

TRINE

UNIVERSITY

COURSE SYLLABUS

COURSE TITLE: Manufacturing Technology and Materials

TERM & YEAR:

COURSE NUMBER: MT 113

TIME & PLACE: Online

NUMBER OF CREDIT HOURS: 3

COURSE DESCRIPTION: A study of commonly used manufacturing processes (machining, casting, extrusion, forging and others) with emphasis on important engineering materials used in production. Materials studied include metals, plastics, ceramics, and composites.

PREREQUISITES: ETD 173

REQUIRED TEXT: Manufacturing Processes for Engineering Materials 6th edition, by Serope Kalpakjian & Steve R. Schmid, Pearson Education Hoboken , NJ, 2017 ISBN 9780134290553

REFERENCES: Fundamentals of Modern Manufacturing, 6th Edition, Mikell P. Groover, John Wiley and Sons Inc.

OTHER MATERIALS: CNC Simulator free software download

LEARNING OUTCOMES: Upon completion of this course, the student should be able to:

1. Identify basic manufacturing machinery and processes that can economically produce various types of products
2. Select appropriate materials compatible with applicable manufacturing processes
3. Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function
4. Describe basic material characteristics and the related testing procedures used to assess their properties

COURSE REQUIREMENTS:

ATTENDANCE/PARTICIPATION:

All students are expected to log in to their courses regularly throughout the week to receive instruction, materials, and updates from the instructor. It is your responsibility to check in and submit your assignments or complete your discussion board postings by the due dates. If you miss 3 classes or more, you will be dropped from the course.

If you do not participate in the course, you will be counted absent. Simply logging in is not enough; you must submit/complete an assignment, post to a discussion board, or other similar assignment tasks to avoid being counted absent. Instructors are required to submit attendance the Monday following each week of class.

GRADING / EVALUATION:

Course grading components will be weighted as follows:

Participation in Discussion Forums

70 Points (7 discussions)

Assigned Exercises	740 Points (8 weekly assignments)
CNC Tutorials	20 Points (2 tutorials)
CNC Simulations	200 Points (2 simulations)
Final	100 points
Total Points Possible	1130 Points

Grades will be determined based on the following percentages:

A	90% to 100%
B+	86% to 89%
B	80% to 85%
C+	76% to 79%
C	70% to 75%
D+	66% to 69%
D	60% to 65%
F	0 to 59%

Graded assignments will normally be returned within one week of submission.

ASSIGNMENT DUE DATES

All weekly assignments are due by 11:59 pm on **Sunday** Evening at the end of each week except for the last week when they are due by **Saturday** Evening by 11:59 pm. Late work as defined in weekly Moodle calendar will be lowered 10 points. Unless prior arrangements are made, work more than 24 hours late will not be graded and receive a zero. If a documentable personal or professional emergency arises, please contact the instructor via email to make alternative submission arrangements.

OTHER POLICIES:

ACADEMIC MISCONDUCT

The University prohibits all forms of academic misconduct. Academic misconduct refers to dishonesty in examinations (cheating), presenting the ideas or the writing of someone else as one's own (plagiarism) or knowingly furnishing false information to the University by forgery, alteration, or misuse of University documents, records, or identification. Academic dishonesty includes, but is not limited to, the following examples: permitting another student to plagiarize or cheat from one's own work, submitting an academic exercise (written work, printing, design, computer program) that has been prepared totally or in part by another, acquiring improper knowledge of the contents of an exam, using unauthorized material during an exam, submitting the same paper in two different courses without knowledge and consent of professors, or submitting a forged grade change slip or computer tampering. The faculty member has the authority to grant a failing grade in cases of academic misconduct as well as referring the case to Student Life.

PLAGIARISM

You are expected to submit your own work and to identify any portion of work that has been borrowed from others in any form. An ignorant act of plagiarism on final versions and minor projects, such as attributing or citing inadequately, will be considered a failure to master an essential course skill and will result in an F for that assignment. A deliberate act of plagiarism, such as having someone else do your work, or submitting someone else's work as your own (e.g., from the Internet, fraternity file, etc., including homework and in-class exercises), will at least result in an F for that assignment and could result in an F for the course.

ELECTRONIC DEVICES

Use of electronic devices including smart watches and cell phones is prohibited during exams or quizzes unless directly allowed by the instructor.

DIGITAL MEDIA DEVICE MISUSE

Our learning environment, including classrooms and public lecture halls, should be free from disruptions from personal communication and media devices. In such settings, cell phones and all other such devices must be turned off. Camera cell phones must be turned off in locker rooms and other such private places.

