligations related to event planning;

(D) assess the implications and responsibilities associated with providing or allowing alcohol at an event; and

(E) research law enforcement requirements for events and meetings.

ATTACHMENT V
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter M. Information Technology [~~Law and Public Service~~]

§127.689. Advanced Cloud Computing (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite [~~Recommended Prerequisites~~] : At least one credit from a [~~in a Level 2 or higher~~] course in computer science, programming, software development, or networking systems. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) The Advanced Cloud Computing course is an exploration of cloud computing. In this course, students explore cloud computing services, applications, and use cases. Students study cloud computing best practices and learn how cloud computing helps users develop a global infrastructure to support use case at scale while also developing and using innovative technologies.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) demonstrate and explain positive workplace behaviors that enhance employability and job advancement such as regular attendance, promptness, attention to proper attire, maintenance of a clean and safe work environment, appropriate voice, and pride in work;~~]

[~~(B) demonstrate and explain positive personal qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;~~]

[~~(C) describe and demonstrate effective reading and writing skills;~~]

[~~(D) use critical thinking skills to solve cloud computing problems; and~~]

[~~(E) demonstrate and explain leadership skills and how to function effectively as a team member.~~]

(1) [~~(2)~~] The student understands the impact of cloud computing technology and compares the major services offered by cloud computing providers. The student is expected to:

(A) describe the benefits and risks of cloud computing and the reasons for switching from on-premises computing to cloud computing;

(B) identify and describe the major types of cloud computing;

(C) generate sample cloud usage plans for a business case study, including a description of how each of the services can be used to improve the business;

(D) explain the purpose of a region, availability zone, and edge location; and

(E) compare the major services offered by cloud computing providers.

(2) [~~(3)~~] The student demonstrates how to store and share content in the cloud. The student is expected to:

(A) identify features and functions of commonly used cloud services;

(B) locate and use common services found in cloud computing consoles;

(C) analyze how cloud services are used in real-world industries;

(D) explain the functions of a domain name system (DNS);

(E) create an object storage bucket;

(F) explain benefits and uses of a content delivery network;

(G) configure web content distribution via edge locations and attach it to a website;

(H) identify the benefits, features, and use cases of different types of block storage;

(I) analyze a use case and recommend the best type of virtual storage for the particular situation;

(J) create a block storage volume or physical record;

(K) attach a block storage volume to a virtual computing instance; and

(L) create a virtual computing instance that hosts a simple website.

(3) [~~(4)~~] The student applies cloud security best practices in relation to identity and access management (IAM). The student is expected to:

(A) identify best practices for IAM;

(B) analyze the cultural and societal impacts of cloud security;

(C) differentiate between a role, user, and policy in cloud security;

(D) identify and use a process to resolve vulnerabilities in a web server;

(E) describe cloud security best practices and explain steps to fix security lapses;

(F) identify the best cloud security service for a given scenario;

(G) demonstrate the use of an IAM system to set up a text alert event; and

(H) compare monitoring and logging services.

(4) [~~(5)~~] The student describes when to use various databases, the benefits of caching data, and how to build a virtual private cloud (VPC). The student is expected to:

(A) compare online transactional processing and online analytical processing;

(B) describe the benefits of caching data;

(C) explain and demonstrate how a load balancer is attached to a webpage;

(D) describe features and benefits of load balancing;

(E) evaluate the performance of a load balancer;

(F) create an application using a platform as a service (PaaS); and

(G) demonstrate the use of a template infrastructure as code to build a VPC.

(5) [~~(6)~~] The student understands the landscape of emerging technologies in the cloud. The student is expected to:

(A) define machine learning and discuss its impacts on society, business, and technology;

(B) identify potential use cases for emerging technology in the cloud;

(C) assess value propositions of using cloud technology;

(D) identify cloud services that can analyze and protect data and manage networks;

(E) define blockchain technology and explain its benefits;

(F) explain the infrastructure of cloud development kits or services; and

(G) demonstrate the use of a software development framework to model and provision a cloud application.

(6) [~~(7)~~] The student resolves common security alerts, diagrams instance states and transitions, and explains how to choose the most cost-efficient instance type. The student is expected to:

(A) describe the shared responsibility security model;

(B) identify security responsibility for cloud resources;

(C) analyze how the shared security model accounts for common threats to the cloud computing model;

(D) identify the steps required to resolve an automated security alert;

(E) describe the six instance states, including pending, running, stopping, stopped, shutting down, and terminated;

(F) identify and diagram the transitions between instance states from launch to termination;

(G) explain instance usage billing for each instance state; and

(H) determine the most cost-efficient instance state for a given situation.

(7) [~~(8)~~] The student differentiates between dynamic and static websites. The student is expected to:

(A) describe and demonstrate the process for setting up a static website;

(B) compare static and dynamic websites;

(C) create a content delivery network distribution to increase the speed of a website;

(D) demonstrate the process to launch a dynamic web server;

(E) create a serverless compute function using a serverless compute console;

(F) describe the main functions of auto scaling;

(G) create a launch template and an auto scaling group; and

(H) develop a plan for monitoring an auto scaling instance or group.

(8) [~~(9)~~] The student demonstrates the benefits and risks of using big data. The student is expected to:

(A) define big data and identify use cases for it within various industries;

(B) identify and evaluate the benefits and risks of big data;

(C) explain how blockchain ensures the validity and immutability of transactions, particularly in the cloud; and

(D) evaluate the benefits and risks of blockchain business applications.

§127.690. Foundations of User Experience (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) In Foundations of User Experience (UX), students analyze and assess current trends in a career field that creates meaningful, approachable, and compelling experiences for users of an array of products, services, and/or initiatives of companies, governments, and organizations. Students gain knowledge of introductory observation and research skills, basic design thinking and applied empathy methodologies, collaborative problem-solving and ideation, and interaction design and solution development. The knowledge and skills acquired from this course enable students to identify real-world problems through research and data-driven investigation and to design solutions while participating in collaborative problem solving. Students are introduced to agile practices and methodologies to develop skills to take solutions from conceptual sketch to digital designs using professional software tools. Students explore how to improve the quality of user interactions and perceptions of products, experiences, and any related services.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills in the IT field with a focus in the area of UX. The student is expected to:~~]

[~~(A) identify job opportunities in UX and accompanying job duties and tasks;~~]

[~~(B) describe and use effective verbal and nonverbal communication skills;~~]

[~~(C) create resumes and portfolios for UX professions;~~]

[~~(D) use critical thinking skills and creativity to present a solution to a user problem; and~~]

[~~(E) work collaboratively in a team to devise and present an efficiency or enhancement solution to a user issue within a given timeline, while incorporating empathy methodology, agile, and design principles.~~]

(1) [~~(2)~~] The student applies professional communications strategies. The student is expected to:

(A) revise presentations for audience, purpose, situation, and intent;

(B) interpret and clearly communicate information, data, and observations;

(C) apply active listening skills to obtain and clarify information;

(D) identify multiple viewpoints of potential diverse users; and

(E) define and exhibit public relations skills that are used by UX designers.

