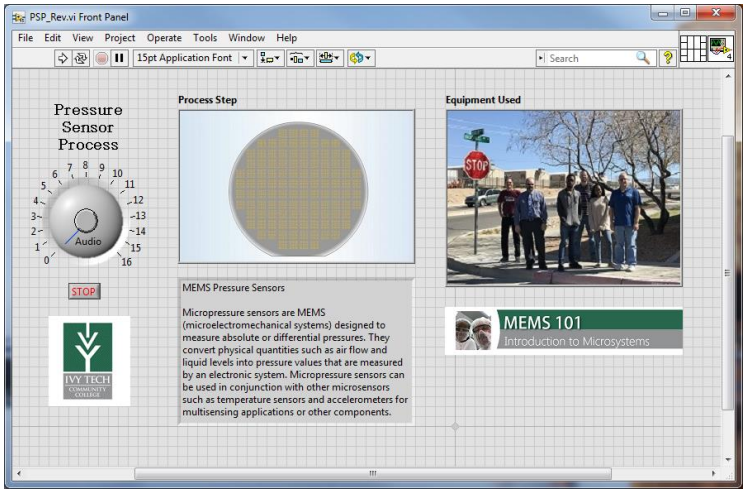
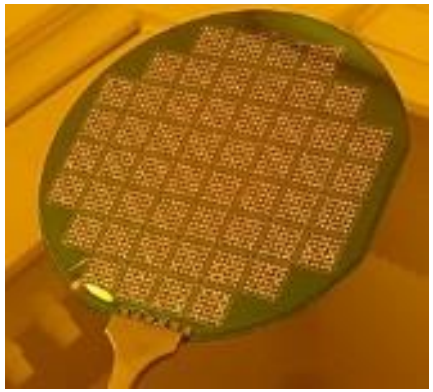
Development of MEMS Course Content using LabView and Arduino

Andrew G. Bell





July 20, 2017

IVY TECH COMMUNITY COLLEGE

CHANGING LIVES
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Ivy Tech Community College is Indiana's largest public postsecondary institution and the nation's largest singly accredited statewide community college system. Ivy Tech serves nearly 170,000 students annually and has campuses throughout Indiana.

We offer TC, AS and AAS degrees in:

Electrical Engineering Technology
Mechanical Engineering Technology
Engineering Technology
Pre- Engineering
Nanotechnology
Design Technology
Electronics and Computer Technology

over 40 degree programs

https://www.ivytech.edu/

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Ivy Tech started its associating with SCME in the Fall of 2012 and has been a Co-PI on Southwest Center for Microsystem Education (SCME) NSF ATE Grant.

MEMS Kits Implementation Plan IVY TECH (Fort Wayne & Valparaiso)								
	MEMS Kit	**ENGT 120**	**METC 111**	**METC 143**	**EECT 111**	**EECT 112**	**ENGR 251**	**ENGT 279**
1	MEMS: Making Micro Machines Kit	X						
2	Dynamic Cantilever Kit		X	X			X	
3	Crystallography Kit			X				
4	Pressure Sensor Model Kit	X			X	X	X	
5	GeneChip Model Kit	X						
6	MEMS Innovators Kit							X
7	Lift-off Kit			X	X			
8	Pressure Sensor Process Kit				X			
9	LIGA Micromachining Simulation Kit			X				
10	Anisotropic Etch Kit			X	X			
11	Rainbow Wafer Kit	X						

The scope of our effort was to integrate the SCME material into some of our engineering programs courses

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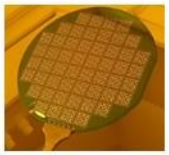
Three new MEMS courses are being developed and taught this summer as part of the NSF ATE grant (DUE 1400470)

MEMS 101
Introduction to Microsystems

Method of Instruction – Classical approach with lectures, labs and quizzes



MEMS 102
Microsystems Characterization

Method of Instruction – some lectures, multiple artifact generation, discovery based

MEMS 103
Microsystems and Electronics

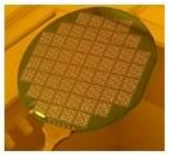
Method of Instruction – Minimal lectures, discovery based, all labs

