UTAH SYSTEM OF HIGHER EDUCATION

Utah System of Higher Education
Composites
FY2028 / 9 Credits (270 Clock-Hours)

Foundational Courses

TECM 1000 Composite Basics — 2 Credits / 60 Clock-Hours

Composite Basics introduces students to the background and history of composite materials. This course covers introductory topics in general composite manufacturing including composite equipment, materials, methods, safety, tools, vocabulary, and processes for proper and quality-assured composite production.

Objectives:
- Define the basic elements of a composite.
- Practice composite lab safety.
- Distinguish various fibers and resin systems.
- Identify a Safety Data Sheet (SDS) and explain its importance.
- Recognize and describe safety requirements and health hazards related to composite materials and manufacturing.
- Describe and use lay-up tools used in the composite manufacturing process.

TECM 1010 Basic Composite Fabrication — 2 Credits / 60 Clock-Hours

This course will introduce terminology associated with composite fabrication. Students will learn about reinforcement fabrics and resins commonly used in the Composites industry. Students will utilize appropriate processes, properly mix matrix materials, and perform vacuum bag and non-vacuum processes.

Objectives:
- Compare the different techniques used in vacuum bag lay-up and non-vacuum bag lay-ups.
- Demonstrate proper bonding techniques.
- Distinguish and perform the different vacuum bagging techniques and perform successful leak check.
- List and describe the components of a vacuum bagging system.
- Demonstrate correct vacuum bag processes.

TECM 1100 Advanced Composite Materials — 3 Credits / 90 Clock-Hours

This course introduces prepreg materials, terminology, storage, handling practices, clean room etiquette, lay-up methods, and manufacturing techniques for creating high-quality prepreg materials. Students develop skills in identifying foreign object debris (FOD) in finished parts and exploring applications for core materials.

Objectives:
- Apply proper prepreg material techniques.
- Identify different types of core materials.
- Describe and perform characteristics of advanced composite materials.
- Describe and perform proper orientation and a balanced lay-up.

TECM 1110 CNC Composite Processes **2 Credits / 60 Clock-Hours**

The CNC Composites course introduces terminology and vocabulary associated with machining composites. Students will demonstrate competency by machining previously made parts with specialized tools and CNC machines. Students will complete projects while practicing filament winders, waterjets, and router tables.

Objectives:
• Identify and explain the use of different types of composite tooling.
• Use different techniques to properly run composite CNC machines.
• Practice CNC safety.

Supplemental Courses Varies by Institution

Davis

TECM 1020 Blueprint Reading **1 Credit / 30 Clock-Hours**

This course will cover reading and interpreting engineering drawings and composite blueprints. This course will explore blueprint symbols, views, part orientation related to composite manufacturing and fabrication, and basic Geometric Dimensioning and Tolerancing as a composite technician.

Objectives:
• Explain part tolerance.
• Interpret and describe the technical information provided on industrial prints through drawings, dimensions, and notes.
• Visualize three-dimensional parts from the standard orthographic projections found on prints, and navigate the total manufacturing print, including lines, scale, language, symbols, title blocks, and other components.
• Visualize parts from drawings consisting of multiple views, including basic, auxiliary, partial, and various types of section views.
• Interpret symbols and notes used to communicate special manufacturing requirements that are not directly illustrated and dimensioned.

TECM 1120 Composite Repair and Part Finish Introduction **1 Credit / 30 Clock-Hours**

In this course, students will learn basic composite repair and paint methods. Students will cover repair assessment, types of damage and repair, and replacing damaged composite materials. Students will learn the steps necessary to produce a finished composite part by doing surface preparation, applying body filler, applying primer, and painting their composite part.

Objectives:
• Perform visual inspections as it relates to damage.
• Describe the types and causes of damage.
• Practice removal of damaged material.
• Demonstrate the skills to return a repaired part back to service life.
• Use proper primer and paint applications.

