1. MME 4310 Polymer Engineering (4371 Special Topics for F17 and F18)

2. 3 Credit Hours, 3 Lecture

3. Associate Prof. David A. Roberson

4. Introduction to Polymers, Third Edition by Robert J. Young and Peter A. Lovell., 2011

5. Specific course information
   a. The course provides a basic introduction to the field of polymer science. Basic concepts of organic chemistry address typical polymerization and copolymerization reactions. The characterization of polymer molecules include discussions of thermodynamic solutions, solubility parameters, colligative properties and scanning electron microscopy. Concepts on the structure and properties of bulk polymers emphasize its relationship to molecular characteristics and manufacturing processes.
   b. MME3407
   c. Elective

6. Specific goals for the course
   a. Learning Outcomes
      - Associate Polymer structure with Mechanical Properties. Articulate the concepts of Polymerizatioin Glass transition, Tan Delta, dynamic mechanical analysis. Classification of Polymers. (Test 1)
      - Define the types of polymer processing methods and associate the differences in processing techniques between different polymer types. Discuss crystallinity in polymers. Understand the concepts related to polymer blending. Explain the effect of interchain bonding on mechanical properties. Connect molecular weight with data obtained from melt flow indexing. (Test 2)
      - Associate mechanical properties of polymers with failure modes. Apply fractography in the failure analysis of polymeric components. (Test 3.)
      - Crosslinking experiment, Shape memory polymer experiment, Polymerization, ATR, Melt flow index, Polymer extrusion, Polymer impact testing (Experiments)

   b. Student Outcomes

	Outcome	Level*	Relevant Activities
1.	(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics	**H**	Interpret instrumentation data in order to characterize structure, property, and process history of materials.
2.	(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	**M**	The health effects of polymeric materials are covered in class.

	global, cultural, social environmental, and economic factors.		
3.	(3) an ability to communicate effectively with a range of audiences	**H**	Students presented lab group activities and fielded questions from various guest observers.
4.	(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	**M**	The effect of mankind's use of polymeric materials is covered in this course.
5.	(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.	**H**	Most assignments are group assignments.
6.	(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions	**H**	Multitude of hands-on activities to grasp the concepts of polymerization, mechanical behavior of polymers, and shape memory polymers.
7.	(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	**L**	Exposure to modern manufacturing techniques such as additive manufacturing occurs in this class.

7. Brief list of topics to be covered

- Introduction to polymers
- ***The Basics:*** Nomenclature, basic polymeric structure
- Polymerization
- Polymer bending
- Polymer rheology
- Thermoplastic composites
- Polymer Additive Manufacturing Processes
- Mechanical properties
- Failure analysis
- Shape memory polymers