COURSE CALENDAR / SCHEDULE:

See course schedule in separate file and due dates will also be shown in Moodle.

ADDITIONAL INFORMATION:

ACADEMIC RESOURCES:

There are several academic services that may be useful to you during the semester along with the library and assistance with digital resources that can found in the University Center LINK.

The links to information here include:

Writing Center:

Math Help Sessions:

Study Sessions:

Parent and Family Support and Parent Newsletter:

Accessibility and Accommodations:

The above are accessible on page one at the following link:

<https://www.trine.edu/academics/success/academic-support-services.aspx>

TRINEONLINE

Course Mapping

MT 113--Manufacturing Technology and Materials

Course Description: A study of commonly used manufacturing processes (machining, casting, extrusion, forging and others) with emphasis on important engineering materials used in production. Materials studied include metals, plastics, ceramics and composites.

Learning Outcomes:

1. Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1)
2. Select appropriate materials compatible with applicable manufacturing processes (LO2)
3. Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)
4. Describe basic material characteristics and the related testing procedures used to assess their properties (LO4)

Week and Title	Weekly Learning Outcome Alignment	Learning Activities and Materials (LO alignment)	Assessments (LO alignment)
Week One: Fundamentals of materials, structure and manufacturing properties of metals (LO1, LO2, LO4)	Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1) Select appropriate materials compatible with applicable manufacturing processes (LO2) Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3) Describe basic material characteristics and the related testing procedures used to assess their properties (LO4)	Read: <ul style="list-style-type: none">• Chapter 2 Fundamentals of the Mechanical Behavior of Materials (LO2 & LO4)• Chapter 3: Structure and Manufacturing Properties of Metals (LO2 & LO4)• Chapters 2 & 3 PowerPoint (LO2 & LO4) Review: <ul style="list-style-type: none">• CNC Simulator Pro website (LO1)	Participate: <ul style="list-style-type: none">• Discussion Board Week 1 + Introductions (LO4) Assignment: <ul style="list-style-type: none">• Complete Chapter 2 & 3 Assignments (LO2, LO4)• Chapter 2 - 2.3, 2.5, 2.20, 2.29, 2.44, 2.52, 2.54, 2.75.• Chapter 3 - 3.2, 3.20, 3.26, 3.38, 3.42, 3.43, 3.47, 3.54• Download CNC Simulator Pro free

			software and test. (LO1)
Week Two: Casting processes, heat treatment and bulk deformation processes (LO1, LO3)	Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1) Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)	Read: <ul style="list-style-type: none"> Chapter 5: Casting Processes and Heat Treatment (LO1, LO3) Chapter 6: Bulk Deformation Processes (LO1. LO3) Chapters 5 & 6 PowerPoint (LO1 & LO3) Watch: <ul style="list-style-type: none"> Chapter 5 YouTube Watch List (LO1) <ol style="list-style-type: none"> DIY Sand Casting: https://www.youtube.com/watch?v=XIRK_SMWX7Y&t=617s Factory Sand Casting: https://www.youtube.com/watch?v=MoTKIQLdtTQ&t=55s Automated Sand Casting: https://www.youtube.com/watch?v=27Uzv5y18ik Lost Foam Casting Animation: https://www.youtube.com/watch?v=GYht8qVcbUs Investment Casting Animation: https://www.youtube.com/watch?v=npHQPXGGkgI Cold Chamber Die-Cast Animation: https://www.youtube.com/watch?v=JLfV_u8HRcY&t=13s Hot Chamber Die-Cast Animation: https://www.youtube.com/watch?v=bzSSfBgkWfc&t=12s Auto Aluminum Die-Cast Process: https://www.youtube.com/watch?v=N6ODcxK8_lg&t=3s Chapter 6 YouTube Watch List (LO1) <ol style="list-style-type: none"> Various Open Die Forging Operations: https://www.youtube.com/watch?v=N6ODcxK8_lg&t=3s Impression-Die Forging Operations: https://www.youtube.com/watch?v=YobXFODkp50 Roll Forming Mill: https://www.youtube.com/watch?v=AuuP8L-Wppl&t=3s Hot Extrusion Animation: https://www.youtube.com/watch?v=vHkwq_2yY9E&t=5s Wire Drawing Animation: https://www.youtube.com/watch?v=pd4Uk8vk09c 	Participate: <ul style="list-style-type: none"> Discussion Board Week 2 (LO1) Assignment: <ul style="list-style-type: none"> Complete Chapter 5 & 6 Assignments (LO1 & LO3) Chapter 5 - 5.1, 5.6, 5.9, 5.30, 5.42, 5.61, 5.62, 5.78, Chapter 5 - 6.1, 6.14, 6.22, 6.41, 6.53, 6.114, 6.122, 6.128 Complete milling and turning tutorials in simulator software (LO1)

