

Engineering Academy Initiative for Alabama

Setting the Mark: A Curriculum Proposal

**State Wide Sharing Meeting
September 11, 2008**



EAIA Goal

To increase the number of high school graduates choosing engineering as a career by providing curriculum and processes that prepare them for college.

Engineering Foundations

Mathematics:

Algebra

Geometry

Trigonometry

Calculus

Science:

Biology

Chemistry

Physics

AP Level Lab Class



Computer Skills

Computer Applications:

word processing
presentation software
spreadsheet
image processing

Programming:

C++

Engineering Tools:

Matlab
Mathcad
Labview
CAD
Solid Modeling

Engineering and Technology Fundamentals

Engineering Careers
Engineering Design Process
Properties of Materials
Structures
Energy and Power Technologies
Mechanical Systems
Fluid, Thermal, and Electrical Systems
Sensors and Controls
Communication Technologies
Manufacturing Technologies



Curriculum Framework

DRAFT

The Engineering Academy Initiative for Alabama

GRADE	MATH	SCIENCE	ENGINEERING	COMPUTER	EXTRA-CURRICULAR RELATED ACTIVITIES
9	Geometry (Honors)	Biology or Honors Biology	Foundations of Engineering	Applications for Engineers ²	BEST Robotics www.bestinc.org
10	Algebra II w/Trigonometry (Honors)	Chemistry or Honors Chemistry	Engineering Applications and Systems I	Programming for Engineers ³	US FIRST http://www.usfirst.org/
11	Pre-Calculus (Honors) ACCUPLACER Placement Test ¹	Physics, AP Physics or Chemistry II	Engineering Applications and Systems II	AP Computer Science	Team America Rocketry Challenge (TARC) http://www.rocketcontest.org/ FIRST Tech Challenge- Tetrax materials http://www.usfirst.org/what/FTC/default.aspx?id=380
12	Calculus or AP Calculus Recommendation: Students should be enrolled in a math class the last semester of senior year.	AP Physics C or AP Chemistry	Engineering Research and Design	Engineering Software Tools ⁴	NASA Student Launch Initiative (SLI) http://education.nasa.gov/edprograms/descriptions/Student_Launch_Initiative.html NASA Great Moonbuggy Race http://moonbuggy.msfc.nasa.gov/

Math and Science Courses

- Follow Alabama Course of Study
- Honors classes if available
- Sequence A through Calculus
- Sequence B through Pre-Calculus
- Placement test after Pre-Calculus
- Use of calculators discouraged
- Seniors in math their last semester

Computer Classes

Computer Applications for Engineers

Covers standards in Alabama COS (Word, Excel, PowerPoint)

Engineering context

Scheduling and time management tools

Flowcharts, diagrams, and image processing

CAD and Solid Modeling – second semester

Programming for Engineers

C++ with engineering applications

AP Computer Science

Java

Engineering Software Tools

MathCad

MatLab/Simulink

Labview

Engineering Classes

Engineering I – Foundations of Engineering

Engineering II – Applications and Systems

Engineering III – Applications and Systems II

Engineering IV – Research and Design



Engineering I

Introduction to Engineering

- Technology Team

- Engineering tasks and careers

- Ethics (including plagiarism)

Problem solving techniques

- Engineering design process

Technical communications

- Engineering notebooks, proposals, progress and final reports

- Sketching and multi-view drawing

- Presentations

- Portfolios

In class or extra-curricular examples:

- Engineering the Future

- Robotics

Engineering II and III

Project and problem based learning units (PPBL), engineering challenges and activities

Real world problems provide context for learning

- Apply knowledge and skill learned in other classes

- Acquire new knowledge

- Scientific and engineering approaches

- Research and design processes

- Traditional methods (lecture, discussion, etc) used appropriately

Schools partner with colleges, universities, industry

- Choose topics of local interest



PPBL

Breadth of multidisciplinary concepts includes fundamental engineering fields of study:

Properties of materials

Structures

Energy and Power Technologies

Fluid, Thermal, and Electrical Systems

Mechanical Systems

Sensors and Controls

Communication Technologies

Manufacturing Technologies



Advantages of PPBL

- Existing units have been developed with materials, training, and support network
- Universities, schools, and industry can team to create new units
- Local industry has an opportunity to collaborate in their specialty and promote to future work force
- Teachers can adjust content and difficulty to meet needs and preferences of students
- Flexible - pacing according to activities (four semesters total)
- Students are encouraged to become more creative

Examples of PPBL

- Infinity Project
- Carnegie Mellon Robotics Curriculum
- Materials World Modules
- Photon PBL
- Project Lead the Way (four years)

Engineering Challenges and Activities

In class or extra-curricular

Team America Rocketry Challenge (TARC)

West Point Bridge Designer

Rocket and Propulsion

Biofuels

Communication and Encryption

Transportation

Life in Space

GPS

Engineering IV

Capstone Project

Independent

Emphasize technical communications

Present to professional engineers (Final Report)

Present to non-technical group (Proposal)

Internship

Two hours/day, no pay, “shadowing”

Possible alternatives

EAlA School Responsibilities

- Provide required classes
- Monitor students completion of classes
- Support teacher training
- Complete 4 semesters worth of units from recommended list
- Send copies of project final reports to state
- Complete required documentation of student participation and demographics

State Level Responsibilities

- Determine schools that qualify for EAIA status
- Designate state allocations
- Maintain a directory of recommended PPBL units
- Encourage training of specific units each year
- Arrange in-state training if possible
- Promote EAIA to industry and coordinate partnerships
- Develop and maintain web-based community for participating professionals

Suggestions and Discussion Points

- Flexibility
- Establish local advisory boards
- Include probability and statistics
- Reduce number of computer classes
- Eliminate senior interns
- Align with Career Tech PreEngineering Program
- Level of instruction: attracting students within general population or preparing advanced students for college