

04 Nov 2022

IUPUI-WL BME Integration Workshop Meeting Notes

Executive Summary:

The IUPUI and Purdue Academic Programs teams met to begin the integration of our academic programs. AM meetings focused on undergraduate programs and PM meetings focused on graduate programs. Central to all discussions and planning are our core values of respect, belonging, and excellence. Our particular focus in academic programs is providing a rigorous and inclusive training environment for our students; with a culture of respect and belonging such that each student attains their highest potential of excellence. The joint IUPUI-Purdue team share these values and a strong collaborative spirit that led to many positive and productive discussions throughout the day.

Purdue's stated goal for the Indianapolis campus is to increase the number of degree seeking students from the current level of ~5,000 to >6,000 students. We estimate that between our graduate and undergraduate programs, BME could double the student population in Indy over the next 5 years, contributing to about 20% of that growth.

The following table summarizes transitions plans for the various IUPUI BME programs

Program	Transition plan	Note
BS	Merge	Course mapping and merging in progress
Dual BS (IUPUI/Butler)	Merge	Butler will need to be engaged at Provost level to negotiate MOU. (could use existing IUPUI/Butler MOU as starting point)
BS / MS (5 th year)	Merge	BS is merging so BS/MS should merge fine
MS BME – non thesis	End 2024	Different from WL PMP MS in requirements and funding
MS BME – thesis	Merge	Similar requirements
MD (IUSM) / MS BME	Merge	Merge with WL PMP MS / MD - Question about transferring IUSM courses to Purdue – need to get grades
BS Neuro (IU) / MS BME	Merge	Special program with Neuroscience – continue
PhD	Merge	New WL milestones, mentoring plans, and PQP process

Course mapping and reconciliation of courses and plan of study requirements will begin immediately. By November 15, 2022 we will provide the provost office with the above information about the program transitions plans. Also, an initial estimate of the short- and long-term teaching resources needed from service classes taught outside of BME that are required for completion of major: Our teaching needs are classified as *high*; 41% of the courses (16 courses outside of engineering, 18 Biomedical Engineering, and 5 First Year Engineering).

Moving forward we will work together to lay out a detailed timeline of a teach-out for IUPUI students, finalize course mapping and curriculum plans, and submit Engineering Faculty Documents (EFDs) to the College of Engineering Curriculum Committee (ECC) for any IUPUI courses that are expected to be continuing through the transition and for the merging curriculum.

Undergraduate Programs Integration Planning summary:

IUPUI Undergrad Program Transitions:

Table 1. Undergraduate Program Transitions		
Program	Transition plan	Note
BS	Merge	Course mapping and merging in progress
Dual BS (IUPUI/Butler)	Merge	Butler will need to be engaged at Provost level to negotiate MOU. (could use existing IUPUI/Butler MOU as starting point)

1. Learning Outcome Comparison:

Learning outcomes for BME curricula at IUPUI and Purdue are based on recommendations from BMES and ABET. Thus, the learning outcomes across the two programs are very similar and a majority of courses offered in both programs are very similar. Similar also is that both curricula seek to provide students with choice of specializing in a particular area of Biomedical Engineering.

Depth areas to be offered in West Lafayette: Biomechanics; Bioinstrumentation (optional neuro focus); Bioimaging; Quantitative Biomedicine

Depth areas to be offered in Indianapolis: Biomechanics; Biomaterials; Bioinstrumentation

Note that these are depth areas that will be offered as of the time of integration in 2024. There is room for expansion and increase in the types of depth areas on each campus as our programs and the field of Biomedical Engineering evolves.

2. Course and Curriculum Mapping:

First year engineering programs are being integrated in the FYE working group. Engineering students matriculate into their professional program in the 3rd semester (2nd year). Alignment between current Purdue and IUPUI courses is shown in Appendix I Table 3.

A draft plan of study that reconciles courses between the two programs is found in Appendix II.

Changes relative to the current Purdue curriculum include:

- Moving BME 206 Biomechanics and Biomaterials Lab from 4th semester (Spring) to 3rd semester (Fall). *Introductory modules will need to be incorporated and some material shifted around. Will need to align BME 206 and BME 214.
- Moving BME 201 Biomolecules from 4th semester (Spring) to 5th semester (Fall) *Note students interested in biomaterials could have the option to take this in 4th semester (Fall).
- Moving BME 205 Molecular and Cellular Bioengineering Laboratory from 3rd semester (Fall) to 5th semester (Fall). *Laboratory modules will change to remove introductory materials and to integrate higher order molecular, cellular (and tissue?) level concepts)
- Statistical Methods course (STAT 350) could be moved to 5th semester

3. Outstanding questions:

- a. We would like the dual BS/BS degree program with Butler to continue under Purdue? Who do we talk to about this?
- b. Indy will need an academic advisor. When will requests for these types of resources be able to be made?
- c. There was a call for proposals for new collaborative research grants between IUPUI and Purdue faculty. Will there also be a call for proposals for new collaborative efforts in course and curriculum development?
- d. How long will the teach-out plan for the professional programs need to be in place? Can students that start FYE in 2023 and matriculate to their professional programs in Fall 2024 be under the new plan of study. We can do this at Purdue because the students do a change of degree (CODO) into their professional program. How will this work for the Indy students. (Our preference is to have FYE 2023/BME 2024 students CODO into the new 2024 curriculum.)