Week Three: Machining Processes (LO1, LO3)	Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1) Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)	Read: <ul style="list-style-type: none"> Chapter 8 Machining Processes (LO1 & LO3) Chapter 8 PowerPoint (LO1 & LO3) Watch: <ul style="list-style-type: none"> Chapter 8 YouTube Watch List (LO1) 1. Material Chip Formation: https://www.youtube.com/watch?v=mRuSYQ5Npek&t=5s 	Participate: <ul style="list-style-type: none"> Discussion Board Week 3 (LO1) Assignment: <ul style="list-style-type: none"> Complete Chapter 8 Assignments (LO1 & LO3)
		2. Animated Lathe Operations: https://www.youtube.com/watch?v=HmP3Qy7n2eI&t=13s 3. Basic Turning on a Manual Lathe: https://www.youtube.com/watch?v=Vm5Chb_2JxA&pbjreload=10 4. Drilling Processes: https://www.youtube.com/watch?v=f5HfRpeT7Fg 5. Animated Milling Cutters: https://www.youtube.com/watch?v=LDxq9AkxYfk 6. Animated Vertical Milling Machine Operations: https://www.youtube.com/watch?v=9UtKxZc3Mjw 7. CNC Mill-Turn Machining Center: https://www.youtube.com/watch?v=70qeRWi9bYs 8. Broaching: https://www.youtube.com/watch?v=rAJx-6SLdPQ	<ul style="list-style-type: none"> Chapter 8 - 8.13, 8.16, 8.35, 8.46, 8.49, 8.67, 8.82, 8.95, 8.102, 8.105, 8.109, 8.120, 8.125, 8.129, 8.130, 8.150 Project: <ul style="list-style-type: none"> Milling and Turning CNC (LO1)

<p>Week Four: Sheet metal processes and abrasive and other material removal processes (LO1, LO3)</p>	<p>Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1)</p> <p>Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)</p>	<p>Read:</p> <ul style="list-style-type: none"> Chapter 7: Sheet Metal processes (LO1, LO3) Chapter 9: Abrasive and Other Material Removal Processes (LO1, LO3) PowerPoint (LO1 & LO3) <p>Watch:</p> <ul style="list-style-type: none"> Chapter 7 YouTube Watch List (LO1) 1.Compound Die Animation: https://www.youtube.com/watch?v=LKEG3p3yx1g&t=3s 2.Progressive Die Animation: https://www.youtube.com/watch?v=8LmwXRpsH7s&t=3s 3.Progressive Die Operation: https://www.youtube.com/watch?v=U8d3YCtr5pA&t=34s 4.Progressive Deep Drawing Animation https://www.youtube.com/watch?v=lm317kHM5U4 5.Aluminum Can Manufacturing: https://www.youtube.com/watch?v=8PITSdTY85I Chapter 9 YouTube Watch List (LO1) 1.How Grinding Wheels are Made: https://www.youtube.com/watch?v=ggMi0Ym6fnM&t=4s 2.Surface Grinder Animation: https://www.youtube.com/watch?v=6_KK_hnSlks 3.Chemical Etching Animation: https://www.youtube.com/watch?v=2O1TyJGXuWY 4.How Wire EDM Works: https://www.youtube.com/watch?v=pBueWfzb7P0&t=4s 5.Water Jet Operation: https://www.youtube.com/watch?v=viEUqlFUQ44 	<p>Participate:</p> <ul style="list-style-type: none"> Discussion board post week 4 (LO1) <p>Assignment:</p> <ul style="list-style-type: none"> Complete Chapter 7 & 9 Assignments (LO1 & LO3) Chapter 7 - 7.11, 7.13, 7.34, 7.45, 7.55, 7.70, 7.77, 7.83, Chapter 9 - 9.1, 9.25, 9.40, 9.44, 9.50, 9.66, 9.70, 9.74
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<p>Week Five: Polymer Processing and Additive Manufacturing (LO1, LO3)</p>	<p>Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1)</p> <p>Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)</p>	<p>Read:</p> <ul style="list-style-type: none"> Chapter 10: Polymer Processing and Additive Manufacturing (LO1 & LO3) Chapter 10 Power Point (LO1 & LO3) <p>Watch:</p> <ul style="list-style-type: none"> Chapter 10 YouTube Watch List (LO1) 1. Plastic Extrusion Animation: https://www.youtube.com/watch?v=k7lb-w7o06s 2. Plastic Tubing Extrusion: https://www.youtube.com/watch?v=wE_KTLIrdMA&t=7s 3. Plastic Injection Molding Animation: https://www.youtube.com/watch?v=b1U9W4iNDiQ 4. Plastic Injection Molding: https://www.youtube.com/watch?v=RMjtmsr3CqA 	<p>Participate:</p> <ul style="list-style-type: none"> Discussion board post week 5 (LO1) <p>Assignment:</p> <ul style="list-style-type: none"> Complete Chapter 10 Assignment (LO1 & LO3) Chapter 10 - 10.1, 10.6, 10.12, 10.24, 10.38, 10.48, 10.49, 10.63, 10.65, 10.68, 10.90, 10.95, 10.96, 10.98, 10.102, 10.114
<p>Week Six: Metallurgy, processing and fastening processes (LO1, LO3)</p>	<p>Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1)</p> <p>Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)</p>	<p>Week Six:</p> <ul style="list-style-type: none"> Chapter 11: Powder Metallurgy and Processing of Ceramics and Glasses (LO1, LO3) Chapter 12: Joining and Fastening Processes (LO1, LO3) Chapters 11 & 12 PowerPoint (LO1 & LO3) <p>Watch:</p> <ul style="list-style-type: none"> Chapter 11 YouTube Watch List (LO1) 1. Powder Metallurgy Cycle Animation: https://www.youtube.com/watch?v=eM49JlmFp0 2. Powder Metallurgy Process: https://www.youtube.com/watch?v=N4-kfSD6XJI Chapter 12 YouTube Watch List (LO1) 1. How Arc Welding Works: https://www.youtube.com/watch?v=TeBX6cKKHWY&t=13s 2. Resistance Welding Animation: https://www.youtube.com/watch?v=66-RK0DPXfU&t=5s 	<p>Participate:</p> <ul style="list-style-type: none"> Discussion board post week 6 (LO1) <p>Assignment:</p> <ul style="list-style-type: none"> Complete Chapter 11 & 12 Assignments (LO1 & LO3) Chapter 11 - 11.3, 11.4, 11.7, 11.34, 11.66, 11.67, 11.86, 11.107, Chapter 12 - 12.2, 12.13, 12.30, 12.83, 12.92, 12.96, 12.102, 12.108 <p>Project:</p> <ul style="list-style-type: none"> Your Milling and Turning Simulations Due (LO1)

