Aviation Technology
AV 4200: COMPOSITE MANUFACTURING PROCESSES
3 Credits – Spring Semester
Instructor: Matt Sinfield

I. Text:
   1. Fundamentals of Composites Manufacturing, 1989, Dr. Brent Strong
   2. Advanced Composites, 1990, Cindy Foreman
II. Reference:
   1. AC43.13-1B, Acceptable Methods, Repair and Alterations, FAA
III. Course Description:
   1. Composite manufacturing processes, composite applications, tooling design and fabrication, wet/hand lay-up, vacuum bagging techniques, autoclave processes, filament winding processes, machining methods, inspection, testing and repair methods.
IV. Course Objectives:
   1. Understand the properties of the composite materials covered in the course and recommend proper application based upon the mechanical properties.
   2. Be knowledgeable of the curing cycles for various composite matrix systems.
   3. Have a basic understanding of defects in composite structures such as resin poor areas, resin rich areas, delaminations, and contamination.
   4. Have a basic understanding of the special problems associated with tooling design.
   5. Have a basic understanding of sandwich composite core materials such as urethane foams, Styrofoam, PVC foam, PR-Rohacell foam and Honeycomb core materials.
   6. Understand the hot wire cutting technique used in prototype model construction.
   7. Have a basic understanding of film and liquid composite structural adhesives.
   8. Have a basic understanding of hand lay-up and automated lay-up techniques.
   9. Have a basic understanding of the vacuum bag oven curing techniques and processes.
   10. Have a basic understanding of autoclave techniques and processes.
   11. Have a basic understanding of filament winding techniques and processes.
   12. Have a basic understanding of mold making for composite structures.
   13. Understand the special problems associated with cutting and machining of composites.
   14. Have a basic understanding of the special problems associated with mechanical fastening of composite structures.
   15. Understand the proper handling, shelf life and storage of composite materials.
   16. Have a basic understanding of finishing and coating of composite structures and the removal problems of such coatings and finishes.
   17. Understand thoroughly the hazards associated with handling, machining and processing composite materials and the proper safety precautions which must be maintained.
   18. Understand composite inspection and test methods sufficient to meet the standards of the FAA.
   19. Understand the composite repair techniques and requirements of the FAA, FAR Part 147.
V. Lab Objectives and Requirements: (All must be accomplished to at least a level 2 as specified in FAR Part 147 of the Federal Aviation Airframe Curriculum, section 1, Airframe Structures) unless otherwise indicated.
   1. Students must demonstrate the ability to:
      1. Use proper safety equipment and the safe processing of composite materials.
      2. Identify the fiber reinforcement materials in at least 3 different laminated composite structure samples.
      3. Locate data for composite structure damage assessment (Level 1)
      4. Select the proper equipment and cut composite materials to patterns.
      5. Hot wire foam materials using correct cutting techniques.
      6. Preform wet lay-up of composite materials per industry standards.

7. Make a part from composite materials using the pre-preg vacuum bag autoclave process.
8. Manufacture a composite part using the filament winding method.
9. Cut, machine and drill finished composite structures.
10. Make test specimens and test to determine tensile and compressive strenghts.
11. Inspect composite parts for defects and analyze the effect on structural integrity and airworthiness.
12. Inspect, test and repair fiberglass, graphite, aramid, honeycomb, composite and laminated primary and secondary structures.
13. Select, install and remove special fasteners in composite structures.

VI. Lab Fees: There is a course fee of $35.00 required for lab instruction supplies and materials.

VII. Examinations:

1.	2 Mid-term Exams	150 pts each
2.	1 Final Exam	300 pts
3.	Quizzes	100 pts
4.	Lab Projects	300 pts
5.	Total	1000 pts

VIII. Grading: Grades will be determined by the percentage achieved of the above total points as follows: (USU standard grading for A-, B+,B-, ect. Will be used)

1. A 90-100%
2. B 80-89%
3. C 70-79%
4. D 60-69%
5. F Below 60%

IX. Accommodations for Persons with Disabilities:

1. If a student has a disability that will require some accommodations by the instructor, the student must contact the instructor and document the disability through the Disability Resource Center, preferably during the first week of the course. Any requests for special considerations related to attendance, pedagogy, taking of examinations, etc., must be discussed with and approved by the instructor. In cooperation with the Disability Resource Center, course materials can be provided in alternative formats—large print, audio, diskette, or Braille.

