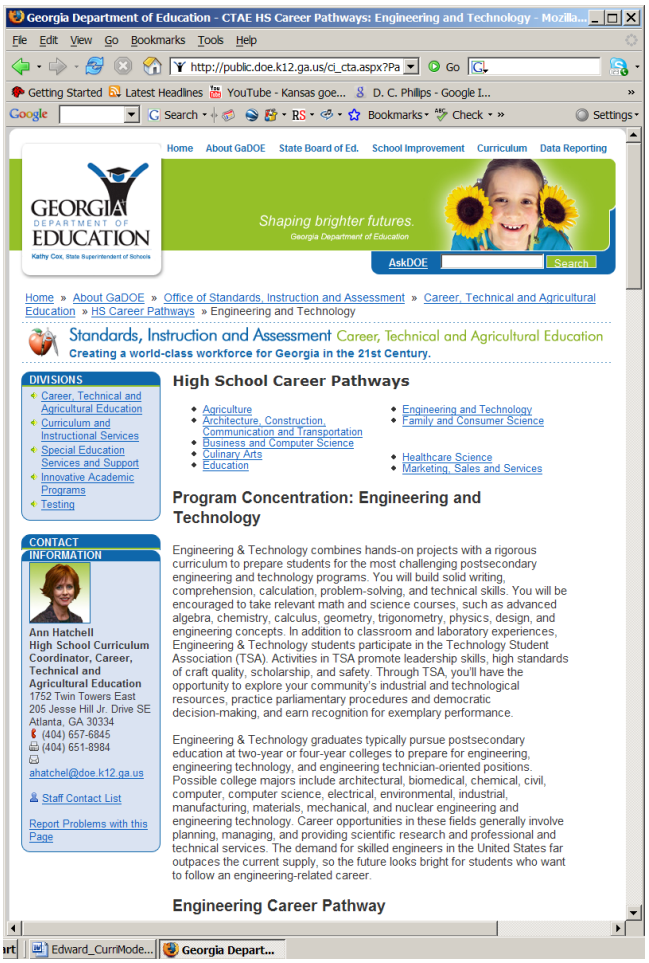
# APPENDIX 1-C

## Proposal for Revised and New Course Description for the University of Georgia and the National Center for Engineering and Technology Education




Writer/Editor:

Edward Locke

# Related to Major

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| EDUC 2120 - Exploring Socio-Cultural Perspectives on Diversity (4 hrs) | Socio-Cultural Diversity and Education (4 hrs) |

**Course Description:** This course covers the topics of original EDUC 2110 (Investigating Critical and Contemporary Issues in Education) and EDUC 2120 (Exploring Socio-Cultural Perspectives on Diversity) and includes two parts. Part 1 (EDUC 2110): "Observations and analyses of critical educational issues influencing the social and political contexts of educational settings in Georgia and the United States. Students examine the teaching profession, the meaning of education and schooling in a diverse culture, and the moral and ethical responsibilities of teaching." Part 2 (EDUC 2120): "The fundamental knowledge of understanding culture and teaching children from diverse backgrounds. Examination of the nature and function of culture, development of individual and group cultural identity, definitions and implications of diversity, and the influences of culture on learning, development, and pedagogy. This course has a required field experience component."
**Note:** This is a modified course description based on the current UGA course description (source: http://bulletin.uga.edu/bulletin/courses/descript/efnd.html). The merger of topics is proposed to free up credit hours for more mathematics courses.

# Engineering and Technology Curriculum Development

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 2320B – Digital Simulation for K-12 Engineering & Technology (3 hrs) | Digital Simulation for K-12 Engineering & Technology (3 hrs) |

**Course Description:** This course would cover the topics and skills of digital simulation software for engineering analysis and design, such as FoilSim (http://www.grc.nasa.gov/WWW/K-12/FoilSim/index.html; for aerodynamic), RocketModeler (http://www.grc.nasa.gov/WWW/K-12/rocket/rktsim.html, for principles of weight, thrust, aerodynamic forces, lift and drag, etc..), The West Point Bridge Designer: (http://bridgecontest.usma.edu/, for bridge design), Yenka (http://www.yenka.com/en/Yenka_Gears/, for electronics PCB simulation, gears set design, statistics modeling, and others), and others that are appropriate for K-12 students. This course will be project-based.
**Note:** This is a proposed course description written by Edward Locke.