SCME Southwest Center for Microsystems Education

MEMS courses have been added to the Ivy Tech course listing and can be used with other course to earn a TC in Electronics and Computer Technology

MEMS 101
Introduction to Microsystems

Technology used – many SCME lectures and kits, some LabView



MEMS 102
Microsystems Characterization

Technology used – LabView, PSPICE Model Editor, Engauge, Multisim

MEMS 103
Microsystems and Electronics

Technology used – LabView, Arduino, sensors and modifies SCME kits

SCME Southwest Center for Microsystems Education

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Developed 8 learning modules based on SCME kits, videos and materials.

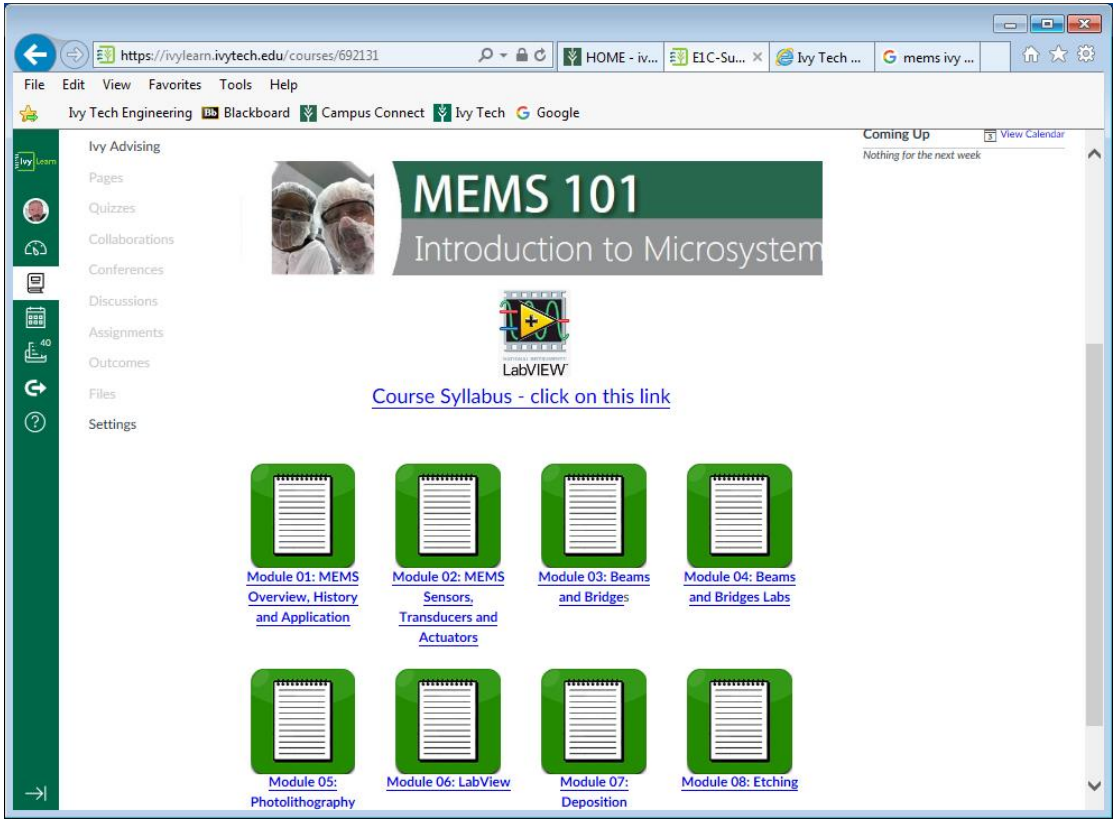
Introduced LabView

LMS – Canvas (IvyLearn)

LabView –student license

SCME Kits - 3 kits used with plan to use more

SCME Modules ~ 22 lectures and YouTube vids.