(2) [~~(3)~~] The student describes the field of UX and common elements in user-centered design. The student is expected to:

(A) analyze the current trends and challenges of the UX field;

(B) analyze and describe the diversity of roles and career opportunities across the UX field;

(C) define terminology associated with UX, including user, user experience, human-centered design, design thinking, persona, user journey, empathy map, mind maps, roadmaps, wireframes, prototypes, and portfolios;

(D) identify and explain the differences between relevant, friendly, and useful experience design;

(E) identify and explain the connection between psychology and behavior with regard to usability;

(F) explain the components of the design thinking methodology for ideation, iteration, co-creation, development, and execution; and

(G) explain how UX design affects everyday lives.

(3) [~~(4)~~] The student discusses and applies the legal and ethical practices that UX designers follow when working with technology, designs, and clients. The student is expected to:

(A) identify and explain ethical use of technology;

(B) explain intellectual property laws, including copyright, trademarks, and patents, and consequences of violating each type of law;

(C) identify violations of intellectual property laws;

(D) explain the consequences of plagiarism; and

(E) demonstrate ethical use of online resources, including using proper citations and avoiding plagiarism.

(4) [~~(5)~~] The student identifies and demonstrates introductory observation and research methods. The student is expected to:

(A) describe the difference between qualitative and quantitative data;

(B) conduct user interviews to gather insights into what users think about a site, an application, a product, or a process;

(C) organize ideas and user data using software tools;

(D) analyze and draw conclusions from qualitative user data collection;

(E) observe and document how users perform tasks through task analysis observations;

(F) define affinity and explain the benefits of affinity and customer journey maps;

(G) use data summaries from user interviews to create personas; and

(H) create a report or presentation, including user interview and observation data summaries, data analysis, and additional findings, for a target audience.

(5) [~~(6)~~] The student applies an understanding of psychological principles used in user-centered design. The student is expected to:

(A) identify and define design principles;

(B) describe how visceral reactions inform the creation of a positive user experience;

(C) select colors to influence human behavior, the human mind, and reactions toward an intended outcome;

(D) explain recognition and scanning patterns and their importance in user-centered design;

(E) define Hick's Law and Weber's Law and explain their impact on UX design decisions;

(F) describe sensory adaptation phenomenon and perceptual set; and

(G) explain the stages of human information processing, including sensing, perceiving, decision-making, and acting.

(6) [~~(7)~~] The student creates effective, accessible, usable, and meaningful solutions for the end user by using UX design principles. The student is expected to:

(A) identify end-user problems and needs in real-world environments;

(B) identify principles of accessibility such as perceivable, operable, understandable, and robust (POUR);

(C) identify and discuss the differences and connections between UX Design, Visual Design, and User Interaction in regard to usability;

(D) communicate potential solutions and ideas with a storytelling approach;

(E) sketch and refine designs within wire-framing and prototypes; and

(F) implement iterations for a design solution using structured testing protocols.

(7) [~~(8)~~] The student collaborates with others to apply UX project management methods. The student is expected to:

(A) identify the relationship between UX research and design-thinking methods; and

(B) explain three different stages and roles of UX project management methods such as agile methods.

(8) [~~(9)~~] The student applies UX design practices and uses technology to create digital assets. The student is expected to:

(A) use design elements such as typeface, color, shape, texture, space, and form to create a visual narrative;

(B) implement design principles such as unity, harmony, balance, scale, novelty, hierarchy, alignment, and contrast to create visual narratives;

(C) identify and explain common elements of Hyper Text Markup Language (HTML) such as tags, style sheets, and hyperlinks;

(D) apply UX design techniques in order to:

(i) create effective user interfaces for browser-based, native, and hybrid mobile applications;

(ii) demonstrate proper use of vector and raster-based design software;

(iii) explain the difference between back-end and front-end development in UX; and

(iv) create a web page containing links, graphics, and text using appropriate design principles;

(E) demonstrate basic sketching skills;

(F) create wireframes using design software;

(G) explain how design fidelity, from sketch to wireframe to prototype to visuals, aligns with and supports agile methodology; and

(H) produce digital assets.

§127.691. Advanced User Experience Design (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. [~~Students shall be awarded one credit for successful completion of this course.~~] This course is recommended for students in Grades 10-12. Prerequisite [~~Required prerequisite course~~] : Foundations of User Experience. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, digital interactions, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) The Advanced User Experience (UX) Design course allows students to apply skills in science and art to integrate technology as a useful, meaningful, memorable, and accessible source for all users. Students will use knowledge from the Foundations of User Experience course to expand the research, design process, testing, and communication skills essential for success in this user-focused career field.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills in the IT field with a focus in the area of UX. The student is expected to:~~]

[~~(A) identify job opportunities in UX and individual skills and abilities needed to apply;~~]

[~~(B) describe and use effective interpersonal and communication skills;~~]

[~~(C) identify and practice the skills associated with at least one UX professional certification;~~]

[~~(D) create a resume and portfolio for a UX position; and~~]

[~~(E) demonstrate adaptability and flexibility by adjusting project outcomes from peer review and critique.~~]

(1) [~~(2)~~] The student understands and demonstrates legal and ethical procedures for UX designers as they apply to the use of information technology. The student is expected to:

(A) identify intellectual property violations within given scenarios; and

(B) formulate and communicate visually, orally, or in writing the ramifications and consequences of plagiarism and copyright infringement within a business context.

(2) [~~(3)~~] The student connects and applies UX design conceptual foundations with real-world scenarios. The student is expected to use proper terms and professional language for UX design context, both orally and in written form.

(3) [~~(4)~~] The student uses different options of project management to produce a successful UX design. The student is expected to:

(A) identify different stages of the UX design process, including research, identification of problem, ideation, prototyping, and testing, and apply these stages to refine or create products;

(B) test partial products during the UX design process and analyze results to inform the refinement phase;

(C) explain the conceptual design, content strategy, and ways to get feedback from various users and stakeholders in the project; and

(D) demonstrate effective time-management and planning to complete project tasks.

(4) [~~(5)~~] The student collects and interprets data through the use of UX tools and protocols. The student is expected to:

(A) create templates for questionnaires, data collection, and summary reports;

(B) analyze data and create a summary of project conclusions that include insights into affordances and constraints of the project design;

(C) distinguish differences in qualitative research methods such as user interviews, ethnography, field studies, focus groups, and usability testing; and

(D) identify and use quantitative methods such as A/B testing, card sorting, heat maps, analytics, and user surveys.