# Engineering and Technology

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5010&5100 - Appropriate Engineering & Technology in Society (4 hrs) | Appropriate Engineering & Technology in Society (4 hrs) |

**Course Description:** This course would cover the topics of original ETES 5010E/7010E (Technology and Society) and ETES 5100/7100 (Appropriate Technological Development) and includes two parts. Part 1 (ETES 5010E/7010E): "Impact of technology on society and culture. Included is the investigation of positive and negative aspects of various technologies, with specific attention to the technology education curriculum." Part 2 (ETES 5100/7100): "Research and development of self-help technologies used to create and maintain appropriate levels of technological growth. Focuses on field projects, programs, and consultancies testing and demonstrating applications of relevant and efficient technological solutions to problems."
**Note:** This is a modified course description based on the current UGA course description (source: http://bulletin.uga.edu/bulletin/courses/descript/etes.html). The merger of topics is proposed to free up credit hours for more mathematics courses.

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090A - Principles of Technology I: Statics and Dynamics (4 hrs) | Statics and Dynamics (4 hrs) |

**Course Description:** This course explores fundamental engineering principles and methods of statics and dynamics, and connects class concepts and knowledge with community-based problems, with a special emphasis on teaching the integration of mathematics, science, and technology. Topics include: Statics Part: General principles (mechanics, concepts, units of measure, numerical calculations), force vectors (scalars and vectors), equilibrium of a particle, free-body diagram, coplanar force systems, force system resultants, equilibrium of a rigid body, structural analysis and internal forces. Dynamics Part: kinematics of a particle, kinematics of a particle: force and acceleration, kinematics of a particle (work and energy, impulse and momentum), planar kinematics of a rigid body (force and acceleration). This would be the first course in the Principle of Technology sequence.
**Note:** This is an updated course description based on the current UGA course description (source: http://bulletin.uga.edu/bulletin/courses/descript/etes.html), and Dr. John Mativo's course syllabus.

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090B - Principles of Technology II: Material Strength & Selection (4 hrs) | Material Strength & Selection (4 hrs) |

**Course Description:** This course explores fundamental engineering principles and methods of strength of materials and material science, and connects class concepts and knowledge with industry-based problems. Topics include: Strength of Materials Part: Stress and strains under axial, shearing, and torsional forces; flexural stresses and deflections of simple beams; columns; and combined stresses. Material Selection: Types, properties, production and treatment of metals, alloys, polymers, ceramics and composites, and semiconductor materials; and material selection and protection against deterioration. Material testing lab projects are included. This would be the second course in the Principle of Technology sequence.
**Note:** This is a new course description. The new course is designed to offer K-12 Engineering and Technology Teacher Education students high school appropriate analytic and predictive skills in the subject of strength of materials (also called mechanics of materials), as well as basic knowledge and skills covered in a material science course in selecting and testing materials used in engineering design. The descriptions drew references from relevant engineering course descriptions from the University of Georgia (ENGR 2140 - Strength of Materials and ENGR 6370 - Material Science, available at http://bulletin.uga.edu/bulletin/courses/descript/engr.html) and California State University Los Angeles (ME 205 - Strength of Materials I, ME 208 - Statics and Strength of Materials, and ME 430 - Properties and Selection of Engineering Materials, available at http://www.calstatela.edu/academic/ecst/me/courses.php).

## Mechanical Design and Manufacturing Option

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5020B - Technical Design Graphics: 3D Solid Modeling and Design (3 hrs) | Technical Design Graphics: 3D Solid Modeling and Design (3 hrs) |

**Course Description:** This course covers three-dimensional modeling of products with simply mechanical components and assemblies, and creation of two-dimensional working drawings (orthographic and isometric), and presentation drawings (assembly and explosion), with parametric computer-aided drafting (CAD) software (such as SolidWorks or Inventor). A semester design project is required. This would be the second course in the Technical Design Graphics sequence.
**Note:** This is a new course description.