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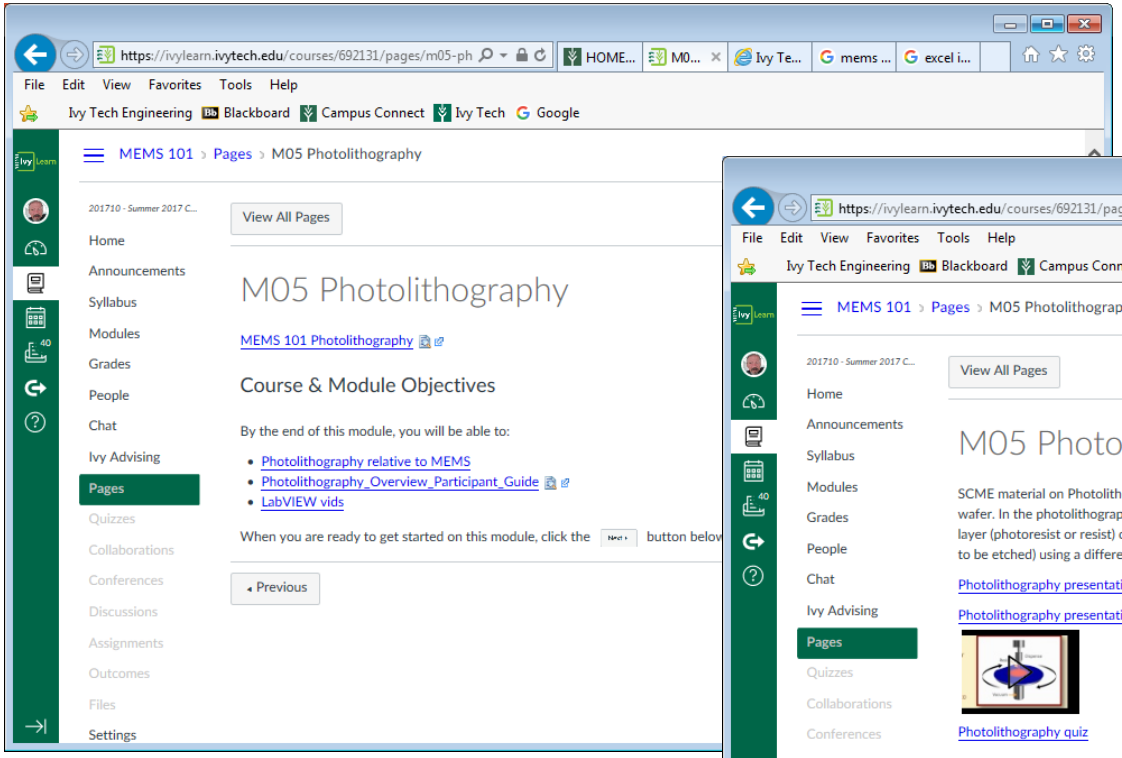
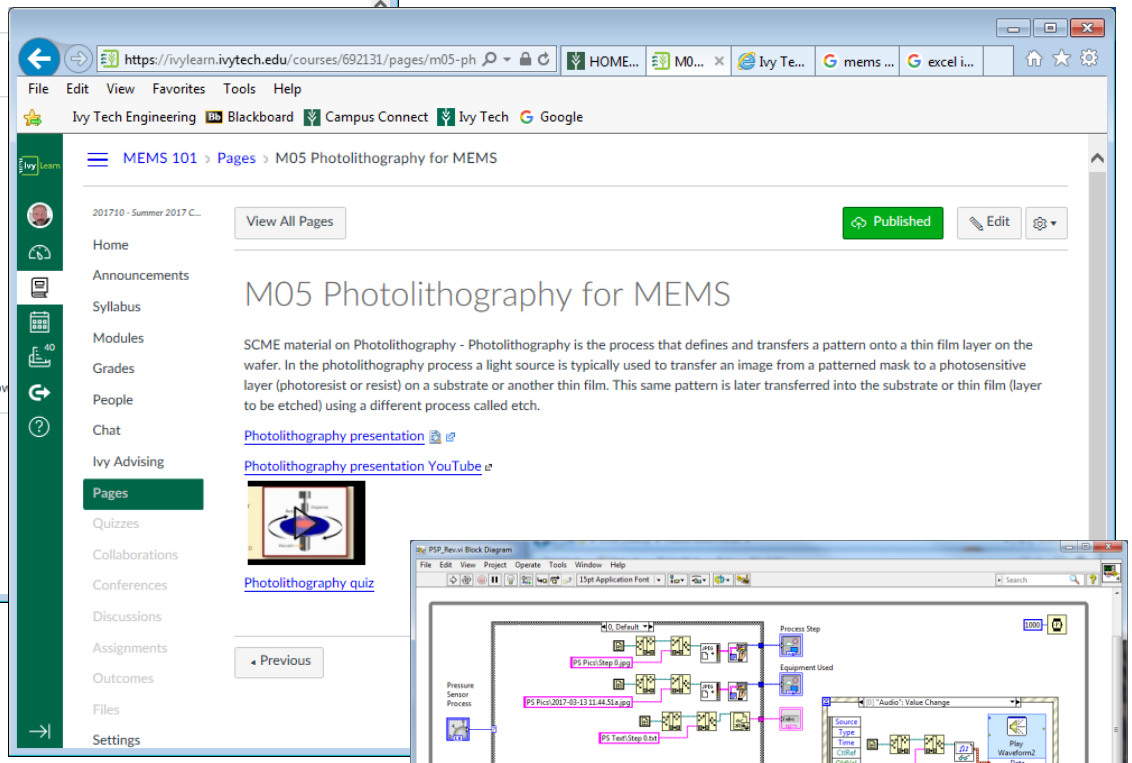
New MEMS Courses - MEMS 101





