

STEM-905: Think Like an Engineer

Independent Study Online Course Syllabus

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Number of Graduate Semester Units: 3
Target Grade Level: K - 14th Grade
Teachers and Professional Developers
Course Access: ce-connect.fresno.edu

Course Description

Think Like an Engineer is a hands-on course designed for you to learn engineering practice and apply it to the classroom. STEM is a national program whose goal is to produce qualified students that will pursue occupations in science, technology, engineering, and math. Engineers are tasked with drawing upon their creative powers to come up with quicker, better, and less expensive ways to do the things that need to be done. Through research and connecting with other STEM educators you will create/adapt hands-on STEM lessons for your students plus experience working on engineering projects in the role of a student. You will connect with a practicing engineer and research engineering jobs. The bottom line, STEM: Think Like an Engineer, will give you the practical knowledge and resources to teach students to make this a better world. This course supports state standards and is appropriate for grades K-14. Access to students is not required.

Note: There is no required book for this course.

Required Texts and Course Materials

Book: There are no required textbooks in this course. Students are responsible for providing their own lab materials.

Online Resources: Relevant online resources that support the course content and encourage further investigation will be available throughout the course assignments. Active hyperlinks are utilized throughout the course and will link to the appropriate information when clicked. These include videos, worksheets, online activities, journal articles and other resources.

Moodle: Moodle is a web-based course management system used to support flexible teaching and learning in both face-to-face and distance courses (e-learning). www.moodle.org, www.demo.moodle.org, www.docs.moodle.org

Course Dates

Self-paced; students may enroll at any time and take up to one year, from the date of registration, to complete assignments. Students may complete assignments in no less than three weeks for a 3-unit course (one week per unit).

National Standards Addressed in This Course

National Standards for Teachers

The projects contained in this course are closely aligned to the ISTE (International Society for Technology in Education.) Numbers in parentheses following each learning outcome and refer to the Seven Educator Standards found at <https://www.iste.org/explore/articleDetail?articleid=1014>.

ISTE Seven Educational Standards for Teachers

1. Learner - Educators continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning.
2. Leader - Educators seek out opportunities for leadership to support student empowerment and success and improve teaching and learning.
3. Citizen - Educators inspire students to positively contribute to and responsibly participate in the digital world.
4. Collaborator - Educators dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems.
5. Designer - Educators design authentic, learner-driven activities and environments that recognize and accommodate learner variability.
6. Facilitator - Educators facilitate learning with technology to support student achievement of the 2016 ISTE Standards for Students.
7. Analyst - Educators understand and use data to drive their instruction and support students in achieving their learning goals.

Continuing Education Student Learning Outcomes (CE-SLO)

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| CE-SLO 1 | Demonstrate proficient written communication by articulating a clear focus, synthesizing arguments, and utilizing standard formats in order to inform and persuade others, and present information applicable to targeted use. |
| CE-SLO 2 | Demonstrate comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts. |
| CE-SLO 3 | Reflect on their personal and professional growth and provide evidence of how such reflection is utilized to manage personal and professional improvement. |
| CE-SLO 4 | Apply critical thinking competencies by generating probing questions, recognizing underlying assumptions, interpreting and evaluating relevant information, and applying their understandings to the professional setting. |
| CE-SLO 5 | Reflect on values that inspire high standards of professional and ethical behavior as they pursue excellence in applying new learning to their chosen field. |

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| CE-SLO 6 | Identify information needed in order to fully understand a topic or task, organize that information, identify the best sources of information for a given enquiry, locate and critically evaluate sources, and accurately and effectively share that information. |
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Course Student Learning Outcomes (C-SLO)

