THE OHIO STATE UNIVERSITY

College of Engineering

Undergraduate Education & Student Services

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Memo

To: Randy Smith, Vice Provost for Academic Programs
From: Rosie Quinzon-Bonello, Assistant Dean for Curriculum and Assessment
Date: January 11, 2024
Re: Informational Item – Curriculum Change to the BS in Biomedical Engineering

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On January 10, 2024, The College of Engineering Committee for Academic Affairs approved the curriculum change proposal submitted by Biomedical Engineering BS program to

Replace the capstone sequence BIOMEDE 4901 and BIOMEDE 4902 with the following three capstone sequence options:

- BIOMEDE 4901.01/4902.01 syllabi (General BME Capstone I/II)
- BIOMEDE 4901.02/4902.02 syllabi (Industry BME Capstone I/II)
- BIOMEDE 4901.03/4902.03 syllabi (Medical Product Development Capstone I/II)

There is no change to the overall number of credit hours to the program. This change is in response to the increase in enrollment in the program, the increase of number of faculty teaching capstone, and the desire to provide a better thematic representation of topics.

Yours sincerely,

Rosie Quinzon-Bonello

Department of Biomedical Engineering

Tanya M. Nocera, Ph.D.
Professional Practice Associate Professor
Director of Medical Product Development Program
3100B Fontana Labs, 140 W. 19th Ave
Columbus, OH 43210
nocera.15@osu.edu
Phone: 614-292-4752

11/20/2023

To: Boyd Panton, CCAA Chair

Re: Changes to BME BS Program (Capstone Sequence)

On behalf of the Department of Biomedical Engineering (BME), I am writing to request a curriculum change for the **BME BS program**.

We are seeking approval to **replace the current BIOMEDE 4901/4902 capstone design sequence with three new thematic capstone course options**, as follows: 1) **BIOMEDE 4901.01/4902.01** General BME Capstone I/II; 2) **BIOMEDE 4901.02/4902.02** Industry BME Capstone I/II; and 3) **BIOMEDE 4901.03/4902.03** Medical Product Development Capstone I/II (for BS-MS students).

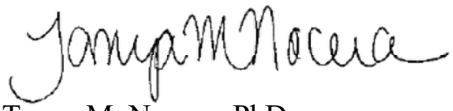
Rationale: This curriculum change request is in response to the growing enrollment in the BME program's current capstone course sequence (BIOMEDE 4901/4902), the addition of multiple faculties teaching this sequence, and the desire to provide a better thematic representation of the types of projects students should expect when enrolling in a capstone sequence led by each faculty member. While the student learning outcomes for all three sections will remain consistent, the creation of three separate decimal sequences will allow each faculty to tailor their individual course syllabi, Carmen pages, course structure, and student deliverables to better support student learning within each theme of projects. Each section will also have its own pre-requisite course requirement, if necessary, to ensure students are best prepared for the type(s) of projects within that section. All three course sequences will fulfill the capstone requirement for the BME major.

BME would like this change to take effect beginning Au24. Attached are the following supporting documents:

1) BIOMEDE 4901/4902 syllabi (current, for reference);
2) BIOMEDE 4901.01/4902.01 syllabi (General BME Capstone I/II);
3) BIOMEDE 4901.02/4902.02 syllabi (Industry BME Capstone I/II);
4) BIOMEDE 4901.03/4902.03 syllabi (Medical Product Development Capstone I/II);
5) New curriculum sheet with new capstone decimal options listed.

If you have any further questions, please contact me at Nocera.15@osu.edu with cc to BME curriculum coordinator and BS-MS advisor, Ashlynn Fisher.1399@osu.edu.

Sincerely,



Tanya M. Nocera, PhD
Professional Practice Associate Professor
Department of Biomedical Engineering

Support Document 1:
Current BIOMEDE 4901 & BIOMEDE 4902 Syllabi

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Biomedical Engineering Capstone Design I

BIOMEDE 4901

Description / Conditions

Transcript Abbreviation:
BME Sr Design I

Course Description:
First course in a two-course BME capstone sequence. Introduction to design principles; challenges of biomedical device design; projects focus on helping persons with disabilities.

Course Levels:
Undergraduate (1000-5000 level)

Designation:
Required

General Education Course:
(N/A)

Cross-Listings:
(N/A)

Course Detail

Credit Hours (Minimum if "Range"selected):
3.00

Max Credit Hours:
(N/A)

Select if Repeatable:
Off

Maximum Repeatable Credits:
(N/A)

Total Completions Allowed:
(N/A)

Allow Multiple Enrollments in Term:
No

Course Length:
14 weeks (autumn or spring)

Off Campus:
Never

Campus Location:
Columbus

Instruction Modes:
In Person (75-100% campus; 0-24% online)

Prerequisites and Co-requisites:
Prereq: Sr standing in BiomedE.

Electronically Enforced:
No

Exclusions:
Not open to students with credit for 501 or 565.01.

Course Goals / Objectives:

- A) Students will be able to develop and list engineering specifications from clinical needs; (4)
- B) Students will be able to demonstrate engineering design and optimization for a new device in a team environment; (c)
- C) Students will be able to take a problem from idea to drawing and physical prototype form using modern engineering tools; (2)
- a) GE Reflctn Booknd LO: Engaged Citiznshp & Intercultural Competency: Studnts consider public health, safety, welfare, global, cultural, social, environmental, & econ factors in applying eng design to produce solutions meeting specified needs.
- b) GE Reflctn Booknd LO: Personal & Professional Development: Students individually assess and pursue personal professional growth in concert with project requirements and personal career goals.
- GE Reflctn Booknd LO: Cultivate Engineering Mindset: Students develop an engineering mindset that demonstrates constant curiosity, makes connections between disparate bodies of information, and seeks opportunities to create value.

Check if concurrence sought:
No

Contact Hours

Contact Hours:

Contact Hours For Each Topic.

Topic	LEC	REC out-of-class	REC in-class	Weekly LAB out-of-class	Weekly LAB in-class
Design Process	14.0	0.0	0	0.0	0
Design Projects	0	0.0	14	0.0	0
Physiology, team-building, device needs finding and specifications	0	0.0	6	0.0	0
Total	**14**	**0**	**20**	**0**	**0**

Grading and Texts

Grading Plan:
Progress - Letter

Course Components:
Lecture

Grade Roster Component:
Lecture

Credit by Exam (EM):
No

Grades Breakdown:

Grades Breakdown

Aspect	Percent
Mini-Project	10%
Homework and class assignments	50%
Class attendance and participation	10%
Presentations	30%

Representative Textbooks and Other Course Materials:

Title	Author	Year

Design of Biomedical Devices and Systems, Marcel Dekker, 2003	King, P.H. and R.C. Fries	2003
Biodesign: The Process of Innovating Medical Technologies" 2nd Ed.,Cambridge University Press, 2010.ISBN(13): 978-0-521-51742-3	S. Zenios, J. Makower, P. Yock, eds	2010

ABET Student Learning Outcomes

ABET-CAC Criterion 3 Outcomes:

(N/A)

ABET-ETAC Criterion 3 Outcomes:

(N/A)

ABET-EAC Criterion 3 Outcomes:

Significant contribution (7+ hours)	2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
Significant contribution (7+ hours)	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Embedded Literacies (UG courses only)

Embedded Literacies Info:

Advanced writing 2.3 Develop scholarly, creative or professional products that are meaningful to them and their audience
Data Analysis - Quantitative 1.4A Evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects
Data Analysis - Qualitative 1.4B Evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects
Technology 1.3 Evaluate the social and ethical implications of technology

Attachments / Additional Notes or Comments

Attachments:

(N/A)

Additional Notes or Comments:

(N/A)

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Biomedical Engineering Capstone Design II

BIOMEDE 4902

Description / Conditions

Transcript Abbreviation:
BME Sr Design II

Course Description:
Second course in a two-course BME capstone sequence. Applying design principles; challenges of biomedical device design; engineering and testing devices that focus on helping persons with disabilities.

Course Levels:
Undergraduate (1000-5000 level)

Designation:
Required

General Education Course:
(N/A)

Cross-Listings:
(N/A)

Course Detail

Credit Hours (Minimum if "Range"selected):
3.00

Max Credit Hours:
(N/A)

Select if Repeatable:
Off

Maximum Repeatable Credits:
(N/A)

Total Completions Allowed:
(N/A)

Allow Multiple Enrollments in Term:
No

Course Length:
14 weeks (autumn or spring)
12 weeks (summer only)

Off Campus:
Never

Campus Location:
Columbus

Instruction Modes:
In Person (75-100% campus; 0-24% online)

Prerequisites and Co-requisites:
Prereq: 4901, or permission of instructor.

Electronically Enforced:
No

Exclusions:
Not open to students with credit for 502 or 565.02.

Course Goals / Objectives:

- • Students will be able to demonstrate team management skills and complete a design project with clinical significance; (5)
- • Students will be able to develop a testing plan and analyze the device prototype against performance metrics (6)
- • Students will be able to deliver a written and oral presentation.
- a) GE Reflctn Booknd LO: Engaged Citiznshp & Intercultural Competency: Studnts consider public health, safety, welfare, global, cultural, social, environmental, & econ factors in applying eng design to produce solutions meeting specified needs.
- b) GE Reflctn Booknd LO: Personal & Professional Development: Students individually assess and pursue personal professional growth in concert with project requirements and personal career goals.
- c) GE Refl Bkend LO: Engaged Citiznshp & Intercultural Competency: Cultivate Engr Mindset: Studnts develop an engr mindset that demonstrates constant curiosity, makes connections betwn disparate bodies of info, & seeks opportunities to create value.
- GE Reflctn Booknd LO: Cultivate Engineering Mindset: Students develop an engineering mindset that demonstrates constant curiosity, makes connections between disparate bodies of information, and seeks opportunities to create value.

Check if concurrence sought:
No

Contact Hours

Contact Hours:

Contact Hours For Each Topic.