Southwest Center for Microsystems Education

CHANGING LIVES
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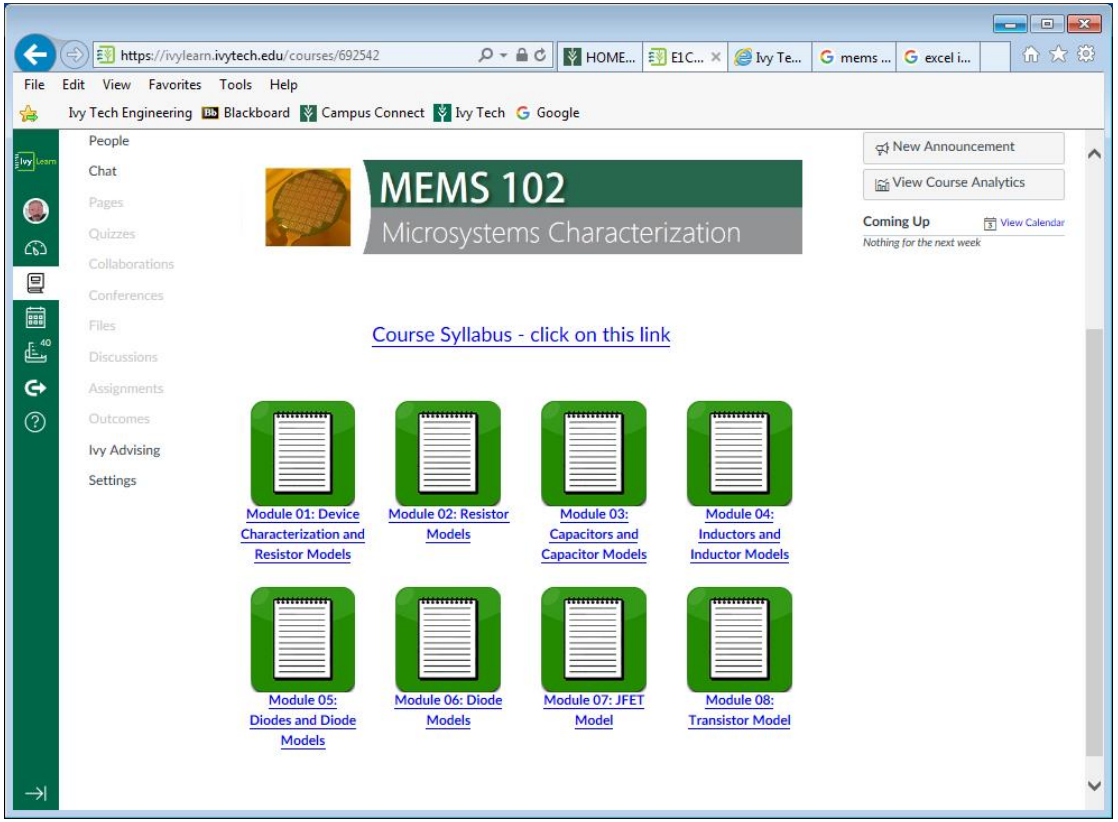
Developed 8 learning modules with 40 artifacts related to device modeling

