

**ROY G. PERRY COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING DEPARTMENT
PRAIRIE VIEW A&M UNIVERSITY**

ASSESSMENT REPORT COVER PAGE

**MCEG 3103
MANUFACTURING PROCESSES LABORATORY**

Spring 2022 SEMESTER

NAME OF INSTRUCTOR: Dr. Jaejong Park

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Assessing students' ability to make informed judgements on ethical and professional responsibilities in engineering while considering the impact of engineering solutions in global, economic, environmental, and societal contexts (Outcome 4.2)

Sample Assignment: Manufacturing essay project

Detailed Course Syllabus
(Distributed to Students at the beginning of the Semester)

MCEG 3103 Manufacturing Processes Laboratory Spring 2022

Course Information

Description

Instructor:	Jaejong Park, Ph.D.
Section # and CRN:	Section P02, 20224
Office Location:	S.R. Collins Building, Room 324
Office Phone:	936-261-9967
Email Address:	japark@pvamu.edu
Office Hours:	Mondays and Wednesdays 12:30 ~2:30 PM Fridays 8~10 AM (Zoom) or by appointment
Mode of Instruction:	Face-to-Face
Course Location:	C.L. Wilson Building, Room 107
Class Days & Times:	Tuesdays 2~4:50 PM
Catalog Description:	This lab includes experiments for metal identification, machinability of materials, effects of factors on surface roughness measurement, material removal rates, and cutting tool force analysis. It also includes illustrations of casting, forging, rolling, and powder metallurgy. Student will be required to design a structure part and perform manufacturing operations.
Prerequisites:	None
Co-requisites:	MCEG 3303
Required Text(s):	None
Recommended Text(s):	Groover, Mikell P., Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, (6th edition), John Wiley & Sons Inc., New York, NY. ISBN: 978-1-118-98764-3

Course Learning Objectives:

	Upon successful completion of this course, students will be able to:	Program Learning Outcome Alignment	ABET Outcome Alignment
1	Develop knowledge of various manufacturing processes and work procedures of manufacturing facilities to fabricate basic engineering components and assemblies;	1, 2, 3	2, 4
2	Select proper manufacturing procedures and materials to design works meeting engineering specifications;	1, 2, 3	2, 4
3	Pursue literature research to acquire useful information to design advanced products.	1, 2, 3	2, 4

Program Educational Objectives

The goal of the Mechanical Engineering Program is to produce industrial, scientific, and technological leaders capable of systematically identifying, addressing, and solving technical problems whose solutions will benefit society. Specific educational objectives of the Mechanical Engineering Program are to produce graduates who will:

1. Have successful careers in engineering and related fields;
2. Advance their careers through increasing levels of responsibilities and leadership
3. Successfully pursue graduate or advanced professional degrees and continuing professional development; and

4. Actively participate in professional and community services

ABET outcomes

Students who enroll in the Mechanical Engineering program are provided with the skill set to make them successful industrial, scientific, and technological leaders by ensuring that by the time of graduation with the BSME degree, they have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principals of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Goals and Overview:

This course is designed to enable mechanical engineering students to gain insights into the capabilities of various manufacturing processes and their work procedures. Illustrations of various machining processes will also be provided to enhance students' design work capability so that students can contribute to their work immediately after graduation.

Major Course Requirements

Students are required to have proper equipment (e.g., Laptops, Desktop computers, Smartphones, etc.) to complete the course requirement. If the student needs an equipment, please contact the financial aid.

Method of Determining Final Course Grade

Course Grade Requirement	Value	Total
1) Lab safety	10%	10
2) Lab exercise & quiz	10%	10
3) Midterm exam	20%	20
4) CNC project	20%	20
5) Hammer project	30%	30
6) Essay	10%	10
Total:		100

Tentative Grading Criteria and Conversion:

A = 90 ~ 100%

B = 80~ 89.9%

C = 70~79.9%

D = 60~69.9%

F = 0~59.9%

If a student has stopped attending the course (i.e. "stopped out") at any point after the first day of class but did not officially withdraw from the course and has missed assignments and exams, including the final exam, and performed below the grade level of a D, a grade of FN (failed-non attendance) will be assigned for the final course grade to ensure compliance with the federal Title IV financial aid regulations. In contrast, if the student has completed all assignments and exams, including the final exam, but performed below the grade level of a D, a grade of F will be assigned for the final course grade.

Detailed Description of Major Assignments:

Assignment Title or Grade Requirement	Description
1) Lab safety	Students following the lab safety policy
2) Lab quizzes	Quizzes on operations of machines
3) Design project report	Quality of the report of design project

4) Main projects production of parts & assembly	Quality of the parts machined by the students
5) Essay	Assessing students' capability of making informed judgements

Course Procedures or Additional Instructor Policies

The instructor reserves the right to alter this syllabus during the semester.

Use of eCourses and PVAMU email

All class-related materials will be posted on [eCourses](#). Important announcements such as quiz and exam time and homework may be sent out through your registered [PVAMU email](#).

Taskstream

Taskstream is a tool that Prairie View A&M University uses for assessment purposes. One of your assignments may be required to be submitted as an "artifact," an item of coursework that serves as evidence that course objectives are met. If applicable, more information will be provided during the semester, but for general information, you can visit Taskstream via the link in eCourses.