| Student Learning Outcomes for This Course By the end of this course student will be able to: | National Standards Addressed* | CE-SLO Addressed** |
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| 1. Demonstrate their understanding of STEM education. | ISTE 1, 4 | CE 1, 2 |
| 2. Demonstrate an understanding of engineering practice. | ISTE 1, 4 | CE 1, 6 |
| 3. Research engineering careers and interview a practicing engineer. | ISTE 1, 3, 4, 7 | CE 1, 2, 6 |
| 4. Demonstrate an understanding of what constitutes a STEM lesson, connect with a STEM resource person, and adapt STEM lessons for their students. | ISTE 1, 3, 4, 5, | CE 2, 4, 6 |
| 5. Create/Adapt and Experience a STEM lesson. | ISTE 1, 2, 3, 4, 5, 7 | CE 1, 2, 4, 6 |
| 6. Create and implement a STEM unit of study | ISTE 2, 3, 5, 6 | CE 2, 4, 6 |
| 7. Reflect on the learning that took place in this class and extend their thinking to future activities. | ISTE 1, | CE 3, 5 |

* Please refer to the section on **ISTE Seven Educational Standards for Teachers**

** Please refer to the section on **Continuing Education Program Student Learning Outcomes**

Topics, Assignments, and Activities

| Module Title | Module Assignments and Activities | Points Possible |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Welcome Topic | <ul style="list-style-type: none"> • Welcome Video • Course Syllabus • Introduce Yourself Forum • Course Rubric | |
| Module 1: About the STEM Initiative | <ul style="list-style-type: none"> • Read and watch videos • Forum 1: Introduce Yourself • 1.1 About the STEM Education | 10 pts |
| Module 2: Engineering Practice | <ul style="list-style-type: none"> • Read and watch videos • 2.1: Engineering Practice | 10 pts |
| Module 3: Engineering Careers | <ul style="list-style-type: none"> • Read, watch videos, research, conduct interview • 3.1 Engineering Careers • 3.2 Assignment: Conduct an Interview • 3.3 Assignment: Engineer Interview Evaluation | 10 pts 20 pts 10 pts |

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| Module 4: Characteristics of an Engineering STEM Lesson | <ul style="list-style-type: none"> • Read, watch videos, research, contact a STEM educator • 4.1 Connecting with Other STEM Educators • 4.2 Adapting STEM Lessons | 10 pts 20 pts |
| Module 5: Real World Problems: Conducting STEM Labs | <ul style="list-style-type: none"> • Read, research, conduct labs • 5.1 Teaching Project-Based Lessons • 5.2 Floating Pennies Lab • 5.3 Create Your Own Lab | 10 pts 20 pts 20 pts |
| Module 6: Creating a STEM Unit of Study | <ul style="list-style-type: none"> • Read, Research • 6.1 Unit of Study | 20 pts |
| Module 7: Course Reflection | <ul style="list-style-type: none"> • Review notes • 7.1 Course Reflection | 10 pts |
| Course Wrap-up – Grading and Evaluation | <ul style="list-style-type: none"> • Course Evaluation • Course Completion Checklist • Grade Request / Transcript Request | |
| | TOTAL POINTS | 170 points |

Grading Policies, Rubrics, and Requirements for Assignments

Grading Policies

- Assignments will be graded per criteria presented in the course rubrics.
- A = 90-100% and B = 80-89%, (anything below 80% will not receive credit.)
- The discernment between an A or a B letter grade is at the discretion of the instructor based on the quality of work submitted (see course rubrics).
- Coursework falling below a B grade will be returned with further instructions.
- All assignments must be completed to receive a grade and are expected to reflect the quality that teacher-training institutions require of professional educators. If completed assignments do not meet this standard, students will be notified with further instructions from the instructor.

Grading Rubrics

| Grade | Percent | Description | Rubric |
|-------|-----------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A | 90-100% | Excellent | Meets all course / assignment requirements with significant evidence of subject mastery and demonstration of excellent graduate level professional development scholarship. |
| B | 80-89% | Very Good | Adequately meets criteria for all course/assignment requirements - demonstrates subject competency with very good graduate level professional development scholarship. |
| NC | Below 80% | Unacceptable | Does not meet the minimum criteria for all course/assignment requirements and demonstrated little, if any, evidence of acceptable graduate level professional development scholarship. |

Writing Requirements

- **Superior:** Writing is clear, succinct, and reflects graduate level expectations. Clearly addresses all parts of the writing task. Maintains a consistent point of view and organizational structure. Includes relevant facts, details, and explanations.