More LabView but with math emphasis

LMS – Canvas (IvyLearn)

LabView –student license

Also used PSPICE Model Editor, Multisim, Excel and Engauge software packages



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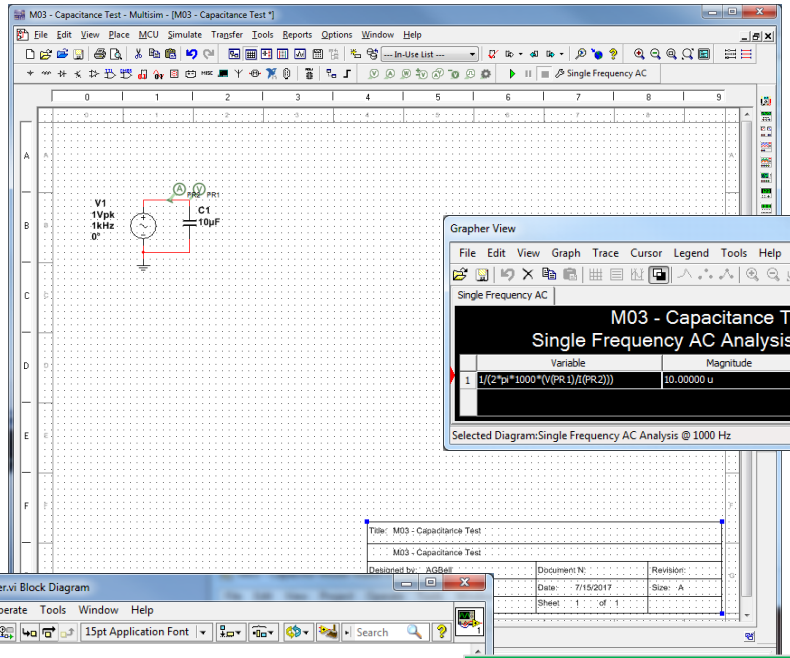
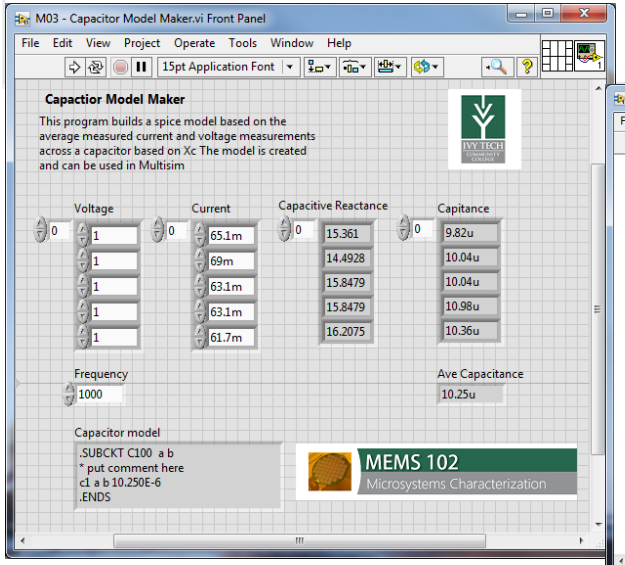
New MEMS Courses - MEMS 102