Assignments & Due Dates

The students are expected to follow the submission guidelines for each assignment. The submission platform may be different for the course assignments. ***Same day late submission will be deducted by 10%. Homework will not be accepted after the day it is due.*** Exceptions will only be made under extreme circumstances and at the discretion of the instructor. Assigned homework will be graded either for completeness and 1~2 problems per set will be graded for correctness. Students are encouraged to work together on the assignments; however, all students must submit an assignment that consist of their own work for any individual assignment.

Academic Integrity

Academic dishonesty of any sort (plagiarism, cheating, fabrication or facilitation) is prohibited under any circumstance. ***Any detected actions of dishonesty will cause the failure of the class directly.***

Examinations and Quizzes

No makeup test or quiz will be given except for documented emergencies.

Semester Calendar

***Exact dates of Face-to-face sessions will be announced at least a week in advance.
The schedule shown below is tentative and subject to change.***

Week	Description of Laboratory Topics
1	Class syllabus General lab safety regulations Assignment: Lab safety quiz
2	Introduction of lab facilities (Lab tour) Understanding engineering drawings of the hammer project Tools for dimension measurement Safety rules, operation procedures of the milling machine Assignment: Quiz 1
4	Hands-on milling machine operations on the hammerhead Safety rules, operation procedures of the drill press Understanding and selection of drill bits Understanding the cutting of threads The selection of drill taps and dies for hammerhead
6	Hands-on drill press operations on the hammerhead Hammerhead thread tapping Safety rules, operation procedures of lathes Understanding of lathe cutting tools Assignment: Quiz 2, Homework 1
7	Hands-on lathe operations on the hammer shaft Assignment: Quiz 3
8	Hands-on lathe operations on the hammer shaft Assignment: Quiz 4
9	Thread cutting of the hammer shaft Introduction of CNC machine CNC Lecture Assignment: Homework 2
10	Midterm exam Essay assignment
11	Hammer handle drilling and tapping Assemble the hammer components together Hammer project final report assignment Design of name initial plates
12	Design of name initial plates Writing and typing CNC codes based on your design
13	Writing and typing CNC codes based on your design CNC code simulation and debugging CNC milling operations
14	Writing and typing CNC codes based on your design CNC code simulation and debugging CNC milling operations CNC milling project final report assignment
If time permits	Introduction of Rapid Prototyping and use of a 3D printer
	3D printing project (optional) assignment

Student Support and Success

John B. Coleman Library

The John B. Coleman Library's mission is to enhance the scholarly pursuit of knowledge, to foster intellectual curiosity, and to promote life-long learning and research through our innovative services, resources, and cultural programs, which support the Prairie View A&M University's global mission of teaching, service, and research. It maintains library collections and access both on campus, online, and through local agreements to further the educational goals of students and faculty. Website: <https://www.pvamu.edu/library/>; Phone: 936-261-1500

Academic Advising Services

Academic Advising Services offers students a variety of services that contributes to student success and leads towards graduation. We assist students with understanding university policies and procedures that affect academic progress. We support the early alert program to help students get connected to success early in the semester. We help refer students to the appropriate academic support services when they are unsure of the best resource for their needs. Faculty advisors support some students in their respective colleges. Your faculty advisor can be identified in PantherTracks. Advisors with Academic Advising Services are available to all students. We are located across campus. Find your advisor's location by academic major at www.pvamu.edu/advising. Phone: 936-261-5911

The University Tutoring Center

The University Tutoring Center (UTC) offers free tutoring and academic support to all registered PVAMU students. The mission of the UTC is to help provide a solid academic foundation that enables students to become confident, capable, independent learners. Competent and caring staff and peer tutors guide students in identifying, acquiring, and enhancing the knowledge, skills, and attitudes needed to reach their desired goals. Tutoring and academic support are offered face-to-face in the UTC, in virtual face-to-face sessions (<https://www.pvamu.edu/student-success/sass/university-tutoring-center/>), and through online sessions (<https://www.pvamu.edu/pvplace/>). Other support services available for students include Supplemental Instruction, Study Break, Academic Success Workshops, and Algebra Study Jam. Location: J. B. Coleman Library, Rm. 307; Phone: 936-261-1561; Email: pvtutoring@pvamu.edu; Website: <https://www.pvamu.edu/student-success/sass/university-tutoring-center/>

Writing Center

The Writing Center provides well-trained peer tutors to assist students with writing assignments at any stage of the writing process. Tutors help students with various writing tasks from understanding assignments, brainstorming, drafting, revising, editing, researching, and integrating sources. Students have free access to Grammarly online writing assistance. Grammarly is an automated proofreading and plagiarism detection tool. Students must register for Grammarly by using their student email address. In addition, students have access to face-to-face and virtual tutoring services either asynchronously via email or synchronously via Zoom. Location: J. B. Coleman Library, Rm. 209; Phone: 936-261-3724; Website: <https://www.pvamu.edu/student-success/writing-center/>; Grammarly Registration: <https://www.grammarly.com/enterprise/signup>

Academic Early Alert

Academic Early Alert is a proactive system of communication and collaboration between faculty, academic advisors, and PVAMU students that is designed to support student success by promptly identifying issues and allowing for intervention. Academic Early Alerts help students by providing a central location to schedule advising appointments, view advisor contact information, and request assistance. Students who recognize that they have a problem that is negatively affecting their academic performance or ability to continue school may self-refer an Academic Early Alert. To do so, students will log in to PV Place and click on Academic Early Alert on the left sidebar. Phone: 936-261-5902; Website: <https://www.pvamu.edu/student-success/early-alert/>