Topic	LEC	REC out-of-class	REC in-class	Weekly LAB out-of-class	Weekly LAB in-class
Build devices	18	0.0	0	0.0	0
Design team updates and meetings	14	0.0	0	0.0	0
Test Devices	10.0	0.0	0	0.0	0
Total	**42**	**0**	**0**	**0**	**0**

Grading and Texts

Grading Plan:
Letter Grade

Course Components:
Lecture

Grade Roster Component:
Lecture

Credit by Exam (EM):
No

Grades Breakdown:

Grades Breakdown

Aspect	Percent
Group update presentations	20%
Group final design presentation	20%
Homework and reports	60%

Representative Textbooks and Other Course Materials:

Title	Author	Year

Design of Biomedical Devices and Systems, Marcel Dekker, 2003	King, P.H. and R.C. Fries	2003
Biodesign: The Process of Innovating Medical Technologies" 2nd Ed.,Cambridge University Press, 2010.ISBN(13): 978-0-521-51742-3	S. Zenios, J. Makower, P. Yock, eds	2010

ABET Student Learning Outcomes

ABET-CAC Criterion 3 Outcomes:

(N/A)

ABET-ETAC Criterion 3 Outcomes:

(N/A)

ABET-EAC Criterion 3 Outcomes:

Significant contribution (7+ hours)	3	an ability to communicate effectively with a range of audiences - pre-2019 EAC SLO (g)
Significant contribution (7+ hours)	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
Significant contribution (7+ hours)	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Embedded Literacies (UG courses only)

Embedded Literacies Info:

Advanced writing 2.3 Develop scholarly, creative or professional products that are meaningful to them and their audience
Data Analysis - Quantitative 1.4A Evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects
Data Analysis - Qualitative 1.4B Evaluate the social and ethical implications of data collection and analysis, especially in relation to human subjects
Technology 1.3 Evaluate the social and ethical implications of technology

Attachments / Additional Notes or Comments

Attachments:

(N/A)

Additional Notes or Comments:

(N/A)

Support Document 2:
BIOMEDE 4901.01/4902.01 syllabi (General BME Capstone I/II)

BME 4901.01: General BME Capstone I

Course Description: First course in the general BME capstone sequence. Introduction to design principles; needs finding, idea generation, and presentation of projects that include a real-world, medically relevant problem with a focus on potential users. Documentation and technical skills are developed throughout the course.

Level: Senior standing in BME
Credits: 3 (1cred lecture, 2cred lab)
Prerequisites: Pre-Req: BIOMEDE 2001; Co-req: BIOMEDE 3701, or permission of instructor
Class Time: Monday 4-5pm (lecture); Wed 3:55-5:45pm and Fri 3:55 – 5:45pm (lab)

Term Offered: Autumn 2024
Call Number:

Instructors: Dr. Mark Ruegsegger
3100A Fontana Lab
Office phone: 247-6890
Email: ruegsegger.1@osu.edu

Staff: Ben Jones
1117 Fontana Lab
Office phone: 688-1331
Email: jones.182@osu.edu

Recommended Textbook:

S. Zenios, J. Makower, P. Yock, eds,"Biodesign: The Process of Innovating Medical Technologies" 2nd Ed.,Cambridge University Press, 2010.ISBN(13): 978-0-521-51742-3

Course Objectives: At the end of the course sequence, students will be able to...

- develop and list engineering specifications from clinical needs; (4)
- demonstrate engineering design and optimization for a new medical product in a team environment; (c)
- take a clinical need from idea to drawing and/or prototype using modern engineering tools; (2)
- demonstrate engineering design & optimization for a new medical product in a team environment; (5)
- test design performance with respect to at least one primary design requirement and standard (6).
- deliver a technical presentation & write a technical team report (3)

Relationship to ABET Program Objectives

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

BME Program Criteria satisfied within this course

(c) Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes

Grading Plan:

10%: Class attendance and participation
5%: Weekly Meetings/Minutes
20%: Problem Definition oral report
10%: Peer Evaluation
10%: Mini-Design Project
20%: Problem Definition written report
10%: Design Concepts & mock-ups
15%: Final Design Proposal oral report

Topics to be covered:

Week	Weekly Schedule	Class Dates	Homework Due
1	Intro, overview of design process; Projects introduced Design Process I: Defining the Problem	A 23 A 25	 Project selections due by midnight (A 25)
2	Team intros and logistics. Design Process II: Functions & Requirements Guest lecture by Liz Gauen, Rehab Engineering Clinical environment and client interviews No class lecture.	A 28 A 30 S 1	Send first email to clinical mentor (A 28)
3	Team meetings with clinical mentor this week! **No Class – Labor Day (Monday, Sept 4)** (No lectures this week)	S 4-8	
4	Team work-session: Background research (Group 1 & 2) or 3D-printer training (Group 3 & 4) Team work-session: Background research (Group 3 & 4) or 3D-printer training (Group 1 & 2) No class	S 11 S 13 S 15	
ECS ENGINERING EXPO (SEPTEMBER 18-19)			
5	Team meetings with Mark (Group 1,2) Team meetings with Mark (Group 3) Team meetings with Mark (Group 4)	S 18 S 20 S 22	 SolidWorks HW Due
6	Team meetings with Mark (Group 1,2) Team meetings with Mark (Group 3) Team meetings with Mark (Group 4)	S 25 S 27 S 29	
7	Design Process III: Concept Generation and Evaluation Team prep day for oral reports	O 2 O 4	

	Problem Definition Oral Report – Group 4	O 6	
8	**Problem Definition Oral Report – Group 1, 2** **Problem Definition Oral Report – Group 3** **No Class – Autumn Break (Oct 12-13)**	O 9 O 11 O 13	
9	Team work sessions: Team concept sketches (Get together 2 of 3 days)	O 16 O 18 O 20	**Prob Def Written Report Due- (O 18)**
10	Team meetings with Mark (Group 1,2) Team meetings with Mark (Group 3) Team meetings with Mark (Group 4)	O 23 O 25 O 27	**Sketches Due (O 23-27)**
11	Team work sessions: Make 1-3 device mock-ups	O 30 - N 3	
12	Team work sessions – finish design; prepare for presentation; check-in with clinical mentor on design status **No Class – Veterans Day (Friday, Nov 10)**	N 6-9	
13	Team meetings with Mark (Group 1,2) Team meetings with Mark (Group 3) Team meetings with Mark (Group 4)	N 13 N 15 N 17	**Mock-ups due (N 13-17)**
14	Team work sessions – finish design; prepare for presentation **No classes - Thanksgiving Break (November 22-24)**	N 20	**Peer Evaluation (N 20)**
15	Team work day for Oral talk and Idea Pitch event OSU Keenan Center – Device Idea Pitch event **Preliminary Design Oral report – Group 4**	N 27 N 29 D 1	
16	**Preliminary Design Oral report – Group 1, 2** **Preliminary Design Oral report – Group 3**	D 4 D 6	**Oral report due (D 6)**
	BME 4901 Final: Thursday, December 14th @ 5:45pm (Preliminary Design Written Report)	D 15	**Written Report Due by 5:45pm (D14)**

Important Class Details

Design Notebook: Each team must create and keep a design notebook and binder. This notebook must be electronic, and will be a permanent record of your work. I will give you a Microsoft OneDrive folder to put all work in. Everything that you do in connection with this course, and with your design, must be entered into the design notebook.

Homework: There is no "traditional" homework (e.g., problem sets) in this course.

Exams: There are no exams.

Peer Evaluation: At the end of the semester, you will be given a chance to confidentially evaluate the performance of your team members. The evaluations count towards 5% of your final grade and helps me ensure that everyone is "pulling their own weight" on the team. However, should there be additional concerns that you have about your team throughout the semester, do not hesitate to bring those concerns to me or any other member of the teaching staff.

Both giving and receiving these peer evaluations provide you with feedback that can help your team improve as a professionals. Therefore, I consider them to be very important and an invaluable portion of the class.

Weekly Meetings with Faculty: In general, each team is expected to have meetings with the engineering faculty every three weeks (or more as needed), and clinical faculty members every three weeks. The purpose of these meetings with faculty is to review progress, discuss any problems, and schedule tasks for the upcoming week. Should you wish to meet with both sides of the teaching team at the same time or during the same week, you are free to do so if scheduling permits.

You, the students, will be running the meetings with the faculty. The ability to effectively run a meeting is a valuable skill, so this will give you an opportunity to practice. A different student will run the meeting each week and will be responsible to setting the agenda for the meeting. However, it is the responsibility of all students to come to the meeting prepared to discuss what has been done the previous week, have a list of questions to ask, and be prepared to receive feedback. In order to complete the meeting within a reasonable amount of time, organization, preparation, and respect for others' time is a must.

A written agenda must be sent to the faculty advisors, and the other members of the team. The person leading the meeting must also bring a hard copy of the agenda to the meeting for all attendees. There is no mandatory format of the agenda. The content of the meeting will vary depending on the timing within the semester. Appropriate items that might be discussed are: progress from the previous week, open questions, difficulties with manufacturing/ordering parts, discussion of design tradeoffs, gauging progress with respect to proposed timelines, planning long-terms goals, assigning tasks for the next week, etc. If you have questions about the content of an agenda, do not hesitate to contact me.

Additionally, one other student will be responsible for taking brief minutes at the meeting and for **sending these minutes out to the rest of the team and all faculty advisors for that team within 24 hours of the meeting.** This job will also rotate among all students and will change weekly. The meeting minutes should be sufficiently detailed to allow everyone, especially the faculty advisors who were not present, to understand the topics discussed at the meeting. Important things to include in the meeting minutes include summaries of important discussions, key decisions that were made, and a list of action items for the members of the team. This is also a great way to look at the division of labor, as everyone should have at least 1 action item assigned to them.

Visits with Clients and Customers: It is tremendously valuable to talk with your clients and customers. We are going to ask you to visit with them**.** It is best that your team makes at least 1 visit while you are further defining your problem and requirements and at least 1 visit to show them your physical prototypes. You are

more than welcome, and encouraged, to visit your clients and customers more than twice during the semester (just have a purpose for every meeting as to not annoy them).