(5) [~~(6)~~] The student creates and analyzes prototypes for UX design products. The student is expected to:

(A) identify a UX problem and list potential solutions;

(B) evaluate potential solutions and create an action plan to address a problem based on desired features and requirements for a UX design product;

(C) create a presentable content strategy and develop conceptual designs and symbolic messages for a UX design prototype;

(D) generate possible solutions with ideation methods such as unstructured discussion, storyboards, brainstorming, role playing, game storming, mind mapping, teamwork games, and sketching;

(E) refine and select ideas for prototyping with a people-centered rationale for the decision;

(F) create low-fidelity prototypes, including sketches, paper models, and click-through prototypes; and

(G) create mockups and high-fidelity prototypes, including digital and physical versions.

(6) [~~(7)~~] The student structures solutions while applying UX design principles. The student is expected to:

(A) explain how the connected layouts, blocks of content, visual designs, and navigation requirements enhance user experience;

(B) explain how the distinguishing of channels and formats during website development impacts usability across different devices;

(C) develop and implement design activities for co-creation, peer-review, and collaborative feedback;

(D) test and evaluate navigation experiences and compare results with current competitors; and

(E) incorporate best practices for references, including adding the designer's voice and signature.

(7) [~~(8)~~] The student describes best practices and plans for a usability test. The student is expected to:

(A) create a usability test plan that includes cognitive, perceptual, emotional, and cultural information about users, data collection requirements, and user testing methods;

(B) execute testing methodologies and collect data for analysis purposes; and

(C) present conclusions and recommendations that apply design principles, communication, and creative skills.

§127.695. Information Technology Troubleshooting (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Information Technology Career Cluster. Recommended prerequisites: Principles of Information Technology and Computer Maintenance/Lab. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry-level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) The Informational Technology Troubleshooting course is about applying logic over technical components to identify and resolve problems. The course focuses on developing a methodical approach in IT troubleshooting and leveraging those skills in a workplace environment. In this course, students learn and use proven troubleshooting methods and apply those in a collaborative workplace setting. Students develop personal success skills, including time management and personal accountability measures, strategies for collaboration and teamwork, and effective written and verbal communication skills. The knowledge and skills acquired in the course enables students to use IT resources and data safely, ethically, and within legal guidelines. Students work within a service level model that helps them to interpret, clarify, and diagnose issues with hardware, software, and networking.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) describe the benefits of effective time management and explain how to manage the use of one's time efficiently;~~]

[~~(B) describe and demonstrate the behaviors of an effective team member;~~]

[~~(C) explain the importance of emotional intelligence in the role of an IT support specialist;~~]

[~~(D) describe and apply strategies to resolve conflicts;~~]

[~~(E) identify and employ active listening skills, including paraphrasing and asking questions for clarification;~~]

[~~(F) communicate effectively orally and in writing when communicating with others, including team members, clients/customers, and others;~~]

[~~(G) identify and apply best practices for email communications;~~]

[~~(H) interpret technical language, documents, and diagrams and translate them into lay terminology;~~]

[~~(I) demonstrate the use of proper grammar and spelling and capture complete thoughts in communications and documentation; and~~]

[~~(J) investigate and discuss potential IT pathways for IT support specialists.~~]

(1) [~~(2)~~] The student develops and models customer-service skills. The student is expected to:

(A) identify and model the characteristics of excellent customer service;

(B) list and demonstrate the steps for opening and greeting a contact;

(C) explain the benefits of using a client's name;

(D) identify habits and situations to avoid when interacting with a client;

(E) explain the importance of keeping clients informed of status changes;

(F) list and demonstrate the steps for putting a client on hold or transferring a call;

(G) identify and demonstrate techniques and strategies for handling difficult calls and situations; and

(H) document all client communications and outcomes clearly and appropriately.

(2) [~~(3)~~] The student applies procedures for various support interaction types. The student is expected to:

(A) describe the primary responsibilities and skills of an IT support specialist and how to deliver consistent, quality service;

(B) explain and demonstrate safety procedures for unpacking, handling, and repacking replacement parts;

(C) describe when to use various support delivery methods and technologies such as in-person, email, phone, web, and remote access;

(D) demonstrate the use of various support delivery models, including in-person, email, phone, web, and remote access technologies, to troubleshoot an issue; and

(E) describe the purpose and value of the security management process and the IT support specialist's role in that process.

(3) [~~(4)~~] The student implements proven troubleshooting methods and strategies within the context of a service level model. The student is expected to:

(A) implement and explain a troubleshooting process for diagnosing issues with hardware, software, and the network;

(B) explain the importance of clearly documenting progress throughout the troubleshooting process;

(C) describe activities common to help desk service level model and incident management processes;

(D) interpret and clarify different types of incidents, problems, and events submitted in the help desk service model or trouble ticketing system;

(E) describe an operational level agreement (OLA) and the role of the IT support specialist in an OLA;

(F) describe what is meant by escalation and the reasons an incident may be escalated;

(G) identify and apply relevant system updates for supported devices; and

(H) describe service and support center metrics, including a service level target and the IT support specialist's role in monitoring and reviewing data related to these metrics.

(4) [~~(5)~~] The student describes and applies best practices for the safe, ethical, and legal use of resources and information. The student is expected to:

(A) demonstrate and describe positive digital citizenship and acceptable use policy when using digital resources;

(B) describe best practices for creating passwords such as increasing password length and password complexity, enforcing password blacklists, resetting passwords, limiting password entry attempts, and using multi-factor authentication;

(C) examine, describe, and demonstrate the use of guidelines for using media, information, and applications protected by copyright;

(D) compare and explain copyright, fair use, public domain, and Creative Commons licensing;

(E) identify and apply licensing guidelines for software, media, and other resources;

(F) explain the importance and uses of encryption;

(G) describe and demonstrate best practices for handling confidential information;

(H) analyze cyber threats and social engineering vulnerabilities and discuss ways to prevent them;

(I) describe various types of security policies and summarize the importance of physical security and logical security measures;

(J) explain the importance of reporting security compromises such as addressing prohibited content and activity; and

(K) identify and demonstrate appropriate data destruction and disposal methods relevant to a given scenario.

