**COETC Course Map**

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| **Course Name:** MET 4370 Advanced Composite Structures: Design, Damage, Repair and Testing | |
| **Instructor Name:** |  |
| **Course Competencies:** | |
| This lecture/laboratory 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. This course includes study and practical application of design, damage control, composite repair, processes and tooling. Also overviews the concepts, principles, and methods employed for nondestructive evaluation (NDE) of composite structures and materials.   1. Distinguish various classes of advanced composite materials 2. Use fundamental equations to obtain orthotropic material properties for a specific composite laminate 3. Design of laminated composite structures: laminated beam, laminated plate, other design issues 4. Select appropriate manufacturing methods based on the product form and material properties 5. Evaluate various composites through use of laboratory experiments for mechanical and environmental performance 6. Evaluate the elastic properties of both long and short fiber composites based on the constituent properties. 7. Evaluate the failure analysis of laminates: damage mechanisms, progressive failure analysis for a laminate. 8. Understand nondestructive testing technologies and their applications to composites manufacturing. | |

**Course Materials (Text, Edition and any other publisher items)**

**Textbooks and/or Resources:**

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| **REQUIRED TEXTBOOK/MATERIALS**:  **Mallick, P.K.** (2008). *Fiber-reinforced composites: materials, manufacturing, and design.* 3rd edition, CRC press. | | | | |
| **Module # and Title** | | **CCNS Competencies** | **Instructional Materials** | **Activities: Learner Interaction**  **& Engagement**  **Assessments and Rubrics** | **OER Content to publish** | |
| 1. Introduction to Advanced Composites Structures | | 1 | Introduction to course, semester plan, syllabus  (Lesson 1) Introduction:   * Definition of composites * Material selection process * Engineering materials | Read the chapter 1 titled “Introduction” from the text book. | Lecture 1.ppt | |
| 1. Physical Characterization Composite Materials | | 1, 2 | * + Fibers   + Matrix   + Thermoset matrix   + Thermoplastic matrix   + Fiber Architecture | Read chapter 2, title “Materials” from the text book  Homework 1 | Lecture 2 | |
| 1. Mechanics of composites materials | | 3,4 | * Macromechanics * Longitudinal Tensile Loading * Elastic Properties of a Lamina * Lamination theory | Read chapter 3 title “Mechanics”  from the textbook  Homework 2 | Lecture 3 | |
| 1. Performance of composite materials | | 5, 6 | * Tensile Properties * Compressive properties * Fatigue properties * Impact properties * Environmental effects | Read chapter 4 title “Performance”  Homework 3 | Lecture 4 | |
| 1. Design | | 7 | * Failure Prediction * Laminate Design Consideration * Joint design * Design Examples * Application Examples | Read chapter 6 title “Design”  Homework 4 | Lecture 5 | |
| 1. Damage and repair | | 3 and 7 | Introduction to types of damages | Homework 5 | Lecture 6 | |
| 1. Non Destructive Inspection | | 8 | Introduction to types of NDI |  | Lecture 7 | |
| 1. Health and safety issues and environmental regulations | | 8 | Industrial Safety Aspects in Machining of Polymer Matrix Composites |  | Lecture 8 | |
| 1. Lab and project Reports | | 5 | * Lab 1 – Compression Molding * Lab 2 – Vacuum-Assisted Resin Transfer Molding (VARTM) * Lab 3 - Electrical Discharge Machining (EDM) of Carbon Fiber * Lab 4 – Compression After Impact (CAI) Testing * Lab 5 – Damage Repair & Non-Destructive Testing (NDT) | Read the lab instructions | Lab reports | |