ENGR 12 Course Outline as of Fall 2011

CATALOG INFORMATION

Dept and Nbr: ENGR 12 Title: HOW STUFF WORKS
Full Title: How Stuff Works - The Science Behind Things
Last Reviewed: 5/21/2007

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	4.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	6.00		Contact Total	105.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade or P/NP
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
A descriptive and interdisciplinary introduction to science through hands-on explorations into the inner workings of today's technological objects and systems. Intended for non-engineering majors. Specific case studies will span many categories including: energy and power, medicine, transportation, agriculture, manufacturing, construction, communications, entertainment. Each study will delve into the underlying scientific principles, the historical development and societal implications.

Prerequisites/Corequisites:

Recommended Preparation:
Eligibility for ENGL 100 or ESL 100

Limits on Enrollment:

Schedule of Classes Information:
Description: A descriptive and interdisciplinary introduction to the sciences through hands-on explorations into the inner workings of everyday objects and systems. Intended for non-engineering majors. (Grade or P/NP)

Prerequisites/Corequisites:
Recommended: Eligibility for ENGL 100 or ESL 100
Limits on Enrollment:
Transfer Credit:
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 2008	Fall 2011
CSU GE:	**Transfer Area**		Effective:	Inactive:
IGETC:	**Transfer Area**		Effective:	Inactive:

CSU Transfer:	Effective:	Inactive:
UC Transfer:	Effective:	Inactive:

CID:

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Outcomes and Objectives:
Upon successful completion of the course, students will be able to:
1. Identify and explain the scientific principles behind specific technological products.
2. Dissect a technological product or system, identify major functional components and trace the flow and/or conservation of energy, material and information.
3. Employ systematic data collection methods to collect accurate measurements in a laboratory setting.
4. Apply the fundamental principles of the scientific method and the engineering design process to the development and implementation of lab experiments and small design projects.
5. Apply computer tools, standard report formats, and oral reporting methods to compile, graphically represent, and deliver experiment data and results as well as to document a design or construction process.
6. Construct small design projects by applying basic scientific principles and engineering design processes.
7. Compare and contrast the fundamental principles of the scientific method and the engineering design process.
8. List and define the types of risk and safety issues related to specific technological products and systems.
9. Identify examples of how scientific inquiry and technological development are imperfect and ongoing evolutionary processes responding to human needs and wants.
10. Debate and appraise the societal and environmental impacts of scientific and technological developments.

11. Debate and judge the tradeoffs made during the design and construction of technological products or systems.
12. Debate and evaluate the merits of allocating additional societal resources to the further development of specific technological products or systems.

Topics and Scope:

Central topics and themes include but are not limited to:
I. The scientific method and the engineering design process
II. Ethical frameworks of science and engineering
III. Conservation of energy and materials
IV. Cost-benefit analysis and the risks and safety of technological products and systems
V. The history and evolution of science and technology
VI. Scientific versus technical writing
The central themes will be explored through a series of (7-30) case studies. The case studies will build in complexity over the course of the semester and will span the broad numbered categories listed below. Specific lettered examples listed are intended as illustrative suggestions only.

1. Energy and Power
   A. Refrigerators
   B. Thermostats
   C. Light bulbs
   D. Microwave ovens
   E. Solar cells
   F. Fuel cells
   G. Turbines
   H. Nuclear power plants
   I. Electrical power grid
   J. Petroleum processing infrastructure
2. Medicine
   A. Prosthetics
   B. Insulin pumps
   C. Heart pumps
   D. X-ray machines
   E. CT and MRI imagers
   F. Medical diagnosis systems
   G. Medical information systems
3. Transportation
   A. Bicycles
   B. Segways
   C. Automobiles
   D. Mag-Lev trains
   E. Space shuttle
   F. Highway systems
   G. Ocean shipping system
4. Agriculture
   A. Grapevine trellis
   B. Archimedes screws
   C. Irrigation sprinklers

D. Well pumps
E. Fertilizer
F. Waste water treatment systems
G. Food processing facilities
H. Agri-businesses
I. Genetic engineering

5. Manufacturing
   A. Wrenches
   B. Drills
   C. Computer chips
   D. Plastics
   E. Packaging
   F. Assembly lines
   G. Mines
   H. Chemical plants
   I. De-manufacturing and recycling systems
6. Construction
   A. Beams
   B. Dams and weirs
   C. Houses
   D. Skyscrapers
   E. Landfills
   F. Egyptian and Meso-American pyramids
   G. Oil drilling platforms
   H. Canal and water delivery systems
7. Communications and Entertainment
   A. Cell phones
   B. Ipods
   C. Violins
   D. CD & DVDs
   E. Televisions
   F. Computers
   G. Microwave transmission towers
   H. The internet
   I. Global positioning systems
   J. Mass media
8. Other
   A. Hair dryers or curling irons
   B. Land mines or improvised explosive devices

Laboratory work:
At least three lab periods will be allocated to each of the following emphases:

1. Mechanical Dissection
2. Scientific Investigation
3. Engineering Design
4. Oral, Graphical, and Written Presentation

The mechanical dissection labs will lay a foundation for the scientific investigation. The engineering design labs will then apply this technological and scientific understanding. Lab reports will incorporate both scientific journal formats and technical memo formats.

Assignment:

1. Reading from the textbook or instructor prepared materials
2. Weekly homework questions
3. Internet research
4. Research reports
5. Exams

Lab Work will include:

6. Dissection reports
7. Scientific investigation reports
8. Design challenges and associated technical memos
9. Oral presentation

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Written homework, Lab reports, Term papers	Writing 15 - 35%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Lab Design Challenges	Problem solving 5 - 15%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Dissection and Oral Presentation	Skill Demonstrations 10 - 20%

Exams: All forms of formal testing, other than skill performance exams.

Multiple choice, True/false, Matching items, Completion, Problem solving and Short Essay	Exams 30 - 50%

Other: Includes any assessment tools that do not logically fit into the above categories.

Participation	Other Category 0 - 10%

Representative Textbooks and Materials:

Bloomfield, "How Things Work, The Physics of Everyday Life", Wiley, 2006
Macaulay, "The New Way Things Work", Houghton Mifflin, 2007
Langone, "The New How Things Work: Everyday Technology Explained", National Geographic, 2004
Nat. Acad. of Engr., "Engineering and the Advancement of Human Welfare", Nat. Acad. Press 1989