

Engineering Concepts and Processes III

8452 36 weeks

Table of Contents

| | |
|---|----|
| Acknowledgments..... | 1 |
| Course Description..... | 2 |
| Task Essentials Table..... | 3 |
| Curriculum Framework..... | 5 |
| Functioning as a Team on an Engineering Project..... | 5 |
| Developing Project Management Skills in an Engineering Design Project..... | 22 |
| Applying Formal Engineering Communication Skills..... | 34 |
| Identifying Product and Process Trends | 38 |
| Exploring Engineering Ethics | 43 |
| SOL Correlation by Task | 45 |
| Entrepreneurship Infusion Units | 47 |
| Appendix: Credentials, Course Sequences, and Career Cluster Information | 49 |

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Course Description

Suggested Grade Level: 11 or 12

Prerequisites: 8451

Engineering Concepts and Processes III is the third course of a four-course sequence that will enable students to solve real-world problems. This course focuses on building an engineering

team, working with case studies, managing projects, delivering formal proposals and presentations, and examining product and process trends. In addition, students continue to apply their engineering skills to determine what postsecondary education engineering pathway they want to follow. Students will participate in STEM-based, hands-on projects as they communicate information through team-based presentations, proposals, and technical reports.

Task Essentials Table

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

| Task Number | 8452 | Tasks/Competencies |
|---|------|---|
| Functioning as a Team on an Engineering Project | | |
| 39 | ⊕ | Explain the purpose and functions of a project team. |
| 40 | ⊕ | Explain the benefits of multiple perspectives and diverse skills in solving practical engineering problems. |
| 41 | ⊕ | Organize a team for an engineering project. |
| 42 | ⊕ | Identify the steps in a team’s life cycle. |
| 43 | ⊕ | Deliver constructive feedback. |
| 44 | ⊕ | Interpret constructive feedback. |
| 45 | ⊕ | Explain the importance of generating consensus for the project idea to team members. |
| 46 | ⊕ | Resolve conflicts within a team. |
| 47 | ⊕ | Identify active-listening techniques. |
| 48 | ⊕ | Explain the benefits of active listening. |
| 49 | ⊕ | Demonstrate formal and informal professional communication. |
| 50 | ⊕ | Perform self-evaluations and a team peer review. |
| Developing Project Management Skills in an Engineering Design Project | | |

| | | | |
|--|---|---|--|
| 51 | + | Define the five phases of a project life cycle. | |
| 52 | + | Identify the objectives of a project. | |
| 53 | + | Identify the components of a well-written goal. | |
| 54 | + | Estimate the available resources for a project. | |
| 55 | + | Allocate resources. | |
| 56 | + | Demonstrate the use of project management tools. | |
| 57 | + | Prioritize the procedures to complete a project. | |
| 58 | + | Identify ways to motivate individuals and teams. | |
| 59 | + | Assign tasks to team members. | |
| 60 | + | Track progress. | |
| 61 | + | Analyze results. | |
| 62 | + | Describe the balance among quality, time, and money. | |
| Applying Formal Engineering Communication Skills | | | |
| 63 | + | Create a proposal for an engineering project. | |
| 64 | + | Create a technical report on an engineering project. | |
| 65 | + | Create a multimedia presentation of a finished proposal. | |
| Identifying Product and Process Trends | | | |
| 66 | + | Assess the economics of product and system life cycles. | |
| 67 | + | Assess a new product or system currently entering the market. | |
| 68 | + | Describe the factors necessary for changes in technology. | |
| 69 | + | Define <i>forecasting</i> . | |
| 70 | + | Research current technological trends. | |
| 71 | + | Explain the objectives and importance of a feasibility study. | |
| Exploring Engineering Ethics | | | |

| | | | |
|----|---|---|--|
| 72 | + | Compare professional and personal ethics. | |
| 73 | + | Identify ethical theories. | |
| 74 | + | Research a real-world case study. | |

Legend: + Essential ○ Non-essential - Omitted

Curriculum Framework

Functioning as a Team on an Engineering Project

Task Number 39

Explain the purpose and functions of a project team.

