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SCHOOL OF MATERIALS ENGINEERING

To: **Engineering Curriculum Committee** **EFD# 54-18**

FROM: David F. Bahr, Head School of Materials Engineering
Date: March 4, 2019

Subject: Proposal for New Graduate Course

Contact for Information if questions arise: Name: R.Byron Pipes
Email: bpipes@purdue.edu

Proposed Course Number:	MSE 58600
Course Title:	Experimental Characterization of Advanced Composite Materials
Short Title:	Exp. Char.Adv. Comp Mat.
Previously taught as:	MSE 59700: 2013, 2015, 2016, 2017, 2018
Course:	3 credit hour. Lecture & lab. 2 lectures / 1 lab session
Proposed offering:	Fall semester

Course Description: The characterization of advanced composite materials is a combined lecture/laboratory course in which polymeric composite laminates will be fabricated of carbon fiber epoxy and subjected to classical test methods appropriate to the determination of the anisotropic, thermoelastic properties. Properties measured will include thermal expansion coefficients, anisotropic elastic constants, biaxial strength properties and interlaminar fracture strengths. The autoclave processing of composite laminates will be discussed and the consolidation, degree of cure and glass transition temperature of the polymeric matrix will be modeled. Microscopic analysis of the composite will be carried out to observe microstructure and measure composition fractions. Lectures will precede each experiment

Neil Armstrong Hall of Engineering ■ 701 W. Stadium Avenue ■ West Lafayette, IN 47907-2045
(765) 494-4100 ■ Fax: (765) 494-1204 ■ www.purdue.edu/MSE

Course Syllabus

• MSE 586 Experimental Characterization of Advanced Composite Materials – R. Byron Pipes

- Sem. 1, Class 3, cr.3. Prerequisites: Junior to Graduate standing in Schools of Engineering.
- The characterization of advanced composite materials is a combined lecture/laboratory course in which polymeric composite laminates will be fabricated of carbon fiber epoxy and subjected to classical test methods appropriate to the determination of the anisotropic, thermoelastic properties. Properties measured will include thermal expansion coefficients, anisotropic elastic constants, biaxial strength properties and interlaminar fracture strengths. The autoclave processing of composite laminates will be discussed and the consolidation, degree of cure and glass transition temperature of the polymeric matrix will be modeled. Microscopic analysis of the composite will be carried out to observe microstructure and measure composition fractions. Lectures will precede each experiment.
- **Goals:**
  The primary goal of this course is the introduction of the student to the characterization methods for the anisotropic properties of advanced composite materials consisting of high performance fibers suspended in polymeric matrices.
- **Objectives:**
  Upon completion of this course the student is expected to be familiar with test methods for advanced composite materials and to be able to carry out these tests to produce property data for a specific material system such as carbon fiber epoxy with a fiber volume fraction. These test methods include: 1) fabrication of test specimens, 2) fiber volume fraction, 3) lamina longitudinal tensile tests, 4) lamina shear test, 5) lamina off-axis tensile test, 6) lamina flexural test, 7) lamina thermoelastic test, 8) laminate tensile test, 9) laminate thermoelastic test, 10) laminate notch strength test, 11) mode I interlaminar fracture test, 12) mode II interlaminar fracture test.

- **Strategies:**
  Two one-hour lectures and one, three-hour lab per week. Each student is required to brief the class on two experiments during the term.
- **Instructors:**
  Professors R. Byron Pipes and Ronald Sterkenburg (AVTech)
- **Text:**
  Carlsson, L.A., Adams, D.F. and Pipes, R.B., Experimental Characterization of Advanced Composite Materials, CRC Press, Taylor and Francis Group, Boca Raton, London and New York, (2014).