Student Counseling Services

The Student Counseling Services unit offers a range of services and programs to assist students in maximizing their potential for success: short-term individual, couples, and group counseling, as well as crisis intervention, outreach, consultation, and referral services. The staff is licensed by the State of Texas and assists students who are dealing with academic skills concerns, situational crises, adjustment problems, and emotional difficulties. Information shared with the staff is treated confidentially and in

accordance with Texas State Law. Location: Hobart Taylor, 2nd floor; Phone: 936-261-3564; Website: <https://www.pvamu.edu/healthservices/student-counseling-services/>

Office of Testing Services

Testing Services serves to create opportunities by offering a suite of exams that aid in the students' academic and professional success. Currently, we administer entrance (HESI A2), college readiness (TSI assessment), Prior Learning (CLEP, DSST), and proctored exams. Location: Wilhelmina Delco, 3rd Floor, Rm. 305; Phone: 936-261-3627; Email: aetesting@pvamu.edu; Website: www.pvamu.edu/testing

Office of Diagnostic Testing and Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, contact the Office of Disability Services. As a federally-mandated educational support unit, the Office of Disability Services serves as the repository for confidential disability files for faculty, staff, and students. For persons with a disability, the Office develops individualized ADA letters of request for accommodations. Other services include learning style inventories, awareness workshops, accessibility pathways, webinars, computer laboratory with adapted hard and software, adapted furniture, proctoring non-standardized test administrations, ASL interpreters, ALDs, digital recorders, Livescribe, and a comprehensive referral network across campus and the broader community. Location: Hobart Taylor, Rm. 1D128; Phone: 936-261-3583; Website: <https://www.pvamu.edu/disabilityservices/>

Center for Instructional Innovation and Technology Services (CIITS)

Distance Learning, also referred to as Distance Education, is the employment of alternative instructional delivery methods to extend programs and services to persons unable to attend college in the traditional manner. The Center for Instructional Innovation and Technology Services (CIITS) supports student learning through online, hybrid, web-assist, and 2-way video course delivery. For more details and contact information, visit:

<https://www.pvamu.edu/dlearning/distance-learning-2-2/students-2/>; Phone: 936-261-3283

Veteran Affairs

Veterans Services works with student veterans, current military and military dependents to support their transition to the college environment and continued persistence to graduation. The Office coordinates and certifies benefits for both the G.I. Bill and the Texas Hazlewood Act. Location: Evans Hall, Rm. 102; Phone: 936-261-3563; Website: <https://www.pvamu.edu/sa/departments/veteranaffairs/>

Office for Student Engagement

The Office for Student Engagement delivers comprehensive programs and services designed to meet the co-curricular needs of students. The Office implements inclusive and accessible programs and services that enhance student development through exposure to and participation in diverse and relevant social, cultural, intellectual, recreational, community service, leadership development, and campus governance. Location: Memorial Student Center, Rm. 221; Phone: 936-261-1340; Website: <https://www.pvamu.edu/studentengagement/>

Career Services

Career Services supports students through professional development, career readiness, and placement and employment assistance. The Office provides one-on-one career coaching, interview preparation, resume and letter writing, and career exploration workshops and seminars. Services are provided for students at the Northwest Houston Center and College of Nursing in the Medical Center twice a month or on a requested basis. Distance Learning students are encouraged to visit the Career Services website for information regarding services provided. Location: Anderson Hall, 2nd floor; Phone: 936-261-3570; Website: <https://www.pvamu.edu/careerservices/>

University Rules and Procedures

Academic Misconduct

Academic dishonesty is defined as any form of cheating or dishonesty that has the effect or intent of interfering with any academic exercise or fair evaluation of a student's performance. The college faculty can provide additional information, particularly related to a specific course, laboratory, or assignment.

You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with the *University Administrative Guidelines on Academic Integrity*, which can be found on the [Academic Integrity webpage](#). Students who engage in academic misconduct are subject to university disciplinary procedures. As listed in the *University Administrative Guidelines on Academic Integrity*, the University Online Catalog, and the Student Code of Conduct, the following are examples of prohibited conduct. This list is not designed to be all-inclusive or exhaustive. In addition to academic sanctions, any student found to have committed academic misconduct that is also a violation of criminal law may also be subject to disciplinary review and action by the Office of Student Conduct (as outlined in the Student Code of Conduct).

Forms of Academic Dishonesty:

1. Cheating: Deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not learned, giving or receiving aid unauthorized by the instructor on assignments or examinations. Examples: unauthorized use of notes for a test; using a "cheat sheet" on a quiz or exam; any alteration made on a graded test or exam which is then resubmitted to the teacher;
2. Plagiarism: Careless or deliberate use of the work or the ideas of another; representation of another's work, words, ideas, or data as your own without permission or appropriate acknowledgment. Examples: copying another's paper or answers, failure to identify information or essays from the internet and submitting or representing it as your own; submitting an assignment which has been partially or wholly done by another and claiming it as yours; not properly acknowledging a source which has been summarized or paraphrased in your work; failure to acknowledge the use of another's words with quotation marks;
3. Collusion: When more than one student or person contributes to a piece of work that is submitted as the work of an individual;
4. Conspiracy: Agreeing with one or more persons to commit an act of academic/scholastic dishonesty; and
5. Multiple Submission: Submission of work from one course to satisfy a requirement in another course without explicit permission. Example: using a paper prepared and graded for credit in one course to fulfill a requirement and receive credit in a different course.