Definition

Explanation should describe the unified purpose of the team—to solve engineering problems—and include the following team members and their specific functions:

- Scientist
- Engineer
- Technologist
- Technician
- Craftsperson

Process/Skill Questions

- What are the advantages of working as a team?
- How are the team members' roles different from one another?
- In what ways do team members' roles sometimes merge?

ITEEA National Standards

9. Engineering Design

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Computer Integrated Manufacturing (CIM)

Debating Technological Issues

Digital Video Production

Engineering Design

Music Production

On Demand Video

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Video Game Design

Webmaster

Task Number 40

Explain the benefits of multiple perspectives and diverse skills in solving practical engineering problems.

Definition

Explanation should include the way a diverse team provides multiple perspectives and should also include

- recognizes cultural differences
- increases the number of potential solutions
- enhances alternatives
- pools knowledge
- encourages collaboration
- encourages teamwork
- improves the quality of solutions.

Process/Skill Questions

- What skills might an individual bring to a team?
- How might cultural differences affect a team?
- Why are there an increased number of solutions when working as a team?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

9. Engineering Design

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Debating Technological Issues

Digital Video Production

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Music Production

On Demand Video

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Video Game Design

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Task Number 41

Organize a team for an engineering project.

Definition

Organization should include

- identifying the design problem
- identifying stakeholders
- identifying skills required to complete a project
- identifying available individual skill sets
- selecting team members
- delegating/assigning team roles
- determining communication methods within the team and between the team and stakeholders.

Process/Skill Questions

- How does one organize an engineering project team?
- What are the criteria used to select team members?
- Who are the stakeholders?
- What is the relationship between the stakeholders and the design team?

ITEEA National Standards

9. Engineering Design

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Digital Video Production

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System Control Technology

Technology Bowl

Technology Problem Solving

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Task Number 42

Identify the steps in a team's life cycle.

Definition

Identification should include

- forming—team members are selected and introduced
- storming—the team works through conflict by using resolution/management techniques
- norming—the team comes together
- performing—the team produces results
- adjourning—the team breaks up.

Process/Skill Questions

- How are the steps in a team's life cycle important to the design process?

- What are the risks of skipping a step?

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Digital Video Production

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Structural Design and Engineering

Structural Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

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Task Number 43

Deliver constructive feedback.

Definition

Delivery should include

- speaking about an idea, not an individual
- providing a positive context
- providing criteria for criticism
- maintaining professionalism.

Process/Skill Questions

- What is unconstructive feedback?
- How is feedback used to improve design?
- What is meant by professionalism?
- How can role-playing hone one's skills in delivering constructive feedback?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

9. Engineering Design

TSA Competitive Events

Chapter Team

Debating Technological Issues

Extemporaneous Speech

Future Technology Teacher

Prepared Presentation

Technology Bowl

Task Number 44

Interpret constructive feedback.

Definition

Interpretation should include applying the following rules for receiving constructive criticism:

- Keep quiet.
- Listen objectively.
- Remain open to accepting feedback and input.
- Remain confident.
- Acknowledge the criticism and use it to improve performance.

Process/Skill Questions

- How is constructive criticism used to improve performance?
- When does constructive criticism cause team dysfunction?
- What would cause a team member to become defensive?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

9. Engineering Design

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Career Prep

Chapter Team

Debating Technological Issues

Digital Video Production

Dragster Design

Engineering Design

Essays on Technology

Extemporaneous Speech

Flight Endurance

Future Technology Teacher

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Music Production

On Demand Video

Photographic Technology

Prepared Presentation

Principles of Technology (Virginia only)

Promotional Design

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Transportation Modeling

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Task Number 45

Explain the importance of generating consensus for the project idea to team members.