(5) [~~(6)~~] The student applies foundational knowledge and skills for the installation, configuration, operation, and maintenance of desktops and workstations. The student is expected to:

(A) explain the procedure used to install and configure motherboards, central processing units (CPUs), and add-on cards relevant to a given scenario such as a custom personal computer configuration to meet customer specifications;

(B) describe how to implement security best practices to secure a workstation, including software-based computer protection tools such as software firewalls, antivirus software, and anti-spyware;

(C) demonstrate how to identify symptoms or error codes, including no power, no POST, no BOOT, and no video, that indicate device issues and explain how to troubleshoot symptoms or error codes;

(D) describe the process used to install, troubleshoot, and replace random-access memory (RAM) types and data storage;

(E) describe how to troubleshoot, clean, repair, or replace internal components, including heat sink units and thermal paste, exhaust vents and fans, power supply units, power adapters, batteries, wireless elements, and wireless wide area network (WWAN) components;

(F) explain the importance of conducting periodic maintenance, including both physical and electronic cleaning, disk checks, routine reboots, data dumps, and testing; and

(G) describe and demonstrate how to prevent, detect, and remove malware using appropriate tools and methods.

(6) [~~(7)~~] The student applies foundational knowledge and skills about the installation, configuration, operation, and maintenance of operating systems (OS) and software. The student is expected to:

(A) describe and demonstrate the use of OS features and tools relevant to given scenarios;

(B) describe and demonstrate the use of OS utilities relevant to given scenarios;

(C) execute OS command-line tools such as ipconfig, netstat, dir, nbtstat;

(D) troubleshoot and document OS problems relevant to a given scenario;

(E) demonstrate how to use features and tools of various operating systems properly;

(F) troubleshoot and document problems in various operating systems; and

(G) explain database concepts and the purpose of a database.

(7) [~~(8)~~] The student installs, configures, operates, maintains, and troubleshoots issues related to peripheral devices relevant to a given scenario. The student is expected to:

(A) explain and demonstrate how to install, configure, maintain, and troubleshoot storage devices;

(B) explain and demonstrate how to install, configure, maintain, and troubleshoot printers, copiers, and scanners, including small office home office (SOHO) multifunction devices and printers;

(C) explain and demonstrate how to install, configure, maintain, and troubleshoot video projectors and video displays; and

(D) explain and demonstrate how to install, configure, maintain, and troubleshoot multimedia devices such as sound cards, speakers, microphones, and webcams.

(8) [~~(9)~~] The student monitors current issues related to the installation, configuration, operation, and maintenance of laptops, tablets, and other mobile devices, including internet of things (IoT) devices. The student is expected to:

(A) explain and demonstrate how to install and configure laptop and netbook hardware to meet customer specifications;

(B) explain and demonstrate how to install components within the display of a laptop;

(C) explain and demonstrate how to connect and configure accessories and ports of mobile devices;

(D) analyze and apply methods used to secure mobile devices;

(E) configure mobile device network connectivity and application support;

(F) demonstrate proper methods to perform mobile device synchronization such as synchronizing information to a laptop or desktop computer; and

(G) explain and demonstrate how to troubleshoot issues relevant to mobile devices, OS, and applications.

(9) [~~(10)~~] The student troubleshoots issues with wired and wireless networks and cloud computing resources. The student is expected to:

(A) explain and demonstrate how to install, configure, and secure a wired network;

(B) explain and demonstrate how to install, configure, and secure a wireless network;

(C) compare wireless security protocols and authentication methods;

(D) analyze, describe, and troubleshoot wired and wireless network problems;

(E) demonstrate the use of appropriate networking tools to fix network issues safely;

(F) explain how computing devices such as laptops and cell phones connect and share data;

(G) describe the components of cloud-computing architectures and features of cloud-computing platforms; and

(H) analyze, describe, and troubleshoot cloud computing resources.

§127.696. Engineering Applications of Computer Science Principles (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 9-12. Prerequisite: Algebra I and at least one credit in a course from the Information Technology Career Cluster . Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology career cluster focuses on the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialists and network analysts.

(3) Engineering Applications of Computer Science Principles teaches rigorous engineering design practices, engineering habits of mind, and the foundational tools of computer science. Students apply core computer science principles to solve engineering design challenges that cannot be solved without such knowledge and skills. Students use a variety of computer software and hardware applications to complete projects.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) cooperate, contribute, and collaborate as a member of a group to attain agreement and achieve a collective outcome;~~]

[~~(B) present written and oral communication in a clear, concise, and effective manner;~~]

[~~(C) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results;~~]

[~~(D) identify tasks and complete tasks with the highest standards to ensure quality products and services; and~~]

[~~(E) analyze cost savings by using a simulation to run experiments before committing more resources.~~]

(1) [~~(2)~~] The student applies concepts of critical thinking and problem solving to engineering applications in computer science. The student is expected to:

(A) identify, analyze, and discuss elements of an engineering problem to develop creative and innovative solutions;

(B) identify, analyze, and discuss the elements and structure of a programming problem to develop creative and innovative solutions;

(C) identify and discuss pertinent information from a customer and existing program for solving a problem;

(D) compare and discuss alternatives to a solution using a variety of problem-solving and critical-thinking skills; and

(E) conduct research to gather technical information necessary for decision making.

(2) [~~(3)~~] The student conducts computer science and engineering laboratory activities using safe and environmentally appropriate practices. The student is expected to:

(A) identify and demonstrate safe practices during hands-on cutting and building activities during computer science and engineering laboratory activities;

(B) identify and demonstrate safe use and storage of electrical components; and

(C) identify and demonstrate appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.

(3) [~~(4)~~] The student applies ethical considerations in designing solutions. The student is expected to:

(A) define and evaluate constraints pertaining to a problem;

(B) identify safety considerations in designing engineering solutions with respect to the system, engineer, and user; and

(C) investigate and explain the importance and application of relevant legal and ethical concepts in computer science such as intellectual property, use of open-source software, attribution, patents, and trademarks.

(4) [~~(5)~~] The student demonstrates an understanding of the structured methods used to collect and analyze information about customer needs. The student is expected to:

(A) analyze information provided by the customer to identify customer needs;

(B) create a process flow diagram based on customer needs to generate ideas for potential user actions, product functions, and design opportunities;

(C) develop a flowchart for a program using the results of a process flow diagram;

(D) create a target specifications table;

(E) identify and describe similar existing solutions; and

(F) construct a functional model based on customer needs to generate ideas for potential user actions, product functions, and design opportunities.

(5) [~~(6)~~] The student develops a user interface and supplemental instructions. The student is expected to:

(A) identify essential tasks to be completed by the user;

(B) identify points of potential confusion or unexpected input by the user;

(C) design a software or user interface that clearly communicates to the user how to complete desired tasks;

(D) develop supplemental user instructions to inform the user of items that cannot be incorporated into an interface such as how to start the program or frequently asked questions;

(E) test a program and the program instructions with an individual who is not familiar with the project;

(F) evaluate and discuss feedback and results from new user testing;

(G) improve and refine a program and the program instructions based on feedback and results of testing; and

(H) re-test a program and the program instructions as necessary after modifications have been made in response to testing and identify any next steps.

