Program Assessment Plan

Program: Computer Engineering, B.S.

Department: School of Engineering

College/School: Parks College of Engineering, Aviation and Technology

Date: 5-21-19

Primary Assessment Contact: Kyle Mitchell

Note: Each cell in the table below will expand as needed to accommodate your responses.

#	**Program Learning Outcomes** What do the program faculty expect all students to know, or be able to do, as a result of completing this program? *Note: These should be measurable, and manageable in number (typically 4-6 are sufficient).*	**Assessment Mapping** From what specific courses (or other educational/professional experiences) will artifacts of student learning be analyzed to demonstrate achievement of the outcome? Include courses taught at the Madrid campus and/or online as applicable.	**Assessment Methods** What specific artifacts of student learning will be analyzed? How, and by whom, will they be analyzed? *Note: the majority should provide direct, rather than indirect, evidence of achievement.* Please note if a rubric is used and, if so, include it as an appendix to this plan.	**Use of Assessment Data** How and when will analyzed data be used by faculty to make changes in pedagogy, curriculum design, and/or assessment work? How and when will the program evaluate the impact of assessment-informed changes *made in previous years*?
1	*(a) an ability to apply knowledge of mathematics, science, and engineering*			

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D VWXGHQW ZRUN IRU WKH SXUSRVH RI PHHWLQJ D VSHFLILHG UHTXLUHPHQW

(a) an ability to apply knowledge of mathematics, science, and engineering

7$%/(6WXGHQW 2XWFRPHV DQG LSFWDLWRRQV DQG GHVFUL

,QGLFDWRU &RXUVH $VVHVVPHQW 'HVFULSWLRQ

$ELOLW\ WR PDWKHPDWLFDOO\
Q GFHV@UIVEH D V\VWSPDVVFIQG V\@WQQW QQLFD

(& ((& (Students will demonstrate an ability to use mathematics or science/engineering principles to characterize a system as evidence d in the project notebooks, technical reports, or technical presentations

,QGLFDWRU 7KLV LQGLFDWRU UVHVWHV PRGHZKHZLEHOLW\ DQG FOW
WKH V\VWHP WKDWHDFWOVLNWHRWKHRUGLQDO V\VWHP

(& (Students will demonstrate an ability to find the thevenin equivalent circuit as evidenced by laboratory reports. The Thevenin equivalent circuit is a simplified model that includes only one voltage source and one impedance/resistance. This circuit behaves the same as the one from which it is drawn

(& (Students will demonstrate the ability to determine/develop the I-V Characteristics equation of semiconductor devices such as diodes and transistors as evidenced by the final exam

(& (Students will demonstrate an ability to find and implement, via a matlab function, the impulse response of a system to remove an echo from an acoustic signal as evidenced by a Matlab computer program

(& ((& (Students will demonstrate an ability to use mathematics or science/engineering principles to create a system model as evidenced in the project notebooks, technical reports, or technical presentations

,QGLFDWRU 7KLHUVLQWRRFWWKRUDEJHOLWH WHRUHWDQWHKHUVLVSHFLI\ RU
FRPSRQHQWV XXLQVWDHPKVHPQJLQHHDQGH WRRZOHGH D ODUJHU ZKR

(& (Students will demonstrate an ability to design an RLC circuit in order to achieve a specific frequency response as evidenced by laboratory reports

(& (Students will demonstrate an ability to develop a matlab function that eliminates an echo from an acoustic signal as evidenced by a Matlab computer program. 7KLV UHTXLUHV WKDW
RXV FRPSRQHQWV EH V\QWKHVL]HG LQWRUUVWHR IQHDWHHRUPR
SXWHU SURJUDP

(& ((& (Students will demonstrate an ability to synthesize, i.e. create or specify or implement, components/subsystemsusing mathematics or science/engineering principles to create a larger whole as evidenced in the project notebooks, technical reports, or technical presentations