Problem Definition and Requirements Report: A written report will be required for each team. You will submit an electronic copy (in Word or PDF) of this report via the Carmen dropbox. The format of this document will be explained in a separate handout.

Design Concepts: One of the important steps in creating a new device is to brainstorm many design concepts. Nothing is worse than rigidly hanging onto your first idea and ramming it through the design process until completion. No matter how crazy some of your initial ideas may seem, they may lead you to more successful ideas.

In this spirit of brainstorming, each you will be required to sketch **20 initial design concepts** in your design notebooks. Each member of the team will be asked to generate 20 initial ideas individually, so there should be 20*n ideas for a team of "n" students. You can help each other brainstorm ideas, but you are responsible for generating a total of 20*n ideas. Since it is very possible that some of your initial ideas will be similar, the coaches *are not looking for exactly 20*n original ideas*. The purpose of this assignment is to generate many potential ideas for your device.

You will be graded solely on the number of concepts that you generate. If you generate 20 concepts, you will earn 20/20 points. If you generate 19 concepts, you earn 19/20 points. Etc. If, in the coaches' opinion, you and your teammates are all generating many ideas that appear to be too similar to each other, the coaches have the option of asking you to generate more concepts. **These concepts must be shown to at least one of your mentors in a meeting.**

Physical 'Mock-ups': Another key step in the design process involves making prototypes of your devices. You can learn a great deal about a design concept by making something that you can "play with". Your clients can also get a better sense of what you are considering and can give you much better feedback on your ideas if you give them something physical to handle. These initial prototype 'mock-ups' can be made from foamcore, Styrofoam, cardboard, PVC, and a host of other materials and can often be completed in less than an hour.

You are responsible for building **prototype 'mock-ups' of 1-3 of your initial designs.** After you down select some of your brainstormed concepts, these prototypes are typically of the designs that you are considering for your decision matrix. It is then *strongly encouraged* that you show these prototypes to your clients/customers as you proceed towards your final design and complete your decision matrix. **You are responsible for showing at least one of your mentors 1- 3 prototypes in a meeting.**

Final Design Proposal Presentation: The purpose of the presentation is to explain to the class how you chose your proposed concept and to give specific design details about your device. **You will, as a group, give a 12-minute oral presentation.**

Final Design Proposal Report: The content of the report will focus on your proposed design and the process by which you arrived at that concept. It will include information from the previous 2 reports of the project, so it is expected that you will have improved those documents in this submission. You will submit an electronic copy (in Word) of this report via the Carmen dropbox. If your coaches request it, you will also submit a hard copy of the report to them. The format of this document will be explained in a separate handout. **The written report must be submitted in the Carmen dropbox.**

IP information for class

- IP Language:
  "Intellectual Property Ownership Notice: Students will potentially not own any rights, title, or interests in inventions developed as part of this course.
  Per The Ohio State University Intellectual Property University Policy (rev. 4-15-2018), all rights, titles, and interests in inventions created during or as a direct result of this class are potentially the sole property of The Ohio State University."
- Table For Students:

Required Documents For Students in Capstone Class		
Scenario	**Student Participation and Assignment Agreement**	**Patent Inventorship Assignment**
Students working on project idea developed by them	No assignment agreement needed	Students would initiate independent of OSU
Students working on project involving background IP/idea/funding/extensive support from Faculty/Department/ University	Required	Required if TCO moves forward with patent
Students working on project involving background IP/idea from External Partner with or without Funding	Required, IP will go directly to company per Capstone Agreement	Required if Company moves forward with patent
Honda Master Capstone Agreement (MCA) Related Projects*	Yes, plus second one for Honda as required by MCA	Required if Company moves forward with patent
Student working on project involving background IP/idea/funding from Government (not R25 grant)	Required	Potentially Required
Project is funded through gift/donation	Required	Potentially required
Project is not funded**	Depends (see above)	Depends (see above)
*Follow Honda Capstone Process **If no funding, determine path based on other scenarios		

How this course works

Mode of delivery: This course will be an in-person class.

Office Hours and Live Sessions: Office hours will be Tuesdays from 12:30-2:30pm, or by appointment.

Credit hours and work expectations: This is a **3.0 credit-hour course**. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 9 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

Grading and faculty response

Instructor feedback and response time

Grading and feedback:

- ALL assignments will be uploaded to the proper Assignment page on Carmen.
- For large weekly assignments, you can generally expect feedback within **7 days**.
- **Email:** I will reply to emails within **24 hours on days when class is in session at the university**.
- **Discussion board:** I will check and reply to messages in the discussion boards every **24 hours on school days**.

BME 4902.01: General BME Capstone II

Course Description: Second course in the general BME capstone sequence. Application of design principles; build/design/test of medical device; and presentation of projects that demonstrate solving an open-ended biomedical problem. Documentation and technical skills are developed throughout the course.

Level: Senior standing in BME
Credits: 3
Prerequisites: Pre-req: BIOMEDE 4901.01, or permission of instructor
Class Time: Monday 4-5pm (lecture); Wed 3:55-5:45pm and Fri 3:55 – 5:45pm (lab)

Term Offered: Spring 2025
Call Number:

Instructors: Dr. Mark Ruegsegger — Office phone: 247-6890
3100A Fontana Lab — Email: ruegsegger.1@osu.edu

Staff: Ben Jones — Office phone: 688-1331
1117 Fontana Lab — Email: jones.182@osu.edu

Recommended Textbook:

S. Zenios, J. Makower, P. Yock, eds,"Biodesign: The Process of Innovating Medical Technologies" 2nd Ed.,Cambridge University Press, 2010.ISBN(13): 978-0-521-51742-3

Course Objectives: At the end of the course sequence, students will be able to...

- develop and list engineering specifications from clinical needs; (4)
- demonstrate engineering design and optimization for a new medical product in a team environment; (c)
- take a clinical need from idea to drawing and/or prototype using modern engineering tools; (2)
- demonstrate engineering design & optimization for a new medical product in a team environment; (5)
- test design performance with respect to at least one primary design requirement and standard (6).
- deliver a technical presentation & write a technical team report (3)

Relationship to ABET Program Objectives

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

BME Program Criteria satisfied within this course

(c) Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes

Grading Plan:

10%: Class attendance and participation
5%: Weekly Meetings/Minutes
10%: Testing Plan written report
10%: Testing Plan oral report

20%: Final Design written report
20%: Preliminary Design written report
15%: Final Design poster
10%: Peer evaluation; final E-portfolio

Topics to be covered:

Week	Weekly Schedule	Semester Dates	Homework Due
1	CLASS OVERVIEW meeting on Monday, Jan 9 Team build time and Group 4 meetings Team build time and Group 5 meetings	J 9 J 11 J 13	
2	Martin Luther King Jr Day (No class on Jan 16) **TCO Idea Pitch Event (ALL teams)** Team build time and Group 6 meetings	J 16 **J 18** J 20	**"Idea Pitch" @ TCO (4:00pm)**
3	Team build time and Group 4 meetings Team build time and Group 5 meetings Team build time and Group 6 meetings	J 23 J 25 J 27	**Standards homework (J 27)**
4	Team build time and Group 4 meetings Team build time and Group 5 meetings Team build time and Group 6 meetings	J 30 F 1 F 3	
5	Team build time and Group 4 meetings Team build time and Group 5 meetings Team build time and Group 6 meetings	F 6 F 8 F 10	
6	Team build time and Group 4 meetings Team build time and Group 5 meetings Team build time and Group 6 meetings	F 13 F 15 F 17	**Invention Disclosure (F 17)**
7	Team build time and presentation preparation time	F 20 - 24	
8	**Testing Plan Oral reports** Group 4 Teams Group 5 Teams Group 6 Teams	 F 27 M 1 M 3	

9	**COMPLETION of PROTOTYPE BUILD!!**	M 6, 8, 10	**Testing Plan Written report (M 10)**
10	**SPRING BREAK (March 13-17)**		
11	Team build and testing time; optional meetings	M 20 M 22 M 24	
12	Prototype analysis, Testing and Group 4 meetings Prototype analysis, Testing and Group 5 meetings Prototype analysis, Testing and Group 6 meetings	M 27 M 29 M 31	**Peer evaluation (M31)**
13	Prototype analysis, Testing and Group 4 meetings Prototype analysis, Testing and Group 5 meetings Prototype analysis, Testing and Group 6 meetings	A 3 A 5 A 7	
14	Prototype analysis, Testing and Group 4 meetings Prototype analysis, Testing and Group 5 meetings Prototype analysis, Testing and Group 6 meetings	A 10 A 12 A 14	
15	Prototype analysis and Poster preparation time	A 17, 19, 21	**Poster due (A 19)**
16	Team showcase preparation session **CoE Capstone Showcase (TBD)**	A 24 A 25	
	Final Written report due Thursday, April 27th @ 4pm	A 27	

Important Class Details

IP Ownership Notice: Students will not own any rights, title, or interests in inventions developed as part of this course. Per The Ohio State University Intellectual Property University Policy (rev. 4-15-2018), all rights, titles, and interests in inventions created during or as a direct result of this class are the sole property of The Ohio State University. Students may request a reassignment of the rights from the Technology Commercialization Office.

E-portfolio: Each team must create and keep an e-portfolio (on Buckeye Box). Everything that you do in connection with this course, and with your design, must be stored in the Buckeye Box team folder. You will be expected to keep all files neatly organized and accessible, especially if you wish to file a patent on your design.

Exams: There are no exams.

Peer Evaluation: Toward the end of the semester, you will be given a chance to confidentially evaluate the performance of your team members. The evaluations count towards 5% of your final grade and helps me ensure that everyone is "pulling their own weight" on the team. However, should there be additional concerns that you have about your team throughout the semester, do not hesitate to bring those concerns to me or any other member of the teaching staff.

