



WEST VIRGINIA UNIVERSITY

Industrial and Management Systems Engineering

IENG 302 – Manufacturing Processes Section 002

Semester: Spring 2020

Time/location: Room ESB-G78A, 03:30 PM - 04:45 PM., Tuesday and Thursday

Number of credit hours: 2

Course Description: Introduction to different manufacturing processes. Study of integrated manufacturing systems impacted by design, materials selection, and process selection. Evaluation of various engineering, economic, and design considerations in selecting materials and manufacturing processes.

Prerequisites: MAE 343 or IENG 301

Co-requisites by topics: None

Textbook/Lecture: Harik & Wuest (2019). *Introduction to Advanced Manufacturing*. SAE Int'l. ISBN of 978-0-7680-9327-8
website: <https://www.sae.org/publications/books/content/r-463/>
WVU IENG 302 students receive a 10% discount when ordering via SAE Customer Service at 724-776-4970 or customerservice@sae.org. Mention the name *Wuest* or *Harik* when ordering the book to receive the discount.

Additional Resources: Manufacturing Videos and Review Questions are available on the companion website: introtomanufacturing.com

Instructor (Lecture): Dr. Zhichao Liu
Assistant Professor, IMSE Department
Room ESB 313, Email: zhichao.liu@mail.wvu.edu
Voice: 304-293-9430
Office hours: Thursday 10:00 - 11:00 am or by appointment



Lecture's semester schedule & topics covered

| Class Schedule for Spring 2020*: | | | | | | | |
|----------------------------------|----------|-----------|-----|--|--------------|------------------------|---|
| Month | Date | Day | No. | Topic | Chapter | Reading | Notes |
| January | 01/14/20 | Tuesday | 1 | Introduction & Syllabus / Overview of Manufacturing | 1 | Read Ch 1 by Jan 21st | First Day of Class |
| January | 01/16/20 | Thursday | 2 | Overview of Manufacturing | 1 | | |
| January | 01/21/20 | Tuesday | 3 | Overview of Mfg. / Deformative Mfg. - Intro & Forging | 1 & 2 | Read Ch 2 by Jan 30th | |
| January | 01/23/20 | Thursday | 4 | Deformative Manufacturing - Rolling & Casting | 2 | | |
| January | 01/28/20 | Tuesday | 5 | Deformative Manufacturing - Casting | 2 | | |
| January | 01/30/20 | Thursday | 6 | Deformative Manufacturing - Sheetmetal & Review | 2 | | |
| February | 02/04/20 | Tuesday | | NO CLASS | 10 | Read Ch 10 by Feb 11th | |
| February | 02/06/20 | Thursday | | NO CLASS | 10 | | |
| February | 02/11/20 | Tuesday | 7 | Subtractive Mfg. - Shape Classification & Process Planning | 2 | | |
| February | 02/13/20 | Thursday | 8 | EXAM I / 8:00am - 9:00am | 1 & 2 (& 10) | | |
| February | 02/18/20 | Tuesday | 9 | Subtractive Manufacturing - Process Planning & Milling | 3 | Read Ch 3 by Feb 18th | Review Exam I |
| February | 02/20/20 | Thursday | 10 | Subtractive Manufacturing - Milling & Drilling | 3 | | |
| February | 02/25/20 | Tuesday | 11 | Subtractive Manufacturing - Drilling & Turning | 3 | | |
| February | 02/27/20 | Thursday | 12 | Additive Manufacturing - Materials Classification & FFF | 4 | Read Ch 4 by Feb 27th | |
| March | 03/03/20 | Tuesday | 13 | Additive Manufacturing - FFF & SLS | 4 | | |
| March | 03/05/20 | Thursday | 14 | Additive Manufacturing - SLS & SLA | 4 | | |
| March | 03/10/20 | Tuesday | 15 | Additive Manufacturing - DED | 4 | | |
| March | 03/12/20 | Thursday | 16 | Additive Manufacturing - Process Planning & Challenges | 4 | | |
| March | 03/17/20 | Tuesday | | NO CLASS | | | Spring Break |
| March | 03/19/20 | Thursday | | NO CLASS | | | Spring Break |
| March | 03/24/20 | Tuesday | 17 | Review Session 3 & 4 | 3 & 4 | | |
| March | 03/26/20 | Thursday | 18 | EXAM II / 8:00am - 9:00am | 3 & 4 | | |
| March | 03/31/20 | Tuesday | 19 | Assembly Processes - Permanent Processes | 5 | Read Ch 5 by Mar 19th | Review Exam II |
| April | 04/02/20 | Thursday | 20 | Assembly Processes - Non-Permanent Processes | 5 | | |
| April | 04/07/20 | Tuesday | 21 | CAD/CAM - Numerical Chain & Geometrical Modeling | 6 | Read Ch 6 by Apr 14th | |
| April | 04/09/20 | Thursday | 22 | CAD/CAM - Mfg. References & G-Code & Review | 6 | | |
| April | 04/14/20 | Tuesday | 23 | EXAM III / 8:00am - 9:00am | 5 & 6 | | Last Day to Drop Class |
| April | 04/16/20 | Thursday | 24 | Polymers Manufacturing - Polymers & Polymerization | 7 | Read Ch 7 by Apr 23rd | Review Exam III |
| April | 04/21/20 | Tuesday | 25 | Polymers Mfg. - Injection Molding & Extrusion Molding | 7 | Read Ch 8 by Apr 28th | Guest Speaker - Dr. Yingbin Hu (MU) <i>(to be confirmed)</i> |
| April | 04/23/20 | Thursday | 26 | Polymers Mfg. - Extrusion Molding & Blow Molding | 7 | | |
| April | 04/28/20 | Tuesday | 27 | Composites Manufacturing | 8 | | Guest Speaker - Dr. Fuda Ning (SUNY) <i>(to be confirmed)</i> |
| April | 04/30/20 | Thursday | 28 | Review Session for Final Exam | 1 - 8, 10 | | Last Day of Classes |
| May | 05/06/20 | Wednesday | 29 | FINAL EXAM / 8am - 10am | 1 - 8, 10 | | Final Exam (comprehensive) |

*SUBJECT TO CHANGE AT DISCRESSION OF INSTRUCTOR AT ANY TIME



Contribution of course to meeting the professional component:

Engineering topics: 100%.