7KH DVVHVVPHQWWHQXEQLFKHDLRO0RZLQJ WDEOH

7$%/($VVHVVPHQW UXEULFV IRU 6WXGHQW 2XWFRP

	5XEULF		
,QG	'RHV QRW PHHW	([SHFWDWLRQV H[SHFWDWLRQV	H[SHFWDWLR
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	(LWKHU WKH IUHTXHQF\ UHVSRQVH IXQFWLRQ LV QRW FRUUHFW RU WKH IXQFWLRQ LV VWDWHG LQFRUUHFWO\	7KH IUHTXHQF\ UHVSRQVH IXQFWLRQ LV FRUUHFW DQG WKH LLOWHU W\SH LV VWDWHG FRUUHFWO\ DQG WKH FDOFXODWLRQ RI WKH FXWRII IUHTXHQFLHV DUH FRUUHFW DQG FRQVLVWHQW ZLWK WKH GHWDLOV	7KH IUHTXHQF\ UHVSRQVH IXQFWLRQ LV FRUUHFW DQG WKH LLOWHU W\SH LV VWDWHG FRUUHFWO\ DQG WKH FDOFXODWLRQ RI WKH FXWRII IUHTXHQFLHV DUH FRUUHFW DQG FRQVLVWHQW ZLWK WKH GHWDLOV
	(LWKHU WKH WKHYHQLQ PRGHO LV LQFRUUHFW RU WKH PRGHO LV FRUUHFW EXW WKH FRPSRQHQW YDOXHV DUH LQFRUUHFW	7KH WKHYHQLQ PRGHO LV FRUUHFW DQG WKH FRPSRQHQW YDOXHV DUH FRUUHFW 7KH FDOFXODWLRQ RI WKH FXWRII IUHTXHQFLHV DUH FRUUHFW DQG FRQVLVWHQW ZLWK WKH GHWDLOV	7KH WKHYHQLQ PRGHO LV FRUUHFW DQG WKH FRPSRQHQW YDOXHV DUH F DOFXODWLRQ RI WKH FXWRII IUHTXHQFLHV DUH FRUUHFW DQG FRQVLVWHQW ZLWK WKH GHWDLOV D

3 U L R U W\ Students will demonstrate an ability to establish an experimental procedure, including identifying specific measurements to acquire, in order to draw meaningful conclusions as evidenced by the laboratory reports, presentations, or project notebooks

6 DQG DIWHU (DXFSKLWWXRGHQWV GHPRQVWUDWH DELOLW\ WR HVWDEOLVK DQ H[SHULPHQWDO SURFHGXUH LQFOXGLQJ LGHQWLI\LQJ VSHFLILF PHDVXUHPHQWV WR DFTXLUH LQ RUGHU WR GUDZ PHDQLQJIXO FRQFOXVLRQV DV HYLGHQFHG E\ WKH ODERUDWRU\ UHSRUWV SUHVHQWDWLRQV RU SURMHFW QRWHERRNV

Students will demonstrate an ability to establish an experimental procedure, including identifying specific measurements to acquire, in order to estimate the internal resistance of a battery as evidenced by the battery technical report or the experiment report

(& ((& (Students will demonstrate an ability to establish an experimental procedure, including identifying specific measurements to acquire, in order to draw meaningful conclusions as evidenced in the project notebooks, technical reports, or technical presentations

, Q G L F D W R U 7 K L V L Q G L F D W R U U H I H U V W R Y D U L D E O H W H V W R S P H U I R U P L Q W K H (& (I D F L O L W D W L R Q Z R U N E H Q F K D Q G R X W 7 K L V U H I H U V W R D Q D E L O L W \ W R S H U I R U P W K H D S S U R S U L D W H W H V W V R U S U R M H F W V

(& ( )RU WKH ORQJ YRZHO VRXQGV REWDLQHG IURP WKH LQVWUXFWRU RU VWXGHQW GDWDEDVH GHWHUPLQH LI WKH VHW RI YRZHO VRXQGV DYDLODEOH DUH VXIILFLHQW WR GHYHORS D XVHIXO GHFLVLRQ WUHH DV HYLGHQFHG E\ D WHFKQLFDO UHSRUW Students will demonstrate an ability to use matlab software functions in order to analyze the vowel sound data as evidenced by a technical report

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3 U L R U W\ Students will demonstrate an ability to recognize readily available equipment and components, in college laboratories, that would allow an experiment to be practically carried out as evidenced by the laboratory reports, presentations, or project notebooks

6 DQG DIWHU)RU WKH LQWHUQDOVWDWHEDWWHU\VHOHFWLRQ H[SHULPHQW WR XVH VWDQGDUG ODERUDWRU\ HTXLSPHQW DQG FRPSRQHQWV Students will demonstrate an ability to establish an experimental procedure that uses readily available equipment and components in college laboratories as evidenced by the battery technical report or the experiment report

(& ((& (Students will demonstrate an ability to recognize and use readily available equipment and components, in college laboratories, that are used to set up and carry out an experiment as evidenced in the project notebooks, technical reports, or technical presentations

, Q G L F D W R U 7 K L V L Q G L F D W R U U H I H U V W R W K H O H Y H O R I G D W D T X D O L W \ W R H Q V X U H W K H V H W R I D F T X L U H G P H D V X U H P H Q W V D U H D G H T X D W H I R U G U D Z L Q J P H D Q L Q J I X O F R Q F O X V L R Q V D V H Y L G H Q F H G E \ W K H W H F K Q L F D O U H S R U W V R U W K H H [S H U L P H Q W U H S R U W

