BE 526/726, MW 10-12, Fall 2009
PHO 202

Professors Wong and Grinstaff
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The primary objective of this course is to teach the chemistry and engineering skills needed to solve challenges in the biomaterials and tissue engineering area. This two semester course (Biomaterials 526/726 and 527/727) is divided into four sections – macromolecular chemistry & material science, physical characterization & properties, materials & biology, and focused biomaterial sections. Biomaterials 726 will concentrate on fundamental principles in biomedical engineering, material science, and chemistry. Specifically, the course will cover the structure and properties of hard materials (ceramics, metals) and soft materials (polymers, hydrogels). For each section, we will provide a theoretical description of the relevant phenomena, give examples of experimental measurements, highlight specific applications, and discuss the physiological requirements/relevance. In **only 726,** there will be a weekly laboratory section that will cover principles of biointerface science and technology.

Syllabus

	NO CLASS		WED 9/2
Lecture	Introduction to Materials in Medicine / Logistics General Biomaterials; Polymers	*Grinstaff*	WED 9/9
Lecture	Polymer structure; Mech Properties; Tg	*Grinstaff*	MON 9/14
Lecture	Mechanical Properties; Composites	*Grinstaff*	WED 9/16
Lab 1 Alginate Part I (Material Preparation)			
Lecture	Hip Implants and Metals	*Grinstaff*	MON 9/21
Lecture	Viscoelasticity	*Grinstaff*	WED 9/23
Lab 2 Alginate Part II (Material Characterization)			
Lecture	Crystal structures	*Grinstaff*	MON 9/28
Lecture	Phase Diagrams	*Grinstaff*	WED 9/30
Lecture	Ternary Phase Diagrams	*Grinstaff*	MON 10/5
Lecture	Exam Review	*Grinstaff*	WED 10/7
Lecture	EXAM 1	*Grinstaff*	TUE 10/13
Lab 3 Poly(HEMA) synthesis			
Lecture	Polymer Introduction and Natural Polymers I (alginate, chitin, collagen, silk, etc)	*Grinstaff*	WED 10/14
Lecture	Natural Polymers II (proteins, genetic engineering, etc)	*Grinstaff*	MON 10/19
Lab 4 Poly(HEMA) characterization			
Lecture	Condensation Polymerizations (polyesters, polyamides, polyethers.	*Grinstaff*	WED 10/21

	mechanisms, etc)		
Lecture	Free Radical Polymerization (PMMA, kinetics, mechanisms, etc	*Grinstaff*	MON 10/26
Lecture	Ring-opening Polymerizations (PLA, PGA, PCA, etc) & Copolymerizations (block, graft, etc	*Grinstaff*	WED 10/28
Lecture	Fibers/Hydrogels/ Scaffolds	*Grinstaff*	MON 11/2
Lecture	Degradation	*Grinstaff*	WED 11/4
Lecture	Exam Review	*Grinstaff*	MON 11/9
Lab 5 Poly(caprolactone) synthesis			
Lecture	EXAM 2	*Grinstaff*	MON 11/16
Lab 6 Poly(caprolactone) purification			
Lecture	Surface vs. bulk; surface tension; Law of LaPlace	*Wong*	WED 11/18
Lab 7 Poly(caprolactone) characterization			
Lecture	Surface characterization	*Wong*	MON 11/23
Lecture	Self-assembly; CMC	*Wong*	MON 11/30
Lecture	Intermolecular and surface forces I	*Wong*	WED 12/2
Lab 8 Materials synthesis; DLS			
Lecture	Intermolecular and surface forces II	*Wong*	MON 12/7
Lecture	EXAM 3	*Wong*	WED 12/9
Lab 9 Contact angle			