(6) [~~(7)~~] The student systematically reverse engineers a product, examines ways to improve the product, and identifies the type of redesign required to make that improvement. The student is expected to:

(A) write or [~~and~~] perform tests, including break testing, for an existing program to determine functionality;

(B) describe unexpected findings from deconstructing existing code;

(C) examine and discuss relevant software libraries to determine their uses and functionality;

(D) construct a flowchart for an existing program;

(E) compare a program's current functionality to the customer's needs;

(F) identify and add missing customer specifications or needs to a program's flowchart;

(G) develop and explain new code that includes customer specifications or improves a product; and

(H) compare and discuss the predicted versus actual functionality of a product to generate ideas for redesign.

(7) [~~(8)~~] The student applies concept generation and selection skills. The student is expected to:

(A) create and explain a black box and functional model of a system;

(B) implement brainstorming, mind mapping, concept sketching, and gallery walk activities to produce new ideas; and

(C) apply concept selection techniques such as a Pugh chart or a weighted decision matrix to design decisions.

(8) [~~(9)~~] The student develops and applies engineering design process skills. The student is expected to:

(A) select and use appropriate tools and techniques to support design activities;

(B) report information about software design solutions in an engineering notebook;

(C) develop, test, and refine programming concepts throughout the development process;

(D) interpret and use an electrical diagram to build a circuit;

(E) create a circuit using a microcontroller, a breadboard, and multiple components;

(F) explain and apply the design process from different starting points by beginning with a baseline design;

(G) use a model or simulation which represents phenomena and mimics real-world events to develop and test hardware;

(H) critique and explain the usefulness and limitations of certain models;

(I) develop a prototype solution; test the prototype solution against requirements, constraints, and specifications; and refine the prototype solution; and

(J) report and describe a product's final design after the prototyping phase.

(9) [~~(10)~~] The student applies mathematics and algorithms in programs. The student is expected to:

(A) apply mathematical concepts from algebra, geometry, trigonometry, or [~~and~~] calculus to calculate the angle of a joint;

(B) apply mathematical calculations cyclically in a program using algorithms; and

(C) evaluate and verify algorithms for appropriateness and efficiency.

(10) [~~(11)~~] The student develops computer programs to support design solutions. The student is expected to:

(A) design and explain software interfaces that communicate with hardware;

(B) identify and apply relevant concepts from computer science, science, and mathematics such as functions, electricity, and mechanics; and

(C) employ abstraction in a program by representing numerical sensor readouts [~~distance and brightness ranges~~] in more intuitive variables and functions.

(11) [~~(12)~~] The student develops and applies computer science skills. The student is expected to:

(A) integrate small discrete programs into a larger complete program solution using systems-thinking skills;

(B) use intuitive variable names correctly and add comments to code to improve readability;

(C) employ abstraction in a program by representing images as data arrays and representing numerical tone frequencies as variables;

(D) convert image information into the correct data type necessary for given library functions;

(E) develop an algorithm that includes logic such as "while" and "if" to accept user trackbar input and display image changes in real time;

(F) develop flowcharts, pseudocode, and commented code to document and explain software design solutions;

(G) design software interfaces that communicate with users and hardware;

(H) employ abstraction to program [~~to~~] an interface, treating imported code as a "black box";

(I) employ abstraction by representing a joint as four points in a plane; and

(J) select and apply correct programming vocabulary and programming skills during program development.

(12) [~~(13)~~] The student develops and uses computer programs to process data and information to gain insight and discover connections to support design solutions. The student is expected to:

(A) explain how to organize complex image and video data for processing;

(B) analyze complex data to make decisions and instruct users; and

(C) develop programs that use incoming data and algorithms to create output data, information, and commands.

§127.697. Geographic Information Systems (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Art, Audio/Video Technology, Principles of Information Technology, Physics for Engineers, or Principles of Applied Engineering. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology career cluster focuses on the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) The Geographic Information Systems (GIS) course employs an analytic process using industry standard software to find trends and patterns in collected data. Whether collecting data first-hand or from reputable websites, GIS aims to use scientific methods to find solutions to various problems and issues.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) produce effective written and oral communication;~~]

[~~(B) describe and demonstrate appropriate verbal and nonverbal communication skills;~~]

[~~(C) describe employers' expectations, appropriate work habits, and good citizenship skills;~~]

[~~(D) identify career development and opportunities in the GIS industry and related industries;~~]

[~~(E) identify and apply competencies related to resources, information, and systems of operation in the geographical information technology industry;~~]

[~~(F) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;~~]

[~~(G) identify and explain the appropriate use of types of personal protective equipment used in the GIS industry; and~~]

[~~(H) explain and give examples of safety and health training requirements specified by standard setting organizations.~~]

(1) [~~(2)~~] The student demonstrates knowledge and appropriate use of computer hardware components and software programs and examines how hardware and software are interrelated. The student is expected to:

(A) use operating systems, software applications, and communication and networking components appropriately;

(B) compare and appropriately use various input, processing, output, and primary/secondary storage devices;

(C) evaluate and select software based on quality, appropriateness, effectiveness, and efficiency; and

(D) solve digital file format and cross platform connectivity compatibility issues.

(2) [~~(3)~~] The student uses data input skills. The student is expected to:

(A) incorporate into a product and use a variety of input devices such as keyboard, scanner, or mouse appropriately; and

(B) use digital keyboarding standards for the input of data.

(3) [~~(4)~~] The student demonstrates knowledge and understanding of what GIS is and the use of GIS technology in different career fields. The student is expected to:

(A) identify historical and contemporary developments in GIS;

(B) describe the basic components of GIS; and

(C) identify appropriate application of GIS technologies in different career fields.

(4) [~~(5)~~] The student demonstrates knowledge and appropriate use of database software. The student is expected to:

(A) design and construct a relational database from a geographic data model using a database software;

(B) use joins, hyperlinks, and relational linking appropriately within a database;

(C) convert data into a data depiction using classifications; and

(D) transfer data from different sources into a database for storage and retrieval.

(5) [~~(6)~~] The student demonstrates knowledge and appropriate use of spatial databases and sources. The student is expected to:

(A) identify and use appropriately various spatial databases and sources such as digital terrain models, digital orthophoto quadrangles, geographic databases, land use and land cover data, digital imagery, hydrographic spatial data, and demographic data; and

(B) describe and demonstrate appropriate use of spatial analysis.

(6) [~~(7)~~] The student demonstrates knowledge and appropriate use of GIS software. The student is expected to:

(A) determine the appropriate software tool from GIS to use for a given task or project;

(B) create queries and spatial queries for finding features, borders, centroids, and networks and determining distance, length, and surface measurements and shapes;

(C) describe characteristics of maps and spatial data; and

(D) identify and use geographical scales, coordinates, and specific map projections.

