George W. Woodruff School of Mechanical Engineering

Georgia Institute of Technology

ME3210-A

# Design, Materials, and Manufacture

Fall 2026

Tue & Thu 2:30-3:15pm

(Revised 4/8/2026)

## Specific Course Information



Brief Description of the Course Content (Catalog Description): Major manufacturing processes, capabilities, and costs. Interaction between design, materials and manufacturing process selection.

Prerequisites or Co-requisites: ME 2110 Creative Decisions and Design, MSE 2001 Engineering Materials, COE 3001 Mechanics of Deformable Bodies

This is a required course in the ME program.

## Expected Outcomes



1) To understand the major manufacturing processes – Students shall demonstrate the ability to identify and describe the major manufacturing processes and their capabilities and limitations;

2) To understand the interactions between design, materials, and manufacturing – Students shall demonstrate the ability to convert design requirements into constraints and objectives for selection of materials and manufacturing processes;

3) To be able to select the appropriate manufacturing processes given single and multiple design and material constraints – Students shall demonstrate the ability to select manufacturing processes under single and multiple constraints and objectives. In addition, students shall demonstrate the ability to use process capability information to select and/or synthesize manufacturing processes and systems.

## Instructor and Grader



Dr. Steven Y. Liang:

Phone: 404-894-8164, Fax: 404-894-9342, GTMI 459

Office Hours: 24/7, by emailing questions/issues to <steven.liang@me.gatech.edu> or to schedule on-line sessions any time.

Homework Grader: TBA

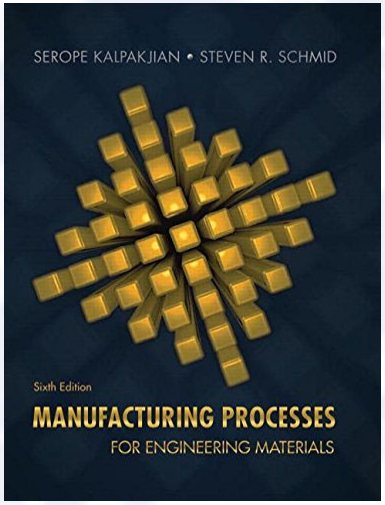
# Texts



*Manufacturing Processes for Engineering Materials*, Serope Kalpakjian and Steven R. Schmid, 6th Ed, Pearson Prentice-Hall, 2016. (Hardcover book)

ISBN-10: 0134290550, ISBN-13: 978-0134290553

- Note: *Not "Manufacturing Engineering and Technology*"
- Any other version (international version, soft cover print, digital copy, etc.) would not work



## References

*Fundamentals of Modern Manufacturing: Materials, Processes, and Systems*, Mikell P. Groover, Prentice Hall, 2012

*Materials and Processes in Manufacturing,*
E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, 2011

## Grading



| | |
|---|---|
| Homeworks (4 or 5) | 10% |
| Pop-quizzes (5) | 10% |
| 1st Midterm Exam, 10/1, Thu, 2:00-3:00pm | 25% |
| 2nd Midterm Exam, 11/12, Thu, 2:00-3:00pm, Non-cumulative | 25% |
| Final Exam, Date and time TBA, (*), Cumulative | 30% |

(*) Students will have the full two hours and fifty minutes to complete the final, unless otherwise stated on syllabus (which is the case here) --- GT Academic Policies

## Rubric for Grading Exam Problems



Full grade for completely correct approach and completely correct answer;

1-point deduction for miscalculations only and everything else correct;

2-point deduction for using wrong variables in correct formulas;

3-point deduction for wrong or missing formulas.

## Pop Quizzes



Totally 5 pop quizzes throughout the semester;

Pop quizzes will be given in closed-book format during lectures. Their dates will not be pre-announced;

Each pop quiz weighs 2 points;

A pop quiz covers the scope in the previous two lectures;

Pop quizzes do not cover assigned reading contents unless they are also discussed in the lectures.