Definition

Explanation should include the way that consensus can

- encourage the team to collaborate to enhance the product
- raise morale

- raise efficiency
- reduce conflict
- promote a willingness to cooperate
- dedicate team members to project vision and results.

Process/Skill Questions

- How does one generate consensus among team members?
- Why does low morale affect team efficiency?
- What methods should one use to maintain focus?

ITEEA National Standards

9. Engineering Design

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Architectural Design

Biotechnology Design

Debating Technological Issues

Digital Video Production

Engineering Design

Music Production

On Demand Video

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Video Game Design

Task Number 46

Resolve conflicts within a team.

Definition

Resolution may include using the following modes of conflict management:

- Accountability
- Avoiding
- Accommodating
- Competing
- Compromising
- Collaborating

If the conflict cannot be resolved, typically a formal grievance process is offered as a final alternative.

Process/Skill Questions

- What causes conflict within a team?
- How can conflict within a team be avoided?
- How does one assign accountability?
- To what situation would each conflict-resolution method apply?

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9. Engineering Design

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Debating Technological Issues

Digital Video Production

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Music Production

On Demand Video

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

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Task Number 47

Identify active-listening techniques.

Definition

Active listening is a way of listening that focuses on the message and ensures that the message is correctly received. Identification of active-listening techniques should include

- expressing interest
- paraphrasing key points back to the speaker
- asking questions
- maintaining eye contact
- refraining from interrupting the speaker
- responding with affirmative nods and appropriate facial expressions
- avoiding distracting actions or gestures that suggest boredom
- stopping all other activities (e.g., turning off music/radio, turning away from a computer, setting down papers)
- keeping comments brief and on topic.

Process/Skill Questions

- How would one demonstrate effective listening skills (e.g., role-playing)?
- How would one demonstrate ineffective listening skills (e.g., role-playing)?

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TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Career Prep

Chapter Team

Debating Technological Issues

Digital Video Production

Dragster Design

Engineering Design

Essays on Technology

Extemporaneous Speech

Flight Endurance

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Geospatial Technology (Virginia only)

Music Production

Structural Design and Engineering

System Control Technology

Technology Problem Solving

Transportation Modeling

Video Game Design

Task Number 48

Explain the benefits of active listening.

Definition

Explanation should include that active listening

- reduces assumption
- clarifies the content of the message between the sender and receiver
- establishes common understanding and expectations
- encourages future communication.

Process/Skill Questions

- How does maturity influence active listening skills?
- How does active listening encourage additional communication and ideas?
- How does active listening reduce assumptions?

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TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Career Prep

Chapter Team

Debating Technological Issues

Digital Video Production

Dragster Design

Engineering Design

Essays on Technology

Extemporaneous Speech

Flight Endurance

Future Technology Teacher

Geospatial Technology (Virginia only)

Music Production

On Demand Video

Photographic Technology

Prepared Presentation

Promotional Design

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Transportation Modeling

Video Game Design

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Task Number 49

Demonstrate formal and informal professional communication.

Definition

Demonstration should include

- formal communication—etiquette expected by everyone other than team members in a working environment
- informal communication—etiquette among team members or peers in a working environment.

Process/Skill Questions

- How would one demonstrate formal communication (e.g., role-playing)?
- How would one demonstrate informal communication (e.g., role-playing)?
- How would one decide which form of communication to use?
- How would either of these forms of communication affect the bottom line/product?

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TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Debating Technological Issues

Digital Video Production

Engineering Design

Extemporaneous Speech

Music Production

On Demand Video

Prepared Presentation

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Video Game Design

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Task Number 50

Perform self-evaluations and a team peer review.

Definition

Performance should include

- establishing a rubric for reviews
- establishing a schedule for reviews
- performing self-evaluations—each team member evaluates his or her performance as a member of the team, using established criteria to review each team member’s role(s) and determining progress on deadlines.