(& ( )RU WKH ORQJ YRZHO VRXQGV UHFRUGHG DUH W KH YRZHO VRXQGV UHFRUGHG DUH VXIILFLHQW WR GHYHORS D XVHIXO GHFLVLRQ WUHH Students will demonstrate an ability to recognize whether the set of vowel sounds acquired is sufficient for developing a useful decision tree as evidenced by a technical report

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3 U L R U W\ Students will demonstrate an ability to recognize whether the set of acquired measurements are adequate for drawing meaningful conclusions as evidenced by the laboratory reports, presentations, or project notebooks

7KHUH LV HYLGHQFH ZKHUH D VHW RI PHDVXUHG GDWD KDV EHHQ DVVHVVHG WR GHWHUPLQH LI LW LV VXLWDEOH IRU GUDZLQJ PHDQLQJIXO FRQFOXVLRQV

(& ((& (Students will demonstrate an ability to recognize the precision of the measured data as evidenced in the project notebook s, technical reports, or technical presentations

, Q G L F D W R U 7 K L H V L Q G L F D W R U E H O R Z L V F R Q V L G H U H G V R O X W L R Q R U P H D V X U H P H Q W G R I L Q W H U H V W D Q G V K R X O

(& ((D F K V W X G H Q W J U R X S Z L O O H [K L E L W V L Q W K H I R O O R Z L Q J F D W H J R U L H V W D Q G V K R X O

7KH DVVHVVPHQWHQXIEQUWFKVHDIURHOOORZLQJ WDEOH

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	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW PHWULF SDLUV KDYH EHHQ LQVSHFWHG DQG WKH SUHFLVLRQ RI WKH YDULRXV YRZHO VRXQGV KDYH EHHQ UHFRJ QL]HG DQG FRQVLGHUHG IRU WKH SXU SRVH RI FDUHIXO DQDO\VLV RI WUHH	7KHUH LV HYLGHQFH WKDW PHWULF SDLUV KDYH EHHQ LQVSHFWHG DQG WKH SUHFLVLRQ RI WKH YDULRXV YRZHO VRXQGV KDYH EHHQ UHFRJQL]HG DQG FRQVLGHUHG DV SDUW RI WKH SXUSRVH RI FDUHIXO DQDO\VLV RI WUHH	7KHUH LV HYLGHQFH WKDW PHWULF SDLUV KDYH EHHQ LQVSHFWHG DQG WKH SUHFLVLRQ RI WKH YDULRXV YRZHO VRXQGV KDYH EHHQ UHFRJQL]HG DQG FRQVLGHUHG DV SDUW RI WKH SXUSRVH RI FDUHIXO DQDO\VLV RI WUHH
	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW DQ\ RI WKH PHWULF SDLUV KDYH EHHQ DVVHVVHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG	7KHUH LV HYLGHQFH WKDW PHWULF SDLUV KDYH EHHQ DVVHVVHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG	7KHUH LV HYLGHQFH WKDW PHWULF SDLUV KDYH EHHQ DVVHVVHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG
	7KHUH LV QR HYLGHQFH WKDW WUHQGV KDYH EHHQ REVHUYHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG	7KHUH LV HYLGHQFH WKDW WUHQGV KDYH EHHQ REVHUYHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG	7KHUH LV HYLGHQFH WKDW WUHQGV KDYH EHHQ REVHUYHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG
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	7KHUH LV QR HYLGHQFH WKDW WKH H[SHULPHQW UHVXOWV DUH QXPHULFDOO\ DVVHVVHG WR GHWHUPLQH WKH SUHFLVLRQ RI UHVLVWDQFH PHDVXUHPHQWV IRU WKH H[SHULPHQWDO FRQFOXVLRQV	7KHUH LV HYLGHQFH WKDW WKH H[SHULPHQW UHVXOWV KDYH EHHQ DVVHVVHG WR GHWHUPLQH WKH SUHFLVLRQ RI UHVLVWDQFH PHDVXUHPHQWV IRU WKH H[SHULPHQWDO FRQFOXVLRQV	7KHUH LV HYLGHQFH WKDW WKH H[SHULPHQW UHVXOWV KDYH EHHQ DVVHVVHG WR GHWHUPLQH WKH SUHFLVLRQ RI UHVLVWDQFH PHDVXUHPHQWV IRU WKH H[SHULPHQWDO FRQFOXVLRQV
	7KHUH LV QR HYLGHQFH WKDW WKH H[SHULPHQW UHVXOWV KDYH EHHQ DVVHVVHG WR GHWHUPLQH ZKLFK PHDVXUHPHQWV VKRXOG EH GLVFDUGHG	7KHUH LV HYLGHQFH WKDW WKH H[SHULPHQW UHVXOWV KDYH EHHQ DVVHVVHG WR GHWHUPLQH ZKLFK PHDVXUHPHQWV VKRXOG EH GLVFDUGHG	7KHUH LV HYLGHQFH WKDW WKH H[SHULPHQW UHVXOWV KDYH EHHQ DVVHVVHG WR GHWHUPLQH ZKLFK PHDVXUHPHQWV VKRXOG EH GLVFDUGHG, IRU H[DPSOH XVLQJ DSSURSULDWH LOOXVWUDWLYH QXPHULF UHVXOWV
	7KHUH LV QR HYLGHQFH WKDW GDWD WUHQGV KDYH EHHQ REVHUYHG DQG WKHVH WUHQGV DUH GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG	7KHUH LV HYLGHQFH WKDW GDWD WUHQGV KDYH EHHQ REVHUYHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG	7KHUH LV HYLGHQFH WKDW GDWD WUHQGV KDYH EHHQ REVHUYHG DQG GLVFXVVHG DV SDUW RI WKH DQDO\VLV RI WUHH DUH GLVFXVVHG
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7KHUH LV QR HYLGHQFH WKDW WKH SUHVLGHQWLDO GHFLVLRQ RI H[SHULPHQWDO GDWD KDV EHHQ UHFRJQL]HG DQG DVVHVVHG IRU SXUSRVH RI GUDZLQJ PHDQLQJIXO FRQFOXVLRQV