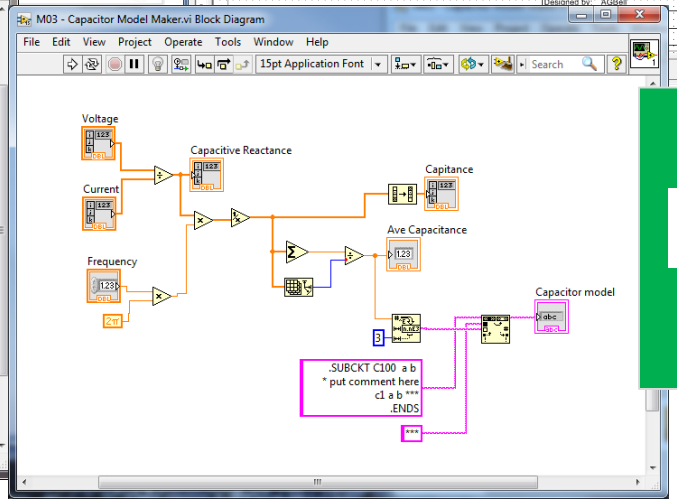
Microsystems Characterization

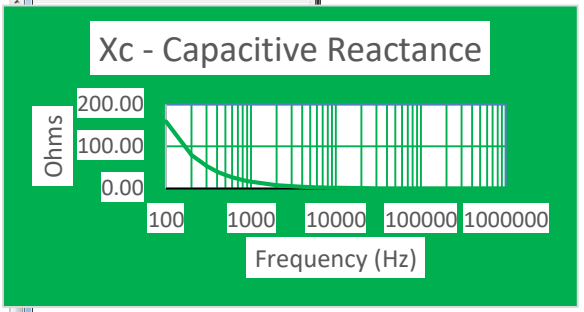
Capacitor Models – Artifacts needed

1. M03 – Capacitor Test.ms14 – This simulation calculates the capacitance based on the Xc formula at a fixed frequency using Multsim
2. M03 – Xc spreadsheet.xlsx – This spreadsheet calculates the Xc of a 10uF capacitor from 100Hz to 1MHz
3. M03 – parallel plate capacitor.xlsx – this spreadsheet is used to study how a parallel plate capacitor works.
4. M03 – PPC prog.vi – this LabView program calculates the value of a parallel plate capacitor.
5. M03 – Capacitor Model Maker.vi – using LabView create a .subckt model for a 10uF capacitor that is based on 5 voltage and current readings.









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Developing 8 learning modules with 8 sensor labs