TECM 1140 Advanced Composite Repair and Part Finish **2 Credits / 60 Clock-Hours**

In Advanced Composite Repair and Part Finish, Students in this course will cover repair procedures specific to advanced composites. Students will demonstrate how to repair composite parts similar to those found in the aerospace industry. Students will then demonstrate proper structural repairs on parts previously built in other courses. Students will demonstrate competency in composites part finish by applying acquired skills to paint and finish their repaired parts. .

Objectives:
• Perform visual inspections as it relates to damage on aerospace grade parts.
• Describe the types and causes of damage to advanced composite parts.
• Practice removal of damaged material on advanced composite parts.
• Demonstrate proper repair procedures for core plug repairs and through part repairs.
• Demonstrate the skills to return an advanced repaired part back to service life.
• Practice surface preparation, including sanding, priming, and painting.
• Use proper primer and paint applications.
• Paint multiple composite parts.

TECM 1201 Autoclave and Alternate Processes **2 Credits / 60 Clock-Hours**

Students will learn autoclave operations and other alternative composite fabrication techniques in this course. Students will become familiar with the terminology associated with autoclave operation and develop the skills to program the autoclave to cure high-strength composite parts. Additionally, students will explore various alternative methods of fabricating composite parts utilizing tools, materials, and equipment used throughout the composite industry.

Objectives:
• Describe the limits and possibilities of alternative manufacturing methods.
• Explain the essential operation of an autoclave.
• Identify components of an autoclave.
• Demonstrate the ability to set up and run an autoclave cure.
• Describe several methods using alternative composite processes.
• Produce a resin-infused part.

TECM 1300 Lean Manufacturing **1 Credit / 30 Clock-Hours**

Lean Manufacturing is used in many businesses and industries to minimize waste, reduce accidents, and operate in a more efficient manner. The main objective of Lean Manufacturing is the concept of continuous and incremental improvements to a product or process while eliminating wasteful or redundant activities. When waste can be identified and eliminated, a product can be built with more efficiency and higher quality in less time.

Objectives:
• Discuss methods used in Lean Manufacturing to solve problems. (Fishbone Diagram, 5 Whys)
• Identify the 8 types of waste.
• Demonstrate 5S.
• Explain what value-added work means.
• Discuss “traceability”, quality stamps, and an employee’s role in accurately maintaining record of process and part compliance.

TECM 1400 Introduction to Composite Engineering **2 Credits / 60 Clock-Hours**

Students in this course will fabricate parts from composite materials. Students will do flexural tests of different composite layups. Using collected data, students will design their own layup and test to see the strengths. Students will develop a working set of drawings for a bridge of their own design. Students will then fabricate that design with high strength to weight being the main objective.

Objectives:
• Identify and compare the various physical properties of different composite materials.
• Calculate strength to weight ratios.
• Practice structure design, drawing, and construction with composite materials.
• Demonstrate procedures used in testing composite structures.

TECM 1410 Carbon Fiber Part Skinning **1 Credit / 30 Clock-Hours**

Carbon Skinning- or wrapping - is used only for cosmetic reasons. The beauty of the various weaves of carbon can make an otherwise unnoticed part become a focal point. In this course, the student will learn methods used to skin a part of their choice. Methods discussed will include part preparation, template making, drapability of fabrics, back wetting, building up resin as a finish topcoat, finish sanding methods, and final polishing.

Objectives:
• Identify the materials needed to carbon fiber skin a part.
• Describe additional techniques to manipulate woven carbon fiber material to conform to a 3-dimensional part.
• Explain the wet layup process in detail.
• Describe uses for epoxy resin.
• Demonstrate time management.
• Execute the processes of sanding and polishing resin to a high luster finish.

TECM 1440 Pattern and Mold Construction **2 Credits / 60 Clock-Hours**

Pattern and mold making are essential skills for the Composites Technician who wants to create their own custom parts. Whether as an entrepreneur or employee, the ability to develop custom molds allows for the construction of almost limitless composite configurations. Students in this course will follow the mold-making process from start to finish by practicing pattern manufacturing, gel coat application, fiberglass reinforcing, mold troubleshooting and repair, and finishing and pulling a sample part from the mold.