7KHUH LV HYLGHQFH WKDW WKH SUHVLGHQWLDO GHFLVLRQ RI H[SHULPHQWDO GDWD KDV EHHQ UHFRJQL]HG DQG DVVHVVHG IRU SXUSRVH RI GUDZLQJ PHDQLQJIXO FRQFOXVLRQV 7KH DVVHVVPHQW LV GHVFULEHG E\ D VLPSOH VWDWHPHQW ZLWK OLWWOH RU QR MXVWLILFDWLRQ HYLGHQW

7KHUH LV HYLGHQFH WKDW WKH SUHVLGHQWLDO GHFLVLRQ RI H[SHULPHQWDO GDWD KDV EHHQ DVVHVVHG IRU SXUSRVH RI GUDZLQJ PHDQLQJIXO FRQFOXVLRQV 7KH DVVHVVPHQW LV FOHDUO\ GHVFULEHG XVLQJ VWDWHPHQWV RU QXPHULF PHDVX

7KHUH LV QR HYLGHQFH WKDW H[SHUL PHQW UHVXOWV KDYH EHHQ DVVHVVHG WR

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, etc.

7$%/(6WXGHQW 2XWFRPHV DQG GHVFULSW

,QGLFDWRU &RXUVH $VVHVVPHQW 'HVFULSWLRQ

$ZDUHQHVV RI DQG DQ DELOLW\ WR (&(7KH SUDFWLFDO OLPLWDWLRQV VXFK DV GLVFHUQ WKH LPSRUWDQFH RI HQYLURQPHQWDO LVVXHV (&(FRQVWUDLQWV IRU D SDUWLFXODU GHVLJQ RU (&((LWKHU WKURXJK FRXUVHZRUN GH RU GHVLJQ FRPSRQHQW (&(WDL WDL(

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(e) an ability to identify, formulate, and solve engineering problems

7$%/(6WXGHQW DVVHVVPHQW LQGLFDWRUV DQG GHVFU

,QGLFDWRU &RXUVH $VVHVVPHQW 'HVFULSWLRQ

$ELOLW\ WR UHFRJQL]H DQG DVVXUH WKH LQWHJULW\ RI
QHHULQJ SUREOHP WR EH VROYHG
RE VHUYDWLRQV (&(1RWHERRN WHFKQLTXHV DQG FKHFNOLVWV UHVHQ

(&(&DOLEUDWH D 3,' FRQWUROOHU IRU WKH

$ELOLW\ WR GHYHORS D KDUGZDUH PRGXOH
VRIWZDUHGHVLJQ0HDVXUH WKH LQWHJULW\ RI
QHHULQJ SUREOHP WR EH VROYHG ([KLELW WKURXJKRXW WKH 3URM
(&(1RWHERRN WHFKQLTXHV DQG FKHFNOLVWV UHVHQ

(&(&DOLEUDWH D 3,' FRQWUROOHU IRU WKH

$ELOLW\ WR VROYH DQ HQJLQHHULQJ PLFV RI D PRELOH URERW
SUREOHP XVLQJ PDWKHPDWLFV DQG RUHDVXUH WKH LQWHJULW\ RI
HQJLQHHULQJ SULQFLSOHV ([KLELW WKURXJKRXW WKH 3URM
(&(1RWHERRN WHFKQLTXHV DQG FKHFNOLVWV UHVHQ

(&(&DOLEUDWH D 3,' FRQWUROOHU IRU WKH

$ELOLW\ WR DVVHVV WKH SHUIRUPLFV RI D PRELOH URERW
PDQFH RI DQ HQJLQHHULQJ0HDVXUHP WKH LQWHJULW\ RI
VROXWLRQ ([KLELW WKURXJKRXW WKH 3URM
(&(1RWHERRN WHFKQLTXHV DQG FKHFNOLVWV UHVHQ