Weekly Meetings with Faculty: We will follow the same guidelines as last semester. Regular meetings with each mentor is expected, and team members should rotate in developing the agenda and meeting minutes.

Testing Plan Oral Report: Your group will give an approximately 12-minute oral presentation during class in the 8th week of the term. The presentation will explain how you will test your device to show if the requirements have been met. You will want to make sure that you consider both the engineering and clinical aspects of all tests that you plan to perform. The format of this presentation will be explained in a separate handout.

Testing Plan Written Report: A written report will be due the week after the Oral Report. You will submit an electronic copy (in Word or PDF) of this report via the Carmen dropbox. The format of this document will be explained in a separate handout.

Invention Disclosure Form: Each student will be asked to complete an invention disclosure form in mid-February. This will serve two important purposes. One, it will give you experience in filling out the form. Two, it will protect the intellectual property of your device, especially for groups that present at a public symposium or other student competition. The online document is found at **innovation.osu.edu**, and guidelines for completing this document will be explained in a separate handout.

End-of-Semester Presentations: Depending on COVID status, you will, as a group, give two presentations.

1. A poster presentation at the College of Engineering Senior Design Showcase. The purpose of the presentation is to show to the public the final status and performance of your device. There will be opportunity for the project to be videotaped. The format of the poster will be explained in a separate handout.
2. A Design Demo at the BME/ME Design Showcase.

Final Device Report: A written report will be due on your final exam date. This report will include all material that you have accumulated throughout the year. You will submit an electronic copy (in Word or PDF) of this report via the Carmen dropbox. The format of this document will be explained in a separate handout.

Support Document 3:
BIOMEDE 4901.02/4902.02 syllabi (Industry BME Capstone I/II)

BME 4901.02: Industry BME Capstone I

Course Description:
This course serves as the first installment of the Industry BME capstone sequence. It provides students with a foundational understanding of design principles, emphasizing the application of these principles in the context of solving real-world industry challenges. Throughout the course sequence, students will engage in a structured process that includes needs finding, idea generation, and prototyping, all centered around addressing medically relevant problems with a keen focus on industry end-users.

Level: UG
Semester Offered: AU
Credits: 3cr (1cr lecture, 2cr lab)
Prerequisites: Pre-Req: BIOMEDE 2001; Co-Req: BIOMEDE 3702, or permission of instructor.

Lecture:	Mondays	3:55 pm – 4:45 pm @ Fontana Lab 1125
Lab:	Wednesdays:	3:55 pm – 5:45 pm @ Team Workshops
	Fridays:	3:55 pm – 5:45 pm @ Team Workshops
Office Hours:	By appointment	
Groupme:	Team generated	

Dr. OR's Groupme:

Course Instructor:
Professor Alexis Ortiz-Rosario
Office: Fontana Lab 3015
Email: ortiz-rosario.1@osu.edu
Office phone: 614-688-1776
Virtual Room: https://osu.zoom.us/j/599175310

Lab Supervisor:
Ben Jones
Office: Fontana Lab 1117
Email: jones.182@osu.edu
Office phone: 614-688-1331

Teaching Assistants:
1. TBD

Course Goals:
Students are expected to demonstrate-

1. *Integration of Theoretical Knowledge:* To apply foundational principles of biomedical engineering acquired throughout the academic program to solve real-world industry challenges.

2. *Interdisciplinary Collaboration:* Foster teamwork and communication skills by working closely with professionals from various disciplines within the biomedical industry, such as clinicians, engineers, and business experts.

3. *Problem Solving and Innovation:* Develop creative problem-solving and innovation in the development of biomedical devices or solutions, addressing specific needs identified by the industry partner and research.

4. *Project Management:* Develop project management skills, including time and resource management, to successfully plan, execute, and complete a complex design project within the specified timeframe.

5. *Personal and Teamwork Growth:* Cultivate individual growth by self-reflecting on personal talents, as well as strengthen the ability to collaborate effectively with diverse team members, emphasizing the importance of teamwork in achieving project goals and addressing multifaceted challenges.

6. *Industry-Relevant Skills:* Gain hands-on experience with industry standards, tools and technologies, while becoming subject matter experts in specific topics related to the design challenge.

Course Objectives (ELOs): At the end of the course sequence, students will be able to...

- develop and list engineering specifications from clinical needs; (4)
- demonstrate engineering design and optimization for a new medical product in a team environment; (c)
- take a clinical need from idea to drawing and/or prototype using modern engineering tools; (2)
- demonstrate engineering design & optimization for a new medical product in a team environment; (5)
- test design performance with respect to at least one primary design requirement and standard (6).
- deliver a technical presentation & write a technical team report (3)

Relationship to ABET Program Objectives

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

BME Program Criteria satisfied within this course

(c) Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes

Recommended Textbook:

S. Zenios, J. Makower, P. Yock, eds, "Biodesign: The Process of Innovating Medical Technologies" 2nd Ed.,Cambridge University Press, 2010.ISBN(13): 978-0-521-51742-3

Grading:

Category	Assignment
Client Reports (30%)	Preliminary Design Reports*
	Prototyping Reports*
	Client Video Updates
	Prototype Showcase
Project Reports (30%)	Problem Definition
	Functions and Requirements
	Concept Sketches
Team Documents (20%)	Asset Map
	Team Agreement
	Weekly Minutes^
	Weekly PowerPoints^
	Semester/Sprint Plan^
Team Evaluations (20%)	First Team Evaluation
	Second Team Evaluation
	Professional Evaluation

**Reports are 10% for document and 5% for oral presentation*

^Team reports are cumulative throughout the semester

COURSE SCHEDULE
Due dates on Carmen

WK	DATE	MODULE	CLASS	HOMEWORK DUE
				due on Fridays
1	8/21	**Initial Setup and Research**	Design Intro | Team Dynamics	Team Agreement + Asset Map
2	8/28		Problem Definition | Research	Draft Problem Definition
3	9/4		Functions | Requirements | Constraints	Draft Func. Requirements
4	9/11		Standards | Concept Generation | BOM	Concept Sketches and Standards
6	9/18		Revision on Design	Prob. Def. & Func. Req. Update
7	9/25		Revision on Concepts	Concept Sketches Update
8	10/2		Report Discussion	
9	10/9		Approve Design	**Preliminary Design Reports**
10	10/16		Project Management/Scrum	Mid-Semester Team Evals
11	10/23	**Minimally Viable Prototyping**	Test | Validation | Collaboration Sprint #1	Testing Matrix
12	10/30		Sprint #2	
13	11/6		Sprint #3	3rd Meeting Report w/ Client
14	11/13		Sprint #4	
15	11/20		Sprint #5	
16	11/27		Sprint #6	Prototyping Reports
17	12/4		Sprint #7	**Prototype Showcase | End of Semester Team Evals**
There will be two peer evaluations during the weeks of 10/12 and 12/7				

CLASS RHYTHM
Typical meetings and due dates for the class

Event	Monday	Tuesday	Wednesday	Thursday	Friday
Class/ Lab	In-person Meeting		Student Team Workshop		Student Team Meetings
HW	In-Class Update		Meeting Minutes Due		Assignment Due

POLICIES AND PROCEDURES

Attendance: Attendance to the class of this course is mandatory.

Carmen website: Carmen contains all course material organized by week.

Late assignments. ***Assignments will be accepted at a 50% grade penalty.*** This rule does not include late assignments due to excusable circumstances (e.g., sickness, family emergency, sponsor-related delays or other uncontrollable situations), whenever possible seek instructor's approval prior to due date.

Final course grade. A weighted average grade will be calculated following the guidelines given in the first page.

Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	E
Points	> 93	> 90	> 87	> 83	> 80	> 77	> 73	> 70	> 67	> 60	< 60

ADDENDUM

Disabilities: The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodation, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodation so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Academic Integrity (Academic Misconduct): If instructors suspect that a student has committed academic misconduct in this course, they are ***obligated by University Rules to report their suspicions*** to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University. Academic Integrity LINK

Sexual Harassment: Sexual harassment includes unwelcome sexual advances, requests for sexual favors, and other physical or verbal conduct of a sexual nature and is not tolerated at Ohio State. For more information, including policy statements, FAQs and complaint forms see: Title IX LINK

IP information for class

- IP Language:
  "Intellectual Property Ownership Notice: Students will potentially not own any rights, title, or interests in inventions developed as part of this course.
  Per The Ohio State University Intellectual Property University Policy (rev. 4-15-2018), all rights, titles, and interests in inventions created during or as a direct result of this class are potentially the sole property of The Ohio State University."'

Required Documents For Students in Capstone Class		
Scenario	**Student Participation and**	**Patent Inventorship Assignment**

	Assignment Agreement	
Students working on project idea developed by them	No assignment agreement needed	Students would initiate independent of OSU
Students working on project involving background IP/idea/funding/extensive support from Faculty/Department/ University	Required	Required if TCO moves forward with patent
Students working on project involving background IP/idea from External Partner with or without Funding	Required, IP will go directly to company per Capstone Agreement	Required if Company moves forward with patent
Honda Master Capstone Agreement (MCA) Related Projects*	Yes, plus second one for Honda as required by MCA	Required if Company moves forward with patent
Student working on project involving background IP/idea/funding from Government (not R25 grant)	Required	Potentially Required
Project is funded through gift/donation	Required	Potentially required
Project is not funded**	Depends (see above)	Depends (see above)
Follow Honda Capstone Process / **If no funding, determine path based on other scenarios		

COVID-19 AND ONLINE COURSE DELIVER

Mode of delivery: This course is 100% in-person. The Monday class will be in-person until the university revokes access to the campus.

Online engagement and attendance: Students are expected to attend the classroom portion either virtually or in-person (based on assignment). The course will be engaging mostly during in-class hours with some portions being outside the classroom activities.

Technology requirements: Students are expected to have a working computer with a webcam (internal/external), a microphone (internal/external) and a stable internet connection.