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090C - Principles of Technology III: Fluid Mechanics and Aerodynamics (3 hrs) | Fluid Mechanics and aerodynamics (2 hrs) |

**Course Description:** This course would include two parts. Fluid Mechanics Part: The fundamental engineering principles and methods of fluid mechanics, with an emphasis on their applications in boat, airplane, barometer and other practical designs. Topics include elements and engineering applications of the laws of fluid behavior to evaluate the forces and energies generated by fluids at rest and in motion. Aerodynamics Part: Air-foil characteristics; transonic, supersonic, and viscous effects on lift and drag; power considerations, airplane performances. AirFoil and other K-12 appropriate simulation software might be used.
This would be the third course in the Principle of Technology sequence of high school appropriate engineering courses that are based on pre-calculus mathematics with a slight inclusion of early calculus (integration and differentiation).
**Note:** This is a new course description. The new course is designed to offer K-12 Engineering and Technology Teacher Education students high school appropriate analytic and predictive skills in the subject of fluid mechanics and aerodynamics. The descriptions drew references from relevant engineering course descriptions from the University of Georgia (ENGR 3160 - Fluid Mechanics, at http://bulletin.uga.edu/bulletin/courses/descript/engr.html) and California State University Los Angeles (ME 303 - Fluid Mechanics I, and ME 403 Aerodynamics, available at http://www.calstatela.edu/academic/ecst/me/courses.php).

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090D - Principles of Technology IV: Heat Transfer and Thermodynamics (3 hrs) | Heat Transfer and Thermodynamics (2 hrs) |

**Course Description:** This course would include two parts. Heat Transfer Part: Fundamental principles of heat transfer; conduction, convection, and radiation; and applications. Thermodynamics Part: The fundamental engineering principles and analytic methods of thermodynamics, with an emphasis on their applications in energy conversion, usage and efficiency. Topics include concepts of equilibrium and temperature; first and second laws of thermodynamics, properties of pure substances; ideal gases; application of thermodynamic principles to closed and open systems, forms of energy, transformations of energy, and energy flows and their applications in engineering systems, such as steam generators, engines and turbines; combustion, vapor cycles; refrigeration; internal combustion engines. This would be the fourth course in the Principle of Technology sequence of high school appropriate

engineering courses that are based on pre-calculus mathematics with a slight inclusion of early calculus (integration and differentiation).
**Note:** This is a new course description. The new course is designed to offer K-12 Engineering and Technology Teacher Education students high school appropriate analytic and predictive skills in the subject of fluid mechanics. The description has drawn references from relevant engineering course descriptions from the University of Georgia (ENGR 3140 - Thermodynamics, at http://bulletin.uga.edu/bulletin/courses/descript/engr.html) and California State University Los Angeles (ME 306 Heat Transfer I, and ME 326A - Thermodynamics I, available at http://www.calstatela.edu/academic/ecst/me/courses.php).

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090E - Mechanism Design and Selection (3 hrs) | Mechanism Design and Selection (3 hrs) |

**Course Description:** This course covers design and selection of mechanical elements and components (such as gears and cams, pulleys, wheels and axles, screws and fasteners and locking devices, linkages, shafts, springs, and others), application of principles of mechanics (kinematic analysis of mechanisms, tolerance and interference, and others), properties of materials, and manufacturing processes. The emphasis is on the design of simple mechanical parts and selection of out-of-shelf mechanical elements and components in the design of products and equipments. Basic analytic formulas appropriate to high school students are covered.
**Note:** This is a new course description. The new course is designed to offer K-12 Engineering and Technology Teacher Education students high school appropriate analytic and predictive skills in the subject of mechanism design and selection. The descriptions drew references from relevant engineering course descriptions from the University of Georgia (ENGR 3300 - Mechanisms and Machine Kinematics, at http://bulletin.uga.edu/bulletin/courses/descript/engr.html) and California State University Los Angeles (ME 323 - Machine Design I, available at http://www.calstatela.edu/academic/ecst/me/courses.php).

## Manufacturing System Option

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5030/7030 - Manufacturing Systems (3 hrs) | Manufacturing Systems (3 hrs) |

**Course Description:** Manufacturing through the design, planning, and development of a specific product. Topics include the practices, systems and procedures used in modern

manufacturing to bring a product to market, such as computer numeric control (CNC) and automated manufacturing processes with industrial robotics; the manufacturing properties of metals, alloys, and nonmetallic materials, as well as standards, safety, quality, and other issues.