7KLV RXWFRPH UHIHUHQFHV DQ DEKLOLW\ WR REWDLQ IRUPXODW
FDUU\ RXW WKH VROXWLRQ DQG DPHQG WKH GHVLJQ DV QHHGHG
LQLWLDWLYH IRUHHGFWRQV]RQWHKEHQFLDQHWLKHJ SUREOHP IRUPXO
IURP WKH VWXGHQW UDWKHU WKDQ DQ LQVWUXFWRU

,QGLFDWRU 7KLV LQGLFDWRU WKHUHIRUH QDQQHEHLOLW\ SURREOHP
LQ RUGHU WR IXUWKHU LQWHJUDWH WKH 7KHVLV LQWR WKH HUHRJQLWLRQ RFF
GXULQJ WKH SURFHVV RI GHVLJQLQJ SURGXFWV RU SUR

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3UIRU WR 6 G @ @ WRLRQ W@–tph–H–pRFÀ@P P'D QVHSWpð``þIPÀp W@

6 DQG DIWHU 7KLHP EHQW WUHU\XHUSHMURVKSDPH DVXXUHGWQW LQWHUQ RI D EDSWLVWV will demonstrate an ability to assess a problem solution related to the battery experiment as evidenced in the project notebooks, technical reports, or technical presentations

(& ((& (Students will demonstrate an ability to assess a problem solution as evidenced in the project notebooks, technical reports, or technical presentations

7KH DVVHVVPHQW WHQXEQ LWFKVHDLRHO OR ZLQJ WDEOH

7$%/($VVHVVPHQW UXEULF 2XWFRPH H

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7KHUH LV OLWWOH RU QR HYLGHQFH WKDW DQ\ DQDO\VLV RU FRQFOXVLRQV DUH EDVHG RQ WKH GDWD	7KHUH LV HYLGHQFH WKDW D FOHDU\ GHILQHG SURFHGXUH KDV EHHQ XVHG WR DQDO\]H GDWD DQG WKDW FRQFOXVLRQV DUH VXSSRUWHG E\ WKH GDWD	7KHUH LV HYLGHQFH WKDW WKH 3, FRQWURROOHU WKDW KDV EHHQ GHVLJQHG DQG LPSOHPHQWHG WR WXQH D 3, FRQWURO V\VWHP LV XQDPELJXRXV DQG UHSHDWDEOH	
7KHUH LV OLWWOH RU QR HYLGHQFH WKDW DQ\ SURFHGXUH IRU FRQWURROOHU KDV EHHQ FUHDWHG RU WHVWHG	7KHUH LV HYLGHQFH WKDW WKH 3, FRQWURO V\VWHP KDV EHHQ WHVWHG DQG WXQHG EXW WKH UHVXOWV DUH QRW FOHDUO\ GRFXPHQWHG RU UHSHDWDEOH	7KHUH LV HYLGHQFH WKDW WKH 3, FRQWURO V\VWHP KDV EHHQ WHVWHG DQG WXQHG XVLQJ D V\VWHPDWLF DSSURDFK DQG WKH UHVXOWV DUH GRFXPHQWHG LQ D FOHDU DQG UHSHDWDEOH PDQQHU	
7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH UHVXOWV RI SSDOLFDWLRQV WR WXQH D 3, FRQWURO V\VWHP DUH FRQVLVWHQW DQG UHSHDWDEOH	7KHUH LV HYLGHQFH WKDW WKH UHVXOWV RI DSSOLFDWLRQV WR WXQH D 3, FRQWURO V\VWHP DUH PRVWO\ FRQVLVWHQW DQG UHSHDWDEOH EXW WKHUH DUH VRPH LQFRQVLVWHQFLHV RU YDULDWLRQV WKDW QHHG WR EH DGGUHVVHG	7KHUH LV VWURQJ HYLGHQFH WKDW WKH UHVXOWV RI DSSOLFDWLRQV WR WXQH D 3, FRQWURO V\VWHP DUH FRQVLVWHQW DQG UHSHDWDEOH DFURVV PXOWLSOH WULDOV DQG FRQGLWLRQV GHPRQVWUDWLQJ D UREXVW DQG UHOLDEOH WXQLQJ SURFHVV	
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7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV KDYH EHHQ UHFRJQL]HG DQG DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG WR WKH GHVLJQ RI D EDWWHU\	7KHUH LV HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV KDYH EHHQ UHFRJQL]HG DQG DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG WR WKH GHVLJQ RI D EDWWHU\	7KHUH LV HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV KDYH EHHQ UHFRJQL]HG DQG DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG WR WKH GHVLJQ RI D EDWWHU\	
7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV WR EH DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG DV SDUW RI WKH GHVLJQ RI D EDWWHU\ WKDW LV VDIH DQG UHOLDEOH DQG PHHWV WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV	7KHUH LV HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV WR EH DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG DV SDUW RI WKH GHVLJQ RI D EDWWHU\ WKDW LV VDIH DQG UHOLDEOH DQG PHHWV WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV	7KHUH LV VWURQJ HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV WR EH DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG DV SDUW RI WKH GHVLJQ RI D EDWWHU\ WKDW LV VDIH DQG UHOLDEOH DQG PHHWV WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV	
7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV WR EH DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG DV SDUW RI WKH GHVLJQ RI D EDWWHU\ WKDW LV VDIH DQG UHOLDEOH DQG PHHWV WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV DQG WKH VWXGHQW KDV HYDOXDWHG WKH VROXWLRQ DJDLQVW WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV DQG SURSRVHG LPSURYHPHQWV WR WKH VROXWLRQ	7KHUH LV HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV WR EH DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG DV SDUW RI WKH GHVLJQ RI D EDWWHU\ WKDW LV VDIH DQG UHOLDEOH DQG PHHWV WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV DQG WKH VWXGHQW KDV HYDOXDWHG WKH VROXWLRQ DJDLQVW WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV DQG SURSRVHG LPSURYHPHQWV WR WKH VROXWLRQ	7KHUH LV VWURQJ HYLGHQFH WKDW WKH VWXGHQW KDV HQJDJHG LQ SURSHUO\ LGHQWLI\LQJ SUREOHPV WR EH DGGUHVVHG WKH GHVLJQ SURFHVV KDV EHHQ IROORZHG DV SDUW RI WKH GHVLJQ RI D EDWWHU\ WKDW LV VDIH DQG UHOLDEOH DQG PHHWV WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV DQG WKH VWXGHQW KDV HYDOXDWHG WKH VROXWLRQ DJDLQVW WKH VSHFLILHG UHTXLUHPHQWV RU FRQVWUDLQWV DQG SURSRVHG LPSURYHPHQWV WR WKH VROXWLRQ	