Nonacademic Misconduct

The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. The Office of Student Conduct will adjudicate such incidents under nonacademic procedures.

Sexual Misconduct

Sexual harassment of students and employees at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating the university's sexual harassment policy will be subject to disciplinary action. In accordance with the Texas A&M University System guidelines, your instructor is obligated to report to the Office of Title IX Compliance (titleixteam@pvamu.edu) any instance of sexual misconduct involving a student, which includes sexual assault, stalking, dating violence, domestic violence, and sexual harassment, about which the instructor becomes aware during this course through writing, discussion, or personal disclosure. The faculty and staff of PVAMU actively strive to provide a learning, working, and living environment that promotes respect that is free from sexual misconduct,

discrimination, and all forms of violence. If students, faculty, or staff would like assistance or have questions, they may contact the Title IX Coordinator at 936-261-2144 or titleixteam@pvamu.edu. More information can be found at www.pvamu.edu/titleix, including confidential resources available on campus.

Pregnancy, Pregnancy-related, and Parenting Accommodations

Title IX of the Education Amendments of 1972 prohibits sex discrimination, which includes discrimination based on pregnancy, marital status, or parental status. Students seeking accommodations related to pregnancy, pregnancy-related conditions, or parenting (reasonably immediate postpartum period) are encouraged to contact Student Disability Services or the Dean of Students' Office for additional information and to request accommodations.

Non-Discrimination Statement

Prairie View A&M University does not discriminate on the basis of race, color, sex, religion, national origin, age, disability, genetic information, veteran status, sexual orientation, or gender identity in its programs and activities. The University is committed to supporting students and complying with The Texas A&M University System non-discrimination policy. It seeks to establish an environment that is free of bias, discrimination, and harassment. If you experience an incident of discrimination or harassment, we encourage you to report it. If you would like to speak with someone who may be able to afford you privacy or confidentiality, there are individuals who can meet with you. The Director of Equal Opportunity & Diversity has been designated to handle inquiries regarding the non-discrimination policies and can be reached at Harrington Science Building, Suite 109 or by phone at 936-261-1744 or 1792.

Class Attendance Policy (See the University Online Catalog for Full Attendance Policy)

Prairie View A&M University requires regular class attendance. Attending all classes supports the full academic development of each learner, whether classes are taught with the instructor physically present or via distance learning technologies such as interactive video and/or the internet. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in the assignment of a grade of "F." Absences are accumulated beginning with the first day of class during regular semesters and summer terms. Each faculty member will include the University's attendance policy in each course syllabus.

Student Academic Appeals Process

Authority and responsibility for assigning grades to students rest with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the University Online Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.

Technical Considerations

Minimum Recommended Hardware and Software:

- Intel PC or Laptop with Windows 10 or later version; Mac with OS High Sierra*
- Smartphone or iPad/Tablet with Wi-Fi*
- High-speed Internet access
- 8 GB Memory
- Hard drive with 320 GB storage space
- 15" monitor, 800x600, color or 16 bit
- Sound card w/speakers
- Microphone and recording software
- Keyboard & mouse
- Most current version of Google Chrome, Safari, or Firefox

Note: Be sure to enable Java & pop-ups in the Web browser preferences

* Smartphones, Google Chrome books, and Android tablets may not be supported. iPads are the only tablets supported.

Participants should have a basic proficiency of the following computer skills:

- Sending and receiving email
- A working knowledge of the Internet
- Microsoft Word (or a program convertible to Word)
- Acrobat PDF Reader
- Windows or Mac OS
- Video conferencing software

Netiquette (online etiquette)

Students are expected to participate in all discussions and virtual classroom chats as directed. Students are to be respectful and courteous to others on discussion boards. Foul or abusive language will not be tolerated. Do not use ALL CAPS for communicating to others AS IT CAN BE INTERPRETED AS YELLING. Avoid slang terms such as "wassup?" and texting abbreviations such as "u" instead of "you." Limit and possibly avoid the use of emoticons. Be cautious when using humor or sarcasm as tone is sometimes lost in an email or discussion post, and the message might be taken seriously or sound offensive.

Video Conferencing Etiquette

When using Zoom, WebEx, or other video conferencing tools, confirm the visible area is tidy, clear of background clutter, inappropriate or offensive posters, and other distractions. Ensure you dress appropriately and avoid using high traffic or noisy areas. Stay muted when you are not speaking and avoid eating/drinking during the session. Before the class session begins, test audio, video, and lighting to alleviate technology issues.

Technical Support

Students should go to <https://mypassword.pvamu.edu/> if they have password issues. The page will provide instructions for resetting passwords and contact information if login issues persist. For other technical questions regarding eCourses, call the Center for Instructional Innovation and Technology Services at 936-261-3283 or email ciits@pvamu.edu.

Communication Expectations and Standards

Emails or discussion postings will receive a response from the instructor, usually in less than 48 hours. Urgent emails should be marked as such. Check regularly for responses.

Discussion Requirement

Online courses often require minimal to no face-to-face meetings. However, conversations about the readings, lectures, materials, and other aspects of the course can occur in a seminar fashion. The use of the discussion board will accomplish this. The instructor will determine the exact use of discussion boards.

It is strongly suggested that students type their discussion postings in a word processing application such as Word and save it to their PC or a removable drive before posting to the discussion board. This is important for two reasons: 1) If for some reason your discussion responses are lost in your online course, you will have another copy; 2) Grammatical errors can be greatly minimized by the use of the spell-and-grammar check functions in word processing applications. Once the post(s) have been typed and corrected in the word processing application, copy and paste to the discussion board.