Process/Skill Questions

- Why perform a peer review?
- How are the results used to keep the project moving forward?
- How can a team peer review determine progress?

ITEEA National Standards

9. Engineering Design

Developing Project Management Skills in an Engineering Design Project

Task Number 51

Define the five phases of a project life cycle.

Definition

Definition should include

- initiating
- planning
- executing
- monitoring and controlling
- closing.

Process/Skill Questions

- What is a project life cycle?
- How is a project truly closed?
- Who is in charge of a project life cycle?

ITEEA National Standards

2. The Core Concepts of Technology

6. The Role of Society in the Development and Use of Technology

TSA Competitive Events

Engineering Design

Task Number 52

Identify the objectives of a project.

Definition

Identification should include

- requirements
- constraints
- optimal solution
- tradeoffs
- goals
- benefit to humankind
- feasibility
- economic feasibility
- sustainability
- risk assessment to the organization.

Process/Skill Questions

- What are the objectives?
- How does one identify the objectives?
- What are the differences between requirements and constraints?
- What is considered an optimal solution?
- What is sustainability?

ITEEA National Standards

2. The Core Concepts of Technology

6. The Role of Society in the Development and Use of Technology

TSA Competitive Events

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Engineering Design

Task Number 53

Identify the components of a well-written goal.

Definition

Identification should include components that

- are written in terms of outcomes rather than actions
- are measurable and quantifiable
- have a clear time frame
- are challenging yet attainable
- are communicated to all necessary organizational members.

Process/Skill Questions

- What are the components of a well-written goal?
- Why is it important to set goals?
- How does one determine whether a goal is attainable?
- How do well-written goals improve team communication?

ITEEA National Standards

9. Engineering Design

TSA Competitive Events

Animatronics

Engineering Design

Task Number 54

Estimate the available resources for a project.

Definition

Estimation should include the predicted available quantities of the following resources:

- Scope of work
- Personnel and skill sets
- Information, research, and data
- Capital
- Cost analysis
- Budget for the project
- Time required for development
- Tools and materials
- Power

Process/Skill Questions

- How does one determine the resources for a project?
- What determines human limitations?
- How does one determine and prioritize critical resources?

ITEEA National Standards

11. Apply the Design Processes

TSA Competitive Events

Architectural Design

Engineering Design

Task Number 55

Allocate resources.

Definition

Allocation should include determining

- required resources
- availability and location of resources
- cost of resources
- schedule for resource usage.

Process/Skill Questions

- How does one effectively allocate resources to a project?
- How does one determine the cost of resources?
- What strategy should be used when determining the location of resources?

ITEEA National Standards

11. Apply the Design Processes

TSA Competitive Events

Architectural Design

Task Number 56

Demonstrate the use of project management tools.

Definition

Demonstration should include

- identifying the critical path
- using a Project Evaluation and Review Technique (PERT) chart
- using a Gantt chart
- using alternative project management tools (e.g., open-source project management software).

Process/Skill Questions

- What is a PERT chart?
- What is a Gantt chart?
- How are PERT and Gantt charts used in project management?

ITEEA National Standards

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

8. The Attributes of Design

TSA Competitive Events

Architectural Design

Engineering Design

Task Number 57

Prioritize the procedures to complete a project.

Definition

Prioritization should include determining a procedural hierarchy and communicating that hierarchy to team members.

Process/Skill Questions

- How does one set/determine priorities?
- What is the effect of not setting priorities?
- How should hierarchy conflicts be resolved in the team?

ITEEA National Standards

11. Apply the Design Processes

8. The Attributes of Design

TSA Competitive Events

Architectural Design

Engineering Design

Task Number 58

Identify ways to motivate individuals and teams.

Definition

Identification should include

- ways to coach, counsel, and reward individuals/teams
- factors that positively influence employee performance
- common reward methods that promote worker motivation and performance (e.g., praise, incentives, professional values).

Process/Skill Questions

- What are the consequences of not motivating team members?