,QGLFDWRU 7KLV UHIHUV WR DQQ DHLLOLWL\WRSZHVWDQGLGQ
SUHVHQWDWLRQ LV HYDOXDWHG LQ KLPDOSUHVHQWDWKRQHV
FRQWHQW DQG WKH SUHVHQWDWLRQ VKDNHU GHOLYHU\

(&(

3 U L R U Students will demonstrate an ability to write and deliver an effective presentation as evidenced by a technical presentation

6 DQG Students will demonstrate an ability to write and deliver an effective presentation as evidenced by the presentation written and delivered as part of the battery experiment

(&((&(Students will demonstrate an ability to write and deliver an effective presentation as evidenced by the presentation written and delivered for the PDR, CDR, or FDR

7KH DVVHVVPHQW

7$%/($VVHVVPHQW 2XWFRPH J

5XEULF

,QG 'RHV QRW PHHW ([SHFWDWLRQV [SHFWDWLRQV

(&(

7KHUH LV HYLGHQFH WKDW WKH WHFKQL
FDO UHSRUW IRU WKH GHYHORSPHQW RI
WKH EDWWHU\ H[SHULPHQW H[KLELWV
RQH RU IHZHU RI WKH IROORZLQJ
WKUHH
D KDV DYHU\ZHDN JUDPPDW
LFDO RU VSHOOLQJ PLVWDNHV DQG WKH
PHDQLQJ RI VHQWHQFHV DUH PRVWO\
FOHDU
E LV PRVWO\ ZHOO RUJDQL]HG ZLWK
FOHDU DQG DSSURSULDWHO\ GHILQHG
VHFWLRQV DQG ZLWK PRVWO\ DSSURSUL
DWH PDWHULDO LQ HDFK VHFWLRQ
F FRQWDLQV PRVWO\ FRUUHFW WHFKQL
FDO FRQWHQW KDV DSSURSULDWH FRQ
FOXVLRQV DQG LW IXOO\ FRPSOHWH

7KHUH LV HYLGHQFH WKDW WKH SRVWHU SUHVHQWDWLRQ LV QRW DSSURSULDWH IRU

(h) the broad education necessary to understand the impa ct of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

7$%/(6WXGHQW 2XWFRPHV DQG GHVFULSWLRQV

,QGLFDWRU &RXUVH $VVHVVPHQW 'HVFULSWLRQ

$ELOLW\ WR LGHQWLI\ WKH QHHG IRU DQG HQJDJH LQ OLIHORQJ OHDUQLQJ DQG NQRZOHGJH RI IXUWKHU D GHVLJQ VROXWLRQ (&(

(& (6W XG HQW V DU H UH TX LU HG WR GH PR QV WU DW H DQ DE LO LW\ WR LG HQ WL I\ DQ G HY DO XD WH UH VR XU FH V IR U WK H SX USR VH RI FD OL EU DW LQ J D 3 ,' FR QW UR OO HU DV HY LG HQ FH G E\ D WH FK QL FD O UH SR UW
Students will demonstrate an ability to identify and evaluate resources for the purpose of calibrating a PID controller as evidenced by a technical report