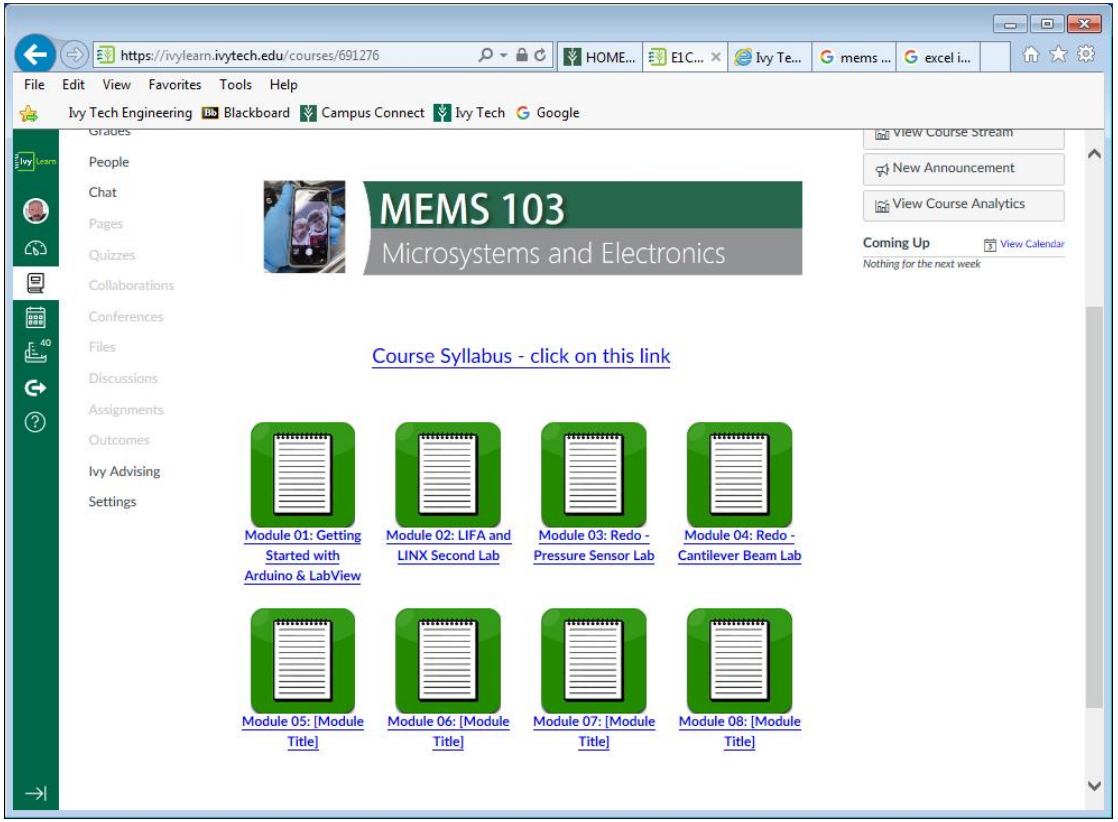
Student written LabView code for data acquisition of sensor data using Arduino UNO and Prototyping Shield

LMS – Canvas (IvyLearn)

