

Composite Technology

(CS-212)

MARBELLA INSTITUTE OF TECHNOLOGY

Course Utility

Composite Technology is crucial to aerospace and aviation applications, as well as many other industries, because of the advantage of composite materials: their properties of strength and stiffness combined with their light weight. It is a constantly changing field with new developments daily, yet the basics needed to successfully design, fabricate and repair composite structures remain the same. Essentials of Advanced Composite Fabrication and Repair is a comprehensive and thorough primer for beginners to this technology, yet also works as an excellent resource for long-time composites professionals.

Course Purpose

Composite Technology transmits the expert's knowledge by studying the the different processes used in the design, fabrication and repair of composite structures. The knowledge is strengthened by executing relevant projects in the LAB hours. Close observation is given to the structural strength and finished quality of the product.

Text Book

The textbook teaches the concepts and methods in a simple and straightforward manner for a wide array of composites fundamentals, including fiber and matrix selection, curing and achieving desired properties, tooling design and use, testing and nondestructive inspection, step-by-step repair instructions and troubleshooting, and also covering the key environmental, health and safety issues that affect the industry.

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UNIT 1 Composite Technology Overview

Class

- 1 Composites vs. Advanced Composites
- 2 Examples of Typical Applications
- 3 Advantages of Composites
- 4 Disadvantages of Composites
- 5 Composites Development Timeline

UNIT 2 Matrix Technology

Class

- 6 Matrix Systems Overview
- 7 Thermosets
- 8 Thermoplastics
- 9 Other Matrix Materials
- 10 Liquid Resins
- 11 Prepregs

UNIT 3 Fiber Reinforcements

Class

- 12 Introduction to Fiber Reinforcements
- 13 Fiber Types and Properties
- 14 Forms of Reinforcement
- 15 Layup Technology

UNIT 4 Basic Design Considerations

Class

- 16 Composite Structural Design
- 17 Resin to Fiber Ratio
- 18 Service Life Considerations

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Unit 5 **Molding Methods and Practices**

Class

- 19 Overview of Molding Methods and Practices
- 20 Semi-Permanent Mold Release Agents
- 21 Vacuum Bagging
- 22 Hand Layup-Wet Layup
- 23 Vacuum Infusion
- 24 Hand Layup - Prepreg
- 25 Oven and Autoclave Equipment
- 26 Filament Winding
- 27 Automated Tape Laying and Automated Fiber Placement
- 28 Resin Transfer Molding
- 29 Pultrusion
- 30 Thermoforming
- 31 Compression Molding

UNIT 6 **Core Materials**

CLASS

- 32 Why Use Sandwich Construction?
- 33 Balsa Core
- 34 Foam Cores
- 35 Honeycomb Cores
- 36 Other Core Types
- 37 Design and Analysis
- 38 General Design Criteria
- 39 Fabrication
- 40 In-Service Use

UNIT 7 **Introduction to Tooling**

CLASS

- 41 Key Factors
- 42 Metal vs. Composite Tooling
- 43 Tooling for Thermoplastics

UNIT 8 **Inspection and Test Methods**

CLASS

- 44 Destructive Coupon Testing
- 45 Resin, Fiber and/or Void Content
- 46 Fire, Smoke and Toxicity (FST) Requirements and Heat
- 47 Non Destructive Testing

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UNIT 9 Adhesive Bonding and Fastening

CLASS

- 48 Adhesive bonding vs. Fastening Composites
- 49 Bonding Methods
- 50 Types of Adhesives
- 51 Surface Preparation
- 52 Cleaning
- 53 Bonding to Core Materials
- 54 Bonding Thermoplastic Composites
- 55 Joint Design
- 56 Drilling and Fastening

UNIT 10 Repair of Composite Structures

CLASS

- 57 Types of Damage
- 58 Damage Detection
- 59 Component Identification
- 60 Paint Removal
- 61 Damage Removal
- 62 Repair Design
- 63 Vacuum Bagging Materials for Composite Repair
- 64 Repair Instructions
- 65 Drilling and Fastening