Texas CTE

Engineering Design and Presentation

Knowledge and skills. ENGDPRS

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.** ENGDPRS.1

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

- A describe and implement the stages of an engineering design process to construct a model; ENGDPRS.2A
- B explain how factors, including complexity, scope, resources, ethics, regulations, manufacturability, maintainability, and technology, impact stages of the engineering design process; ENGDPRS.2B
- C explain how stakeholders impact an engineering design process; and ENGDPRS.2C
- D analyze how failure is often an essential component of the engineering design process. ENGDPRS.2D

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

- A explain the legal value of maintaining an engineering notebook as intellectual property; ENGDPRS.3A
- B describe the proper implementation of an engineering notebook, including notebook type, documentation, signatures, adding external materials, sealing, and dating; and ENGDPRS.3B
- C create and maintain an engineering notebook by recording ideas, notes, decisions, findings, and corrections. ENGDPRS.3C

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

- A research and explain the process and phases of project management, including initiating, planning, executing, and closing; ENGDPRS.4A
- B explain the roles and responsibilities of team members, including project managers and leads; ENGDPRS.4B
- C research and evaluate methods and tools available for managing a project; ENGDPRS.4C

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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; ENGDPRS.4D

E describe how project requirements, constraints, and deliverables impact the project schedule and influence an engineering design; ENGDPRS.4E

F explain how a project budget, including materials, equipment, and labor, is developed and maintained; and ENGDPRS.4F

G describe the importance of management of change (MOC) and how MOC applies to project planning. ENGDPRS.4G

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

A describe and compare the roles of an industry technician, engineering technologist, and engineer; ENGDPRS.5A

B identify educational requirements and career opportunities for engineers, engineering technologists, and industry technicians; ENGDPRS.5B

C research and describe various engineering disciplines such as mechanical, civil, aerospace, biomedical, chemical civil, computer, electrical, petroleum, and other related and emerging fields; ENGDPRS.5C

D investigate and describe the requirements of engineering licensure and industry-based certifications; ENGDPRS.5D

E investigate and describe elements of teamwork critical for success in the engineering and technology industries such as communication, active listening, and time management; ENGDPRS.5E

F research and describe industry standards and governmental regulations such as health and safety and environmental regulations applicable to a design problem; and ENGDPRS.5F

G analyze and discuss ethical issues related to engineering and technology. ENGDPRS.5G

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:** ENGDPRS.6

A describe the various roles and responsibilities of a project team; ENGDPRS.6A

B identify the strengths of individual team members to assign roles and distribute tasks within a team; and ENGDPRS.6B

C describe and demonstrate appropriate behaviors such as active listening and clear communication while serving as a team leader and member on projects. ENGDPRS.6C

7 **The student practices safe and proper work habits. The student is expected to:** ENGDPRS.7

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A identify and explain the appropriate use of types of personal protective equipment used in industry; ENGDPRS.7A

B explain and comply with safety guidelines and procedures as described in relevant manuals, instructions, and regulations; ENGDPRS.7B

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; ENGDPRS.7C

D describe the various types of electrical hazards in the workplace and the risks associated with electrical hazards; ENGDPRS.7D

E describe the various control methods to prevent electrical hazards in the workplace; ENGDPRS.7E

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; ENGDPRS.7F

G describe the appropriate disposal of selected hazardous materials and wastes; ENGDPRS.7G

H perform routine maintenance on selected tools, equipment, and machines; ENGDPRS.7H

I demonstrate proper handling, use, and storage of tools and materials; and ENGDPRS.7I

J research and describe the consequences of negligent or improper equipment maintenance. ENGDPRS.7J

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

A describe and compare characteristics and dimensional changes of two-dimensional (2D) and three-dimensional (3D) figures; ENGDPRS.8A

B draw and manipulate geometric shapes in three dimensions; ENGDPRS.8B

C create 2D views of a 3D object; and ENGDPRS.8C

D explain the symmetry of figures through the proportionate transformation of objects. ENGDPRS.8D

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:** ENGDPRS.9

A use single and multi-view projections to represent 3D objects in a 2D format; ENGDPRS.9A

B use appropriate line types in engineering drawings to represent 3D objects in a 2D format; ENGDPRS.9B

C use orthographic and pictorial views to represent 3D objects in a 2D format; ENGDPRS.9C

D use auxiliary views to represent 3D objects in a 2D format; ENGDPRS.9D

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E use section views to represent 3D objects in a 2D format; ENGDPRS.9E

F prepare and revise annotated multi-dimensional production drawings in computer-aided design and drafting to industry standards; ENGDPRS.9F

G apply best practices for file structure and management to efficiently retrieve and edit files; ENGDPRS.9G

H use advanced dimensioning techniques, including annotation scale; and ENGDPRS.9H

I construct and use CADD drawings to develop a model or prototype for presentation. ENGDPRS.9I

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

A design product components using a variety of technologies; ENGDPRS.10A

B research and analyze the applications of different types of CADD software for various engineering problems; ENGDPRS.10B

C create and interpret engineering drawings using industry standards; ENGDPRS.10C

D describe how quality, reliability, and safety can be designed into specific products; ENGDPRS.10D

E identify specific requirements of users with special needs and modify a product design to accommodate users with special needs; ENGDPRS.10E

F research and explain the patenting process and analyze opportunities for potential patents related to a project; and ENGDPRS.10F

G use multiple software applications for concept presentations. ENGDPRS.10G

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

A identify and describe the steps needed to produce a prototype; ENGDPRS.11A

B identify and use appropriate tools, equipment, machines, and materials to produce the prototype; ENGDPRS.11B

C present the prototype and explain how the prototype meets the project requirements; and ENGDPRS.11C

D evaluate the successes and failures of the prototype(s) in the context of an iterative design process. ENGDPRS.11D

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

A identify and define an engineering problem; ENGDPRS.12A

B formulate goals, objectives, and requirements to solve an engineering problem; ENGDPRS.12B

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C investigate and select appropriate materials for a particular product to be designed; ENGDPRS.12C

D explain the importance of manufacturability and maintainability when designing a product; ENGDPRS.12D

E determine design constraints such as personnel, resources, funding, feasibility, and time associated with an engineering problem; ENGDPRS.12E

F identify requirements, including health, safety, social, environmental, ethical, regulatory, and legal constraints, defining an engineering problem; ENGDPRS.12F

G identify alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions; ENGDPRS.12G

H test and evaluate proposed solutions using engineering practices such as experiments, simulations, statistical analysis, and critical design review; and ENGDPRS.12H

I select and justify a preferred solution to a problem using structured techniques such as a decision tree, design matrix, or cost-benefit analysis. ENGDPRS.12I

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

A present the solution in a professional manner; ENGDPRS.13A

B solicit and evaluate feedback on the solution and presentation; and ENGDPRS.13B

C present learning experiences, including essential skills gained, areas of personal growth, challenges, and solutions, encountered throughout the design process. ENGDPRS.13C