Onsite Research Seminar Syllabus

1. Overview

Title	**Engineering the Future and Plastic Electronics**	
Mode	Professor Sessions & Teaching Fellow Sessions	
Prerequisites	Required course/knowledge	Introductory physics, chemistry, and biology. Introductory Engineering topics
	Recommended Materials for preparing for the course	Background reading on introduction to engineering, microscopy, sensors, data science, 3D printing. Background reading on introduction to polymers

2. Program Introduction and Objectives

Course Description	**PART 1:** A selection of cutting-edge tools is rapidly expanding the possibilities for critical technology development and applications. From consumer electronics to aerospace to healthcare to business, these emerging tools are shaping the technology of tomorrow. This course will explore the engineering and science concepts behind these tools and techniques. Together we will explore how three critical advances: i) 3D printing, ii) electronic sensors and sensor networks and iii) artificial intelligence for engineering are shaping the world to come. **PART 2** (in person only)**:** A new age of electronic devices made with plastic-like materials that can conduct electricity and emit light is quickly changing what is possible. From consumer electronics like televisions and smartphones to medical implants for brain-machine interfaces, this emerging class of "plastic electronics" is at the forefront of the technology of tomorrow. This course will explore the science behind these materials as well as their applications. Together we will answer questions such as how do plastic electronics conduct electricity? How do they emit light? What is an LED? How does a plastic solar cell work? What is a brain-machine interface? How can medicine benefit from plastic electronics?
Software/Tools (if any)	

3. Program Schedule

Session	Session I (by Professor)		Reading Materials
1 (online)	**Topic**	**Introduction to engineering tools and future technology trends**	
	Detail	-Engineering challenges for the future -historical engineering concepts and tools -emerging engineering tools -key examples -manufacturing -characterization -big data -Final projects	
2 (online)	**Topic**	**3D Printing**	
	Detail	-Recap lecture 1 key points -What is 3D printing -Why does it matter -Overview primary methods -Material classes -Material characterization -Example problems -Example applications	
3 (onsite)	**Topic**	**Introduction to plastic electronics and key applications**	
	Detail	-plastic properties -traditional electronics -plastic electronics -key applications -lights, displays -solar cells -medical devices -computers -how they are made -Final projects	
4 (onsite)	**Topic**	**Electronic sensors and sensor networks**	
	Detail	-Recap lecture 2 key points -Intro to electronic sensors and networks -Types of sensors -Internet of things -Sensor applications -Software interface -Case studies	
5	**Topic**	**Light from plastic electronics**	

(onsite)	**Detail**	Recap lecture 1 key points -What is light -How do electric lights work -What is an LED -Plastic LED (OLED) -Overview of device physics -unique properties -tunable color -flexibility -processability - cost -Example applications	
6 **(onsite)**	**Topic**	**Artificial intelligence for engineering**	
	Detail	-Review lecture 3 key points - What is artificial intelligence - Relate AI in engineering -data, data in engineering -Image analysis -Material design -Sensor feedback loops -Industry examples	
7 **(onsite)**	**Topic**	**Solar power from plastic electronics**	
	Detail	-Recap lecture 2 key points -Power from light -Solar cells -Plastic solar cells -Physics overview -unique properties -tunable color -flexibility	
8 **(onsite)**	**Topic**	**Solar power in practice**	
	Detail		
9 **(onsite)**	**Topic**	**Plastic electronics for medical applications**	
	Detail	Review lecture 3 key points -Electronics in medicine -Brain machine interfaces -Key biology/medical concepts -Plastic electronics for biology -unique properties -ion conductivity -mechanical properties -sensitivity -Example applications	

10 (onsite)	**Topic**	**Recent advances in bioelectronics**	
	Detail		
11 (onsite)	**Topic**	**discussing research papers**	
	Detail		
12 (onsite)	**Topic**	**Some sort of review activity**	
	Detail		
13 (onsite)	**Topic**	**Final Project Discussion Session**	
	Detail	1) determine project idea 2) outline project report 3) divide responsibilities among group members	
17 (onsite)	**Topic**	**Final presentation in person**	
	Detail		
18 (onsite)	**Final Presentation**		

Session	Date	Session II (by Teaching Fellow)
1 (online)	**Sun July 2**	
2 (online)	**Sun July 9**	
3 (onsite)	**Mon July 17**	
4 (onsite)	**Tue July 18**	
5 (onsite)	**Fri July 21**	
6 (onsite)	**Tue July 25**	

4. Assignments

Requirements	Assignment 1： Assignment 2： Assignment 3：
Submission Deadline	____ hours/days after distribution/ announcement

Does the teaching fellow need to grade assignment(s)?	Yes ( )	No ( )
Will standard answers be provided?	Yes ( )	No ( )

5. Final Oral and Written Project

Detailed requirements of the final project:

- Grouping: individual/group work (please advise the group size)
- Topic(s)
- ...

5.1 Final Oral Presentation

- Oral Project Requirements (e.g: if slides needed; Format; Criteria; Deadline):

5.2 Final Written Report

- Written Project Requirements (e.g: word count; style; criteria; Deadline):

6. Evaluation

Percentage basis of evaluation (total: 100%):
Participation: _____;
Assignments: _____;
Final Project: _____ (Oral: _____; Written: _____).