

COURSE TITLE: Engineering Concepts

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**Forsyth County Schools
Course Syllabus 2022/2023**

Course Description: Engineering Concepts is the second course in the engineering pathway. This course introduces students to the fundamental principles of engineering. Students learn about areas of specialization within engineering and engineering design, and apply engineering tools and procedures as they complete hands-on instructional activities.

Standards: Forsyth County offers many State Board of Education approved CTAE Career Pathways with three sequenced courses. *To view course standards, pathway guides, and plans of study, visit the following links:*

Standards: <https://www.gadoe.org/Curriculum-Instruction-and-Assessment/CTAE/Pages/cluster-pathway-courses.aspx>

Programs of Study:

<https://www.gadoe.org/Curriculum-Instruction-and-Assessment/CTAE/Pages/Programs-of-Study.aspx>

STEM-EC-1 is included in all CTAE courses to demonstrate employability skills required by business and industry.

- 1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.
- 1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.
- 1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.
- 1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.
- 1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.
- 1.6 Present a professional image through appearance, behavior and language.

STEM-EC-2 Demonstrate and follow safety, health, and environmental standards related to the Science, Technology, Engineering, and Math (STEM) workplaces

- 2.1 Implement workplace and product safety standards such as Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), International Organization for Standardization (ISO), Good Manufacturing Practice (GMP), and Underwriters Laboratories (UL).
- 2.2 Demonstrate and incorporate safe laboratory procedures in the classroom, lab, and field environments.
- 2.3 Explain the impact of safety standards such as Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), International Organization for Standardization (ISO), Good Manufacturing Practice (GMP), and Underwriters Laboratories (UL) relating to engineering fields.
- 2.4 Implement safety precautions to maintain a safe work environment.

STEM-EC-3 Describe the characteristics of engineering disciplines and engineered products.

- 3.1 Explain a contemporary definition of engineering.
- 3.2 Compare and contrast engineering to other approaches for solving technological and design problems.
- 3.3 Explain the duties and responsibilities of an Engineer.
- 3.4 Analyze and evaluate the implications of ethics in the engineering field.
- 3.5 Describe the principal fields of engineering specialization and identify associated career tracks.
- 3.6 Explain the developmental and life cycle of an engineered product.
- 3.7 Understand cost and risk analysis along with market analysis that is completed when creating engineered products.

STEM-EC-4 Demonstrate the knowledge and skills required to pursue the full range of engineering post-secondary education and career opportunities.

- 4.1 Explain the relationship between STEM and non-STEM Majors.
- 4.2 Identify and describe educational requirements for engineering occupations along with locations where programs of study are available.
- 4.3 Compare and contrast the differences and similarities between engineering and engineering technology degrees.
- 4.4 Analyze the need to be a life-long learner in the field of engineering.
- 4.5 Identify and explain salaries associated with the different fields of engineering, including business services, healthcare, consulting services and technical administrative support in the consideration of career segments.

STEM-EC-5 Explain a whole systems approach to the engineering design process to solve a technical problem.

- 5.1 Describe the role of problem identification and definition, brainstorming, research, specifications, constraints, criteria, alternative solutions, analysis, decision making, communication, evaluation, and modification as activities comprising the engineering design process.
- 5.2 Apply the engineering design process to the solution of a technical problem.
- 5.3 Optimize and justify design solutions based on cost, time, schedule, and performance constraints.
- 5.4 Communicate design solutions to peers and potential consumers using graphical media, oral presentations, and technical writing.
- 5.5 Evaluate the design based on consumer research, peer feedback, financial and safety risk, and cost benefit analysis to optimize the design solution.
- 5.6 Demonstrate an understanding of the continuous improvement process as it applies to new designs and modifications of existing designs for new applications.

STEM-EC-6 Employ critical thinking skills and teamwork skills when working in groups to solve problems, to make decisions, achieve group goals and use team members' talents effectively.

- 6.1 Identify and describe common tasks that require employees to use problem-solving skills.
- 6.2 Analyze elements of a problem to develop creative solutions.
- 6.3 Describe the value of using problem-solving and critical thinking skills to improve a situation or process.
- 6.4 Create ideas, proposals, and solutions to problems.
- 6.5 Work with others to achieve objectives in a timely manner.
- 6.6 Promote the full involvement and use of team members' individual talents and skills.
- 6.7 Demonstrate teamwork processes that provide team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution.
- 6.8 Take responsibility for shared group and individual work tasks.
- 6.9 Demonstrate sensitivity to and value for diversity.
- 6.10 Apply peer evaluation techniques to critique group members.
- 6.11 Integrate business principles when working as a team.

STEM-EC-7 Summarize and apply engineering solutions through the audience appropriate application of engineering graphics and technical writing.