## What happens if you have to miss quizzes?



A quiz “Pass” will be granted to excused absence due to Institute activities (field trips, professional conferences, athletic events, etc.) only, under Instructor’s **prior** approval;

Each quiz Pass counts as the average of all other quizzes;

For examples:

| $Q_1$ | $Q_2$ | $Q_3$ | $Q_4$ | $Q_5$ | | $Q_1$ | $Q_2$ | $Q_3$ | $Q_4$ | $Q_5$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | P | 1 | 2 | → | 2 | 1 | 1.5 | 1 | 2 |

| $Q_1$ | $Q_2$ | $Q_3$ | $Q_4$ | $Q_5$ | | $Q_1$ | $Q_2$ | $Q_3$ | $Q_4$ | $Q_5$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | P | 1 | P | 2 | → | 3 | 1.67 | 1 | 1.67 | 3 |

## What happens if you have to miss all quizzes?



In case of 5 Passes (missed all 5 quizzes), all quizzes will be assigned zeros first, then the semester total will be multiplied by a factor of 100/90.

## Letter Grade Conversion Scheme



The final cut-off is the decision of the instructor, taking into account the following:

(1) It is guaranteed that (the Set of Standard) an absolute scale of A=100~90; B=89.9~80; C=79.9~70; D=below 69.9 is used, or

(2) Alternatively, the relative scale of A=top 30%, B, C, and D=the next 30%, 30%, and 10% is considered. (If CIOS participation is more than 90%, this becomes A=top 35%, B=next 35%, C and D=the 20%, and 10%.)

Will go for either (1) or (2), whichever gives a better letter grade.

F will only be assigned to extremely low performance and with exam(s) missed.

## Letter Grade Conversion Scheme



For Examples:

| Fall 2025: | Spring 2025: | Fall 2024: | Spring 2024: |
|---|---|---|---|
| A=100~81; | A=100~76; | A=100~78; | A=100~76; |
| B=80~74, | B=75~66, | B=77~70, | B=75~66, |
| C=73~67, | C=65~52, | C=69~59, | C=65~63, |
| D=below 66; | D=below 52; | D=below 59; | D=below 63; |
| CIOS: 87% ☹ | CIOS: 85% ☹ | CIOS: 84% ☹ | CIOS: 91% |

# Grade Transparency



For grade transparency and privacy, grade distribution will be posted after each midterm and right before the final.