BME 4902.02: Industry BME Capstone II

Course Description: This course serves as the second installment of the Industry BME capstone sequence. It provides students with a foundational understanding of design principles, emphasizing the application of these principles in the context of solving real-world industry challenges. Throughout the course sequence, students will engage in a structured process that includes needs finding, idea generation, and prototyping, all centered around addressing medically relevant problems with a keen focus on industry end-users.

Level: UG
Semester Offered: SP
Credits: 3
Prerequisites: BIOMEDE 4901.02, or permission of the instructors.

Lecture:	Mondays	3:55 pm – 4:45 pm @ Fontana Lab 1125
Lab:	Wednesdays:	3:55 pm – 5:45 pm @ Team Workshops
	Fridays:	3:55 pm – 5:45 pm @ Team Workshops
Office Hours:	By appointment	
Groupme:	Team generated	

Class Groupme:

Course Instructor:
Professor Alexis Ortiz-Rosario
Office: Fontana Lab 4100A
Email: ortiz-rosario.1@osu.edu
Office phone: 614-688-1776
Virtual Office: https://osu.zoom.us/j/599175310

Lab Supervisor:
Ben Jones
Office: Fontana Lab 1117
Email: jones.182@osu.edu
Office phone: 614-688-1331

Teaching Assistants:

- TBD

Course Goals:

1. *Prototype Testing and Validation Proficiency*: Develop the ability to design comprehensive testing protocols and methodologies to rigorously evaluate the performance, safety, and reliability of biomedical engineering prototypes. Understand the principles of experimental design and statistical analysis to draw meaningful conclusions from test data.

2. *Industry Collaboration and Integration*: Foster strong partnerships and collaboration with industry professionals to gain insights into industry-specific standards, expectations, and best practices related to testing and validating biomedical prototypes. Integrate industry expertise to enhance the quality and relevance of the testing and validation processes.

3. *Regulatory Compliance and Quality Assurance*: Acquire an in-depth understanding of the regulatory frameworks and quality assurance processes governing biomedical device testing and validation. Learn how to navigate compliance requirements and ensure that the developed prototype meets industry standards and regulations.

4. *Feedback Incorporation and Iterative Design*: Develop the ability to effectively incorporate feedback obtained from prototype testing, industry experts, and end-users. Utilize feedback to iteratively refine the prototype, optimizing its design, functionality, and usability to better address identified needs and requirements.

5. *Presentation and Communication of Results*: Enhance skills in presenting and communicating testing and validation results in a clear, concise, and compelling manner to diverse stakeholders, including industry professionals, project stakeholders, and peers. Learn to articulate findings, discuss implications, and propose recommendations for further improvement based on the data collected.

Course Objectives (ELOs): At the end of the course sequence, students will be able to...

- develop and list engineering specifications from clinical needs; (4)
- demonstrate engineering design & optimization for a new medical product in a team environment; (c)
- take a clinical need from idea to drawing and/or prototype using modern engineering tools; (2)
- demonstrate engineering design & optimization for a new medical product in a team environment; (5)
- test design performance with respect to at least one primary design requirement and standard (6).
- deliver a technical presentation & write a technical team report (3)

Relationship to ABET Program Objectives

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

BME Program Criteria satisfied within this course

(c) Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes

Recommended Textbook:
S. Zenios, J. Makower, P. Yock, eds,"Biodesign: The Process of Innovating Medical Technologies" 2nd Ed.,Cambridge University Press, 2010.ISBN(13): 978-0-521-51742-3

Grading:

Category	Assignments
Client Report (50%)	Sprint Update Report
	Final Report
	Final Prototype Showcase
Project Documents (25%)	Product Concept Sketch
	Prototype Update Video
	1st Build - Mockup
	1st Validation Protocol + Results
	2nd Build
	2nd Validation Protocol + Results
	Final Build
Team Reports (25%)	Weekly Minutes^
	Weekly PowerPoints^
	Proposal for Next Steps
^Cumulative assignments	

COURSE SCHEDULE
Due dates on Carmen

WK	DATE	CLASS	Objective	**TASKS DUE** *due on Friday of second sprint week*
1	1/09	**Sprint 1**	Sensor Tests / Product Concept Sketches	Sensor Test Video Product concept sketch
2	**1/16**			
3	1/23	**Sprint 2**	Build Iteration #1: Mockup	3D Drawings + Build
4	**1/30**			
5	2/6	**Sprint 3**	Validation Testing #1	Validation Protocol and Results
6	**2/13**			
7	2/20	**Sprint 4**	Build Iteration #2	3D Drawings + Build Sprint Update Report/Presentation
8	**2/27**			
9	3/6	**Sprint 5**	Validation Testing #2	Validation Protocol and Results (Updated)
10	**3/13**			
11	3/20	**Sprint 6**	Build Iteration #3	3D Drawings + Build
12	**3/27**			
13	4/3	**Sprint 7**	Preparing for Presentations	Proposal for Next Steps
14	**4/10**			
15	4/17	***FINAL PRESENTATION / POSTER***		Final Presentation / Final Report
There will be two peer-evaluations during the weeks of 3/1 and 4/19				

CLASS SRINNG RHYTHM (2-Week Cycle)
Typical meetings and due dates for the class

Event	Monday	Tuesday	Wednesday	Thursday	Friday
1st Week	In-person Meeting		Virtual Team Meeting		
2nd Week	In-Class Update		Virtual Team Meeting		Assignment Due

POLICIES AND PROCEDURES

Attendance: Attendance to the class of this course is mandatory.

Carmen website: Carmen contains all course material organized by week.

Late assignments. ***Assignments will be accepted at a 50% grade penalty.*** This rule does not include late assignments due to excusable circumstances (e.g. sickness, family emergency, or other uncontrollable situations), whenever possible seek instructor's approval prior to due date.

Final course grade. A weighted average grade will be calculated following the guidelines given in the first page.

Letter	A	A-	B+	B	B-	C+	C	C-	D+	D	E
Points	> 93	> 90	> 87	> 83	> 80	> 77	> 73	> 70	> 67	> 60	< 60

ADDENDUM

Disabilities: The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

This course uses the default SLDS Flex Plan (if student is approved for it):

- *Attendance (if graded): 50% additional excused absences;*
- *Participation (if graded): Asynchronous opportunity to make up points (e.g. written contribution, reading summary);*
- *Quizzes/Exams (if date-specific): Makeup opportunity within 1 week;*
- *Deadlines (for solo assignments): Extend up to 3 days.*

**This plan can call for more flexibility depending on the student's situation. Please communicate with me for changes.*

Academic Integrity (Academic Misconduct): If instructors suspect that a student has committed academic misconduct in this course, they are ***obligated by University Rules to report their suspicions*** to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University. Academic Integrity LINK

Sexual Harassment: Sexual harassment includes unwelcome sexual advances, requests for sexual favors, and other physical or verbal conduct of a sexual nature and is not tolerated at Ohio State. For more information, including policy statements, FAQs and complaint forms see: Title IX LINK

IP information for class

- IP Language:
  "Intellectual Property Ownership Notice: Students will potentially not own any rights, title, or interests in inventions developed as part of this course.

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Required Documents For Students in Capstone Class		
Scenario	**Student Participation and Assignment Agreement**	**Patent Inventorship Assignment**
Students working on project idea developed by them	No assignment agreement needed	Students would initiate independent of OSU
Students working on project involving background IP/idea/funding/extensive support from Faculty/Department/ University	Required	Required if TCO moves forward with patent
Students working on project involving background IP/idea from External Partner with or without Funding	Required, IP will go directly to company per Capstone Agreement	Required if Company moves forward with patent
Honda Master Capstone Agreement (MCA) Related Projects*	Yes, plus second one for Honda as required by MCA	Required if Company moves forward with patent
Student working on project involving background IP/idea/funding from Government (not R25 grant)	Required	Potentially Required
Project is funded through gift/donation	Required	Potentially required
Project is not funded**	Depends (see above)	Depends (see above)
Follow Honda Capstone Process / **If no funding, determine path based on other scenarios		

COVID-19 AND ONLINE COURSE DELIVER

Mode of delivery: This course is 50% online. The Monday class will be in-person until the university revokes access to the campus. The Wednesday session is open for students to meet. *Email me if this arrangement does not work for you.*

Online engagement and attendance: Students are expected to attend the classroom portion either virtually or in-person (based on assignment). The course will be engaging mostly during in-class hours with some portions being outside the classroom activities.

Technology requirements: Students are expected to have a working computer with a webcam (internal/external), a microphone (internal/external) and a stable internet connection.

Support Document 4:
BIOMEDE 4901.03/4902.03 syllabi (Medical Product Development BME Capstone I/II)

BIOMEDE 4901.03 – Medical Product Development Capstone I

MPD Program Capstone Sequence

Course Description: First course in a culminating BME design sequence for those enrolled in the BS-MS pathway in Medical Product Development (MPD). Introduction to the Biodesign process, focused on opportunity definition, market analysis, and user-centered co-design in collaboration with clinical and corporate partners, is provided in this course. Professional and technical skills related to biomedical industries are also developed.

Pre-requisites: Pre-Req: BIOMEDE 2001 and Enrollment in the BME BS-MS MPD pathway, or permission of instructor

Class Time: M 3:55 – 4:45pm (lecture); WF 3:55 – 5:45pm (lab)

Instructors:	**Prof. Tanya Nocera, PhD**	(she/her)	Email: nocera.15@osu.edu
	Prof. Lauren Eichaker, PhD	(she/her)	Email: eichaker.1@osu.edu
	Prof. Doug Boyd, PE, PMP	(he/him)	Email: boyd.849@osu.edu

Textbook: ***Biodesign: The Process of Innovating Medical Technologies***, Second Edition, Yock, et al., ISBN 978-1-107-08735-4 Available through OSU Library

Supplemental Online Resources: ebiodesign.org

Course Expectations. In this course sequence, students are expected to:

- ***establish effective team, client and user relationships*** through implementation of practices, such as empathy, user-centered design and communication, that support high performance, continuous improvement, and enhanced impact of designs.
- ***perform professionally*** by exhibiting integrity, accepting responsibility, taking initiative, and providing leadership necessary to ensure project success.
- ***apply prior knowledge and independent research*** from sources such as clinical shadowing, publications, patents, etc., to define opportunities and generate solutions for unmet biomedical needs.
- ***make decisions using user needs and design requirements,*** while satisfying relevant societal, economical, regulatory, professional, and/or other constraints.
- ***manage project schedule and resources*** to ensure timely and within-budget milestone completion.
- ***pursue professional development*** through individual assessment and pursuit of personal professional growth in concert with project requirements and personal career goals.