- What are some typical professional incentives?
- How does positive feedback influence team performance?

ITEEA National Standards

9. Engineering Design

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Debating Technological Issues

Digital Video Production

Engineering Design

On Demand Video

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Video Game Design

Webmaster

Task Number 59

Assign tasks to team members.

Definition

Assignment should include

- establishing individual timelines (i.e., amount of time proposed for each task)
- considering the talents and skills of team members
- considering the way team members work together
- scheduling team processes (e.g., development meetings, professional/project/progress evaluations)
- establishing performance benchmarks/standards/expectations.

Process/Skill Questions

- What is the best way to assign tasks?
- What techniques should be used to assign timelines?
- What are benchmarks?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

9. Engineering Design

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Debating Technological Issues

Digital Video Production

Engineering Design

Music Production

On Demand Video

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Video Game Design

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Task Number 60

Track progress.

Definition

Tracking should include assessing project performance of the following:

- quality of the product
- meeting project milestones
- team member performance (peer reviews)

Process/Skill Questions

- How does one determine milestones?
- How are milestones used to track progress?

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Animatronics

Architectural Design

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Career Prep

Chapter Team

Debating Technological Issues

Digital Video Production

Dragster Design

Engineering Design

Essays on Technology

Extemporaneous Speech

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Geospatial Technology (Virginia only)

Music Production

On Demand Video

Photographic Technology

Prepared Presentation

Principles of Technology (Virginia only)

Scientific Visualization (SciVis)

Structural Design and Engineering

Structural Engineering

System Control Technology

Technology Problem Solving

Transportation Modeling

Video Game Design

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Task Number 61

Analyze results.

Definition

Analysis should include measuring and assessing the

- effectiveness of project results
- efficiency of project results.

Process/Skill Questions

- How does one analyze results?
- What happens if the results do not match the goal?
- What steps should be taken if there is a discrepancy?

ITEEA National Standards

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

5. The Effects of Technology on the Environment

8. The Attributes of Design

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Career Prep

Chapter Team

Debating Technological Issues

Dragster Design

Engineering Design

Essays on Technology

Extemporaneous Speech

Flight Endurance

Future Technology Teacher

Geospatial Technology (Virginia only)

Music Production

On Demand Video

Photographic Technology

Prepared Presentation

Principles of Technology (Virginia only)

Promotional Design

Scientific Visualization (SciVis)

Structural Design and Engineering

System Control Technology

Technology Bowl

Technology Problem Solving

Transportation Modeling

Video Game Design

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Task Number 62

Describe the balance among quality, time, and money.

Definition

Description should include the balance among the quality of the product, the time to complete the product, and the cost of making the product.

Process/Skill Questions

- What is the quality triangle?
- How does one develop quality criteria?
- How does one determine cost?

ITEEA National Standards

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

5. The Effects of Technology on the Environment

8. The Attributes of Design

TSA Competitive Events

Animatronics

Biotechnology Design

Engineering Design

Applying Formal Engineering Communication Skills

Task Number 63

Create a proposal for an engineering project.

Definition

Creation should include

- persuasive, informative, clear, concise proposal
- introduction
- statement of the problem
- objective or thesis
- method of attack/rhetorical strategy
- alternatives
- justification
- resources
- evaluation
- budget
- appendix.

Process/Skill Questions

- What is an engineering proposal?
- What are the steps when creating an engineering proposal?
- What is a real-world example of an engineering proposal?

ITEEA National Standards

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

TSA Competitive Events

Biotechnology Design

Engineering Design

Essays on Technology

Prepared Presentation

Scientific Visualization (SciVis)

Task Number 64

Create a technical report on an engineering project.

