COURSE NUMBER	**ME 470**
COURSE TITLE	**Engineering Materials and Processes**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	**Kwabena A. Narh**
COURSE DESCRIPTION	Students will learn the unique properties of the various commercial thermosetting and thermoplastic resins. An introduction to viscoelastic theory and its relationship to measurable properties of plastics. Other engineering properties such as fatigue resistance, flammability, chemical resistance, and electrical properties will be presented. Material selection procedure for design of plastic products will also be presented.
PREREQUISITE(S)	ME 215 - Strength of Materials MECH 237 - Engineering Materials and Processes
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Elective
REQUIRED MATERIALS	Principles of Polymer Engineering, N.G. McCrum, C.P. Buckley and C.B. Bucknall, Hanser Publishers, New York, 1997.
Other supplemental materials (not Required)	1. Mechanical Properties of Polymer and Composites, L.E. Nielsen and R.F. Landel, Mercel Dekker, Inc. 2. Plastics Product Design and Process Engineering, Harold Belofsky, Hanser/Gardner, (1995)
COMPUTER USAGE	Use of Autodesk Moldflow for troubleshooting plastics manufacturing problems.

COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRITERIA:	Course Learning Outcomes	SOs[*]	Expected Performance Criteria
	1 **identify** different classes of plastics for engineering purposes	1	**Homework Assignment** (80% of the students will earn a grade of 70% or better on this project)
	2. **identify** specific plastics properties for design purposes	1	**Competency Question** (A question designed to assess achievement of a CLO that is so central to the course that only a 100% correct solution is acceptable for demonstrating that the student has acquired this competency)
	3. **use** polymer handbooks, manufacturers' website, etc in	1, 6	**Design Project** (80% of the students will earn

finding plastics properties			a grade of 70% or better on this project)
4. **identify** which property factor must be considered for a specific product	1, 2		**Exam Question** (80% of the students will earn a grade of 70% or better on this question)
5. **evaluate** effects of environmental conditions on plastic products	3		**Report** (80% of the students will earn a grade of 70% or better on the report)
6. **evaluate** the effects of plastics waste streams on environment	3		**Same as 5**
7. **perform** productivity analysis, for troubleshooting the manufacturing process	1, 2, 4, 6		**Project** (80% of the students will earn a grade of 70% or better on this project)

CLASS TOPICS	0. Introduction to Plastics: classification of plastics - commodity, engineering, specialty. Mechanical Properties of Plastics. 1. Molecular weight and Molecular weight distribution -measure and statistical analysis. 2. Physical Properties - density, viscosity, effect temperature and pressure. 3. Viscoelasticity - physical models, mathematical models, constitutive equations, application to real situations, stress relaxation, shear recovery, relevance to design. 4. Mechanical Properties of Plastics - tensile, flexural, compressive, shear, impact, fatigue, creep, complex, strengths and moduli, measurement and test methods, relevance of data to design, effect of temperature. 5. Electrical Properties - comparative tracking index, dielectric strength, arc resistance measurement and test methods. 6. Thermal properties - specific heats, thermal conductivity and diffusivity, measurement, differential scanning calorimetry (DSC). 7. Environmental testing: weathering, chemically aggressive environment, Flammability & Combustion. 8. Additives - effect on properties. Alloys - synergisms. Composites - reinforcing fibers, orientations, anisotropy, laminates. 9. Materials Selection: Properties for Design. 10. Design Project..

STUDENT OUTCOMES (SCALE: 1-3)	1	2	3	4	5	6	7
	3	3	1	3		2	

3 – Strongly supported   2 – Supported   1 – Minimally supported

*Student Outcomes