COVID-19 Campus Safety Measures

To promote public safety and protect students, faculty, and staff during the coronavirus pandemic, PVAMU has adopted policies and practices to limit virus transmission.

- **Self-monitoring** - Students should follow CDC recommendations for self-monitoring. Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.

- **Face Coverings** - Face coverings (cloth face covering, surgical mask, etc.) are recommended in classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource, and support offices, and outdoor spaces where 6 feet of physical distancing is challenging to maintain reliably.
- **Physical Distancing** - Physical distancing should be maintained between students, instructors, and others in course and course-related activities where possible.
- **Personal Illness and Quarantine** - Students required to quarantine are to participate in courses and course-related activities remotely and must not attend face-to-face course activities. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities. Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence. To receive an excused absence, students must provide appropriate documentation to the Office for Student Conduct, studentconduct@pvamu.edu.

End of Semester Course Assessment Report

This summary contains the following Information

1. Performance Statistics

- Total number of students in class
- The class average performance (**stated as %**) in each course outcome assessed in this class and the **two previous times course was assessed**.
- The acceptable class average for the class in each outcome area as set by your Department. **You cannot use any number of your choice**
- Percentage of students who scored below the expected average in each outcome.

2. Implementation Summary

- Brief summary of plans implemented during the semester based on last assessment report

3. Perceived Problems

- Instructor's **critical evaluation** of perceived problems that affected students' performance. **Realistic problems should be identified throughout the semester and summarized in this section of the report.**

4. New Plans for Addressing Problems

- Instructor's plans for addressing the perceived problems the next time the class is taught. **These should be specific enough for another instructor to implement. Most of these should be things that, you, the instructor can implement to help students to improve. Be creative.**

5. Overall Trend over last three assessment periods

- Instructors summary of overall performance trend for each outcome measured over the last three periods.

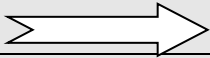
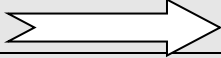
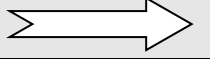
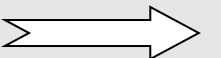
5. Were Expectations Met?

- Answer **YES** if the **class average was above the expected average** and the **stated percentage of students** scored at or above the expected average, else answer NO.

END OF SEMESTER COURSE OUTCOME ASSESSMENT REPORT
MCEG 3031 MANUFACTURING PROCESSES LABORATORY
SPRING 2022 SEMESTER

Report Prepared by: Dr. Jaejong Park

Report Date: May 20, 2022

Semester	Analysis Type	Number of Students	Outcome 4.2 Assessing students' ability to make informed judgements on ethical and professional responsibilities in engineering while considering the impact of engineering solutions in global, economic, environmental, and societal contexts			
			Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average
Spring 2022	Direct	26	70	70	86.53	88.5
Spring 2021	Direct	31	70	70	76.98	87.1
Spring 2020	Direct	30	70	70	75.86	73.3
Implementation Summary	Items implemented from previous report or after meeting previous instructor	The target assignment was designed to expose students to successful industrial revolutions and draw conclusions such that they are aware of professional responsibilities as engineers.				
Perceived Problems	Perceived problems are directly related to the PC and the sub items under them 	A small portion of the students showed lack of ability to make engineering inference using existing or provided data/literature.				
Plans for Addressing Problems	Plans for address specific measures to address PC and their sub areas 	Various industrial examples will be introduced to the class to show how engineers devise or enhance design based on lessons learned from the past to increases the positive impact and reduce negative impact on the global society.				
Overall Trend over Periods	Ascertain if there were improvements over previous semesters 	Students' performance met the expectations this semester as the class average and % students meeting the expected average were well above 70% and 70% respectively. Especially the course average has improved greatly this semester.				
Were Expectations Met?		Yes				

**Grade Sheet Showing
Student and Class Performance in Outcomes
The computed semester average in each outcome
as stated in the Assessment report are
highlighted in boldface**

**Grade Sheet Showing Student and Class
Performance in Course Outcomes
MCEG 3031 Manufacturing Processes Laboratory
SPRING 2022 Semester**

Outcome 2	
Total	PCENT
100	100
90	90
80	80
90	90
40	40
95	95
95	95
100	100
95	95
100	100
100	100
20	20
100	100
100	100
100	100
80	80
95	95
100	100
100	100
50	50
90	90
95	95
100	100
90	90
90	90
70	70
85	85
	86.53

PECIFIC ASSIGNMENTS USED TO ASSESS OUTCOME – 4.2

Performance criterion:

Assessing students' ability to make informed judgements on ethical and professional responsibilities in engineering while considering the impact of engineering solutions in global, economic, environmental, and societal contexts (Outcome 4.2).

Sample Assignment: Manufacturing Essay Project

**MECHANICAL ENGINEERING DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
MCEG3103
MANUFACTURING PROCESSES LABORATORY
Spring 2022
Instructor: Dr. Jaejong Park**

Title of Assignment

Manufacturing Essay Project

Outcome 4

An ability to make informed judgements on ethical and professional responsibilities in engineering while considering the impact of engineering solutions in global, economic, environmental, and societal contexts

Brief Description of the suitability of this assignment for the outcome

This project examines the students' ability to identify the impact of manufacturing advancements on certain industry from literature review. This will give students opportunity to understand the importance of engineer's decision making to minimize negative impact on economy, environment and the society.