Definition

Creating a report should include developing the following:

- Abstract
- Introduction
- Research questions and/or hypothesis
- Methods and materials
- Results
- Conclusions
- Appendices (e.g., raw data, sketches, notes, surveys)
- References for sources consulted/cited

Process/Skill Questions

- What is the purpose of an abstract?
- What elements belong in an abstract?
- Why should one include appendices with raw data in a technical report?
- What is the difference between expository writing and technical writing?
- Why are spelling, sentence structure, correct grammar, and precise usage crucial in technical writing?
- How can one determine how much information to include to make one's technical report complete without becoming too verbose?
- Why is it important to include references for sources?

ITEEA National Standards

11. Apply the Design Processes

12. Use and Maintain Technological Products and Systems

TSA Competitive Events

Biotechnology Design

Engineering Design

Essays on Technology

Prepared Presentation

Task Number 65

Create a multimedia presentation of a finished proposal.

Definition

Creation of a multimedia presentation should

- use persuasive techniques
- include a title
- include a concept of an audience
- include an introduction with a thesis
- contain a body that includes examples and other supporting materials, references, documentation of resources, and a conclusion.

Additional elements of a presentation should include any combination of

- storyboards, sketches, and/or notes
- images, video clips and/or still photographs or art, with attention to the use of colors and overall composition
- audio elements (e.g., music, narration, sound effects)
- transitions
- models or simulations.

Process/Skill Questions

- What are the characteristics of a good multimedia presentation?
- How does one choose what information to present?
- How does one design a presentation for a particular audience?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

TSA Competitive Events

Photographic Technology

Prepared Presentation

Scientific Visualization (SciVis)

Video Game Design

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Identifying Product and Process Trends

Task Number 66

Assess the economics of product and system life cycles.

Definition

Assessment should include researching and summarizing all facets (e.g., materials, processes, systems, impacts, consequences) involved in life cycles (e.g., how long the product or system will last, end-of-life disposal, preventive maintenance programs).

Process/Skill Questions

- What is a system life cycle?
- What are the consequences of failing to assess a system life cycle?
- What are the benefits of preventive maintenance?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

13. Assess the Impact of Products and Systems

19. Manufacturing Technologies

8. The Attributes of Design

9. Engineering Design

Task Number 67

Assess a new product or system currently entering the market.

Definition

Assessment should include

- researching a product or system (e.g., need, history, target market)
- evaluating the function and effectiveness of a product or system
- predicting a product or system's life cycle
- evaluating the cost factor of a product or system
- exploring the socio-ecological effects of a product or system.

Process/Skill Questions

- What criteria are used to assess a product?
- How will cost factor affect the life cycle of a product?
- How does one determine the socio-ecological effects of a system?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

13. Assess the Impact of Products and Systems

19. Manufacturing Technologies

TSA Competitive Events

Architectural Design

Engineering Design

Task Number 68

Describe the factors necessary for changes in technology.

Definition

Description of factors should include

- societal needs and readiness
- technological availability
- technological advances
- economics
- availability of materials

- human resources (e.g., education, skills).

Process/Skill Questions

- What drives technology?
- What is technological determinism?
- How do materials affect technology?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

7. The Influence of Technology on History

TSA Competitive Events

Biotechnology Design

Task Number 69

Define *forecasting*.

Definition

Definition should state that forecasting is an analysis of past and present technologies to predict future products and systems.

Process/Skill Questions

- How do companies use forecasting?
- What is an example of successful forecasting?

ITEEA National Standards

13. Assess the Impact of Products and Systems

Task Number 70

Research current technological trends.

Definition

Research should result in identifying products, processes, or ideas that have improved and evolved over time. Research should examine the following areas of the designed world:

- Manufacturing technologies
- Construction technologies
- Energy and power technologies
- Information and communication technologies
- Agriculture and related biotechnologies
- Medical technologies
- Transportation technologies

Process/Skill Questions

- What is a technological trend?
- How is tracking a technological trend advantageous?
- What is an example of a technological trend?