Student Learning Objectives:

1. Describe a variety of major manufacturing processes, such as casting, bulk metal working, plastics processing, machining, and welding.
2. Apply concepts from prerequisite courses to understand the origin of, and to estimate the value of, the relevant process parameters for major manufacturing processes.
3. Identify causes of common manufacturing defects and recommend process changes to reduce defects.
4. Select a manufacturing process based on material, part geometry, and number of parts to produce.

Course Relationship to ABET Program Educational Outcomes:

Outcome 1 - An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Key Abilities Students Will Acquire: (1) Ability to understand manufacturing processes capabilities and applications, (2) Demonstrate a moderate proficiency in the use of actual manufacturing processes, and (3) Ability to select appropriate manufacturing processes based on material properties, cost, and other factors.

Grading:

| | |
|--|-------------|
| Test #1 | 30% |
| Test #2 | 30% |
| Test #3 | 30% |
| <i>(Lowest test score will be dropped resulting in 60% contribution to overall grade from tests)</i> | |
| Total Contribution from Tests | 60% |
| Final Exam Comprehensive) | 40% |
| Total: | 100% |

Grading Scale:

- A = 90 – 100%
- B = 80 – 89%
- C = 70 – 79%
- D = 60 – 69%
- F = 59% or less



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Tests (60%): Three tests will be given during the semester. Tests will determine 60% (30% each) of your final average. The tests will begin promptly at 8:00 am and end at 9:00 am. If you arrive late you will not be given extra time to complete the test. Failure to attend a test results in the assignment of a zero for that test grade. Typically, tests are composed of two portions: 15 multiple choice / knowledge questions (60 points) and 2 exercises (40 points). Grade forgiveness for the lowest test grade is available. The grade forgiveness can be used for out of town travel, personal and/or school events (e.g., job interview, sports participation, health care visit, etc.) or any emergency situation. Students will have their lowest test grade automatically dropped.

Final Exam (40%): The final exam is comprehensive of the course material covered during the semester. The exam will determine 40% of your final average. Typically, final exams are composed of two portions: 20 multiple choice / knowledge questions (60 points) and 4 exercises (40 points). There will be no makeup of the final exam. Failure to attend the final exam results in the assignment of a zero for the final grade.

In-Class Quizzes / Homework / Extra-Work: In-class Quizzes / Homework / Extra-Work will not be graded. Their purpose is to prepare you for the exams and give you an indication of your understanding of the class material throughout the semester.

General Exam Information:

- Tests and the Comprehensive Final will be closed book although you will be provided an official class formula sheet that will also be posted in advance. You may not bring any other notes, cell phones, or other electronic device such as a smart watch. No headsets or hearing aids will be allowed. Sunglasses, baseball caps, hoods, or any other head gear is not allowed (exception might be granted based on medical reasons or religious beliefs).
- Students are required to check all pages of a test. Missing a test question is the sole responsibility of the student.
- Students that fail to write their name on the exam will be assigned a zero on the exam.
- The use of programmable calculators or smart devices (including smart-phones, smart watches, tablets, cameras, wearable devices, etc.) on exams and quizzes is prohibited.
- All exams, tests, and other materials are the intellectual property of the instructor. Any form of copying, publishing, or uploading is prohibited without written consent.

General rule on recording devices: It is not allowed to take pictures, videos, or any other form of recording during any class, review sessions, office hour discussion, and other official class event without official permission of the instructor in written form. Failure to comply may result in failure of class and/or assignment and/or dismissal from the class.

Statement on Attendance: Attendance is mandatory. Attendance will be recorded at the instructors discretion regularly or randomly. Students are responsible for all material covered in class. It is not the instructor's job to provide notes, etc. for students who have not attended



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lectures. Failure to attend on test days will result in a grade of zero on that test. Any absence during exams is covered by test forgiveness policy, with no exceptions. Late arrival to a scheduled exam/final leads to an automatic zero. The instructor may allow the student to take the exam on an individual basis, however i) only in case no one has previously handed in the exam, and ii) no extra time will be allotted in any case.

Statement on Student Behavior in the Classroom:

Since you are all professionals in training, you are expected to conduct yourself in a professional manner while in this class. For instance, while the class is in progress, everyone is expected to remove hats and sunglasses, put away the newspaper, **refrain from eating and drinking**, and **turn off cell phones**. Students are expected NOT to talk to other students or laugh or create any such unwanted noise or other disruptions during the class period. Disruptive students will be warned during the class period that such behavior will not be tolerated and will possibly be re-seated. If disruption continues, the student will be required to leave the class and be referred to the Department Chair and/or other administrators for disciplinary action.

Academic Integrity

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me BEFORE the assignment is due to discuss the matter.

WVU Inclusivity Statement

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see <http://diversity.wvu.edu>.