

# Additive Manufacturing

## Program Offered

- Minor in Additive Manufacturing

## Program Description

The Minor in Additive Manufacturing provides undergraduate students with the practical, interdisciplinary skills to apply cutting-edge manufacturing techniques to a wide range of industries, including aerospace, biomedical, defense and energy, among others.

This program highlights the process, design, materials, data aspects and operational efficiency aspects of additive manufacturing with an emphasis on additive manufacturing of structural materials and smart manufacturing operations.

## Minor and ASI in Additive Manufacturing

The interdisciplinary Additive Manufacturing program will prepare undergraduates to meet the challenges of careers in additive manufacturing. Undergraduate students have the following degree options:

- Area of Special Interest (12 credits)
  - Requirements: AMFG401 and 9 credits of electives (see Table 1)
- Minor (18 credits)
  - Requirements: AMFG401 and 15 credits of electives (see Table 1)

**Table 1:** Undergraduate elective courses, listed by specialty area (AMFG531, AMFG 511 and FEGN 526 require approval by appropriate program directors)

### Additive Manufacturing of Structural Materials

MEGN381	MANUFACTURING PROCESSES	3.0
MEGN412	ADVANCED MECHANICS OF MATERIALS	3.0
AMFG421	DESIGN FOR ADDITIVE MANUFACTURING	3.0
AMFG531	MATERIALS FOR ADDITIVE MANUFACTURING	3.0
AMFG498	SPECIAL TOPICS IN ADVANCED MANUFACTURING	1-6
AMFG511	DATA DRIVEN ADVANCED MANUFACTURING	3.0
FEGN525	ADVANCED FEA THEORY & PRACTICE	3.0
FEGN526	STATIC AND DYNAMIC APPLICATIONS IN FEA	3.0

## Courses

### AMFG401. ADDITIVE MANUFACTURING. 3.0 Semester Hrs.

(II) Additive Manufacturing (AM), also known as 3D Printing in the popular press, is an emerging manufacturing technology that will see widespread adoption across a wide range of industries during your career. Subtractive Manufacturing (SM) technologies (CNCs, drill presses, lathes, etc.) have been an industry mainstay for over 100 years. The transition from SM to AM technologies, the blending of SM and AM technologies, and other developments in the manufacturing world has direct impact on how we design and manufacture products. This course will prepare students for the new design and manufacturing environment that AM is unlocking. Prerequisites: MEGN200 and MEGN201 or equivalent project classes. 3 hours lecture; 3 semester hours.

### AMFG421. DESIGN FOR ADDITIVE MANUFACTURING. 3.0 Semester Hrs.

(II) Design for Additive Manufacturing (DAM) introduces common considerations that must be addressed to successfully design or re-design parts for additive manufacturing methods. Industry-leading hardware and FEA software will be used to explore all phases of the DAM workflow, including topology optimization, additive process simulation, distortion compensation, and in-service performance. 3 hours lecture; 3 semester hours.

### AMFG422. LEAN MANUFACTURING. 3.0 Semester Hrs.

Throughout the course, students will learn to apply skillsets to real world problems, focusing on lean and six-sigma principles and methodologies. The course is taught with a focus on the DMAIC structure of implementation (Define, Measure, Analyze, Improve and Control) for improving and implementing process efficiencies in industry. The course is split into three general subject areas; 1) Lean manufacturing principles, 2) six-sigma and statistical process control (SPC) methodologies and 3) Implementation techniques focusing on graphical and numerical representation of processes using R. Students will receive an in-depth overview of Lean manufacturing principles and will perform case studies at local industries to implement learned skill-sets. Next, students will step-through several hands-on activities using real products to investigate six-sigma and perform SPC analysis, identifying shifts in process data and learning how to shift processes into capable processes. Lastly, students will learn about various implementation techniques for industry and will perform an in-depth analysis of the course topics based on the industry tours performed. Prerequisite: MEGN381.

### AMFG423. DESIGN AND ANALYSIS OF EXPERIMENTS. 3.0 Semester Hrs.

This course introduces effective experimental design and analysis methodologies relevant to all engineering and scientific disciplines to maximize the information learned from every experiment (test case) while minimizing the total number of tests. We will be using state-of-art methods steeped in statistics to effectively set up your experiments, understand what the results are telling you, and clearly communicate the results to peers and leadership. We apply a disciplined systems engineering approach across the four major experimental phases: plan, design, execute, and analyze. This hands-on class will focus on understanding concepts and practical applications while relying less on the statistical theoretical development. Prerequisite: MATH 201 is recommended, not required.

### AMFG498. SPECIAL TOPICS IN ADVANCED MANUFACTURING. 1-6 Semester Hr.

(I, II) Pilot course or special topics course. Topics chosen from special interests of instructor(s) and student(s). Usually the course is offered only once. Prerequisite: none. Variable credit; 1 to 6 credit hours. Repeatable for credit under different titles.