



Course Syllabus: Advanced Topics in Circuits & Microsys. - EE 391A

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 391A
Course Title	Advanced Topics in Circuits & Microsys.
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	02:30 PM - 04:00 PM Mon Wed

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Muhammad Mustafa Hussain	MuhammadMustafa.Hussain@Kaust.edu.sa	+966128084450		M/W 1:15 – 2:15 PM

Teaching Assistant(s)	
Name	Email
TBD	TBD

Course Information	
Comprehensive Course Description	For nearly two decades, there has been a rising interest in the scientific community about physically flexible and stretchable electronics. Initial approaches have focused on innovation in material and chemistry. With the scientific breakthrough in organic and molecular electronics, more tractions have been observed in this general class of emerging electronics. Today organic light emitting diode (OLED) based displays are commercially available. However, to overcome some fundamental challenges related to limited mobility and stability, scientific community has reenergized their interest through 1D (nanotubes and wires), 2D (graphene, dichalcogenides) and amorphous oxide semiconductor materials based low thermal budget compatible flexible and stretchable electronics. While many breakthroughs have been observed in the area of energy harvesting, storage and sensors, limited demonstrations can be found focusing comprehensive approach on fully flexible and stretchable electronic system development to initiate a new branch of electronic applications. In that regard, traditionally reliable but rigid mono-crystalline thin film electronic materials such as silicon, silicon germanium, III-V, gallium nitride based electronics are being investigated for flexible and stretchable electronics. Exciting progress has been made. Overall the subject area is exciting and multi-disciplinary as it bridges many different corners of the scientific community. It is therefore, a complex task to present a neutral and comprehensive course work in one semester on these variety of topics. Therefore, for the first time, in this course we will study physics and mechanics, materials and chemistry, devices and circuits and finally system level integration aspects of flexible, stretchable and reconfigurable electronics. I personally believe the attempt and the effort will be humble and rewarding.
Course Description from Program Guide	
Goals and Objectives	The goals and objectives of this course is to spark interest and quench the “interest and excitement thirst” of students about the emerging class of flexible, stretchable and configurable electronics focusing on wearable, implantable, bioresorbable and other innovative applications.
Required Knowledge	College level knowledge on Physics, Chemistry, Mathematics and Biology. Knowing about electronic devices, optoelectronics, semiconductor physics, microfabrication and/or electronic circuits is a bonus.
Reference Texts	Recent review and journal + conference papers.

Method of evaluation	40.00% - Homework /Assignments 60.00% - Final exam
Nature of the assignments	All: assigned reading, case study, paper presentation, group project, written assignment, etc.
Course Policies	<ul style="list-style-type: none">-Presence in the lab (if appropriate) during group project is mandatory.-Presence in the lectures is highly encouraged.-Late work submission is not accepted unless there is natural disaster, personal injury, family distressed situation, university closer.-Every submission is individual except group project.
Additional Information	N/A

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/23/2017 Wed 01/25/2017	Introduction on flexible electronics Introduction on stretchable electronics
2	Mon 01/30/2017 Wed 02/01/2017	Materials – flexible solid state monocrystalline electronics Materials – flexible amorphous oxide electronics
3	Mon 02/06/2017 Wed 02/08/2017	Materials – flexible and stretchable 2D electronics Materials – flexible 1D electronics <u>Home work posted (due in one week from posting date).</u>
4	Mon 02/13/2017 Wed 02/15/2017	Materials – flexible organic electronics Printed electronics
5	Mon 02/20/2017 Wed 02/22/2017	Flexible and stretchable logic devices Flexible and stretchable memory Home work posted (due in one week from posting date).
6	Mon 02/27/2017 Wed 03/01/2017	Flexible and stretchable RF electronics Flexible and stretchable sensors
7	Mon 03/06/2017 Wed 03/08/2017	Flexible and stretchable displays Flexible and stretchable photovoltaic Home work posted (due in one week from posting date).
8	Mon 03/13/2017 Wed 03/15/2017	Flexible and stretchable energy harvesters Flexible and stretchable energy storage
9	Mon 03/20/2017 Wed 03/22/2017	3D printed embedded electronics Transient electronics Home work posted (due in one week from posting date).
10	Mon 03/27/2017 Wed 03/29/2017	Artificial skin Implantable electronics
11	Mon 04/03/2017 Wed 04/05/2017	Spring break: no class
12	Mon 04/10/2017 Wed 04/12/2017	No class
13	Mon 04/17/2017 Wed 04/19/2017	Robotics and vehicular technology flexible and stretchable electronics and systems Human-machine interfacing
14	Mon 04/24/2017 Wed 04/26/2017	Wearable electronics Performance and reliability Home work posted (due in one week from posting date).
15	Mon 05/01/2017 Wed 05/03/2017	No class
16	Mon 05/08/2017 Wed 05/10/2017	No class
17	Mon 05/15/2017 Wed 05/17/2017	Final Exam
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Note

The instructor reserves the right to make changes to this syllabus as necessary.