- **Standard:** Writing is acceptable with very few mistakes in grammar and spelling. Addresses most parts of the writing task. Maintains a mostly consistent point of view and organizational structure. Includes mostly relevant facts, details, and explanations.
- **Sub-standard:** Writing contains noticeable mistakes in grammar and spelling. Does not address all parts of the writing task. Lacks a consistent point of view and organizational structure. May include marginally relevant facts, details, and explanations.

Lesson Plan Requirements

- **Superior:** Instructional goals and objectives clearly stated. Instructional strategies appropriate for learning outcome(s). Method for assessing student learning and evaluating instruction is clearly delineated and authentic. All materials necessary for student and teacher to complete lesson clearly listed.
- **Standard:** Instructional goals and objectives are stated but are not easy to understand. Some instructional strategies are appropriate for learning outcome(s). Method for assessing student learning and evaluating instruction is present. Most materials necessary for student and teacher to complete lesson are listed.
- **Sub-standard:** Instructional goals and objectives are not stated. Learners cannot tell what is expected of them. Instructional strategies are missing or strategies used are inappropriate. Method for assessing student learning and evaluating instruction is missing. Materials necessary for student and teacher to complete lesson are missing.

Instructor/Student Contact Information

Throughout the course participants will be communicating with the instructor and their classmates on a regular basis using asynchronous posting forums. Students are provided with instructor contact information in the event they want to make email or phone contact. In addition, students are encouraged to email or phone the instructor at any time. Students will also receive feedback on the required assignments as they are submitted.

Forums

Participation is an important expectation of this course and all online courses. Online forums promote reflection and analysis while allowing students to appreciate and evaluate positions that others express. Forum postings are open to be viewed by all students in the course, so do not post sensitive or personal information about your students. While students may not be engaging with the same students throughout this course, they will be expected to offer comments, questions, and replies to the forum questions whenever possible. The faculty role in the forums is that of an observer and facilitator.

Coursework Hours

Based on the Carnegie Unit standard, a unit of graduate credit measures academic credit based on the number of hours the student is engaged in learning. This includes all time spent on the course: reading the textbook, watching videos, listening to audio lessons, researching topics, writing papers, creating projects, developing lesson plans, posting to discussion boards, etc. Coursework offered for FPU Continuing Education graduate credit adheres to 45 hours per semester unit for the 900-level courses. Therefore, a student will spend approximately 135 hours on a typical 3-unit course.

Services for Students with Disabilities

Students with disabilities are eligible for reasonable accommodations in their academic work in all classes. In order to receive assistance, the student with a disability must provide the Academic Support Center with documentation, which describes the specific disability. The documentation must be from a qualified professional in the area of the disability (i.e. psychologist, physician or educational diagnostician). Students with disabilities should contact the Academic Support Center to discuss academic and other needs as soon as they are diagnosed with a disability. Once documentation is on file, arrangements for reasonable accommodations can be made. For more information and for downloadable forms, please go to <https://www.fresno.edu/students/academic-support/services-students-disabilities>.

Plagiarism and Academic Honesty

All people participating in the educational process at Fresno Pacific University are expected to pursue honesty and integrity in all aspects of their academic work. Academic dishonesty, including plagiarism, will be handled per the procedures set forth in the Fresno Pacific University Catalogue and Handbook - <https://handbook.fresno.edu/graduate/academic-policies>

Technology Requirements

To successfully complete the course requirements, course participants will need Internet access, can send and receive email, know how to manage simple files in a word processing program, and have a basic understanding of the Internet. Please remember that the instructor is not able to offer technical support. If you need technical support, please contact your Internet Service Provider.