**Note:** This is a modified course description based on the current UGA course description for ETES 5030/7030 - Manufacturing Systems (source: http://bulletin.uga.edu/bulletin/courses/descript/etes.html), with inclusion of topics in the Foundations of Manufacturing and Materials Science course under the Manufacturing Career Pathway published by Georgia Department of Education. In addition, the descriptions drew references from relevant engineering course descriptions from California State University Los Angeles (ME 327 - Manufacturing Processes, available at http://www.calstatela.edu/academic/ecst/me/courses.php; and TECH 360 - Modern Manufacturing, at http://www.calstatela.edu/academic/ecst/tech/courses.php).

| **Course Name** | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090F - Robotics and Automatic Systems (3 hrs) | Robotics and Automatic Systems (3 hrs) |

**Course Description:** Extensive study of computer aided design (CAD), computer numerical control (CNC), robotics, computer assisted manufacturing (CAM), programmable logic controllers, automated guided vehicles (AGV), and computer integrated manufacturing (CIM). This course include hands-on projects using relevant CAD and CAM programs.

**Note:** This is a new course description adopted from the State of Georgia Department of Education Engineering and Technology Career Pathways (Source: http://public.doe.k12.ga.us/ci_cta.aspx?PageReq=CICTAEET).

| **Course Name** | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090G - Production Enterprises (3 hrs) | Production Enterprises (3 hrs) |

**Course Description:** "The purpose of this course is to give students an understanding of how to design and implement a production system. Students learn how businesses engage in the production of products beginning with pre-production activities and continuing through post-production activities. Additionally, students will learn about the historical and societal impact of production. Students will also develop an understanding of careers available in manufacturing and the skills and education required for those careers."

**Note:** This is a new course description adopted from the State of Georgia Department of Education Engineering and Technology Career Pathways (Source: http://public.doe.k12.ga.us/ci_cta.aspx?PageReq=CICTAEET).

# Electrical and Electronics Option

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090H - ETES 5090H - Electronics Circuitry & Component Selection (3 hrs) | Electronics Circuitry & Component Selection (3 hrs) |

**Course Description:** Introduction to electronics. Functions of various circuit element and electronic components, circuit models, and techniques for circuit analysis, including Olm's law, Kirchhoff's laws and others. Circuit analysis lab experiments for verification of the laws of electric circuits, as well as simple and real-life circuitry design projects are included.

**Note:** This is a new course designed to qualify K-12 Engineering and Technology Teacher Education students to teach the course with the same name under the State of Georgia Department of Education Engineering and Technology Career Pathways (Source: http://public.doe.k12.ga.us/ci_cta.aspx?PageReq=CICTAEET), which has the following description: "This course is designed for beginning students who are interested in careers related to the design, production, analysis, repair, and operation of devices that use electronics. The course should be designed around major individual and class projects that promote critical thinking, problem solving, and abstract reasoning that encourages the student to become an investigative life long learner. Teachers should develop units around real-life work centered situations that integrate content across the curriculum. The integrated project should provide the student with opportunities to develop and demonstrate technical, academic, cognitive, and personal competencies. Job shadowing, interviews, and internships are encouraged. A variety of teaching methods such as class discussions, demonstrations, class activities, homework, and modules should be used to prepare and assist the student with developing a competency base. At the end of each unit, students should be evaluated using a variety of assessments that consider multiple learning styles, abilities, and skills. Assessments should include daily work habits, class assignments, homework, tests, organization, and project evaluation. Students are expected to set goals, research careers, and develop plans for achieving desired goals." The course description draws references from relevant engineering course descriptions from the University of Georgia (ENGR 2170 - Electrical Circuits, at http://bulletin.uga.edu/bulletin/courses/descript/engr.html) and California State University Los Angeles (EE 204 - Circuit Analysis and EE 211 Electric Circuits Laboratory, available at http://www.calstatela.edu/academic/ecst/me/courses.php).

| Course Name | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090I - Advanced AC and DC Circuits (3 hrs) | Advanced AC and DC Circuits (3 hrs) |

**Course Description:** This course covers DC circuits with hands-on experiences in using VOM and DVM for basic electrical measurement and troubleshooting; and AC circuits with hands-on experiences testing inductors and capacitors and using oscilloscope for

various voltage, frequency, and phase relationships measurement. Additional topics include DC and AC motors and generators.