Due Date: May. 1, 2022 (Extended)

NO LATE SUBMISSION WILL BE ACCEPTED

PROJECT DETAILS

Manufacturing is a value-adding sector of an economy and it takes a big portion of the U.S. GDP (12.2% in the year 2011). Pick one industry from the following lists and write an **essay** to describe the impacts of manufacturing advancements on global, economic, environmental, or societal environments. Draw a conclusion and make inferences. Give a list of the references at the end of your essay and cite them properly in your context.

- Automotive industry
- Oil and gas industry
- Airplane industry
- Industrial robotics
- Industrial automation
- Biomedical industry

REQUIREMENTS

- 5 pages minimum (including figures), 11-font, double spaced, the 1-in margin on all four sides
- Figures combined should not occupy more than ½ page. That is, your write-up has to be at least 4.5 pages long
- Use at least five references. Use proper citation using APA or MLA styles - Provide appropriate references at the end. Direct copy and paste using quotation marks is considered plagiarism.
- Excessive Turnitin match report may result in zero grades. - **Since multiple submission is allowed and you will be able to see the Turnitin match report right away, you can check your similarity and address accordingly to avoid zero grades.**
- The submission file should be a pdf.
- Reference pages do count towards 5 page requirement.

**MECHANICAL ENGINEERING
DEPARTMENT
PRAIRIE VIEW A&M UNIVERSITY**



**MCEG 3103
Spring 2022**

Literature Review

**Submitted by,
Thomas Hale**

4/20/2022

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Abstract

Additive manufacturing in all of its components, has been part of the manufacturing community for more than 40 years. The roots began in 1981 when Hideo Kodama of the Nagoya Municipal Industrial Research Institute published his findings regarding a solid printed model utilizing Stereolithography [1]. A few years later, in 1989, what is now commonly called 3D printing (FDM) was developed by what is now one of the largest 3D printer companies in the industry (Stratasys) [1].

1989 was also the same year that manufacturers in the aerospace industry began creating parts utilizing these new methods [2]. Fast forward to the last decade, companies like NASA, SpaceX, Hoversurf and many more are harnessing the capabilities of additive manufacturing to product everything from combustion engines to bodies. Each of these companies have been able to capitalize on the speed and effectiveness of the many varieties of additive manufacturing to create innovative designs in months instead of years.

One of the most remarkable aspects of additive manufacturing is the ability to spend less resources to produce the same results. This means less material wasted when prototyping parts, expanding that to less land needing mined for the metals and metal ores to create the alloys commonly used today. A 3D part for instance, literally is created with only the material set by the geometry vs losing 40-60% of the material needing to be machined off. The reduction in electricity, petrol products to lubricate the machines and services required to operate large machining operations.

1. Introduction to Additive Manufacturing

Additive manufacturing consists of seven main categories. Material extrusion, powder bed fusion, material jetting, binder jetting, directed energy deposition, sheet lamination and Vat photopolymerisation[3]. The one most people think of when it comes to AM, is 3D printing, which can encompass many of the methods stated.

In additive manufacturing methods, polymers, ceramics, and metals can all be used [4]. Although polymers are the most commonly used materials in all seven AM methods, some additive techniques prefer the usage of specific materials over others. Materials are frequently produced as powders or wire feedstock.

LOM is also utilized in conjunction with a variety of sticky papers, chocolate, and polymer/adhesive sheets. When printing with this method, the quality of the final product will be largely determined by the quality of the material. Due to the high temperatures and pressures involved in the techniques discussed above, the post-manufacturing characteristics of a material may differ from those achieved through normal manufacturing processes.

This technology is helping engineers' prototype versions of their projects more quickly and cost- effectively than ever before. Currently, the main priority of companies is to accelerate their product development. "Forbes states reliance on additive manufacturing increased from 29% in 2017 to 39% in 2018, using the printing machine for 55% of prototyping, 43% of production, and 41% for Proof of Concept models." The additive manufacturing market for global aerospace and defense is forecasted to grow from 15.10 billion in 2021 to 83.90 billion by 2029. [5]

Insight into the global aerospace industry and the role which additive manufacturing plays will be elaborated on below.

1.1 Hoversurf

Hoversurf, which is modern air mobility Technology Company, is aiming to create futuristic vehicles that have aerospace capabilities. The primary goal of this company is to reduce the costs of the manufacturing process and the time needed for those operations. Hoversurf is also utilizing metal powder and carbon fiber to create printed versions of the parts for these automobiles. A few of the projects they have worked on in the past include Hover Drove Taxi, Cargo Drone, and Scorpion models [6]. Formula is the name of one of their Hoverbikes which can travel up to 320 km/h, with a range of up to 450 km. Harnessing the environmentally respectful aspect of quiet electric motors, it provides the unique experience hipsters crave.



Figure 1.1-Hoversurf taxi

1.2 NASA

NASA and Virgin Orbit, aerospace companies at the forefront of the industry actively searched to create a combustion chamber which combined several materials, each with excellent capabilities, and takes advantage of cutting-edge manufacturing processes. It takes months to build, test, and ship a conventional combustion chamber. That's just the way it is. There are ways to speed up production by using additive manufacturing. Machines for additive manufacturing (commonly known as 3D printing) are ready to improve on current methods. It opens up new

possibilities for design and performance, as well as producing a piece of equipment that is incredibly long-lasting.