AV 4200

COMPOSITE MANUFACTURING PROCESSES

TEXT: FUNDAMENTALS OF COMPOSITES MANUFACTURING - Brent Strong

SUPPLEMENTAL TEXT: ADVANCED COMPOSITES - Cindy Foreman

REFERENCE: AC43.13- - FAA

COURSE OUTLINE AND STUDY GUIDE

DATE		SUBJECT	STUDY ASSIGNMENT
1/5/09	1	Introduction	FC Chapter 1, p l - 8 AC Chapter 1, p 1 - 16
1/7/09	2	Matrix Materials	FC Chapter 2, p 9 - 30 AC Chapter 3, p 33 – 43
1/12/09	3	Matrix materials cont.	FC Chapter 2, p 31 - 46 AC Chapter 3, p 44
1/14/09	4	Reinforcements	FC Chapter 3, p 47 - 65 AC Chapter 2, p 17 - 21
1/19/09		**Martin Luther King Holiday**	

1/21/09	5	Fabrics and Other Reinforcements	FC Chapter 3, p 66 - 80 AC Chapter 2, p 21 - 32
1/26/09	6	Mechanical Properties	FC Chapter 4, p 85 - 106
1/28/09	7	Manufacturing Methods	FC Chapter 5, p107-125 AC Chapter5, p 51 - 58
2/2/09	8	Pultrusion/Molding/Spray-up	FC Chapter 5, p 126 - 137 AC Chapter 8, p 85-96
2/4/09	9	Thermoplastic processes/Thermosets/ Tools	FC Chapter 5, p 137 – 158 AC Chapter10, p111 – 119
2/9/09	10	**1st Mid-term Exam Chapters 1 - 5 AC Chapters 1-5, 8, 10**	
2/11/09	11	Fabrication and Assembly	FC Chapter 6, p 161 - 172 AC Chapter 4, p 45 - 49
2/16/09		**Lincoln/Washington Holiday**	
2/17/09	12	Fabrication and Assembly Cont.	
2/18/09	13	Adh./Mech. Joining/Sandwich Const.	FC Chapter 6, p 173 - 177 AC Chapter 7, p 71 - 83
2/23/09	14	Painting and Coating	FC Chapter 6, p 178 - 180 AC Chapter 12, p 178 - 179
2/25/09	15	Testing and Quality Assurance	FC Chapter 7, p 183 - 192
3/2/09	16	Cured Laminate testing	FC Chapter 7, p l97 - 208
3/4/09	17	**2nd Mid-term Exam FC Chapters 6 - 7 AC Chapters 4,7, 12**	
3/9-13/09		**Spring Break**	
3/16/09	18	Damage Control/Detection/Repair	FC Chapter 8, p 209 - 215 AC Chapter 11, p 121 - 150
3/18/09	19	Damage Control cont.	
3/23/09	20	Repair Procedures and Consequences	FC Chapter 8, p 215 - 218
3/25/09	21	Types of Repairs - Failures/Delamination	AC Chapter 12, p 151 - 159
3/30/09	22	Damage and Repair to Laminated Struct.	AC Chapter 12, p 160 - 168
4/1/09	23	Repairs to Honeycomb Structures	AC Chapter 12, p 169 - 176
4/6/09	24	Lightening Protection	AC Chapter 12, p 177
4/8/09	25	Composite Uses	FC Chapter 9, p 219-222
4/13/09	26	Aircraft Applications	FC Chapter 9, p 223 - 226
4/15/09	27	Automotive/Marine/Sports/Electrical	FC Chapter 9, p 227 - 230
4/20/09	28	**Review for Final Exam Comprehensive**	
4/22/09	29	Open day	
??????		**Final Exam 9:30 am — 11:20 am Comprehensive**	