Objectives:
• Explain the terms describing pattern design.
• Demonstrate simple plug fabrication using your pattern design.
• Demonstrate proper gel coat application.
• Demonstrate proper mold reinforcing.
• Demonstrate simple single and multi-piece mold making techniques.
• Discuss Gel Coat repair and mold finishing.

TECM 1800 Composite Capstone I **1 Credit / 30 Clock-Hours**

This course will build upon prior instruction and experience to meet or exceed industry standards. In collaboration with an instructor, students plan a composite material build, including materials arrangement, blueprint design, and writing a work order to specification and time.

Objectives:
• Develop a personal project in collaboration with instructors.
• Design a blueprint and a work-order for your personal project.
• Develop a cost analysis for your personal project.

TECM 1810 Composite Capstone II **2 Credits / 60 Clock-Hours**

In this course, students will complete their planned project from the previous capstone project. Students will demonstrate their mastery of composite material building and pave the way for successful careers in the composites industry.

Objectives:
• Produce a composite part using your design.
• Solve issues that arise during the lay-up process.
• Document lessons learned during your personal project.
• Meet original design parameters.

TEBP 1100 Digital Literacy **2 Credits / 60 Clock-Hours**

The Digital Literacy course explores current technology. Students will practice appropriately and effectively using tools for productivity and collaboration tools; finding reliable information; creating content; communicating safely; and identifying credibility and bias in modern digital environments.

Objectives:
• Demonstrate digital citizenship and appropriate interpersonal digital information.
• Describe concepts relating to common digital environments, software, hardware, and operating systems.
• Describe digital security threats and explain how to protect personal devices and digital content.
• Use tools and technologies to collaborate.
• Create, edit, and save digital content and manage digital information.
• Navigate the internet and evaluate the integrity of digital information.

TEDR 1225 Production Drafting Basics **2 Credits / 60 Clock-Hours**

The Production Drafting Basics course delves into the practical realm of blueprint reading for manufacturing. Students will learn about industry standards to successfully interpret technical drawings.

Objectives:
• Identify and explain the components of a technical drawing.
• Interpret and analyze information presented on technical drawings.
• Interpret common symbols, abbreviations, and annotations used in technical drawings.
• Apply blueprint reading skills to solve practical problems.
• Use a CAD system as a drafting tool.

WKSK 1400 Workplace Success **2 Credits / 60 Clock-Hours**

Workplace Success is designed to help students develop essential work habits and attitudes as well as human-relation skills needed to maintain gainful and satisfying employment. Topics include common challenges faced in the workplace, such as presenting yourself professionally, developing a professional work ethic, developing interpersonal skills, navigating office politics successfully, and planning and managing your career.

Objectives:
• Demonstrate a positive attitude and set and accomplish personal and career goals.
• Manage time, stress, organization and finances.
• Explain conflict resolution, negotiation and communication in the workplace.
• Display a strong work ethic and illustrate accountability.
• Perform work within a group effectively and discuss the value of negotiation and compromise.
• Describe the basics of public speaking and presenting a professional demeanor.
• Implement career goals and take active control of professional life.

WKSK 1500 Job Seeking Skills **1 Credit / 30 Clock-Hours**

Job Seeking Skills explores how to prepare and successfully apply to potential career opportunities. During this course, you will be presented with essential job-seeking skills needed to find gainful employment.

Objectives:
• Create a professional resume, cover letter and reference sheet.
• Utilize online tools successfully to create an e-portfolio.
• Expand and develop networking skills.
• Utilize online resources effectively to find job openings.
• Demonstrate the ability to fill out job applications in a professional manner.
• Perform successfully in a job interview.
• Demonstrate appropriate follow-up procedures.

