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Materials & mechanics problem-based learning project for undergraduates

Gipson, Kyle, gipsonkg@jmu.edu; Prins, Robert, Department of Engineering, James Madison University

ABSTRACT

Materials & Mechanics is part of the core courses of the Madison Engineering curriculum that is an integrated subject course taken in the junior year at James Madison University. The emphasis of the course is to provide a working foundation for exploring the governing principles of materials science and the mechanics of materials. The course fuses the theory and application of the mechanics of materials within science-led and design-led approaches to develop a plan for materials selection. A semester long team-based project that attempts to underscore the interconnectedness of structure, properties, processing, and performance of materials in products has been developed. Each team is assigned a material family to select a material candidate for use as part of a shelf system for the home market. The focus of the discussion will be the semester long, team-based, experiential, open-ended, and nondirected project that was motivated by providing Madison Engineering students with an “industrial new hire” type of experience. There are modules that focus on aspects of the project but the entire project encompasses the translation of customer desires into functional attributes for the purpose of selecting materials that will yield a valued and sustainable final product. Students must span the design space to understand how materials have been used in the past for this particular application to creating draft drawings and calculations depicting the load that will be experienced by each component of the system to physical material testing and analysis that will allow them to produce a scaled version of a conceptual prototype.