(& (
3 UL RU W R 6W XG HQW V Students will demonstrate an ability to identify and evaluate resources for the purpose of acquiring appropriate knowledge to further a de sign solution as evidenced by project notebooks, technical reports, or technical presentations

6 DQ G DI WH U 6W XG HQW V Students will demonstrate an ability to identify and evaluate re sources for the purpose of developing a battery measurement experiment as evidenced in the project notebooks, technical reports, or technical pre - sentations

(& ((& (Students will demonstrate an ability to identify and evaluate resources for the purpose of acquiring appropriate knowledge to further a design solution as evidenced in the project notebooks, technical reports, or technical presentations

,QGLFDWRU 7KLV LQGLFDWRU UHODWHV WR DQDO\]LQJ GDWD WR RE WDLQ
UHVRXUFHV WR IXUWKHU D GHVLJQ VROXWLRQ

(& (Students will demonstrate an ability to read and understand material found in appropri - ate resources to calibrate a PID contro ller as evidenced by a technical report

(& (
3 UL RU W R 6W XG HQW V Students will demonstrate an ability to read and understan d material found in appro - priate resources to further a design solution as evi denced by project notebooks, technical reports, or technical presentations

6 DQ G DI WH U 6W XG HQW V Students will demonstrate an ability to read and understand material found in appropriate resources for the pur - pose of developing a battery measurement experiment as evidenced in the project notebooks, technical reports, or technical presentations

(& ((& (Students will demonstrate an ability to read and understan d material found in appropriate resources to fu rther a design solution as evidenced in the project notebooks, technical reports, or technical presentations

,QGLFDWRU 7KLV LQGLFDWRU XVHG WR GHVLJQ VROXWLRQV WR
%\ ‡DSSO\· ZH PHDQ VXFK WKLQJV DV HVWR PDWH KRZ WR RSHUDWH RU SURJUDP
WR IXUWKHU D GHVLJQ VROXWLRQ

(& (Students will demonstrate an ability to apply acquired knowledge to calibrate a PID controller for the purpose of controlling a robot to track a wall, as evidenced by a technical report

(& (
3 UL RU W R 6W XG HQW V Students will demonstrate an ability to apply acquired knowledge to further a design solution as evidenced by project notebooks, technical reports, or technical presentations

6 DQ G DI WH U 6W XG HQW V Students will demonstrate an ability to apply acquired knowledge for the purpose of developing a battery mea - surement experiment as evidenced in the project notebooks, technical reports, or technical presenta - tions

(& ((& (Students will demonstrate an ability to apply acquired knowledge to further a design solution as evidenced in the project notebooks, technical reports, or technical presentations