4. Next Steps –

Teach-out timeline

Prior to Jan 31, 2023 a detailed timeline of the teach out plan

List of students that will be affected

Estimation of # of students on co-op that may impact timeline changes

Timeline of courses that will be offered and for how long

Weekly team meetings - UG transition team will meet weekly to move these plans forward

Curriculum reconciliation – subgroup will identify and work with instructors of courses that are similar to compare and decide if similar enough to merge into one, to keep separate and offer both (but students only can take one).

Graduate Program Integrations Integration Planning summary:

IUPUI Grad Programs Transitions:

Table 3. Graduate Program Transitions		
Program	Transition plan	Note
BS / MS (5 th year)	Merge	BS is merging so BS/MS should merge fine
MS BME – non thesis	End 2024	Different from WL PMP MS in requirements and funding
MS BME – thesis	Merge	Similar requirements

MD (IUSM) / MS BME	Merge	Merge with WL PMP MS / MD - Question about transferring IUSM courses to Purdue – need to get grades -
BS Neuro (IU) / MS BME	Merge	Special program with Neuroscience – continue!
PhD	Merge	New WL milestones, mentoring plans, and PQP process

5. ***Grad Graduate Student Transitions*** – See Tables in IUPUI Grad Student Info document created by Julie – all new PhD students will enter WL BME 2023; Current PhD students at IUPUI will need WL BME co-chair until 2024; 2 PhD students at IUPUI with IUSM PI will need co-chair from WL BME and IUSM faculty should apply for courtesy in WL BME; all PhD students who pass PQP at IUPUI before 2024 will be allowed to enter WL BME as qualified students; BS/MS students can double count up to 12 credits at WL BME;
6. ***IUPUI Grad Course Transitions*** – subgroup will identify courses with similar title and ask instructors to compare and decide if similar enough to merge into one, to keep separate and offer both (but students only can take one), or if different enough that students can take both;
7. Other IUPUI graduate program **global agreements** (institutional grad agreements) to transition - None –
8. Other related issues - how long to have access to student records (transcripts, progression to degree, advising...); Need to make registrations for IUSM course (life sciences, etc.) really easy as a draw for students to be in Indy;

APPENDIX I. Current Purdue and IUPUI BME core course alignment

Table 1. UNDERGRADUATE CORE COURSE ALIGNMENTS		
Purdue	IUPUI	Notes
BME courses:		
200-Level		
214 Fundam. Mech. Analysis	241 Introd. Biomechanics	
206 Biomechanics and Biomaterials Lab	243 Biomechanics Lab	
290 Frontiers in BME	ENG 125?	*Purdue adding a ENG 103 course with same content as 290. Will be an equivalent.
201 Biomolecules	CHEM-C Organic Chemistry 1	
205 Biomolecular and Cellular Systems Laboratory	354 Cell and Tissue Lab	these might not be current equivalents, needs to be looked at
207 Fundamentals of Bioinstrumentation and Measurement	222 Introductory Biomeasurements and 224 Biomeasurements Lab	
256 Physiological Modeling of Human Health	334 Biomedical Computing	these might not be current equivalents, needs to be looked at
202 Thermodynamics of Biological Systems		
300-Level		
ECE 301 Signals and Systems	331 Biosignals and Systems	we would like this to be taught in WL BME in future
	381 Implantable Materials and Biological Responses	
	383 Implantable Materials Lab	
	388 Applied Biomaterials	
301 Bioelectricity	411 Quantitative Physiology in BME	these might not be current equivalents, needs to be looked at
360 Introduction to Bioimaging		
304 Biotransport Fundamentals	442 Biofluid Mechanics 461 Transport Processes in BME	
314 Experimental Measurement in Biomechanics	352 Applied Biomechanics	
356 Math Models & Methods in Physiology		
366 Data Science in BME		
390 Prof. Dev & Design in BME	302 BME Prof. Dev and Design	
389 Junior Design Laboratory		

STAT 350 Statistical Measurements (or equivalent)	322 Probability and Statistics in BME	
400-Level		
489 Prof. Elements of Design		
490 Senior Design	491 Biomed Eng Design I	
	491 Biomed Eng Design II	IUPUI has a required two semester sequence for senior design
Other courses (Not including FYE ENG courses or communications courses)		
*BIOL 230 Biol. Of Living Cell	BIO-K 234 Cell Biology	*taken only by engineers. Cell bio, with elements of eng
MATH 165 Analy Geom, Calc 1	MATH 165 Analy Geom, Calc 1	
MATH 166 Analy Geom, Calc 2	MATH 166 Analy Geom, Calc 2	
MATH 261 Multivariate Calculus	MATH 261 Multivariate Calculus	
MATH 262 Linear Algebra and Diff Eqns	MATH 266 Diff Eqns and MATH 171 Multidimensional Mathematics	*Purdue students can also take Linear Algebra and Diff Eqn separately to fulfill this requirement
PHYS 172 Modern Mechanics	PHYS 152 Mechanics	
PHYS 214 Electricity and Optics	PHYS 251 Heat, Electricity, and Optics	