(7) [~~(8)~~] The student demonstrates knowledge and appropriate use of GIS data collection devices. The student is expected to:

(A) plan and conduct supervised GIS and Global Positioning System (GPS) experiences;

(B) initialize and prepare a GPS receiver for data collection;

(C) collect geographical coordinates from a GPS receiver; and

(D) transfer data from a GPS device to a personal computer.

(8) [~~(9)~~] The student acquires electronic information in a variety of formats. The student is expected to:

(A) collect electronic information in various formats, including text, audio, video, and graphics; and

(B) gather authentic data from a variety of electronic sources to use for individual and group GIS projects.

(9) [~~(10)~~] The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:

(A) explain project management guidelines for designing and developing GIS projects; and

(B) design solutions for a project using visual organizers such as flowcharts or schematic drawings.

(10) [~~(11)~~] The student produces a product using a variety of media. The student is expected to:

(A) publish information in a variety of formats, including hard copies and digital formats; and

(B) prepare a presentation of GIS information using graphs, charts, maps, and presentation software.

(11) [~~(12)~~] The student examines GIS maps, reports, and graphs. The student is expected to:

(A) explain industry-standard legends used in GIS;

(B) describe symbols, scaling, and other map elements used in GIS;

(C) generate GIS reports and graphs; and

(D) create maps using a variety of map display types such as choropleth, heat maps, dot density maps, topographic maps, or graduated symbols maps.

§127.698. Raster-Based Geographic Information Systems (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Geographic Information Systems. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology career cluster focuses on the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) In Raster-Based Geographic Information Systems (GIS), students study local problems; acquire information, including images or aerial photographs; process the acquired data; and merge the acquired data with vector data. Students plan, conduct, and present solutions for locally based problems.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) produce effective written and oral communication;~~]

[~~(B) describe and demonstrate appropriate verbal and nonverbal communication skills;~~]

[~~(C) describe and demonstrate various workplace expectations, including proper work attire and professional conduct;~~]

[~~(D) describe time-management skills, including prioritizing tasks, following schedules, and tending to goal-relevant activities to optimizes efficiency and results;~~]

[~~(E) explain the importance of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed;~~]

[~~(F) explain and discuss the responsibilities of workers and employers to promote safety and health in the workplace and the rights of workers to a secure workplace;~~]

[~~(G) identify and explain the appropriate use of types of personal protective equipment used in the GIS industry; and~~]

[~~(H) explain and give examples of safety and health training requirements specified by standard setting organizations.~~]

(1) [~~(2)~~] The student demonstrates knowledge of the GIS field and related careers. The student is expected to:

(A) identify employment and career opportunities in GIS-related fields;

(B) identify and explore career preparation learning experiences, including job shadowing, mentoring, apprenticeship training, and preparation programs;

(C) identify industry certifications for GIS-related careers, including careers related to raster-based GIS; and

(D) discuss and analyze ethical issues related to GIS and technology and incorporate proper ethics in submitted projects.

(2) [~~(3)~~] The student explores various roles in team projects. The student is expected to:

(A) explain the importance of teamwork in the field of GIS;

(B) describe principles of effective teamwork, including collaboration and conflict resolution; and

(C) explain common characteristics of strong team leaders and team members.

(3) [~~(4)~~] The student investigates the history and use of aerial photography. The student is expected to:

(A) explain fundamental principles of cameras and lenses as they pertain to GIS and aerial photography;

(B) research and explain the history of aerial photography, including aerial platforms;

(C) explain various uses of aerial photography;

(D) compare vertical and oblique aerial photography; and

(E) identify cities, bridges, shorelines, roads and other important features in aerial photos.

(4) [~~(5)~~] The student develops an understanding of electromagnetic and thermal radiation. The student is expected to:

(A) explain how forms of radiation propagate through space and interact with matter;

(B) research and describe the behavior of waves, including refraction, scattering, absorption, and reflection, in relation to radiation;

(C) describe the properties and laws of thermal radiation;

(D) compare the particle and wave models of electromagnetic energy;

(E) differentiate maps based on electromagnetic versus thermal radiation imagery; and

(F) evaluate whether electromagnetic or thermal radiation imagery is appropriate based on the conditions.

(5) [~~(6)~~] The student explores active and passive microwave remote sensing. The student is expected to:

(A) compare active and passive microwave remote sensing;

(B) explain geographic characteristics, including surface roughness, moisture content, vegetation, backscatter and biomass, and urban structures, detected by remote sensing images; and

(C) provide a detailed analysis of radar images.

(6) [~~(7)~~] The student learns the functions and applications of the tools, equipment, and materials used in GIS and raster-based analysis. The student is expected to:

(A) describe how to use raster-based software;

(B) download spatial data and raster images and re-project the data and images to match the Digital Orthophoto Quadrangle (DOQ) or Digital Orthophoto Quarter Quadrangle (DOQQ);

(C) identify remote sensing equipment and describe the difference between the Global Positioning System (GPS) and the Global Navigation Satellite System (GLONASS);

(D) describe GPS measurements and perform measurements with handheld GPS devices using GPS or GLONASS systems; and

(E) compare the advantages, disadvantages, and limitations of remote or unmanned sensing.

(7) [~~(8)~~] The student uses scientific practices in imagery analysis. The student is expected to:

(A) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology;

(B) collect GIS data;

(C) organize, analyze, evaluate, make inferences, and predict trends from GIS data; and

(D) communicate valid conclusions using appropriate GIS vocabulary, supportive maps, summaries, oral reports, and technology-based reports.

(8) [~~(9)~~] The student uses project-management skills to research and analyze locally based problems. The student is expected to:

(A) identify and collect data necessary to evaluate a local problem, including defining the problem and identifying locations of the concern;

(B) develop a plan and project schedule for completion of a project developed to address a local concern using raster-based GIS technology;

(C) create a GIS map to illustrate a problem using remote sensing images gathered from sites such as the National Aeronautics and Space Administration, National Oceanic and Atmospheric Administrations, and United States Geological Survey;

(D) evaluate GIS map features to identify solutions to a problem;

(E) develop solutions to minimize, reverse, or solve problem using raster-based GIS technology; and

(F) organize and present findings related to a local problem in a final report or portfolio with data and solutions generated using raster-based GIS technology.

§127.699. Spatial Technology and Remote Sensing (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Information Technology Career Cluster. Recommended prerequisites:

Geographic Information Systems and Raster-Based Geographic Information Systems. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Information Technology career cluster focuses on the design, development, support, and management of hardware, software, multimedia, and systems integration services. This career cluster includes occupations ranging from software developer and programmer to cybersecurity specialist and network analyst.