7KH DVVHVVPHQW WHQXUH QXPEHU LV FKDQJLQJ WDEOH

7$%/($VVHVVPHQW UXOH WHFKQLFDO 6WXGHQW 2

	5XEULF		
,QG 'RHV QRW PHHW	([SHFWDWLRQV[SHFWDWLRQ[		
	(&(		
	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH DQDO\VRXUFHV KDYH EHHQ HYDOXDWHG IRU WKH SXUSRVH RI DFTXLULQJ NQRZOHGJH IRU WKH SXUSRVH RI LQJ D 3,' FRQWURROOHU	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH DQDO\VRXUFHV KDYH EHHQ HYDOXDWHG IRU WKH SXUSRVH RI LQJ D 3,' FRQWURROOHU	
	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH DQDO\VRXUFHV KDYH EHHQ XQGHUVWRRG IRU WXQLQJ D 3,' FRQWURROOHU	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH DQDO\VRXUFHV KDYH EHHQ XQGHUVWRRG IRU WXQLQJ D 3,' FRQWURROOHU	
	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH DQDO\VW KDV WHFKQLTXHV IRU FRQWURROOHU KDYH EHHQ SURERHP RI FRQWUROOHU URERW	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW WKH DQDO\VW KDV WHFKQLTXHV IRU FRQWURROOLQJ D PREHLRQHJ URERW REÀ 0P P	
	(&((&(		
	7KHUH LV OLWWOH RU QR HYLGHQFH RI 7KRPH[DV SHOYLGHQFH RI PX ZKHWKHU QHHG IRU QZKOH QHHG IRU[DPSZOHQRZKHUHWKQHHG HG 0°@‘ EHHQ LGHQWLILHGDV VEHHQWLRQHQWLHGDV SDUW RI DQ HQJLQHHULQJ GHVLJQ WLQHHULQJ GHVLJQ RI DQ HQJLQH PÀJ GH		
	7KHUH LV OLWWOH RU QR HYLGHQFH RI 7KRPH[DV SHOYLGHQFH RI PXO ZKHUHV bXUFHV KDYHKHHQHVHQWLHV KHDPSEHHVQZKHWKHW ILHG IRU WKH SXUSRVHGVHDFTXLQJ NQRZOHGJH DV SDUWRQRZQHGJH DV SDUWRI DQ HQJLQHHULQJ GHVLJQ	7KHUH LV OLWWOH RU QR HYLGHQFH RI 7KRPH[DV SHOYLGHQFH RI PXOV ILHG IRU WK QHZRZQHGJH DV SDUW RI DQ HQJLQHHULQJ GHVLJQ	
	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW QHZ NQRZOHGJH WKDW VEHQHZ NQRZOHGJH DTXLUHG IURP UH IRU WKH SXUSRVH RI IXUWKHU LQJ GHVLJQ	7KHUH LV OLWWOH RU QR HYLGHQFH RI 7KRPH[DV SHOYLGHQFH RI PXOV ZKHUHQHZ NQRZOHGJH WKDW VEHQHZ NQRZOHGJH DTXLUHG IURP UH IRU WKH SXUSRVH RI IXUWKHU LQJ GHVLJQ	
	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW QHZ NQRZOHGJH KDV EHHQ DSSOLHG IRU WKH SXUSRVH RI IXUWKHU LQJ DQ HQJLQHHULQJ GHVLJQ QHZ NQRZOHGJH KDV EHHQ DSSOLHG	7KHUH LV OLWWOH RU QR HYLGHQFH WKDW QHZ NQRZOHGJH KDV EHHQ DSSOLHG IRU WKH SXUSRVH RI IXUWKHU LQJ GHVLJQ	7KHUH LV OLWWOH RU QR HYLGHQFH RI 7KRPH[DV SHOYLGHQFH RI PXOV ZKHUHQHZ NQRZOHGJH WKDW VEHQHZ NQRZOHGJH DTXLUHG IURP UH IRU WKH SXUSRVH RI IXUWKHU LQJ GHVLJQ

(j) a knowledge of contemporary issues

7$%/(6WXGHQW 2XWFRPHV LQGLFDWRUV DQG GHVFU

,QGLFDWRU &RXUVH $VVHVVPHQW 'HVFULSWLRQ

$ELOLW\ WR LGHQWLI\ &(I FXUUHQW WUHQGV LQ SURIHVVLRQDO\ UHODWHG LQGXVWULHV

6XPPDUL]H D WHFKQRORJLFDO SURGXFW RU WUH
LQ ED WWHU\ WHFKQRORJ\
([KLELW WKURXJKRXW WKH FRXUVH DQG GHH 3URM
1RWHERRN WHFKQLTXHV SHUIRUPV

7KLV RXWFRPH UHIHUV WR VWXGHQW DELOLW\ WR LGHQWLI\ FXUUHQW WUHQGV LQ WKH HOHFWULF FDUEDWWHU\ LQGXVWULHV VX
WHFKQRORJ\ IRU WKH HOHFWULF FDUEDWWHU\ LQGXVWU\ PRWRU WHFK
RU F\EHUVHFXULW\ OL\QUHOZLRUQWG RQDWKH LQWHUQHW

,QGLFDWRU 7KLV LQGLFDWRU UHIHUV WR VWXGHQW DELOLWLHV WR GHVLJQ DQG LQVSHFW DQG WHVW
LQGXVWULHV 7KH WHFKQRORJ\ PRWRU WHFK

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

7$%/(6WXGHQW 2XWFRPHV LQGLFDWRUV DQG GHVFU

,QGLFDWRU &RXUVH $VVHVVPHQW 'HVFULSWLRQ

$ELOLW\ WR XVH GDWD RU (8VH D ’00 WR PHDVXUH VRPH DVSHFW RI D FLU
HTXLSPHQW IRU HQJLQHHUL ((8VH D 0DUN PHDVXUHPHQW WR PHDVXUH VRPH DVSHFW RI D FLU
WLFH (& (8VH DQ RVFLOORVFRSH WR PHDVXUH SHDVPHWHU
(& (8VH WKH ;LQLQ[VRIWZDUH WR YHULI\ D
$ELOLW\ WR XVH DSSURULDWH VRIW ;UL WH D 0DWODE FLUFXLW WR DQDO\VH K IURP
ZDUH IRU HQJLQHHULQJ (& SUDFWLFH DFRXVWLF VLJQDO

$ELOLW\ WR XVH DSSURSULDWH
GHYORSPHQW WRROV IRU HQJLQHÀ 0U L

(& (Students will demonstrate an ability to use the matlab development environment to write a computer program as evid enced in laboratory reports.