**Note:** This is a new course designed to qualify K-12 Engineering and Technology Teacher Education students to teach the course with the same name under the State of Georgia Department of Education Engineering and Technology Career Pathways (Source: http://public.doe.k12.ga.us/ci_cta.aspx?PageReq=CICTAEET), which has the following description: "This course is designed for beginning students who are interested in careers related to the design, production, analysis, repair, and operation of devices that use electronics. The course should be designed around major individual and class projects that promote critical thinking, problem solving, and abstract reasoning that encourages the student to become an investigative life long learner. Teachers should develop units around real-life work centered situations that integrate content across the curriculum. The integrated project should provide the student with opportunities to develop and demonstrate technical, academic, cognitive, and personal competencies. Job shadowing, interviews, and internships are encouraged. A variety of teaching methods such as class discussions, demonstrations, class activities, homework, and modules should be used to prepare and assist the student with developing a competency base. At the end of each unit, students should be evaluated using a variety of assessments that consider multiple learning styles, abilities, and skills. Assessments should include daily work habits, class assignments, homework, tests, organization, and project evaluation. Students are expected to set goals, research careers, and develop plans for achieving desired goals." The course description draws references from relevant technology course descriptions from California State University Los Angeles (TECH 120 - DC Electronics and TECH 221 - AC Electronics, available at http://www.calstatela.edu/academic/ecst/tech/courses.php).

| **Course Name** | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5090J - Digital Electronics (3 hrs) | Digital Electronics (3 hrs) |

**Course Description:** Analysis and design of electronic devices in this course might include the following: transistors, and operational amplifiers, switching mode circuits, diode circuit, opto-electronic devices, logic gates, active filters and communication circuits, timers, optoelectronics, machine vision, and others.

**Note:** This is a new course designed to qualify K-12 Engineering and Technology Teacher Education students to teach the course with the same name under the State of Georgia Department of Education Engineering and Technology Career Pathways (Source: http://public.doe.k12.ga.us/ci_cta.aspx?PageReq=CICTAEET), which has the following description: "Students have opportunities to apply prior learning in electronics to the digital world in which they live. Students use applications of mathematics and science to predict the success of an engineered solution and complete hands-on activities with tools, materials, and processes as they develop functional devices and working prototypes aided by computer simulations."

The course description draws references from relevant technology course descriptions from the University of Georgia (ENGR 3270 - Electronics I, and ENGR 4270 - Electronics II**,** at http://bulletin.uga.edu/bulletin/courses/descript/engr.html), and from California State University Los Angeles (EE 336 - Electronics, EE 372 - Digital Electronics, available at http://www.calstatela.edu/academic/ecst/ee/courses.php; and TECH 323 - Industrial Electronics, available at http://www.calstatela.edu/academic/ecst/tech/courses.php).

## Capstone Engineering Design Courses

| **Course Name** | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5110A/7110A - Engineering Design I (3 hrs) | K-12 Engineering Design I (3hrs) |

**Course Description:** This is the first class in the Capstone Engineering Design course sequence, and features two simple engineering design projects. This course covers the systematic approach to solving technological problems using engineering design processes. Establishment of engineering design principles to guide, to collect data, and to evaluate the design process. Focus on creativity, resourcefulness, and the ability to visualize and think abstractly. Topics include identification of major components of the engineering design process, review of fundamentals of engineering statics, dynamics, and thermodynamics, development of engineering design strategies that incorporate creativity in engineering based problems, production of models of engineering designed solutions to specific technological problems, analysis of engineering design solutions based on ISO 9000 design criteria, construction of prototypes of engineering design solutions, connecting class concepts and knowledge with community-based problems, and integrate engineering applications into the engineering and technology education curriculum.
**Note:** This is a modified course description based on the current UGA course description (source: http://bulletin.uga.edu/bulletin/courses/descript/etes.html) and Dr. Mativo's syllabus.

| **Course Name** | |
|---|---|
| **For University of Georgia** | **For National Center for Engineering & Technology** |
| ETES 5110B/7110B - Engineering Design II (3 hrs) | K-12 Engineering Design II (3 hrs) |

**Course Description:** This is the second class in the Capstone Engineering Design course sequence, and features complex engineering design projects with ill-structured problems. Students will complete the projects with a comprehensive portfolio featuring engineering design notebook, research report and CAD working drawings. This course continues to explore the same principles of engineering covered in ETES 5110A/7110A, but with a focus on solving ill-structured engineering design problems, connecting class concepts and knowledge with community and industry-based problems, and integrate engineering applications into the engineering and technology education curriculum.
**Note:** This is a new course description written by Edward Locke for Dr. John Mativo.