APPENDIX II: Undergraduate Plan of Study: DRAFT

Suggested Plan of Study - Effective Fall 2023 or Fall 2024

Credit hours required for graduation: 130

Changes relative to current Purdue BME PoS highlighted

Freshman Year

<i>First Semester</i>	<i>Second Semester</i>
(4) MA 16500 Analytical Geom. & Calc. I	(4) MA 16600 Analytical Geom & Calc. I
(4) CHM 11500 General Chemistry	(4) Science Selective~ (CHM 116 <i>recommended</i>)
(2) ENGR 13100 Transforming Ideas to Innov I	(4) PHYS 17200 Modern Mechanics
(3) Oral or Written Communication	(2) ENGR 13200 Transforming Ideas to Innov II
13	(3) Oral or Written Communication
	17

Sophomore Year

<i>Third Semester</i>	<i>Fourth Semester</i>
(3) BME 21400 Fund of Biomech Analysis	(3) BME 20700 Fund of Bioinstr & Meas
(1) BME 20600 Biomech & Biomaterial lab-8wk	(3) BME 25600 Physiol. Modeling of Human Health
(1) BME 29000 Frontiers in BME	(3) STAT 35000 Statistical Methods (<i>or equiv.</i>)
(3) BIOL 23000 Biology of the Living Cell	(4) MA 26200+ Linear Algebra & Ordinary Diff. Eq.
(4) MA 26100 Multivariate Calculus	(3) BME 29500 Thermodynamics in Bio Sys II
(3) PHYS 24100 Electricity and Optics	16
(3) Science Selective~ (<i>Programming</i>)	
18	

Junior Year

<i>Fifth Semester</i>	<i>Sixth Semester</i>
(3) BME 20100 Biomol: Strct, Funct & Engr Apl	(2) BME 39000 Profes Devlp & Design in BME
(1) BME 20500 Biomolec & Cellular Syst Lab-8wk	(2) BME 38900 Junior Design Lab
(3) BME 3XX Pathway Course (<i>primary path</i>)	(3) BME 3XX Pathway Course (<i>primary path</i>)
(3) BME 3XX Pathway Course (<i>secondary path</i>)	(3) General Education Elective
(1) BME 38000 Junior Professionalization	(3) Technical Elective (<i>Quantitative Breadth</i>)
(3) Technical Elective	(3) Gen. Ed. or Ethics/Policy Elective
(3) Gen. Ed. or Ethics/Policy Elective	16
17	

Senior Year

<i>Seventh Semester</i>	<i>Eighth Semester</i>
(3) BME 48901 Senior Design Project	(3) Technical Elective
(1) BME 49000 Professional Elements of Design	(3) Technical Elective (<i>Data Science-focused QB</i>)
(3) Technical Elective	(3) Life Science Elective
(3) Life Science Elective	(3) General Education Elective
(3) General Education Elective	(3) Unrestricted Elective
(3) General Education Elective	(2) Unrestricted Elective
16	17

Depth Area:	FALL	SPRING
*Bioelectronics	BME 301 Bioelectronics	ECE 301 Signals & Systems
Biomechanics	BME 304 Biotransport Fundamentals	BME 314 Exp. Methods in Biomechanics
Biomaterials	BME 38100 Implantable Materials & Biol. Resp.	BME 35200 Cell & Tissue Mechanics
	BME 38300 Implantable Materials Lab	BME 35400 Cell & Tissue Lab
OR		
Biomaterials	BME 304 Biotransport Fundamentals	BME 38100 Implantable Materials & Biol. Resp. BME 38300 Implantable Materials Lab*
*Bioimaging	ECE 301 Signals & Systems	BME 360 Biomed Image Processing
*Quantitative Biomed.	BME 356 Math Mod & Method in Physiology	BME 366 Foundations in Data Sci in BME

****NOTES:**

- Biomaterials Depth Area to be offered only in Indy
- How similar are the IUPUI Cell and Tissue Mechanics courses (BME 352) to BME 314 Fundamentals of Biomechanical Analysis? Can they concepts be integrated?
- Can aspects of the IUPUI BME 383 Implantable materials Lab and BME 354 Cell and Tissue Lab be incorporated into the BME 206 and BME 205 Labs?
- Bioimaging and Quantitative Biomedicine Pathways to be offered in West Lafayette
- Get Imaging and Instrumentation of agree on timing of taking ECE 301. Teach our own BME Signals and Systems in WL
- - Need to review remaining Indianapolis BME 300-level and 400-level courses to determine if they are depth options or technical electives.