

Spring 2021

ME 678-102: Engineering Design of Plastic Products

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ME-678-102 ENGINEERING DESIGN OF PLASTICS PRODUCTS

SPRING 2021

Virtual Class Day and Time: Thursday: 6:00 PM – 8:20 PM, via WebEx

Login Information: njit.webex.com

Virtual classroom Access Code: 920 274 937

Host: Prof. K. Albert Narh, Phone: (973) 596-3353, Email: kwabena.a.narh@njit.edu

TEXTBOOK: Engineering Design with Polymers and Composites, James C. Gerdeen, Harold W. Lord and Ronald A.L. Rorrer (2012), 2nd Edition; ISBN: 978-1-4398-6052-6

REFERENCE BOOKS

1. Plastics Product Design and Process Engineering, Harold Belofsky, Hanser/Gardner, (1995)
2. Moldflow Design Guide by Jay Shoemaker (Ed.)
3. Plastics Part Design for Injection Molding by R.A. Malloy, Hanser/Gardner
4. Mechanical Properties of Polymer and Composites, L.E. Nielsen and R.F.Landel, Mercel Dekker, Inc.1994
5. Design and Manufacture of Plastic Parts, R.L.E. Brown, John Wiley & Sons, New York, 1980
6. Principles of Polymer Engineering, by N.C. McCrum, C.P. Buckley and C.B. Bucknall.

For some useful simulations on characteristics of Polymers, Check out the following Case Western Reserve University website: <http://plc.cwru.edu/tutorial/enhanced/main.htm>

HOMEWORK: About 6 in total. Homework assignments are usually due one week after posting on canvas. Late homework submission will not be accepted except in the case of a prior excuse. Solutions will be discussed in virtual class and solutions will be posted on canvas. Homework submissions are via canvas as email attachment

FINAL GRADE: Course average is based on term exams, homework and a design project Report.

<u>Item</u>	<u>Weight (%)</u>
Exam 1	25
Homework	15
Design Project	30
Final Examination	30

GRADING SCALE: The grading scale will be as follows: A (90-100); B⁺ (85-89); B (80-84); C⁺ (75-79); C (70-74); D (56-69) (not applicable for graduate course); F (≤55)

CLASS RULES: Late Homework submissions NOT ALLOWED.

Virtual Office Hours: Tuesday 2:00 PM - 3:00 PM, via WebEx (same login info and Access code).

NJIT STUDENT HONOR CODE

THIS WILL BE STRICTLY ENFORCED. ANY PLAGIARISM WILL BE REPORTED TO DEAN OF STUDENTS, AND THE CULPRIT WILL BE BANNED FROM SUBMITTING HOMEWORK SOLUTIONS HENCE FORTH.

PLAGIARISM IS PRESENTING THE WORK OF OTHERS AS ONE’S OWN.

NOTE: All the above items may be subject to change on the instructor's discretion.
(For example, the Grading Scale may be adjusted to reflect the class average.)

Week	TOPICS	Reading Material
<p>1,2</p> <p>1/21/2021, 1/28/2021</p>	<p>Introduction/Overview to Plastics</p> <p>Definitions and Classifications</p> <p>Thermoplastics, Thermosets, Elastomers (Rubbers): Family Characteristics</p> <p>Special Systems: Liquid crystalline polymers, Copolymers (random, block, graft), Polyalloys (blends and alloys); Cross-linking</p> <p>Physical States and Transitions:</p> <p>States: Melt; Solid; Crystalline State, Amorphous (Glassy and Rubbery States): Crystallinity and its Measurement</p> <p>Thermal Transitions: 1) Glass Transition Temp. T_g; 2) Melting Temp. T_m</p> <p>Molecular weight and molecular weight distribution.</p> <p>Measurements of T_g and T_m</p>	<p>Textbook Chapter 1</p> <p>Textbook Chapter 1</p> <p>Textbook Chapter 1</p> <p>Belofsky Chapter 4</p>
<p>3,4</p> <p>2/04/2021, 2/11/2021</p>	<p>Mechanical Properties of Solid Polymers</p> <p>Time-Independent Properties: short-term Properties: Tensile Properties;</p> <p>Stress-Strain Relations; Flexural, Compressive, Shear, Hardness.</p> <p>Factors Affecting Short-Term Properties: Temp, Strain Rate, MW, Cross-Linking</p> <p>Time-Dependent Properties:</p> <p>Short Term Properties: Impact Properties; Long Term Properties: Creep/Stress Relaxation; Fatigue</p>	<p>Textbook Chapter 2</p> <p>Textbook Chapter 4</p>
<p>5,6</p> <p>2/18/2021, 2/25/2021</p>	<p>Viscoelasticity: Creep/Stress Relaxation (Details), Mechanical and Models.</p> <p>Additives and Modifiers - Effect on properties. Composites - reinforcing fibers, Mechanics of fiber reinforcement</p>	<p>Textbook Chapter 3</p> <p>Textbook Chapter 6</p>

7 3/04/2021	Fundamentals of Melt Rheology: Classification of fluid behavior, Generalized Newton’s Law of Viscosity, Effect of temperature and pressure on melt viscosity, Effect of molecular weight and MWD on viscosity, Viscosity, Equation, Power Law fluids, Flow models: How to interpret rheology graphs	Belofsky Chapter 7
8 3/11/2021	Fracture Mechanics of Polymers	
9 3/14/2021- 3/21/2021	SPRING RECESS	SPRING RECESS
10 3/25/2020	Exam 1	
11 4/01/2021	Non-Mechanical Properties: (a) Thermal Properties Design Project: Computer Lab	Chapter 7 Autodesk Moldflow
12 4/08/2021	Non-Mechanical Properties: (b) Optical, Electrical and Environmental Properties Design Project: Computer Lab	Belofsky Chapter 6 Autodesk Moldflow
13-15 4/15/2021- 4/22/2021	Design Project: Computer Lab	Autodesk Moldflow
15 (5/06/2021)	Project Reports Due	Reading Day 2
Final Examination (Open Books, Open notes) Date: 5/TBD/2021 Time: 6:00-8:30pm		

*The reading assignments for the textbook are listed in the syllabus. Unfortunately, there are topics that will be covered that are not covered as well as I would like or are not covered at all. I will supplement the textbook material via lectures, reference books, and via handouts of additional material. **Students will be contacted before any changes are made to the above syllabus.***