- 7.1 Communicate design specifications through Engineering drawings and multiple medias.
- 7.2 Apply tools to mathematically analyze engineering design problems.
- 7.3 Apply accurate dimensions to a technical drawing, including size and geometric tolerances.
- 7.4 Prepare a persuasive proposal for an engineering solution.
- 7.5 Document engineering design processes using an engineering design notebook.
- 7.6 Prepare a report of engineering design activities including a description of analysis, optimization, and selection of a final solution.
- 7.7 Research and benchmark a technological problem or idea.
- 7.8 Use oral and visual communication skills to deliver an engineering design presentation.

STEM-EC-8 Apply basic engineering tools and resources to aid in data collection and problem solution sets.

- 8.1 Demonstrate understanding and application of various measurement systems.
- 8.2 Demonstrate understanding and application of various base units in both English and international systems (SI).
- 8.3 Demonstrate an understanding of the importance of tool calibration and precision measurement instruments.
- 8.4 Demonstrate the use of precision measuring instruments to measure and inspect parts to optimize the solution to a problem.
- 8.5 Use appropriate technologies or applications to generate data to optimize solutions to a problem.
- 8.6 Graphically display the collection of data.
- 8.7 Use laboratory tools, equipment, and technologies to demonstrate the properties of materials.

STEM-EC-9 Cite evidence for the role of troubleshooting, research and development, inventions, and innovations in problem solving.

- 9.1 Demonstrate an understanding of the difference between an invention and an innovation and the importance in developing solutions.
- 9.2 Use appropriate evaluation tools while troubleshooting during the design process.
- 9.3 Examine business and industry research to prepare devices and systems for the marketplace.
- 9.4 Use an interdisciplinary approach to problem solve.

STEM-EC-10 Explore the use of social media and other 21st century technologies and their impact(s) on the fields of engineering and technology.

- 10.1 Demonstrate an understanding of the different types of social media utilized in market products.
- 10.2 Evaluate positive and appropriate utilization of social media in the workplace.
- 10.3 Employ open communication through social media applications as a medium across multiple platforms.
- 10.4 Investigate the impact(s) of various uses of social media (e.g., positive, negative, intended, unintended, etc.).
- 10.5 Explain aggregate data collected from researched social media platforms.

STEM-EC-11 Critique and synthesize how related career and technology student organizations are integral parts of career and technology education courses. Students will develop leadership, interpersonal, and problem-solving skills through participation in co-curricular activities associated with the Technology Student Association (TSA).

- 11.1 Explain the goals, mission and objectives of Career Technical Student Organizations (CTSOs).
- 11.2 Explore the impact and opportunities a student organization (TSA) can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs.
- 11.3 Explore the local, state, and national opportunities available to students through participation in related student organization (TSA) including but not limited to conferences, competitions, community service, philanthropy, and other (TSA) activities.
- 11.4 Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.
- 11.5 Demonstrate teamwork, leadership, interpersonal relations, and project management.
- 11.6 Through teamwork, apply the skills and abilities in requirements analysis and configuration control while working with plans, processes, and projects as assigned.
- 11.7 Through teamwork, use the skills required in project management to track and assess the progress of a plan, process, or project as assigned.
- 11.8 Through teamwork, apply the skills in quality assurance as well as those in process management and development for appropriate applications of systems integration techniques to an assigned project.
- 11.9 Effectively use project management techniques (e.g., teamwork, appropriate time management practices, effective organizational skills, conduct analysis of cost, resources, and production capacity, and quality practices with continuous improvement).
- 11.10 Understand and demonstrate proper work ethics when working with plans, processes, and projects, as assigned.

CTSO Affiliation (Career Tech Student Organizations): CTSOs are co-curricular organizations with leadership programs and competitive events which reflect current curriculum standards and competencies for the instructional programs they serve. Teachers infuse CTSO activities into the instructional activities, thereby helping students see the real world value of their academic studies. The CTSO for this course appears below, and students are encouraged to take advantage of these additional leadership opportunities.

FIRST Robotics: The mission of FIRST Robotics is to inspire young people to be science and technology leaders and innovators, by engaging them in exciting mentor-based programs that build science, engineering, and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership.

BEST Robotics: Through participation in this project-based STEM program, students learn to analyze and solve problems utilizing the Engineering Design Process, which helps them develop technological literacy skills. It is these skills that industry seeks in its workforce.

TSA: The mission of the Technology Student Association is learning to lead in a technical world. TSA enhances personal development, leadership, and career opportunities in STEM, whereby members apply and integrate these concepts through intracurricular activities, competitions, and related programs.

VEX Robotics: The mission of VEX Robotics is to envision a world where every student has the opportunity to be inspired by the excitement of hands-on, minds-on STEM learning and the feeling of creating something with technology.

Electrathon America: The mission of Electrathon America is to provide hands on opportunities for participants to learn about STEM principles as they design and build an electric vehicle for competition.

Required Assignments: Engineering Concepts will require students to demonstrate proficiency based on summative, formative assessments and class based projects.