Week Seven: Tribology, metrology, product quality and automation. (LO1, LO3, LO4)	<p>Identify basic manufacturing machinery and processes that can economically produce various types of products (LO1)</p> <p>Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)</p>	<p>Read:</p> <ul style="list-style-type: none"> Chapter 4: Tribology, Metrology, and Product Quality (LO4) Chapter 14: Automation of Manufacturing Processes and Operations (LO1 & LO3) Chapters 4 & 14 PowerPoint (LO1, LO3, & LO4) <p>Watch:</p> <ul style="list-style-type: none"> Chapter 14 YouTube Watch List (LO1) 1.Industrial Robots at Audi: https://www.youtube.com/watch?v=rbki4HR41-4 	<p>Participate:</p> <ul style="list-style-type: none"> Discussion board post week 7 (LO1) <p>Assignment:</p> <ul style="list-style-type: none"> Complete Chapter 4 & 14 Assignments (LO1, LO3, LO4) Chapter 4 - 4.2, 4.17, 4.30, 4.32, 4.41, 4.61, 4.63, 4.68
	<p>Describe basic material characteristics and the related testing procedures used to assess their properties (LO4)</p>	<p>2.Industrial Robots at Tesla: https://www.youtube.com/watch?v=WYnOGAvQEgk 3.Amazon Order Picking Robots: https://www.youtube.com/watch?v=Ox05Bks2Q3s</p>	<ul style="list-style-type: none"> Chapter 14 - 14.1, 14.5, 14.14, 14.26, 14.29, 14.52, 14.53,,
Week Eight: Competitive Aspects of Product Design and Manufacturing (LO3)	<p>Explain various tradeoffs and economic factors affecting manufacturing processes while considering costs, processing, and product function (LO3)</p>	<p>Read:</p> <ul style="list-style-type: none"> Chapter 16 Competitive Aspects of Product Design and Manufacturing (LO3) Chapter 16 PowerPoint (LO3) 	<p>Assignment:</p> <ul style="list-style-type: none"> Complete Chapter 16 assignments (LO3) Chapter 16 16.1, 16.4, 16.6, 16.8, 16.23, 16.35, 16.36 <p>Final Exam – (LO1, LO2, LO3, LO4)</p>