Course Objectives. At the end of the course sequence, students will be able to….

- develop and list engineering specifications from clinical needs; (4)
- demonstrate engineering design and optimization for a new medical product in a team environment; (c)
- take a clinical need from idea to drawing and/or prototype using modern engineering tools; (2)
- demonstrate engineering design & optimization for a new medical product in a team environment; (5)
- test design performance with respect to at least one primary design requirement and standard (6)
- deliver a technical presentation & write a technical team report (3)

Relationship to ABET Program Objectives

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use

engineering judgment to draw conclusions.

BME Program Criteria satisfied within this course

(c) Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes

Grading Plan: *This course follows the standard OSU Grading Plan.*

30%: Professionalism, Client Relations
20%: Project Management
30%: Reports, Presentations
20%: Other Course Deliverables

Pace of course activities: This course is divided into **weekly modules** that are released one week ahead of time. Students are expected to keep pace with weekly activities but may schedule efforts freely within that time frame.

Credit hours and work expectations: This is a 3 cr-hour course. According to Ohio State bylaws on instruction (go.osu.edu/credithours), students should expect around 1 hrs per week of time spent on direct instruction (class lectures and instructor-led activities) and 4 hours per week of "practical or experimental work" (workshops and client meetings), in addition to 2-3 hours of outside work (readings, project assignments, etc) to receive a *passing* grade. Note a *passing* grade does not equate to an "A."

Disabilities: Any student who feels they may need an accommodation based on the impact of a disability should contact the instructors privately to discuss your specific needs. Please contact Disability Services at to coordinate reasonable accommodations for students with documented disabilities.

Autumn Semester Tentative Schedule and Workload Expectations

Note: schedule is subject to change.

			Topic	Deliverables *Due dates are subject to change*
1	23-Aug	W	Welcome, Overview, MS presentations	
		TEAM		
2	28-Aug	M	Project Descriptions, Empathy Workshop	
	30-Aug	W	Secondary Research - Library Workshop (FL 1125)	**Strengths Assessment** **Asset map** Due 9/4
		TEAM		**Project Applications** Due 9/4
3	4-Sep	M	**NO CLASS - Labor Day**	
	6-Sep	W	Teams Announced, Strengths Workshop (Charter)	**Team When2Meet** Due 9/6
		TEAM		
4	11-Sep	M	Client Relations and Project Management, Part 1	Client Kickoffs by Sept 22
	13-Sep	W	Wednesday Workshop	
		TEAM		**Charter** Due 9/15
5	18-Sep	M	**Biodesign Process and Needs Exploration**	**Watch Lecture 1** (26min) **Ref: Biodesign 1.1, 1.2**
	20-Sep	W	Wednesday Workshop	
		TEAM		**Research Plan** Due 9/22
6	25-Sep	M	**Defining Opportunity (Stakeholders, Existing Solutions)**	**Watch Lecture 2** (18min) **Ref: Biodesign 2.2, 2.3**
	27-Sep	W	Wednesday Workshop	
		TEAM		
7	2-Oct	M	**Building Empathy for Users (Experience Charts, Personas)**	**Watch Lecture 3** (20 min)
	4-Oct	W	Wednesday Workshop	
		TEAM		
8	9-Oct	M	**Market Analysis, Part 1**	**Watch Lecture 4a** (21 min) **Ref: Biodesign 2.4; 2.5**
	11-Oct	W	**NO CLASS - Fall Break/BMES Conference**	
		TEAM		
9	16-Oct	M	**Market Analysis, Part 2 (Business Models)**	**Watch Lecture 4b** (14 min) **Ref: Biodesign 2.4; 2.5**
	18-Oct	W	Wednesday Workshop	
		TEAM		
10	23-Oct	M	**Need Statement and Need Criteria**	**Watch Lecture 5** (23 min) **Ref: Biodesign 1.3**
	25-Oct	W	Wednesday Workshop	
		TEAM		
11	30-Oct	M	**Client Relations and Project Management, Part 2**	**Design Notebook Check**
	1-Nov	W	Wednesday Workshop	
		TEAM		Schedule client presentations
12	6-Nov	M	**Effective Presentations and Constructive Feedback**	**Self-Evaluations** Due 11/6
	8-Nov	W	Wednesday Workshop	
		TEAM		
13	13-Nov	M	**Team presentations #1: Opportunity Definition**	**Presentation Slides** Due 11/13
	15-Nov	W	Wednesday Workshop	**Report #1** Due 11/15

		TEAM		
14	20-Nov	M	Team Time: Presentation feedback, eval submission	Peer Evaluations Due 11/20
	22-Nov	W	**NO CLASS - Thanksgiving Break**	
		TEAM		
15	27-Nov	M	**Translating Opportunity to Specifications**	Watch Lecture 6 (13 min)
	29-Nov	W	Wednesday Workshop	
		TEAM		
16	4-Dec	M	Team Time: report #1 feedback, Specs Doc, Gantt Chart	**Requirements, Functions, Specs** Due 12/4
	6-Dec	W	Semester Wrap-up and Spring Overview	**Spring Gantt Chart** Due 12/6
		TEAM		**Design Notebook Check**
	Finals			**Revised Report #1** (to Carmen, Client) Due 12/11

Important Class Details

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Carmen site: You should have access to the Carmen site for the Medical Product Development section of BME 4901. **All course deliverables must be uploaded to Carmen for grading and assessment purposes.**

Team Charter: Your team will collaborate to create a team charter. Each individual team member will agree to a role and responsibility, as well as a shared sense of purpose in pursuing the project objectives. Adherence to the team charter will be expected of all team members.

Documentation: Documentation is a key factor to the success of the project. The team maintains an ongoing record (design notebook) of the project in electronic form on your team's project Microsoft Team/OneDrive. Documentation includes all submitted assignments, meeting minutes, research results, technical documentation, trip visit summary reports, etc. **The use of Google Drive or Docs is not allowed in order to protect client confidentiality.** If applicable, each person maintains and submits an Intellectual Property Notebook. In order to protect sponsor information created and exchanged during the project, all students sign a Student Participation Agreement at the beginning of the project.

Written Reports: Written documents are cumulative throughout the academic year, and follow the format identified in the respective assignment description. Due to the wide range of project types, some sections of the assignment description may not apply or may require modification to fit the project. The team should work with their project advisor to identify these changes. Course faculty will review and comment on each deliverable. **When submitting the next assignment of the report, teams are required to respond to comments and incorporate recommended changes in the previously submitted section. A portion of the overall evaluation depends on the effectiveness and completeness of these changes.**

Oral Presentations: Typically, presentations are in PowerPoint form to summarize the written document for the client. Teams will present each presentation in class to peers and instructors before presenting to the clients. Course faculty will grade and comment on the presentation. Client feedback may also be incorporated.

Professionalism: This course serves as a transition into the professional working world. In addition to abiding by the Code of Student Conduct, you are expected to conduct yourselves in a professional manner in all interactions, including peer-to-peer, student-to-instructor, and with all client and clinician communications. Students are expected to exhibit honesty and integrity, give respect, accept responsibility, take initiative, and provide leadership necessary to ensure project success and client satisfaction. This includes attendance and participation in course, team and client meetings. Please note that ***discrimination and harassment against any individual is strictly prohibited, and will not be tolerated***. Please refer to the **BME Standard Syllabus Resources** on Carmen for info on reporting discrimination and harassment. Professionalism within internal-facing and external-facing contexts will be evaluated throughout the year.

Peer, Self, Instructor, Client Evaluations: Evaluating oneself and one's team members is a real and regular part of the professional world. You will be asked to complete evaluations in a professional manner, and provide constructive and honest feedback to your peers, instructors, and clients in a way that helps

everyone grow professionally. This activity will be part of the Professionalism grade. Clients may also be given the opportunity to provide evaluations of team members throughout the project duration.

Status Updates: We will be meeting as a class approximately twice per week, as noted in the course schedule. As we dive deeper into the projects, each team will be asked to present regular status update presentations (template provided).

Meeting Roles and Responsibilities: You, the students, will be planning and leading meetings with corporate clients and clinicians. The ability to effectively run a meeting is a valuable skill. The following roles should be assigned, on a rotating schedule, so that each team member has an opportunity to serve in each capacity multiple times:

1) **Meeting Lead**: responsible for creating and sharing an agenda at **least 24 hours prior** to the scheduled meeting to all team members, clients, and any other in attendance. Mentors should always be cc'ed. This individual will be responsible for leading the conversation and ensuring the meeting addresses all agenda items.
2) **Meeting Documenter**: responsible for documenting meeting notes (minutes) and ensuring documentation is properly stored on Microsoft Teams/OneDrive. This individual will also be responsible for emailing the minutes to all team members, clients, and any others in attendance (mentors always cc'ed) **no more than 24 hours after** the meeting.
3) **Full Team**: It is the responsibility of all team members to come to the meeting on time and prepared to meet the agenda goals. Everyone should be involved in the agenda planning, be attentive, and contribute input or ask questions as appropriate.

Academic Integrity (Academic Misconduct): Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, *The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty.* **Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus my constitute "Academic Misconduct."**

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. ***Ignorance of the University's Code of Student Conduct is never considered an "excuse" for academic misconduct***, so the BME faculty members recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If instructors suspect that a student has committed academic misconduct in this course, they are ***obligated by University Rules to report their suspicions*** to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact your instructors.