Availability for Extra Help: Extra help is available during "Open Lab" hours on Tuesdays & Thursdays after school until 5:00pm, and during IF time.

Makeup Work: Make up work is defined as work assigned during a student's absence, not work assigned prior to an absence. The student has five (5) school days upon returning to school to complete make-up work. The teacher has the discretion to grant a longer period to make up work, if there are extenuating circumstances.

Grading Calculations:

Non-EOC Course Average = 50% (1st Sem. Course Work) + 50% (2nd Sem. Course Work)
1st and 2nd Semester Course Work = 75% Summative + 25% Formative

Grading Policy:

A = 90 – 100
B = 80 – 89
C = 70 – 79
Failing = Below 70

Formative Assessments include, but are not limited to homework, class work, practice tests, rough drafts, and sections of projects/ research papers/presentations.

Summative Assessments include, but are not limited to unit tests, final projects, final essays, final research papers, and final presentations.

Learning Resources/Textbook(s): All learning resources, both print and digital, are meant to support and enhance the student learning experience of this class. Below are the names of the textbooks and websites that will be used in this course. Some of the web-based resources require parent permission per federal regulations. Federal laws that guide parent permission requirements are as follows:

- **Children's Internet Protection Act (CIPA):** The school is required by CIPA to have technology measures and policies in place that protect students from harmful materials including those that are obscene and pornographic. Any harmful content contained within inappropriate sites will be blocked. <http://fcc.gov/cgb/consumerfacts/cipa.html>
- **Children's Online Privacy Protection Act (COPPA):** COPPA applies to commercial companies and limits their ability to collect personal information from children under 13 years of age. No personal student information is collected for commercial purposes. <https://www.ftc.gov/tips-advice/business-center/guidance/complying-coppa-frequently-asked-questions-0>

- **Family Educational Rights and Privacy Act (FERPA):** FERPA protects the privacy of student education records and gives parents the right to review records. Under FERPA, schools may disclose directory information in certain circumstances.
<http://www2.ed.gov/policy/gen/guid/fpco/ferpa>

Please review the resource lists below. Each website related to the curriculum resources is provided along with their privacy policies. Should you have any questions regarding these resources immediately contact the course teacher via email or phone.

** The following resources are county approved. These resources may vary by school due to sequencing, pacing, curriculum design, and/or individual needs of students.*

Name of Resource*	Hard copy/Website	Privacy Policy
Virtual Job Shadow	Website	https://www.virtualjobshadow.com/resources/policy/
Talk Hiring Job Interview Practice	Website	https://www.talkhiring.com/privacy-policy
Amatrol Learning	Classlink	https://amatrol.com/privacy/
Autodesk Suite	Website	https://www.autodesk.com/company/legal-notices-trademarks/privacy-statement
YouScience	Website	https://www.youscience.com/privacy-policy/
Office 365	Classlink	
SolidProfessor	Classlink	
SolidWorks	Website	Privacy Policy
SP2- OSHA Certification	Website	https://sp2.org/privacy-policy/

**** The following resources are web-based resources that require parent permission. By signing the syllabus, the parent is approving these resources. Should you have any questions regarding any of these classroom resources, please contact your student's teacher via email.**

Parent Initial for Approval **	Name of Resource	Website	Privacy Policy
	O*Net Online	https://www.onetonline.org/	https://www.onetcenter.org/privacy.html

Dress for Success: Career and technical education pathways in Forsyth County incorporate Dress for Success Days throughout the school year. These experiences allow students to foster confidence and continue to develop a positive self-image, while understanding the importance of dressing well for their future profession. At certain intervals throughout the course, students will analyze industry standards of the profession and study the importance of dressing well for a job interview. This will culminate into being fully prepared for Community Mock Interviews which occur as students complete a career pathway.

Industry Credentialing/Credentials of Value (EOPA): Students are encouraged to select a career pathway beginning in the ninth or tenth grade that is connected to college and career goals. This course is one of three courses in the career pathway chosen by a student. At the conclusion of the third pathway course, students will be required to take an industry credentialing assessment. This assessment provides students an opportunity to demonstrate what they have learned by completing an online, nationally recognized exam and allows students the ability to earn a FCS Pathway Medallion and State Career Pathway Diploma Seals upon graduation. Student directory information may be shared with credentialing vendors offering the assessment.

The rigorous/technical coursework that you have been taking or will take in future years will provide you the foundational knowledge you will need for this exam. Your teacher will provide you with the testing details and share the study guide and resources that are available to also assist you in preparation for this industry certification exam.

Credential of Value (EOPA) Assessment Name: Engineering Assessment (State Developed), Test Code: 7773
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Credential of Value (EOPA) Assessment Vendor: NOCTI
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Resource section. I will support my student following the classroom expectations outlined in this course syllabus. I agree that I am the person who is legally allowed to consent for my student whose name is listed below.

Student's Name (Print)

Parent's Name (Print)

Parent Signature

Date