(3) In Spatial Technology and Remote Sensing, students receive instruction in industry standard geospatial extension software and geospatial tools, including global positioning systems (GPS), and training in project management and problem solving related to geographic information systems (GIS).

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:~~]

[~~(A) produce effective written and oral communication;~~]

[~~(B) describe and demonstrate effective verbal and nonverbal communication skills;~~]

[~~(C) describe workplace expectations, including appropriate work attire and professional conduct;~~]

[~~(D) describe and demonstrate principles of effective teamwork, including collaboration and conflict resolution;~~]

[~~(E) describe and demonstrate effective use of time management skills, including prioritizing tasks, following schedules, and tending to goal-relevant activities to optimize efficiency and results;~~]

[~~(F) explain the importance of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks with little or no direction; and~~]

[~~(G) identify consequences and appropriate actions related to discrimination, harassment, and inequality in the workplace.~~]

(1) [~~(2)~~] The student demonstrates knowledge of the GIS field and GIS-related careers. The student is expected to:

(A) identify employment and career opportunities in spatial technology and remote sensing related GIS fields;

(B) describe and explore career preparation learning experiences, including job shadowing, mentoring, apprenticeship training, and preparation programs;

(C) identify industry certifications for GIS-related careers, including careers that use or benefit from spatial technology; and

(D) analyze and discuss ethical issues related to the field of spatial technology and remote sensing technology and spatial technology and remote sensing technology projects.

(2) [~~(3)~~] The student applies basic GIS software knowledge and skills to explore the use of various geographic projections in GIS software. The student is expected to:

(A) identify and use Mercator map projection;

(B) identify and use Albers conic map projection; and

(C) research and explain the evolution of and need for different map projections.

(3) [~~(4)~~] The student explores the application of GPS technology. The student is expected to:

(A) define and use data terminology related to GPS;

(B) identify and use appropriately GPS receiver components;

(C) describe various applications of GPS coordinates such as locating fire hydrants, extinguishers, lighting, and parking lots; and

(D) compare the accuracy of GPS coordinates from different receivers such as smartphones, tablets, and GPS handheld devices.

(4) [~~(5)~~] The student demonstrates knowledge and understanding of the types and components of unmanned remote sensing platforms. The student is expected to:

(A) identify major components of aerial, terrestrial, and submersible remote sensing platforms;

(B) determine the most appropriate remote sensing platform to use based on various conditions;

(C) differentiate the types of sensing systems used by each type of platform, including active, passive, spectrometer, radar, LiDAR, scatter meter, and laser altimeter platforms; and

(D) compare situations in which different unmanned remote sensing platforms and sensing systems might be used.

(5) [~~(6)~~] The student demonstrates skills related to GIS data analysis. The student is expected to:

(A) evaluate findings and potential problems using GIS data;

(B) create models that represent collected GIS data;

(C) create, query, map, and analyze cell-based raster data; and

(D) analyze density, distance, and proximity of various data points using spatial analyst tools.

(6) [~~(7)~~] The student analyzes geospatial socioeconomic data to create three-dimensional maps to demonstrate findings. The student is expected to:

(A) identify key sources of and gather and organize geospatial socioeconomic data;

(B) plan, organize, and create thematic maps;

(C) convert two-dimensional themes to a three-dimensional map to demonstrate features, distributions, and themes; and

(D) interpret, draw conclusions about, and justify findings related to geospatial socioeconomic data.

(7) [~~(8)~~] The student uses spatial technology to develop and analyze a location map. The student is expected to:

(A) identify and collect data using GPS and unmanned systems and identify the boundaries and topography of a location;

(B) analyze how the location of a community impacts resources and hardships such as jobs or traffic in the community;

(C) create a map of a location that includes buildings and facilities, adjacent streets, and transportation sites using GIS software; and

(D) develop a map that includes categories for a facility's features such as restrooms, spaces allocated for core activities, emergency equipment, and excavation routes.

(8) [~~(9)~~] The student documents spatial technology knowledge and skills. The student is expected to:

(A) create a spatial technology and remote sensing portfolio that includes attainment of technical skill competencies and samples of work such as location maps and spatial technology and remote sensing-based reports; and

(B) present a portfolio to peers or interested stakeholders.

ATTACHMENT VI
Text of Proposed New 19 TAC

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter N. Law and Public Service

§127.773. Legal Research and Writing (One Credit), Adopted 2025.

(a) Implementation.

(1) The provisions of this section shall be implemented by school districts beginning with the 2025-2026 school year.

(2) School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills, Adopted 2025) as an integral part of this course.

(b) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: at least one credit in a course from the Law and Public Service Career Cluster. Recommended prerequisite: Court Systems and Practices. Students shall be awarded one credit for successful completion of this course.

(c) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Law and Public Service Career Cluster focuses on planning, managing, and providing legal services, public safety, protective services, and homeland security, including professional and technical support services.

(3) Legal Research and Writing provides an introduction to the study and practice of legal writing and research. This course is designed to introduce students to the methods and tools used to conduct legal research, develop and frame legal arguments, produce legal writings such as briefs, memorandums, and other legal documents, study U.S. Constitutional law, and prepare for appellate argument(s).

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations [~~leadership or extracurricular organizations~~] .

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(d) Knowledge and skills.

[~~(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to achieve business and industry employability skills standards such as attendance, on-time arrival, meeting deadlines, working toward personal and team goals every day, and ethical use of technology.~~]

(1) [~~(2)~~] The student conducts legal research. The student is expected to:

(A) plan a legal research strategy;

(B) access print and online research materials to find and analyze case law;

(C) describe the difference between mandatory and persuasive authority;

(D) research mandatory and persuasive case history using online databases such as Lexis-Nexis;

(E) explain how to shepardize case law;

(F) critique other's legal writing(s) to determine whether cited case law and other legal sources were correctly referenced and relied upon for precedential holdings;

(G) evaluate and apply concepts found in Bluebook citation rules to one's writing.

(2) [~~(3)~~] The student prepares , drafts, and defends legal arguments. The student is expected to:

(A) read and analyze case law;

(B) read and analyze case procedural history;

(C) apply legal precedent to current legal issues; and

(D) develop arguments based on research, relevant case law, statutes, and public policy [~~supported by case law research~~] .

(3) [~~(4)~~] The student understands , prepares, and drafts [~~and prepares~~] legal documents. The student is expected to:

(A) use and interpret legal reference documents such as the Bluebook to follow and apply requirements for legal writing and citations;

(B) prepare and draft legal briefs that include standard elements, including an introduction , [~~and~~] table of authorities , brief answer, introduction, argument, counter-argument, and conclusion ;

(C) prepare and draft memoranda [~~memorandums~~] that follow a standard legal format; and

(D) prepare and draft other legal documents such as demand letters and pleadings.

