**AE 7793: Manufacturing of Composites**

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| Credit Hours: | 3-0-3 | |
| Prerequisites: | ME 4793 or ME 4794 or AE 4793 or AE 4794 or CEE 4793 or CEE 4794 or CHE 4793 or CHE 4794 or PTFE 4793 or PTFE 4794. | |
| Catalog Description: | Major manufacturing techniques of metal-ceramic and polymer-matrix composites. Modeling of processes with emphasis on fundamental mechanisms and effects. Crosslisted with ME, CHE, CEE, MSE, and PTFE 7793. | |
| Textbooks: | Timothy G. Gutowski, *Advanced Composites Manufacturing*; John Wiley, 1997. | |
| Prerequisites by topic: | * Composite material properties * Composite mechanics * Composite materials selection | |
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| Goals: | Advanced study of fundamental principles and mechanisms in composites processing. | |
| Topics: | * Section 1: Manufacturing of fibers and preforms for composites   + Weaving and braiding for cloths and 3-D preforms. Non-woven materials.   + Fiber coatings for interface control. Interface chemistry and physics.     - Processing methods. Coatings for polymer, metal, ceramic and carbon composites.    Section 2: Layup and winding methods   * Prepreg manufacturing * filament winding * layup and consolidation methods    Section 3: Liquid infiltration processing   * Fundamentals: wetting; viscous flow in porous media; rheology of liquid polymers. Heat transfer. * Injection molding methods for polymer matrix composites * Pressure infiltration for metal matrix composites (including alloy solidification).    Section 4: Infiltration and pyrolysis processing   * Ceramic and carbon matrix precursor materials. Pyrolysis chemistry. Mass and volume yields. * Polymer infiltration and pyrolysis (PIP) process. Evolution of pore and matrix structure. Process limits near full density. * Chemical vapor infiltration(CVI) process. Process variations. Evolution of pore and matrix structure. Process limits near full density.    Section 5: Testing and Inspection   * Statistics and sampling. * Density and dimension measurements. * Optical methods- dye penetration and opacity. * Ultrasonics. * X-ray and neutron radiography. * IR thermography. | |
| Delivery Mode (%): | |  |  | | --- | --- | | Lecture | 100 | | |
| Grading scheme (%): | |  |  | | --- | --- | | Homework | 30 | | Exams | 70 | | |