The first full-scale 3D printed copper rocket engine part was developed at Marshall Space Flight Center, located at Huntsville, Alabama and at Glenn Research Center, located in Cleveland, Ohio[7]. Using proven NASA additive copper alloy, GRCo-84, to strengthen this new engine thrust chamber immensely.

Virgin Orbit has their own hybrid additive/subtractive machine, which enabled them to apply a second bimetallic super alloy jacket and mill the item precisely. Glenn and Virgin Orbit experts consulted on testing shortly after the manufacturing combustion chamber was completed in late 2018 and early 2019. “The combination of multiple optimized materials and additive manufacturing technologies represents a significant advancement from the compromises typically made in the production of 3D printed rocket engine combustion chambers, Kevin Zagorski.”[8]

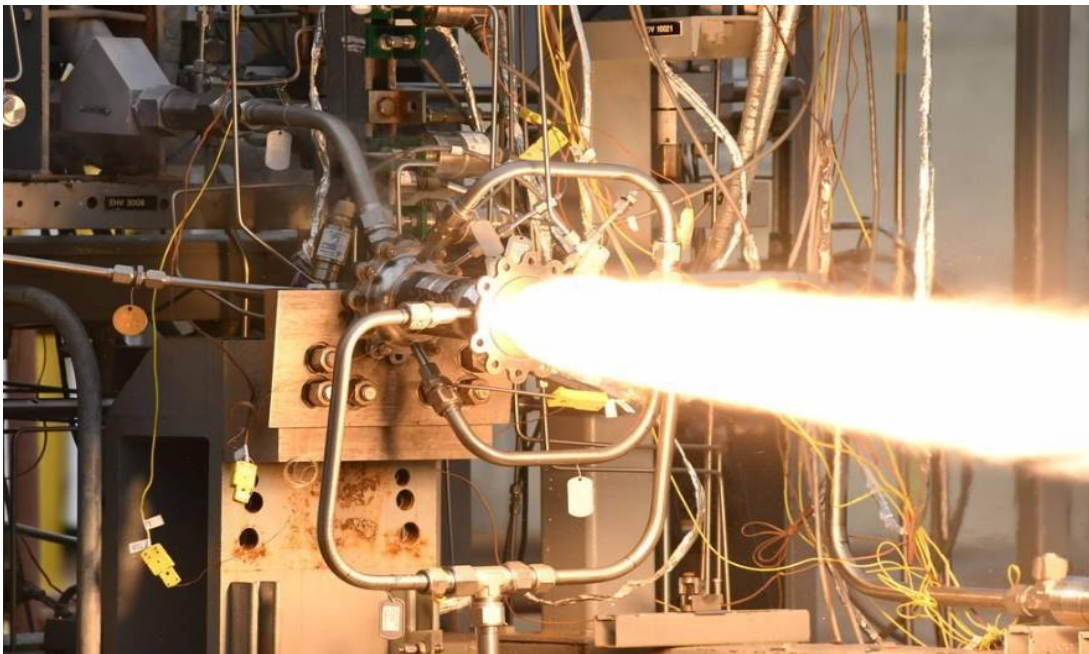


Figure 1.2 – Nasa Test firing a unit

Researchers at NASA and Virgin Orbit will continue to investigate improved additive manufacturing options, including the introduction of even higher-performing metals and the refinement of the printing technique. Both pioneers look to improve the cost, performance, and lead time of Virgin Orbit's propulsion system for the Launcher One Vehicle through additive printing advances. The goal is to keep improving access to space by making launch technology safer, faster, and less expensive. For decades to come, the employment of instruments like the additive manufacturing machining will be vital technology in achieving the nation's strategic goals in space.

NASA has been known for pioneering and utilizing “cutting edge” technologies to aid with the many obstacles involved with space exploration. The use of additive manufacturing will continue to push their capabilities to the new Frontier.

1.3 Space X

2014 was a big year for SpaceX, since this is when they began utilizing additive manufacturing to build full scale rocket components. It was also the first year they launched an FDM component into orbit. The corporation is now using additive manufacturing technologies, including Direct Metal Laser Sintering (DMLS), to produce parts in exponentially less time than traditional machining options previously available. With Elon Musk looking to colonize Mars by 2050, these advancements will surely help.

“SpaceX being one of the leaders in new age rocket technology, developing rockets that can be refueled and reused numerous times because to the high-performance components produced via additive manufacturing”[9].

In order to develop additive manufacturing for aerospace gear, SpaceX claims to have spent nearly three years perfecting their recipe and strategy to maximize their efforts. Using direct metal laser sintering (DMLS), the company created an engine chamber for a SuperDraco engine out of Inconel [9]. This is a high-performance super alloy, often seen in use for turbocharger components.

Previously this material was considered tough to manufacture, due to its hardness, machining it takes a long time.



Figure 1.3 – SuperDraco printed engine chamber [9]

SpaceX successfully ignited the engine chambers at their maximum thrust of 16,000 lb per engine. Which is a testament to the abilities of the additive technology. When compared to traditional machining, the additive manufacturing significantly reduced lead time: three months from design conception to the first hot-fire test. SpaceX successfully completed certification testing for the SuperDraco rocket, which comprised numerous launches, extended firing durations, and considerable deviations from nominal fuel flow and temperature[9]. This new discover was so important because the SuperDraco is capable of being revived an unlimited number of times. Additionally, they are capable of deep throttle, which provides astronauts with enormous amounts of power while keeping precision control.

