

Title: Development of Advanced Composite Materials course for Engineers

Abstract:

The purpose of the presentation is to describe how and why an advanced composite materials course for engineering students has been developed over the last year. This was achieved through research, consulting, teaching and hands-on applications in the lab and working with industry. The presentation will take the listener from conception, through development, to final assessment modalities of the course. The course will be taught Spring term 2009.

The presentation will discuss what composites are. Composites incorporate two or more materials combined to provide physical properties and attributes that are superior to either of those materials alone. They are increasingly used as modern manufacturing and building materials and there is a rapid growth in their use in transportation (bicycles, motorcycles, cars, trucks, RVs, planes, trains, and snowmobiles), infrastructure (bridges, paving, water and sewage systems, piping), sporting equipment (skis, snowboards, tennis rackets, running shoes, camping gear, boats) packaging and many other products that we design and use every day. Composites are corrosion resistant, high strength, easy to manufacture and have many other advantages over conventional materials.

The presentation will explain why engineers need to understand composites and their application. Engineers today need to understand the physical properties of composites as well as how to select the correct ones for a given application, they need to understand the actual application of composites so that they are knowledgeable incorporating them into the design and manufacturing of tomorrow's products. The need for this understanding is urgent, having a sustainable component; as we must design lighter, longer lasting, more fuel efficient modes of transportation as well as lighter and easier to construct building products. These products produce less waste, sometimes can be recycled and lower our carbon footprint.

Project Objectives:

The presentation will describe the outline, labs, assessment methods and references used in the course (as shown below) :

- ***A one term three credit upper level course specifically devoted to advanced composites has the following outline:*** 1) an introduction to composites, 2) a technology overview of composites, 3) an in-depth look at the matrix component of composites and complete discussions of the various materials and physical behavior, 4) a thorough study of fiber reinforcements and their properties, 5) a study of design and manufacturing with advanced composites, 6) discussions of core and filler materials and how they are incorporated into products, 7) lectures on the design, manufacture and use of composite tooling, 8) lectures on fastening, machining and adhesive bonding of composites, 9) discussions of composite repair, 10) lectures on testing and inspection methods used when working with composites and a look at composites of the future.
- ***Composite course lectures and labs will be shown with an emphasis on manufacturing in aerospace, ground transportation, infrastructure, sporting goods and custom container***

packaging. Weekly labs follow the sequence of the outline items listed above and give students hands-on experience in design, selection and building products with different advanced composites.

- **A knowledge base for coursework on composites** was developed by visiting and working with industries that use advanced composites as a major part of their production process in producing their product in order to enhance the understanding of these materials as well as gather information for coursework. Strengthened industry partnerships provided real world applications for the lecture and lab development.
- **Labs were designed and developed to** allow the students to work hands on with composites and to gain an applicable understanding of how to use them. There is one lab per week and each lab progresses from learned techniques from the previous week from material handling to mold building to design and manufacturing of real products.

Activity description (during the presentation):

- Using PowerPoint, discuss the course outline and syllabus in detail and provide an overview of each of the topics in the outline.
- Using PowerPoint, discuss the labs and give an overview of the lab content, set up and reporting that will be done by the students.
- Discuss the new 'Advanced Composites' elective course that is being developed for introduction @ OIT for Spring term 2009 and how this fits into the engineering programs on campus and how it fits with the existing materials courses that are being taught.
- Assessment methods for both the lecture and lab component will be discussed with sample illustrations i.e., lab reports, tests, homework and in class discussion activities.
- Describe the partnership benefits resulting from visiting and working with Boeing, Freightliner, Cessna, Monarch Coaches, Aquaglass and ECS Composites while developing this course.

Grade levels targeted: 2 yr college students taking materials courses could use this as an elective; 4 yr college students taking engineering and materials courses; graduate students taking advanced materials courses. A condensed version could be used for one or two day training seminars in composites for industry or anyone interested in furthering their knowledge on advanced composites.

Time required for presentation: A synopsis of this work will be presented in a one hour lecture.

Equipment and supplies needed for the presentation: Projector for use with laptop for PPT presentation, Internet hook up for online video clips (samples of materials will also be available to help to illustrate some of the hands on lab projects).

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