LabView –student license

Use LINX and LIFA LabView Add-ons

Use modified SCME kits and DFRobot Sensor kits



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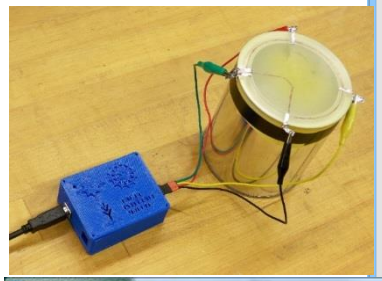
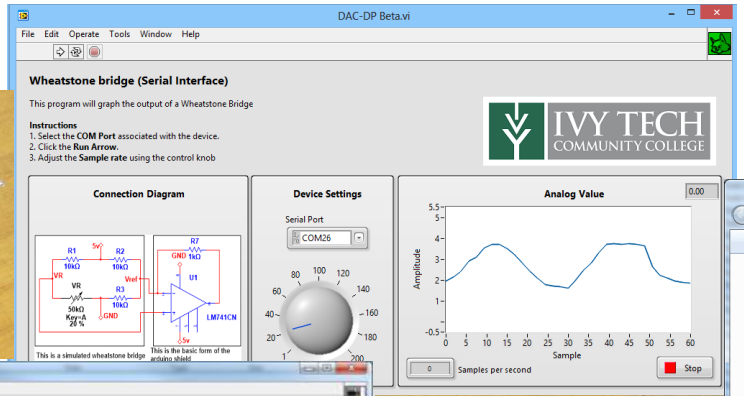
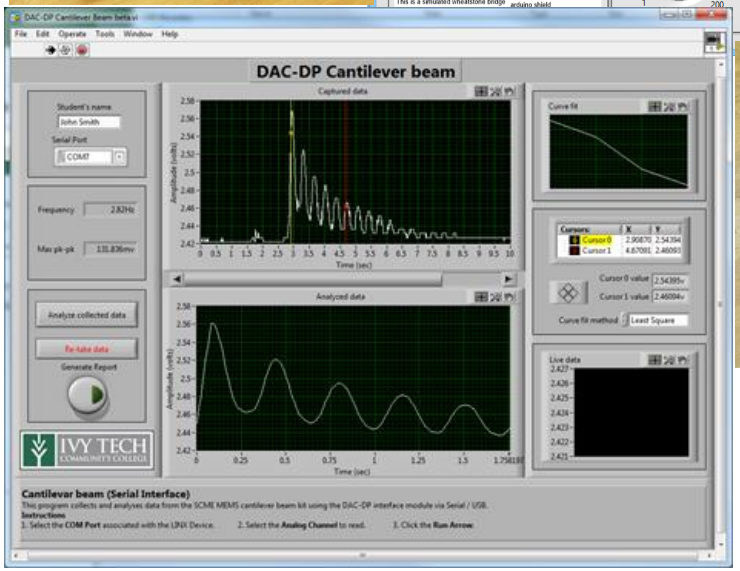
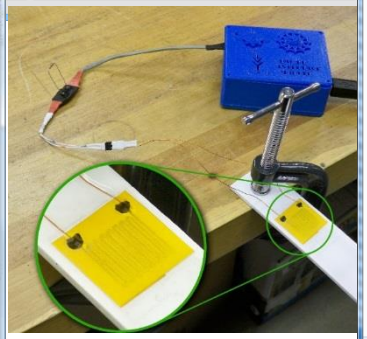
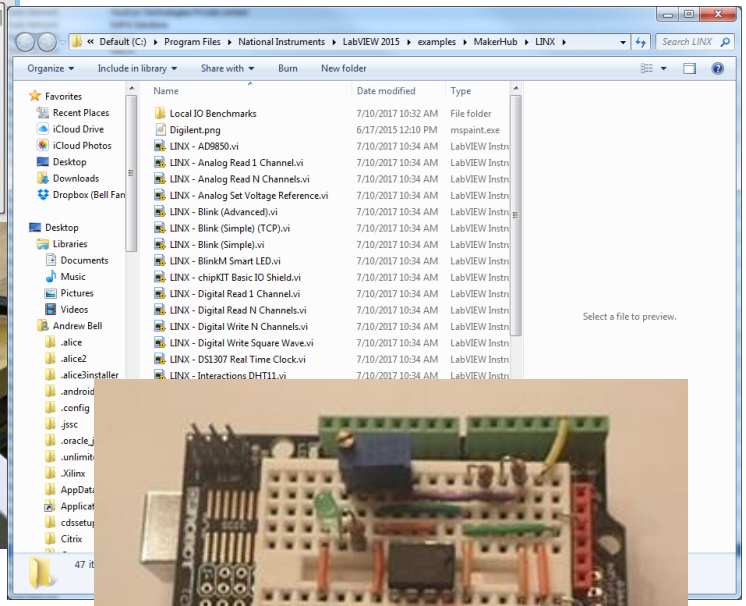
New MEMS Courses - MEMS 103

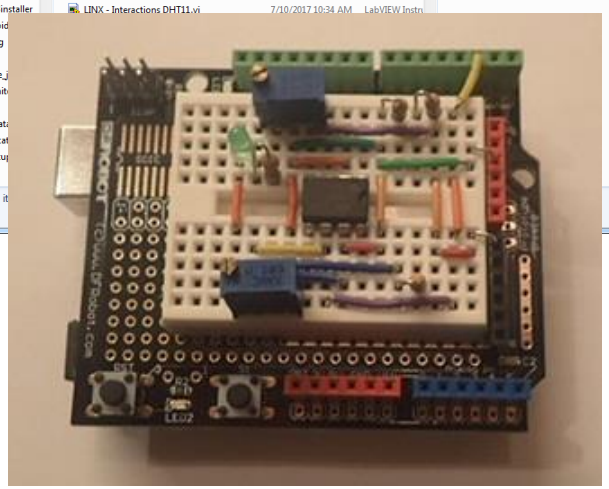












SCME Southwest Center for Microsystems Education

ARDUINO

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Evaluate student feedback on three courses and make modification to improve quality of instruction.

Update SCME – Ivy Tech kits for use in MEMS courses

Provide SCME with supplemental instructional material

Construct mini-kit for online courses.

http://www.scme-nm.org/
http://www.ivytech-mems.org/
http://faculty.ivytech.edu/~mems/
http://faculty.ivytech.edu/~abell118/

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Questions?