Other sources of information on academic misconduct (integrity) to which you can refer include:
The Committee on Academic Misconduct web pages (oaa.osu.edu/coam/home.html)
Ten Suggestions for Preserving Academic Integrity (oaa.osu.edu/coam/ten-suggestions.html) Eight Cardinal Rules of Academic Integrity (www.northwestern.edu/uacc/8cards.html)

BME 4902.03 – Medical Product Development Capstone II

MPD Program Capstone Sequence

Course Description: Second course in a culminating BME design sequence for those pursuing the BS-MS pathway in Medical Product Development (MPD). Application of the Biodesign process, focused on concept generation and screening in collaboration with clinical and corporate partners, is achieved in this course. Professional and technical skills related to biomedical industries are also developed.

Pre-requisites: Pre-Req: BIOMEDE 4901.03 and Enrollment in the BME BS-MS MPD pathway, or permission of instructor

Class Time: M 3:55 – 4:45pm (lecture); WF 3:55 – 5:45pm (lab)

Instructors:

Prof. Tanya Nocera, PhD	(she/her)	Email: nocera.15@osu.edu
Prof. Lauren Eichaker, PhD	(she/her)	Email: eichaker.1@osu.edu
Prof. Doug Boyd, PE, PMP	(he/him)	Email: boyd.849@osu.edu

Textbook: ***Biodesign: The Process of Innovating Medical Technologies***, Second Edition, Yock, et al., ISBN 978-1-107-08735-4 Available through OSU Library
Supplemental Online Resources: ebiodesign.org

Course Expectations. In this course sequence, students are expected to:

- ***establish effective team, client and user relationships*** through implementation of practices, such as empathy, user-centered design and communication, that support high performance, continuous improvement, and enhanced impact of designs.
- ***perform professionally*** by exhibiting integrity, accepting responsibility, taking initiative, and providing leadership necessary to ensure project success.
- ***apply prior knowledge and independent research*** from sources such as clinical shadowing, publications, patents, etc., to define opportunities and generate solutions for unmet biomedical needs.
- ***make decisions using user needs and design requirements,*** while satisfying relevant societal, economical, regulatory, professional, and/or other constraints.
- ***manage project schedule and resources*** to ensure timely and within-budget milestone completion.
- ***pursue professional development*** through individual assessment and pursuit of personal professional growth in concert with project requirements and personal career goals.

Course Objectives: At the end of this course sequence, students will be able to…

- develop and list engineering specifications from clinical needs; (4)
- demonstrate engineering design and optimization for a new medical product in a team environment; (c)
- take a clinical need from idea to drawing and/or prototype using modern engineering tools; (2)
- demonstrate engineering design & optimization for a new medical product in a team environment; (5)
- test design performance with respect to at least one primary design requirement and standard (6)
- deliver a technical presentation & write a technical team report (3)

Relationship to ABET Student Learning Outcomes (SLOs)

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. An ability to communicate effectively with a range of audiences;
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use

engineering judgment to draw conclusions.

BME Program-Specific Criteria Addressed Within this Course

c. analyzing, modeling, designing, and realizing BME devices, systems, components, or processes.

Grading Plan: *This course follows the standard OSU Grading Plan.*

30%: Professionalism, Client Relations 30%: Reports, Presentations
20%: Project Management 20%: Other Course Deliverables

Status Updates (typically on Mondays)

Projects will be student team driven in collaboration with clients and with support and guidance from faculty mentors. Each week, teams will prepare a status report using the 4-up slide template, and will present to faculty mentors and peers as an opportunity to gain feedback on project progress.

Workshop Time (typically on Wednesdays)

Teams are expected to be in Fontana 1136 advancing their projects, unless an alternative plan is discussed with the instructors. Instructors will be available to support teams as needed.

Client Meetings

Every effort should be made to find a regularly scheduled client meeting time OUTSIDE of the class time. Please work with your instructors to coordinate such that at least one instructor is available to attend the client meetings.

Credit hours and work expectations: This is a 3 credit-hour course. According to Ohio State bylaws on instruction (go.osu.edu/credit hours), students should expect around 3 hours per week of time spent on direct instruction (class meetings, and workshop activities, for example) in addition to 6 hours of outside work (readings, team meetings, client meetings, and project assignments, for example) to receive a *passing* grade. Note a *passing* grade does not equate to an "A."

Disabilities: Any student who feels they may need an accommodation based on the impact of a disability should contact the instructors privately to discuss your specific needs. Please contact Disability Services at to coordinate reasonable accommodations for students with documented disabilities.

Spring XXXX Tentative Schedule and Workload Expectations

Schedule is subject to change.

Wk.	Day	Date	Topic	Deliverables
1	M		**Welcome Back; Spring Structure**	Sp23 Gantt chart, client scheduling
	W		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
2	M		**MLK DAY – no class**	
	W		**Brainstorming and Ideation** ***Fontana 1136****: Workshop time*	**Watch Lecture 7** (22 min) **Ref: Biodesign 3.1** Evaluation Reflections/Action Plan Professionalism Self-Evals
	CLIENT			
3	M		**Initial Concept Selection** ***1110/1124:*** **Status Updates w/Faculty Mentors**	**Watch Lecture 8** (15 min) **Ref: Biodesign 3.2** Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
4	M		**Concept Exploration and Testing** **Status Updates w/Faculty Mentors** **SWE CAREER FAIR Mon(virtual) + Tues, 12-5p**	**Watch Lecture 9** (12 min) **Ref: Biodesign 4.5** Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
5	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
6	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
7	M		**Mid-Semester Formal Presentations**	Slides, Updated Project Report
	W		**Mid-Semester Formal Presentations**	Design Notebook Checkpoint
	CLIENT			
8	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
9	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
10			**SPRING BREAK – no class**	
11	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
12	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	Design Showcase Poster Draft
	CLIENT			
13	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
14	M		***1110/1124:*** **Status Updates w/Faculty Mentors**	Progress Report: 4-up
	W		***Fontana 1136****: Workshop time*	
	CLIENT			
15	M		**End of Term Formal Presentations**	Slides, End of Term Project Report
	W		**End of Term Formal Presentations**	Design Notebook Checkpoint
	Finals		**COE Design Showcase - TBD**	End of Term Professionalism Self-Evals

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If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact your instructors.

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The Committee on Academic Misconduct web pages (oaa.osu.edu/coam/home.html)

Ten Suggestions for Preserving Academic Integrity (oaa.osu.edu/coam/ten-suggestions.html) Eight Cardinal Rules of Academic Integrity (www.northwestern.edu/uacc/8cards.html)

Support Document 5:
New BIOMEDE Curriculum Sheet

B.S. Biomedical Engineering (SAMPLE #1) 2022-2023 Academic Year

Student Information

Name:_____ OSU Email:_____

Suggested Curriculum

This should be used as a **guide** only. Semester offerings are subject to change.

Year	Autumn	Spring
1	___ CHEM 1210 *(Gen Chem 1)* ..... 5 hr ___ MATH 1151 *(Calculus 1)* ..... 5 hr ___ ENGR 1181 *(Fundamentals of Engr 1)* ..... 2 hr ___ ENGR 1100 *(Engineering Survey)* ..... 1 hr ___ General Education *(Foundation)* ..... 3 hr	___ CHEM 1220 *(Gen Chem 2)* ..... 5 hr ___ MATH 1172 *(Engineering Math A)* ..... 5 hr ___ ENGR 1182 *(Fundamentals of Engr 2)* ..... 2 hr ___ PHYSICS 1250 *(Mechanics, Thermal, Waves)* ..... 5 hr ___ Gen Ed 1201 *(Launch Seminar)* ..... 1 hr
2	___ MATH 2173 *(Eng Math B)* ..... 3 hr ___ BIOLOGY 1113 *(Gen Biology)* ..... 4 hr ___ BIOMEDE 2000 *(Intro to BME)* ..... 3 hr ___ MECHENG 2040 *(Statics & Mechanics)* ..... 4 hr ___ BIOMEDE 2800 *(Physio/Anat Lab)* ..... 3 hr	___ MATH 2174 *(Linear Algebra & Diff EQ)* ..... 3 hr ___ PHYSICS 1251 *(E&M, Optics, Modern Phys)* ..... 5 hr ___ BME 2200 *(Cells and Molecules)* ..... 3 hr ___ MATSCEN 2010 *(Intro to Engr Materials)* ..... 3 hr ___ STAT 3450 *(Prob and Stat)* ..... 2 hr ___ BIOMEDE 2001 *(Prof Development)* ..... 1 hr
3	___ BIOMEDE 2700 *(Num Simulation in BME)* ..... 2 hr ___ MECHENG 3500 *(Thermo)* ..... 3 hr ___ Career Course ..... 3 hr ___ †BIOMEDE4X10 *(Domain 1)* ..... 3 hr ___ BIOMEDE 3701 *(BME Labs)* ..... 2 hr ___ General Education *(Foundation)* ..... 3 hr	___ BIOMEDE 3702 *(Meas & Instrum Lab)* ..... 3 hr ___ † BIOMEDE 4X10 *(Domain 2)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr ___ Career Course ..... 3 hr
4	___ BIOMEDE 4901.0X *(Capstone 1)* ..... 3 hr ___ Career Course *(Engineering)* ..... 3 hr ___ †BIOMEDE4X10 *(Domain 3)* ..... 3 hr ___ General Education *(Theme: Citizenship for Just)* ..... 4 hr ___ BIOMEDE 3703 *(Quantitative Physiol)* ..... 3 hr	___ BIOMEDE 4902.0X *(Capstone 2)* ..... 3 hr ___ Career Course *(Engineering)* ..... 3 hr ___ Career Course *(BME 5000-level)* ..... 3 hr ___ General Education *(Theme: Student Choice)* ..... 4 hr ___ General Education *(Foundation)* ..... 3 hr

Total Hours to complete the degree program = 131

Program Options

†Domain Options (choose 3)

BIOMEDE 4110 *(Bioimaging)*
BIOMEDE 4210 *(Biotransport)*
BIOMEDE 4310 *(Biomaterials)*
BIOMEDE 4410 *(Biomechanics)*
BIOMEDE 4510 *(Molecular, Cellular, & Tissue Eng)*
BIOMEDE 4610 *(Biomedical Micro-/Nano-Tech*

Student Information

Name:_____ OSU Email:_____

Suggested Curriculum

This should be used as a **guide** only. Semester offerings are subject to change.