(4) [~~(5)~~] The student studies and analyzes U.S. Constitutional law. The student is expected to:

(A) analyze the relationship between the U.S. Constitution, Common Law, [~~and~~] state law(s), and local law(s);

(B) analyze the legal, social, and historical implications of court decisions affecting the interpretation of the U.S. Constitution;

(C) predict possible outcomes of future cases and frame arguments in ways that are likely to garner the support of the judiciary;

(D) critique cases related to U.S. Constitutional law and other current legal issues such as free exercise clause, establishment clause, due process, and equal protection; and

(E) critique cases related to current legal issues.

(5) [~~(6)~~] The student participates in a class moot court simulation. The student is expected to:

(A) research and evaluate case law on a current legal issue;

(B) read and evaluate appellant, respondent, and amici briefs associated with the chosen case;

(C) write an appellate brief; and

(D) prepare an oral argument and respond to questions during the presentation of the argument.

ATTACHMENT
Text of Proposed Amendment to 19 TAC

Chapter 74. Curriculum Requirements

Subchapter A. Required Curriculum

§74.3. Description of a Required Secondary Curriculum.

(a) (No change.)

(b) Secondary Grades 9-12.

(1) A school district that offers Grades 9-12 must provide instruction in the required curriculum as specified in §74.1 of this title. The district must ensure that sufficient time is provided for teachers to teach and for students to learn the subjects in the required curriculum. The school district may provide instruction in a variety of arrangements and settings, including mixed-age programs designed to permit flexible learning arrangements for developmentally appropriate instruction for all student populations to support student attainment of course and grade level standards.

(2) A [~~The~~] school district must offer [~~the~~] courses listed in subparagraphs (A)-(J) of this paragraph , unless selection from a list of courses is specified, and maintain evidence that students have the opportunity to take these courses:

(A) English language arts--English I, II, III, and IV and at least one additional advanced English course;

(B) mathematics--Algebra I, Algebra II, Geometry, Precalculus, and Mathematical Models with Applications;

(C) science--

(i) Integrated Physics and Chemistry, Biology, Chemistry, Physics ; [~~,~~] and

(ii) at least two additional science courses selected from Aquatic Science, Astronomy, Earth Systems Science [~~Earth and Space Science~~] , Environmental Systems, Advanced Animal Science, [~~Advanced Biotechnology,~~] Advanced Plant and Soil Science, Anatomy and Physiology, Physics for Engineering, Biotechnology I, Biotechnology II, Engineering Design and Problem Solving, Food Science, Forensic Science, Medical Microbiology, Pathophysiology, Scientific Research and Design, [~~and~~] Engineering Science , Fluid Mechanics, Mechanics of Materials, and advanced level biology, chemistry, physics, and environmental science courses offered as dual credit as referenced in §74.11(i) of this title (relating to High School Graduation Requirements) or a course selected from §74.12(b)(3)(A) or (B) of this title (relating to Foundation High School Program) [~~, Advanced Placement (AP) Biology, AP Chemistry, AP Physics 1: Algebra Based, AP Physics 2: Algebra Based, AP Environmental Science, AP Physics C: Electricity and Magnetism, and AP Physics C: Mechanics. The requirement to offer two additional courses may be reduced to one by the commissioner of education upon application of a school district with a total high school enrollment of less than 500 students. Science courses shall include at least 40% hands-on laboratory investigations and field work using appropriate scientific inquiry~~] ;

(D) social studies--United States History Studies Since 1877, World History Studies, United States Government, World Geography Studies, Personal Financial Literacy, Economics with Emphasis on the Free Enterprise System and Its Benefits, and Personal Financial Literacy and Economics [~~. The requirement to offer both Economics with Emphasis on the Free Enterprise System and Its Benefits and Personal Financial Literacy and~~

~~Economics may be reduced to one by the commissioner of education upon application of a school district with a total high school enrollment of less than 500 students~~] ;

(E) physical education--at least two courses selected from Lifetime Fitness and Wellness Pursuits, Lifetime Recreation and Outdoor Pursuits, or Skill-Based Lifetime Activities;

(F) fine arts--courses selected from at least two of the four fine arts areas (art, music, theatre, and dance)--Art I, II, III, IV; Music I, II, III, IV; Theatre I, II, III, IV; or Dance I, II, III, IV;

(G) career and technical education-- three or more career and technical education courses for four or more credits with at least one advanced course aligned with a specified number of Texas Education Agency-designated programs of study determined by enrollment as follows:

(i) one program of study for a district with fewer than 500 students enrolled in high school;

(ii) two programs of study for a district with 501-1,000 students enrolled in high school;

(iii) three programs of study for a district with 1,001-2,000 students enrolled in high school;

(iv) four programs of study for a district with 1,001-5,000 students enrolled in high school;

(v) five programs of study for a district with 5,001-10,000 students enrolled in high school; and

(vi) six programs of study for a district with more than 10,000 students enrolled in high school.

(H) languages other than English--Levels I, II, and III or higher of the same language;

(I) computer science--one course selected from Fundamentals of Computer Science, Computer Science I, or another advanced computer science course [~~AP~~] [~~Advanced Placement (AP)~~] [~~Computer Science Principles~~] ; and

(J) speech--Communication Applications.

(3) The following requirements may be reduced to one by the commissioner of education upon application of a school district with a total high school enrollment of less than 500 students:

(A) the requirement to offer two additional science courses; and

(B) the requirement to offer both Economics with Emphasis on the Free Enterprise System and Its Benefits and Personal Financial Literacy and Economics.

(4) [~~(3)~~] Districts may offer additional courses from the complete list of courses approved by the State Board of Education to satisfy graduation requirements as referenced in this chapter.

(5) [~~(4)~~] A [~~The~~] school district must provide each student the opportunity to participate in each course the district is required to offer or selects to offer as specified [~~all courses listed~~] in subsection (b)(2) of this section. The district must provide students the opportunity each year to select courses in which they intend to participate from a list that includes all courses required to be offered in subsection (b)(2) of this section. If the school district will not offer the required courses every year, but intends to offer particular courses only every other year, it must notify all enrolled students of that fact. A school district must teach a course that is specifically required for high school graduation at least once in any two consecutive school years. For a subject that has an end-of-course assessment, the district must either teach the course every year or employ options described in Subchapter C of this chapter (relating to Other Provisions) to enable students to earn credit for the course and must maintain evidence that it is employing those options.

[~~(5) For students entering Grade 9 beginning with the 2007-2008 school year, districts must ensure that one or more courses offered in the required curriculum for the recommended and advanced high school programs include a research writing component.~~]

(c) (No change.)