ITEEA National Standards

13. Assess the Impact of Products and Systems

14. Medical Technologies

15. Agricultural and Related Biotechnologies

16. Energy and Power Technologies

17. Information and Communication Technologies

18. Transportation Technologies

19. Manufacturing Technologies

20. Construction Technologies

7. The Influence of Technology on History

TSA Competitive Events

Biotechnology Design

Debating Technological Issues

Essays on Technology

Transportation Modeling

Task Number 71

Explain the objectives and importance of a feasibility study.

Definition

Explanation should include

- defining *feasibility study*
- summarizing reasons for conducting a feasibility study
- explaining the importance of using a feasibility study in guiding a project.

Process/Skill Questions

- What are the five areas of feasibility involved in a feasibility study (technology and system, economic, legal, operational, schedule)?
- What is a cost-benefit analysis, and how is it a factor in an engineering design project?
- What is the difference between legal and ethical considerations in an engineering design project?

ITEEA National Standards

13. Assess the Impact of Products and Systems

9. Engineering Design

TSA Competitive Events

Architectural Design

Engineering Design

Geospatial Technology (Virginia only)

Exploring Engineering Ethics

Task Number 72

Compare professional and personal ethics.

Definition

Comparison should include

- professional ethics—rules of conduct required or understood as a part of a particular workplace and profession
- personal ethics—rules of conduct one freely ascribes to without being required to do so by any external moral authority (e.g., workplace, profession, religion, social club).

Process/Skill Questions

- How do personal ethics affect professional ethics?
- Why might professional ethics be new to employees?

ITEEA National Standards

4. The Cultural, Social, Economic, and Political Effects of Technology

TSA Competitive Events

Career Prep

Debating Technological Issues

Digital Video Production

Engineering Design

Music Production

Webmaster

Task Number 73

Identify ethical theories.

Definition

Identification should include

- utilitarianism—concerned with protecting the happiness and well-being of the greatest number of any group over that of the individual
- duty—concerned with acting out of expectation and performed out of a sense of obligation to family, profession, country
- rights—concerned with protecting the happiness and well-being of the individual over that of any group
- virtue—concerned with helping people develop good character traits, such as kindness and generosity, and placing less emphasis on which rules people should follow.

Process/Skill Questions

- How might utilitarianism effect an engineering project?
- Why is duty an important ethical theory?
- Do individuals' rights always need to be considered when working on an engineering project?

ITEEA National Standards

4. The Cultural, Social, Economic, and Political Effects of Technology

TSA Competitive Events

Biotechnology Design

Engineering Design

Task Number 74

Research a real-world case study.

Definition

Research should include an examination of reliable resources (e.g., the Internet, periodicals, newspapers, textbooks). The case study should include a detailed and documented intensive study of a topic, such as a design issue that stresses factors contributing to the case's success or failure.

Process/Skill Questions

- What are case studies?
- Are all case studies about failure of a project?
- Why are case studies an important part of research?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

4. The Cultural, Social, Economic, and Political Effects of Technology

6. The Role of Society in the Development and Use of Technology

8. The Attributes of Design

9. Engineering Design

TSA Competitive Events

Animatronics

Architectural Design

Biotechnology Design

Career Prep

Engineering Design

SOL Correlation by Task

| | | |
|----|--|---------------------|
| 39 | Explain the purpose and functions of a project team. | English: 11.5, 12.5 |
|----|--|---------------------|