As an example

| HW1 | HW2 | HW3 | HW4 | HW5 | QZ1 | QZ2 | QZ3 | QZ4 | MT1 | MT2 | Total-to-date(*) | Grade-to-date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10.0 | 10.0 | 9.0 | 10.0 | 10.0 | 2 | 2 | 2 | 2 | 25 | 25 | 69.76 | A |
| 10.0 | 10.0 | 10.0 | 10.0 | 8.5 | 2 | 2 | 2 | 2 | 25 | 23 | 67.64 | A |
| 9.5 | 10.0 | 9.0 | 9.0 | 10.0 | 2 | 2 | 2 | 2 | 24 | 24 | 67.40 | A |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 2 | 2 | 2 | 23 | 23 | 65.88 | A |
| 9.5 | 10.0 | 9.0 | 9.5 | 10.0 | 2 | 1 | 2 | 2 | 23 | 24 | 65.52 | A |
| 9.3 | 10.0 | 10.0 | 8.5 | 10.0 | 1 | 2 | 1 | 2 | 25 | 23 | 65.46 | A |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 2 | 2 | 23 | 23 | 64.88 | A |
| 9.3 | 10.0 | 10.0 | 10.0 | 0.0 | 2 | 2 | 2 | 2 | 23 | 24 | 64.42 | A |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 2 | 2 | 25 | 20 | 63.88 | A |
| 10.0 | 8.0 | 10.0 | 10.0 | 10.0 | 2 | 2 | 1 | 2 | 23 | 21 | 62.52 | A |
| 9.8 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 2 | 2 | 25 | 18 | 61.94 | A |
| 9.5 | 10.0 | 9.0 | 7.0 | 10.0 | 2 | 2 | 2 | 2 | 23 | 20 | 61.92 | A |
| 9.5 | 9.5 | 10.0 | 10.0 | 10.0 | 2 | 1 | 2 | 1 | 23 | 21 | 61.76 | A |
| 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 2 | 2 | 25 | 18 | 61.64 | A |
| 9.5 | 8.5 | 9.0 | 9.3 | 10.0 | 1 | 2 | 1 | 2 | 23 | 21 | 61.10 | A |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 2 | 1 | 1 | 24 | 19 | 60.88 | A |
| 9.5 | 10.0 | 8.0 | 8.5 | 10.0 | 1 | 1 | 2 | 1 | 23 | 21 | 60.04 | A |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 2 | 1 | 1 | 21 | 20 | 58.88 | A |
| 10.0 | 10.0 | 10.0 | 9.0 | 10.0 | 2 | 1 | 2 | 2 | 21 | 19 | 58.76 | A |
| 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 2 | 1 | 21 | 19 | 58.00 | A/B (**) |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 1 | 2 | 21 | 19 | 57.88 | B |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1.7 | 1 | 2 | 23 | 16 | 57.58 | B |
| 10.0 | 0.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 0 | 1 | 23 | 20 | 56.60 | B |
| 9.5 | 10.0 | 9.0 | 9.0 | 10.0 | 2 | 1 | 2 | 2 | 18 | 20 | 56.40 | B |
| 9.5 | 8.8 | 8.0 | 9.7 | 10.0 | 2 | 1 | 1 | 2 | 20 | 19 | 56.03 | B |
| 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 2 | 1 | 2 | 21 | 16 | 55.88 | B |
| 9.5 | 10.0 | 10.0 | 10.0 | 9.6 | 2 | 1 | 1 | 1 | 25 | 14 | 55.78 | B |
| 8.5 | 10.0 | 10.0 | 10.0 | 9.6 | 2 | 1 | 2 | 2 | 18 | 19 | 55.54 | B |
| 9.0 | 10.0 | 7.0 | 6.2 | 9.0 | 2 | 1 | 1 | 1 | 21 | 19 | 54.89 | B |
| 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 1 | 2 | 19 | 18 | 54.76 | B |
| 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1 | 1 | 2 | 17 | 20 | 54.76 | B |
| 9.0 | 10.0 | 7.0 | 5.9 | 10.0 | 2 | 1 | 1 | 1 | 19 | 20 | 54.06 | B |
| 9.3 | 7.5 | 10.0 | 10.0 | 10.0 | 1 | 2 | 1 | 2 | 18 | 18 | 53.22 | B |
| 9.5 | 10.0 | 9.0 | 9.5 | 10.0 | 2 | 2 | 2 | 2 | 18 | 15 | 52.52 | B |
| 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | 2 | 1.3 | 1 | 1 | 19 | 16 | 52.06 | B |
| 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | 2 | 2 | 2 | 2 | 12 | 20 | 51.15 | B |
| 9.5 | 9.5 | 9.0 | 9.5 | 10.0 | 1 | 1 | 1 | 1 | 19 | 16 | 50.40 | B |
| 9.0 | 10.0 | 8.0 | 9.5 | 10.0 | 2 | 1 | 1 | 1 | 14 | 20 | 50.16 | B/C (**) |
| 7.0 | 8.5 | 10.0 | 10.0 | 10.0 | 0 | 1 | 0 | 2 | 19 | 16 | 48.92 | C |
| 10.0 | 8.1 | 10.0 | 10.0 | 10.0 | 0 | 1 | 2 | 2 | 18 | 14 | 48.54 | C |
| 9.5 | 7.5 | 10.0 | 10.0 | 10.0 | 1 | 1 | 1 | 1 | 14 | 18 | 47.28 | C |
| 9.5 | 7.5 | 10.0 | 10.0 | 10.0 | 2 | 1 | 1 | 1 | 17 | 14 | 47.28 | C |
| 10.0 | 0.0 | 10.0 | 10.0 | 0.0 | 2 | 1 | 1 | 0 | 15 | 19 | 45.20 | C/D (**) |
| 9.5 | 6.8 | 10.0 | 10.0 | 10.0 | 2 | 2 | 2 | 1 | 12 | 15 | 45.10 | D |
| 8.0 | 5.9 | 9.0 | 9.0 | 8.0 | 1 | 1 | 0 | 1 | 14 | 18 | 44.56 | D |
| 8.5 | 0.0 | 8.0 | 9.7 | 0.0 | 2 | 0 | 2 | 1 | 18 | 12 | 41.29 | D |
| 7.0 | 8.5 | 9.0 | 9.0 | 10.0 | 2 | 1 | 1 | 1 | 9 | 15 | 39.44 | D |
| 0.0 | 0.0 | 8.0 | 9.5 | 10.0 | 2 | 2 | 0 | 1 | 10 | 15 | 36.60 | D |

Note: (*) Total-to-date=((A+B+C+D+E)*12/50)+F+G+H+I+J+K
(**) Marginal

## Policies



- Homeworks are considered mini take-home exams, and shall be done on individual basis and will be deemed cheating otherwise.
- Prior to the due dates, instructor can only clarify the homework problem statements but will not discuss how the homeworks are to be solved.
- Late homework will not be accepted NO MATTER WHAT. The instructor and TA intentionally discard late homework submission emails and Canvas comments.
- There may be a homework due on 12/1(*), although not likely.
- Students submitting all homeworks receive favorable consideration if the final semester grade is marginal.