Moodle: This course will be delivered totally online at <https://ce-connect.fresno.edu>. Moodle is a learning management system that provides students access to online resources, documents, assignments, knowledge checks, forums, etc. Moodle is easy to learn and has a friendly user interface. There are also some student tutorials on the Center for Online Learning website at Fresno Pacific University - <https://col.fresno.edu/student>.

Moodle Login and Passwords: Students will need to have internet access to log onto <https://ce-connect.fresno.edu>. The username and password for Moodle access will be sent to you by the university using the email address you submitted at the time of registration. The instructor will then contact you with a welcome communication. If you need help with your username and password recovery, please contact the Continuing Education office at (800) 372-5505 or (559) 453-2000 during regular office hours - Mon-Fri 8:00 am to 5:00 pm (pacific) or email them at prof.dev@fresno.edu.

Getting Help with Moodle: If you need help with Moodle, please contact the Center for Online Learning (COL), by telephone or the website. Help by phone (559) 453-3460 is available Mon-Fri 8:00 am to 5:00 pm (pacific) or by filling out a "Request Services" form at <https://col.fresno.edu/contact/request-services>. If asked, please identify that you are with the "School = Continuing Education".

Final Course Grade and Transcripts

When all work for the course has been completed, students will need to logon to the Continuing Education website (<https://ce.fresno.edu/my-account>) and "Request Final Grade". Once the

instructor receives the requests and submits the grade online, students may log back in to view their Final Grade Report or order transcripts online. Please allow at least two weeks for the final grade to be posted. For more information, see the Continuing Education Policies and Procedures at <https://ce.fresno.edu/ce-policies-and-procedures>.

University Policies and Procedures

Students are responsible for becoming familiar with the information presented in the Academic Catalog and for knowing and observing all policies and procedures related to their participation in the university community. A summary of university policies may be found on the university website at <https://www.fresno.edu/students/registrars-office/academic-catalogs>.

Fresno Pacific University Student Learning Outcomes (FPU-SLO)

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| FPU-SLO 1 | Student Learning Outcomes Oral Communication: Students will <i>exhibit</i> clear, engaging, and confident oral communication – in both individual and group settings – and will critically <i>evaluate</i> content and delivery components. |
| FPU-SLO 2 | Written Communication: Students will <i>demonstrate</i> proficient written communication by <i>articulating</i> a clear focus, <i>synthesizing</i> arguments, and utilizing standard formats in order to <i>inform</i> and <i>persuade</i> others. |
| FPU-SLO 3 | Content Knowledge: Students will <i>demonstrate</i> comprehension of content-specific knowledge and the ability to apply it in theoretical, personal, professional, or societal contexts. |
| FPU-SLO 4 | Reflection: Students will <i>reflect</i> on their personal and professional growth and <i>provide evidence</i> of how such reflection is utilized to manage personal and vocational improvement. |
| FPU-SLO 5 | Critical Thinking: Students will <i>apply</i> critical thinking competencies by <i>generating</i> probing questions, <i>recognizing</i> underlying assumptions, <i>interpreting</i> and <i>evaluating</i> relevant information, and <i>applying</i> their understandings to new situations. |
| FPU-SLO 6 | Moral Reasoning: Students will <i>identify</i> and <i>apply</i> moral reasoning and ethical decision-making skills, and <i>articulate</i> the norms and principles underlying a Christian worldview. |
| FPU-SLO 7 | Service: Students will <i>demonstrate</i> service and reconciliation as a way of leadership. |
| FPU-SLO 8 | Cultural and Global Perspective: Students will <i>identify</i> personal, cultural, and global perspectives and will employ these perspectives to <i>evaluate</i> complex systems. |
| FPU-SLO 9 | Quantitative Reasoning: Students will accurately <i>compute</i> calculations and symbolic operations and <i>explain</i> their use in a field of study. |
| FPU-SLO 10 | Information Literacy: Students will <i>identify</i> information needed in order to fully understand a topic or task, <i>explain</i> how that information is organized, <i>identify</i> the best sources of information for a given enquiry, <i>locate</i> and critically <i>evaluate</i> sources, and accurately and effectively <i>share</i> that information. |