Ogden-Weber

TECM 1025 Manufacturing Fundamentals **2 Credits / 60 Clock-Hours**

Course Description: This course introduces students to the fundamental skills used in a manufacturing environment. Students will learn the proper selection, use, and care of common hand tools and precision measuring equipment. Instruction includes linear measurement, measurement systems, tool discrimination, basic inspection practices, and interpreting engineering drawings and blueprints. Students will apply these skills through hands-on activities involving part measurement, dimensional verification, drawing interpretation, and basic manufacturing tasks.
Emphasis is placed on accuracy, proper tool use, safety, and the ability to obtain and interpret the information needed to manufacture and inspect parts.

Objectives:
• Identify and properly use common hand tools and precision measuring equipment.
• Perform accurate measurements using U.S. customary and metric units.
• Select the appropriate measuring tool based on the required accuracy and tool discrimination.
• Interpret basic engineering drawings, blueprints, symbols, dimensions, and tolerances.
• Verify part dimensions and features against blueprint requirements.
• Apply safe and proper tool handling practices in a manufacturing environment.

TECM 1115 Advanced Cutting and Layup Techniques **3 Credits / 90 Clock-Hours**

Course Description: This course provides hands-on experience in the design, automated cutting, kitting, and fabrication of advanced composite materials. Students will use PatternSmith software to develop flat-pattern ply geometry and prepare digital files for automated cutting. Students will operate an Autometrix cutting table to cut and organize composite material kits and then use the completed kits to fabricate composite parts. Previously learned layup and vacuum bagging techniques will be reinforced as students' progress from digital ply design through final part preparation.

Objectives:
- Create and modify flat-pattern ply geometry using PatternSmith software.
- Prepare digital ply files for automated cutting and efficient material utilization.
- Set up and operate an Autometrix cutting table to accurately cut composite materials.
- Identify, organize, and prepare cut plies into production-ready kits.
- Fabricate composite parts using prepared kits and proper ply orientation and sequencing.
- Apply previously learned layup and vacuum bagging techniques to complete composite assemblies.

TECM 1250 CNC Applications for Composites **3 Credits / 90 Clock-Hours**

Course Description: This course provides hands-on training in advanced and automated composite manufacturing processes. Students will prepare and vacuum bag composite parts for autoclave processing, including proper thermocouple placement, and use ACS control software to initiate, monitor, and document cure cycles. Students will use laser projection technology to assist with accurate ply placement and orientation. Filament winding processes are introduced through the fabrication of tow-preg components using hoop and helical winding patterns, followed by processing, mandrel extraction, and finishing operations. Students will also use abrasive waterjet equipment to cut and machine composite materials and finished composite parts.

Objectives:
- Prepare and vacuum bag composite parts for autoclave processing, including proper thermocouple placement and process setup.
- Use ACS autoclave control software to initiate, monitor, and evaluate composite cure cycles.
- Utilize laser projection equipment to accurately position and orient composite plies during layup.
- Set up and perform filament winding operations using tow-preg materials, including hoop and helical winding patterns.
- Process, extract, and perform finishing operations on filament-wound composite parts.
- Set up and operate abrasive waterjet equipment to safely cut and machine composite materials and finished parts.

TECM 1600 Composite Tool Making and Vacuum Infusion **2 Credits / 60 Clock-Hours**

This course will explore the advantages and disadvantages of metal and composite tooling and the vacuum infusion process. This course will also cover tooling requirements common to the composites industry. Additionally, this course will explore safe and proper execution of a vacuum infusion process on a given project within the course.

Objectives:
• Identify tooling commonly used in the industry.
• Define terminology associated with tooling.
• Distinguish between the advantages and disadvantages of metal tooling.
• Distinguish between the advantages and disadvantages of composite tooling.
• Explain several molding methods used in the industry.
• Demonstrate proper techniques relating to composite tool making.
• Define terminology associated with the vacuum infusion process.
• Describe the advantages and disadvantages of the vacuum infusion process.
• Demonstrate proper vacuum infusion processes.

TECM 1820 Composite Projects I **1 Credit / 30 Clock-Hours**

This course will explore the planning and execution of complex projects related to composite materials as assigned by the program advisor. Coursework will vary with the work accessible and may be limited to materials and machinery available. This course will provide instructor-led guidance to build upon prior instruction and experience to meet or exceed industry standards as well as practice in professional level work according to industry standards determined by the composites industry.