Year	Autumn	Spring
1	___ CHEM 1210 *(Gen Chem 1)* ..... 5 hr ___ MATH 1151 *(Calculus 1)* ..... 5 hr ___ ENGR 1181 *(Fundamentals of Engr 1)* ..... 2 hr ___ ENGR 1100 *(Engineering Survey)* ..... 1 hr ___ General Education *(Foundation)* ..... 3 hr	___ PHYSICS 1250 *(Mechanics, Thermal, Waves)* ..... 5 hr ___ MATH 1172 *(Engineering Math A)* ..... 5 hr ___ ENGR 1182 *(Fundamentals of Engr 2)* ..... 2 hr ___ General Education *(Foundation)* ..... 3 hr ___ Gen Ed 1201 *(Launch Seminar)* ..... 1 hr
2	___ CHEM 1220 *(Gen Chem 2)* ..... 5 hr ___ MATH 2173 *(Eng Math B)* ..... 3 hr ___ BIOLOGY 1113 *(Gen Biology)* ..... 4 hr ___ STAT 3450 *(Prob and Stat)* ..... 2 hr ___ MATSCEN 2010 *(Intro to Engr Materials)* ..... 3 hr	___ MATH 2174 *(Linear Algebra & Diff EQ)* ..... 3 hr ___ BIOMEDE 2000 *(Intro to BME)* ..... 3 hr ___ BIOMEDE 2001 *(Prof Development)* ..... 1 hr ___ MECHENG 2040 *(Statics & Mechanics)* ..... 4 hr ___ BIOMEDE 2800 *(Anatomy for Engineers)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr
3	___ PHYSICS 1251 *(E&M, Optics, Modern Phys)* ..... 5 hr ___ BME 2200 *(Cells and Molecules)* ..... 3 hr ___ BIOMEDE 2700 *(Num Simulation in BME)* ..... 2 hr ___ MECHENG 3500 (*Thermo)* ..... 3 hr ___ BIOMEDE 3702 *(Meas & Instrum Lab)* ..... 3 hr	___ †BIOMEDE4X10 *(Domain 1)* ..... 3 hr ___ Career Course ..... 3 hr ___ BIOMEDE 3701 *(BME Labs)* ..... 2 hr ___ BIOMEDE 3703 *(Quantitative Physiol)* ..... 3 hr ___ General Education *(Theme: Student Choice)* ..... 4 hr
4	___ BIOMEDE 4901.0X *(Capstone 1)* ..... 3 hr ___ † BIOMEDE 4X10 *(Domain 2)* ..... 3 hr ___ Career Course ..... 3 hr ___ Career Course *(Engineering)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr ___ General Education *(Theme: Citizenship for Just)* ..... 3 hr	___ BIOMEDE 4902.0X *(Capstone 2)* ..... 3 hr ___ †BIOMEDE4X10 *(Domain 3)* ..... 3 hr ___ Career Course *(Engineering)* ..... 3 hr ___ Career Course *(BME 5000-level)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr ___ General Education *(Theme: Citizenship for Just)* ..... 3 hr

Total Hours to complete the degree program = 131

Program Options

†Domain Options (choose 3)

BIOMEDE 4110 *(Bioimaging)*
BIOMEDE 4210 *(Biotransport)*
BIOMEDE 4310 *(Biomaterials)*
BIOMEDE 4410 *(Biomechanics)*
BIOMEDE 4510 *(Molecular, Cellular, & Tissue Eng)*
BIOMEDE 4610 *(Biomedical Micro-/Nano-Tech)*

B.S. Biomedical Engineering (SAMPLE #3) 2022-2023 Academic Year

Student Information

Name:_____ OSU Email:_____

Suggested Curriculum

This should be used as a **guide** only. Semester offerings are subject to change.

Year	Autumn	Spring
1	___ CHEM 1210 *(Gen Chem 1)* ..... 5 hr ___ MATH 1151 *(Calculus 1)* ..... 5 hr ___ ENGR 1181 *(Fundamentals of Engr 1)* ..... 2 hr ___ ENGR 1100 *(Engineering Survey)* ..... 1 hr ___ General Education *(Foundation)* ..... 3 hr	___ CHEM 1220 *(Gen Chem 2)* ..... 5 hr ___ MATH 1172 *(Engineering Math A)* ..... 5 hr ___ ENGR 1182 *(Fundamentals of Engr 2)* ..... 2 hr ___ General Education *(Foundation)* ..... 3 hr ___ Gen Ed 1201 *(Launch Seminar)* ..... 1 hr
2	___ PHYSICS 1250 *(Mechanics, Thermal, Waves)* ..... 5 hr ___ MATH 2173 *(Eng Math B)* ..... 3 hr ___ BIOLOGY 1113 *(Gen Biology)* ..... 4 hr ___ BIOMEDE 2800 *(Anatomy for Engineers)* ..... 3 hr ___ STAT 3450 *(Prob and Stat)* ..... 2 hr	___ MATH 2174 *(Linear Algebra & Diff EQ)* ..... 3 hr ___ MATSCEN 2010 *(Intro to Engr Materials)* ..... 3 hr ___ BIOMEDE 2000 *(Intro to BME)* ..... 3 hr ___ BIOMEDE 2001 *(Prof Development)* ..... 1 hr ___ MECHENG 2040 *(Statics & Mechanics)* ..... 4 hr ___ General Education *(Foundation)* ..... 3 hr
3	___ PHYSICS 1251 *(E&M, Optics, Modern Phys)* ..... 5 hr ___ BME 2200 *(Cells and Molecules)* ..... 3 hr ___ BIOMEDE 2700 *(Num Simulation in BME)* ..... 2 hr ___ MECHENG 3500 (*Thermo)* ..... 3 hr ___ BIOMEDE 3702 *(Meas & Instrum Lab)* ..... 3 hr	___ †BIOMEDE4X10 *(Domain 1)* ..... 3 hr ___ Career Course ..... 3 hr ___ BIOMEDE 3701 *(BME Labs)* ..... 2 hr ___ BIOMEDE 3703 *(Quantitative Physiol)* ..... 3 hr ___ General Education *(Theme: Student Choice)* ..... 4 hr
4	___ BIOMEDE 4901.0X *(Capstone 1)* ..... 3 hr ___ † BIOMEDE 4X10 *(Domain 2)* ..... 3 hr ___ Career Course ..... 3 hr ___ Career Course *(Engineering)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr ___ General Education *(Theme: Citizenship for Just)* ..... 3 hr	___ BIOMEDE 4902.0X *(Capstone 2)* ..... 3 hr ___ †BIOMEDE4X10 *(Domain 3)* ..... 3 hr ___ Career Course *(Engineering)* ..... 3 hr ___ Career Course *(BME 5000-level)* ..... 3 hr ___ General Education *(Foundation)* ..... 3 hr ___ General Education *(Theme: Citizenship for Just)* ..... 3 hr

Total Hours to complete the degree program = 131

Program Options

†Domain Options (choose 3)

BIOMEDE 4110 *(Bioimaging)*
BIOMEDE 4210 *(Biotransport)*
BIOMEDE 4310 *(Biomaterials)*
BIOMEDE 4410 *(Biomechanics)*
BIOMEDE 4510 *(Molecular, Cellular, & Tissue Eng)*
BIOMEDE 4610 *(Biomedical Micro-/Nano-Tech)*

Career Electives

Select **15 hours total** from the approved list. **6 hours** must be in Engineering. An **additional 3 hours** must be in Biomedical Engineering at the 5000-level or higher.

Career Elective 1	Career Elective 2	Career Elective 3 (Engineering)
_____	_____	_____

Career Elective 4 (Engineering)	Career Elective 5 (BME 5000-level)
_____	_____

Capstone Requirement

Select **one** Capstone sequence from the below list, taken over **two** semesters, for a total of **6 hours**.

BIOMEDE 4901.01/4902.01 - General BME Capstone I/II
BIOMEDE 4901.02/4902.02 - Industry BME Capstone I/II
BIOMEDE 4901.03/4902.03 - Medical Product Development Capstone I/II (open to MPD students only)

General Education Requirement

General Education Launch Seminar
1 hr

Foundations: Writing and Information Literacy
3 hr

Foundations: Mathematical & Quantitative Reasoning/Data Analysis
Fulfilled by MATH 1151 Degree Requirement
0-5 hr

Foundations: Literary, Visual and Performing Arts
3 hr

Foundations: Historical & Cultural Studies
3 hr

Foundations: Natural Science
Fulfilled by CHEM 1210 Degree Requirement
0-5 hr

Foundations: Social & Behavioral Sciences
3 hr

Foundations: Race, Ethnic and Gender Diversity
3 hr

Theme: Citizenship for a Diverse & Just World ^^
4-6 hr

Theme: Student Choice ^^ *
4-6 hr

General Education Reflection
Embedded into Major Capstone Degree Requirement
0 hr

^^ Theme Credit Hours
Themes may completed by (one) 4 credit hour course or (two) 3 credit hour courses. We recommend one 4 credit hour course for degree planning purposes.

*** Theme: Student Choice**
Courses in *Health & Wellness Theme* can overlap with Career Elective

Student Choice options will be updated on an ongoing basis. For the most up-to-date listing of Theme options, please see the Undergraduate Education website on the New General Education requirements: https://ugeducation.osu.edu/general-education-information-students

Approved general education courses for each category can be found in the following places:

- classes.osu.edu
- Schedule Planner
- Search for Classes

(filter by *Term*, *Campus*, *Class Attribute* "General Education – New", and *Class Attribute Value* "GEN Foundation" or "GEN Theme")