| | | |
|----|---|---|
| 40 | Explain the benefits of multiple perspectives and diverse skills in solving practical engineering problems. | English: 11.5, 12.5 History and Social Science: GOVT.16 |
| 41 | Organize a team for an engineering project. | English: 11.5, 12.5 |
| 42 | Identify the steps in a team's life cycle. | English: 11.5, 12.5 |
| 43 | Deliver constructive feedback. | English: 11.1, 12.1 History and Social Science: GOVT.1, GOVT.16 |
| 44 | Interpret constructive feedback. | English: 11.1, 12.1 History and Social Science: GOVT.1 |
| 45 | Explain the importance of generating consensus for the project idea to team members. | English: 11.5, 12.5 |
| 46 | Resolve conflicts within a team. | English: 11.1, 12.1 History and Social Science: GOVT.1, GOVT.16, VUS.1 |
| 47 | Identify active-listening techniques. | English: 11.1, 12.1 History and Social Science: GOVT.1, GOVT.16 |
| 48 | Explain the benefits of active listening. | English: 11.1, 12.1 |
| 49 | Demonstrate formal and informal professional communication. | English: 11.1, 12.1 History and Social Science: GOVT.1, GOVT.16, VUS.1 |
| 50 | Perform self-evaluations and a team peer review. | English: 11.1, 12.1 History and Social Science: GOVT.1, GOVT.16 |
| 51 | Define the five phases of a project life cycle. | English: 11.3, 12.3 |
| 52 | Identify the objectives of a project. | English: 11.5, 12.5 |
| 53 | Identify the components of a well-written goal. | English: 11.5, 12.5 |
| 54 | Estimate the available resources for a project. | |
| 55 | Allocate resources. | |
| 56 | Demonstrate the use of project management tools. | English: 11.5, 12.5 |
| 57 | Prioritize the procedures to complete a project. | English: 11.1, 12.1 |
| 58 | Identify ways to motivate individuals and teams. | English: 11.5, 12.5 |
| 59 | Assign tasks to team members. | English: 11.5, 12.5 |
| 60 | Track progress. | |
| 61 | Analyze results. | English: 11.5, 12.5 |

| | | |
|----|---|---|
| | | Mathematics: AFDA.8, AII.9, PS.8*, PS.9*, PS.10* |
| 62 | Describe the balance among quality, time, and money. | English: 11.5, 12.5 |
| 63 | Create a proposal for an engineering project. | English: 11.1, 12.1 |
| 64 | Create a technical report on an engineering project. | English: 11.1, 12.1 |
| 65 | Create a multimedia presentation of a finished proposal. | English: 11.5, 11.8, 12.5, 12.8 |
| 66 | Assess the economics of product and system life cycles. | English: 11.5, 11.8, 12.5, 12.8 History and Social Science: GOVT.1, GOVT.15, GOVT.16 |
| 67 | Assess a new product or system currently entering the market. | English: 11.5, 11.8, 12.5, 12.8 |
| 68 | Describe the factors necessary for changes in technology. | English: 11.5, 12.5 History and Social Science: GOVT.1, GOVT.9, GOVT.15, VUS.1, VUS.13, VUS.14 |
| 68 | Define <i>forecasting</i> . | English: 11.3, 12.3 Mathematics: PS.1*, PS.8* |
| 70 | Research current technological trends. | English: 11.4, 11.5, 12.5 History and Social Science: GOVT.9, GOVT.15, VUS.8, VUS.13, VUS.14, WHII.9 |
| 71 | Explain the objectives and importance of a feasibility study. | English: 9.5, 11.5, 12.5 |
| 72 | Compare professional and personal ethics. | English: 11.5, 12.5 History and Social Science: GOVT.1, GOVT.16 |
| 73 | Identify ethical theories. | English: 11.5, 12.5 |
| 74 | Research a real-world case study. | English: 11.5, 11.8, 12.5, 12.8 History and Social Science: GOVT.1, VUS.1 Mathematics: PS.8* |

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- Pre-Engineering Certification Examinations
- Strasys Additive Manufacturing Certification – Level 1 Examination
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Engineering Analysis and Applications II (8451/36 weeks)
- Engineering Explorations I (8450/36 weeks)
- Engineering Practicum IV (8453/36 weeks)

| Career Cluster: Science, Technology, Engineering and Mathematics | |
|--|---|
| Pathway | Occupations |
| Engineering and Technology | Computer Software Engineer Electrical Engineer Materials Engineer Project Manager Quality Engineer |