(*) Other graded work (HW, etc) may be due on these (final instruction) days, provided that the assignments and deadlines were listed on the syllabus at the beginning of the semester --- GT Academic Policies

## Policies

- It is student's responsibility to look up, with or without notifications, all materials and instructions posted on Canvas.

- Two midterms will be closed books/notes, with one crib sheet (both sides) no larger than 8½" by 11" and calculator (without memory and communication capability such as phones or computers) allowed.

- The final exam will be open books/notes – you are allowed to use any books, notes, lecture slides, etc. However, discussing with any other student or consultant is prohibited. Use of AI software is permitted but it needs to be declared following the answers. Any violation will be considered cheating.

- Absence from a class (due to Institute activities) with instructor's PRIOR approval will receive pass for quiz or make-up for missed exam. However, it is the student's responsibility to make up the missed lecture content in preparation for subsequent quiz, homework, and exams.

## Policies



- Complete lecture notes will not be provided. In the case of a missed class, student needs to find the complete lecture notes from his/her classmates.

- Even when a class absence is granted, relevant homework still needs to be submitted on the scheduled due date.

- Absence from any exam or quiz without instructor's PRIOR approval will result in a zero point for that test.

- Personal travel is generally not a justification for rescheduling an exam.

- All acts of cheating will lead to a zero point for that grading item plus a 10-point reduction of the overall semester grade. It will also be reported to the VP/Dean of Students without exception.

## Policies



- In case of academic, physical, technological, or other barriers on campus, the Office of Disability Services (https://disabilityservices.gatech.edu/) may help.

- Please take note of Academic Honor Code | Policy Library and https://catalog.gatech.edu/rules/21/.

- Any discussion with the instructor regarding the grades in this semester shall be made before Monday, 8/30/2027.

# Schedule



| Week | Tuesday | Thursday |
|---|---|---|
| **1** | August 18 (Lecture 1)<br>Syllabus and Introduction | August 20 (Lecture 2)<br>Key Manufacturing Considerations |
| **2** | August 25 (Lecture 3)<br>Design for Manu & Assembly | August 27 (Lecture 4)<br>Design for Manu & Assembly |
| **3** | September 1 (Lecture 5)<br>Material Variety and Functionalities | September 3 (Lecture 6)<br>Material Variety and Functionalities |
| **4** | September 8 (Lecture 7)<br>Material Variety and Functionalities | September 10 (Lecture 9)<br>Material Variety and Functionalities |
| **5** | September 15 (Lecture 8)<br>Material Variety and Functionalities | September 17 (Lecture 10)<br>Material Variety and Functionalities |
| **6** | September 22 (Lecture 11)<br>Surfaces and Quality | September 24 (Lecture 12)<br>Surfaces and Quality |
| **7** | September 29 (Lecture 13)<br>Surfaces and Quality | October 1<br>1st Midterm Exam |
| **8** | October 6<br>Holiday | October 8 (Lecture 14)<br>3-D Printing |

# Schedule



| Week | Thursday | Thursday |
|---|---|---|
| **9** | October 13 (Lecture 15)<br>3-D Printing | October 15 (Lecture 16)<br>Casting |
| **10** | October 20 (Lecture 17)<br>Casting | October 22 (Lecture 18)<br>Casting |
| **11** | October 27 (Lecture 19)<br>Forming | October 29 (Lecture 20)<br>Forming |
| **12** | November 3 (Lecture 21)<br>Forming | November 5 (Lecture 22)<br>Machining |
| **13** | November 10 (Lecture 23)<br>Machining | November 12<br>2nd Midterm Exam |
| **14** | November 17 (Lecture 24)<br>Non-Traditional Processes | November 19 (Lecture 25)<br>Semiconductor Manufacturing |
| **15** | November 24 (Lecture 26)<br>Semiconductor Manufacturing | November 26<br>Holiday |
| **16** | December 1 (Lecture 27)<br>Semiconductor Manufacturing | December<br>Final Exam TBA |