Objectives:
• Demonstrate proper planning and execution of a complex project.
• Use previous courses and experiences as they pertain to the project.
• Demonstrate proper composite processes.

TECM 1830 Composite Projects II **2 Credits / 60 Clock-Hours**

This course will explore the planning and execution of complex projects related to composite materials as assigned by the program advisor. Coursework will vary with the work accessible and may be limited to materials and machinery available. This course will provide instructor-led guidance to build upon prior instruction and experience to meet or exceed industry standards as well as practice in professional level work according to industry standards determined by the composites industry.

Objectives:
• Demonstrate proper planning and execution of a complex project.
• Use previous courses and experiences as they pertain to the project.
• Demonstrate proper composite processes.

Snow

TECM 1020 Blueprint Reading **1 Credit / 30 Clock-Hours**

This course will cover reading and interpreting engineering drawings and composite blueprints. This course will explore blueprint symbols, views, part orientation related to composite manufacturing and fabrication, and basic Geometric Dimensioning and Tolerancing as a composite technician.

Objectives:
• Explain part tolerance.
• Interpret and describe the technical information provided on industrial prints through drawings, dimensions, and notes.
• Visualize three-dimensional parts from the standard orthographic projections found on prints, and navigate the total manufacturing print, including lines, scale, language, symbols, title blocks, and other components.
• Visualize parts from drawings consisting of multiple views, including basic, auxiliary, partial, and various types of section views.
• Interpret symbols and notes used to communicate special manufacturing requirements that are not directly illustrated and dimensioned.

TECM 1040 Workplace Success **1 Credit / 30 Clock-Hours**

Workplace Success is an introductory course that provides students with the essential tools to be successful in today's workplace environment. Students will also develop soft skills that apply to real work environments, including communication, writing, planning and organizing, and time management.

Objectives:
• Demonstrate effective workplace communication.
• Analyze issues, make sound decisions, and overcome problems.
• Demonstrate time management skills in the workplace.
• Work effectively and respectfully with others.

TECM 1200 Autoclave Processing **1 Credit / 30 Clock-Hours**

This course will cover the vocabulary and safety practices needed for the essential operation of the autoclave and associated software. Students will keep records and reports for jobs using the autoclave. Students will gain the experience necessary for autoclave operation.

Objectives:
• Run a program on the autoclave.
• Define the functions of an autoclave.
• Describe and identify characteristics of curing advanced composite materials.
• Describe and perform the functions of a curing system.
• Properly use and maintain thermocouples.

TECM 1210 Filament Winding **2 Credits / 60 Clock-Hours**

In the Filament Winding course, students will be introduced to the foundational topics of advanced filament winding in composites. Students will be introduced to safety, creating a wind, generating motion, chain/transition wind, viewing, and editing motion.

Objectives:
• Recognize and describe safety requirements and health hazards related to composite filament winding.
• Generate fiber path, helical, circumferential, bottle, and nonlinear fiber paths using carbon fiber, fiberglass, and resin systems.
• Chain/transition winds using segment flags.
• Describe and define materials used in advanced filament winding.

TECM 1220 Quality Assurance **2 Credits / 60 Clock-Hours**

The Quality Assurance course will introduce students to the quality inspection of manufacturing. After completion of this course, students will understand how to inspect a product and compare it to engineered blueprints to determine quality.

Objectives:
• Demonstrate the basic underlying principles of quality inspection.
• Use hand tools, computer-assisted measurements, and other modern-day inspection methods.
• Demonstrate quality inspection procedures to real-world applications.
• Explain the basics of the CMM.

TECM 1230 Metrology **1 Credit / 30 Clock-Hours**

Metrology covers introductory topics in basic metrology. Students will be introduced to the fundamental skills and the uses of calipers, micrometers, height gages, scales, and tape measures.

Objectives:
• Demonstrate the proper use of metrology equipment.
• Describe and use calipers and micrometers.
• Describe and use scales and height gages.
• Describe and use a tape measure properly.