2. Global, economic, environmental, and societal Impacts

With the advent of any new technology or design, one of the things an engineer has to keep in mind, is how this affects the world around us. Additive manufacturing has the unique distinction of being mostly positive when compared to traditional manufacturing processes. There are many benefits in the context of global, economic, environmental and societal impacts.

Being able to produce a part from only the material required for its specific geometry alleviates the loss of material when considering traditional processes of having to remove material, which is then lost to scrap [10]. This drives the overall cost down to manufacture each piece. This also requires less metal ore to be mined from all over the world, saving more of the environment. Protecting societies all over the world by producing parts that last without having to damage the environment.

Additionally, the same facility space is not required for the equipment traditionally needed as well as the need for less storage. Smaller facilities drive the need for less, steel beams, wooden studs for walls, and the list goes on. Traditionally, spare parts would have to be kept around for decades, in the event one needed to be reproduced or retested properly. As long as the CAD/STL/OBJ files are “on hand” a part can be easily reproduced as well as altered quickly!

In the past, working in teams on the global scale, each location may not have the same capabilities to test and produce the parts sold. Instead of having to incur the cost of shipping materials around the globe, a smaller investment for a printer can be made to produce whatever is needed.

Conclusion

Companies, such as Hoversurf, NASA, Space X, as well as all manufacturing industries are choosing to move to adding additive manufacturing to their operations. As it continues to expand and rapidly advance industry's' ability to push the envelope when it comes to innovation and exploration. Companies save money via the use of additive manufacturing due to the decrease in both time and cost associated with the process. In the aerospace sector, many of the additive manufacturing process are allowing for leaps and bounds in innovation. Since the techniques are delivering significant competitive advantages owing to the fact that they can adapt to the geometrical complexity and bespoke design of the item to be made. Lighter weight products, multi-material products, ergonomic products, efficient short production runs, fewer assembly errors and, as a result, lower associated costs, lower tool investment costs, a combination of different manufacturing processes and optimized use of materials, and a more sustainable manufacturing process are all possible, depending on the field of application being pursued. In conclusion, it can be concluded that additive manufacturing will be one of the most significant breakthrough industrial approaches in the next years.

Work cited

1. Schotte, Greg. "A Brief History of Additive Manufacturing." *A Brief History of Additive Manufacturing*, blog.trimech.com, 00 2019, <https://blog.trimech.com/a-brief-history-of-additive-manufacturing>.
2. "Additive Manufacturing Is Slowly Disrupting Aerospace Engineering." *Wevolver*, www.wevolver.com, 13 Jan. 2021, <https://www.wevolver.com/article/additive-manufacturing-is-slowly-disrupting-aerospace-engineering>.
3. "The 7 Categories of Additive Manufacturing | Additive Manufacturing Research Group | Loughborough University." *The 7 Categories of Additive Manufacturing | Additive Manufacturing Research Group | Loughborough University*, www.lboro.ac.uk, <https://www.lboro.ac.uk/research/amrg/about/the7categoriesofadditivemanufacturing/>. Accessed 20 Apr. 2022.
4. "Materials | Additive Manufacturing Research Group | Loughborough University." *Materials | Additive Manufacturing Research Group | Loughborough University*, www.lboro.ac.uk, <https://www.lboro.ac.uk/research/amrg/about/materials/#:~:text=Three%20types%20of%20material%20can,of%20certain%20materials%20over%20others>. Accessed 20 Apr. 2022.
5. "3D Printing Market Size, Growth | Global Research Report [2029]." *3D Printing Market Size, Growth | Global Research Report [2029]*, www.fortunebusinessinsights.com, <https://www.fortunebusinessinsights.com/industry-reports/3d-printing-market-101902>. Accessed 20 Apr. 2022.
6. "Home | HOVERSURF." *HOVER*, www.hoversurf.com, <https://www.hoversurf.com/>. Accessed 20 Apr. 2022.
7. Sertoglu, Kubi, et al. "NASA and Virgin Orbit 3D Print Multimetalllic Chamber for Rocket Engine - 3D Printing Industry." *3D Printing Industry*, 3dprintingindustry.com, 31 May 2019, <https://3dprintingindustry.com/news/nasa-and-virgin-orbit-3d-print-multimetalllic-chamber-for-rocket-engine-156409/>.
8. "NASA and Virgin Orbit 3D Print, Test Rocket Combustion Chamber." *NASA*, www.nasa.gov, <https://www.nasa.gov/centers/marshall/news/news/releases/2019/nasa-and-virgin-orbit-3d-print-test-rocket-combustion-chamber.html>. Accessed 20 Apr. 2022.

9. "SpaceX Reveals 3D-Printed Rocket Engine Parts | Designnews.Com." Designnews.Com, www.designnews.com, 26 Oct. 2016, <https://www.designnews.com/design-hardware-software/spacex-reveals-3d-printed-rocket-engine-parts>.
10. Gayette, Mike. "Top 10 Advantages of Additive Manufacturing." *Top 10 Advantages of Additive Manufacturing* | PTC, www.ptc.com, 21 July 2021, <https://www.ptc.com/en/blogs/cad/10-additive-manufacturing-advantages>.

Assessment

Grade out of 100

100

Assignment Comments



The concept of additive manufacturing is so smart and fascinating as you mentioned in your essay. It added so much opportunity to many things we do but at the same time there are downsides that its process inherently has such as material anisotropy, etc. X

Jaejong Park, May 9 at 1:49pm