Engineering Faculty Document No. 25-21

October 12, 2020

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Biomedical Engineering

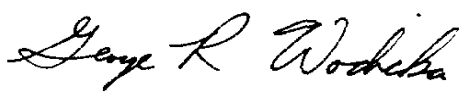
RE: New Graduate Course, BME 56400, Ethical Engineering of Medical Technologies

The Faculty of the School of Biomedical Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

BME 56400: Ethical Engineering of Medical Technologies
Term Offered: Spring, Summer, or Fall, Lecture 3, Cr. 3
Requisites, Restrictions, and Attributes: None

Description: This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice.

Reason: The course is unique at the university in that it teaches both a theoretical and practical approach to ethical engineering specifically focused on medical technologies. Advanced undergraduates, masters (research, professional, and distance), and PhD students in all disciplines of engineering interested in careers in the medical technology industries will benefit from this course by learning to identify and respond to common ethical issues that are widely experienced in engineering of medical technologies. This course is important preparation for professional engineering practice. This course has been taught for more than 10 years as a one-credit course, BME 59500. Due to the increased demand, and need for a 3-credit expanded version to support training for professional MS BME students, this course was developed and offered for the first time in Spring 2020 with an enrollment of 16 & 15 on-campus and at-a-distance respectively.



George R. Wodicka,
Dane A. Miller Head and Professor
Weldon School of Biomedical Engineering

BME 56400 Ethical Engineering of Medical Technologies

Spring 2021
CRN 19479 (Lecture) or 20728 (Distance Learning)

Credit Hours: **3**
Days and Times: **MWF 11:30 pm – 12:20 pm**
Room: **1083 MJIS** [Martin Jischke Hall of Biomedical Engineering]
BrightSpace Website: http://XXXX

Description: The medical devices industry is facing many challenges. While innovations in lifesaving new technologies are transforming medical practice, the rapid pace at which these developments are emerging and the intense pressures of the competitive industry is challenging the ethical training of the engineers involved. In addition, the regulatory environment for medical device development has been changing dramatically, leaving companies with more questions than answers on how to best practice safe and effective medical device development. These changes are creating opportunities for ethical problems to arise-- and they have. Recent documentaries, such as *The Bleeding Edge* and *Bleed Out* highlights some of the concerns over the state of the industry. This course examines many of the ethical challenges surrounding the design, development, and deployment of medical technologies. Issues will be analyzed from multiple frameworks and perspectives including industry, government, and society. Students will learn and practice identification and analysis of ethical issues. They will develop empathic and decision-making skills designed to prepare them as engineers to deal productively and ethically with issues in professional practice. Guest speakers will include thought leaders from clinical medicine, engineering innovation, and the healthcare products industry who will offer their professional insights. The final project of the course will be a paper analyzing the ethical development of an emerging medical product. This course is designed for graduate students and upper-level students in all engineering disciplines.

NOTE: For biomedical engineers, this 3-credit course satisfies the ethics and policy in healthcare requirement for undergraduates and counts toward the ethical, regulatory, and medical device development requirement for professional MS and other graduate course for thesis MS degrees.

Instructors:
Dr. Andrew Brightman, Assistant Head, Associate Professor of Engineering Practice, Weldon School of Biomedical Engineering, email: aob@purdue.edu

Dr. Michael Hiles, Senior Vice President & Chief Scientific Officer, Cook Biotech, Inc., Adjunct Professor, Basic Medical Sciences and Biomedical Engineering, email: hiles@purdue.edu

Teaching Assistant:
To be determined…
Office Hours: by appointment

ABET Student Outcome and Performance Indicators: This course maps directly to *Student Educational Outcome 4* and the related performance indicators **(4a-4e)**.

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;
    a. Recognize and describe professional and ethical codes of conduct, and ethical dilemmas which pertain to a practicing biomedical engineer.
    b. Explain ethical considerations relevant to experimentation with animal and human subjects.
    c. Justify selection of a biomedical engineering process in research or product development based on an economic analysis.
    d. Identify and/or describe how biomedical engineering solutions affect society.
    e. Recognize contemporary issues impacting biomedical engineering.

Student Learning Objectives: Students who successfully complete this course will be able to:

1. Easily recognize and analyze personal and systemic ethical issues and challenges to ethical reasoning and social responsibility (**4a, 4b, 4d, 4e**) …
2. Independently engage in empathy building activities to enhance their abilities to understand and value the perspectives of other stakeholders (**4d**) ….
3. Effectively use a structured, iterative, and collaborative decision-making process that considers the perspectives of multiple stakeholders in optimizing a design decision (**4a, 4b, 4c**)…

…when facing an engineering problem in design and development of medical devices or assistive technologies that are ethical and socially responsible.

Learning Strategies: In as much as is possible the course will focus on active and experiential learning strategies. Students will be engaged in discussions and debates about ethical issues of real engineering cases involving medical devices and assistive technologies. Students will engage in dialogue with content experts and thought leaders from clinical, academic, and industry perspectives. Students will also engage with non-technical expert users of medical and assistive technologies to gain perspectives differing from their own. They will also learn techniques for empathic perspective-taking and tools for ethical reasoning. Students will be challenged with individual and group experiential learning activities, multiple ethics case studies, as well as three team-based reports for the semester.

Text Books: This course has no text books. Students will engage with scholarly literature, recent news articles, presentations, and relevant videos. (see updated Scholarly Reference List)

Team-Based Reports: Each of the three reports will be addressing a real case involving the design, development, and deployment of an emerging medical device or assistive technology. Details of the reports and other assignments will be posted in BBL.

1. **Ethical Issues Analysis Report** - based on a team analysis of the ethical issues identified
2. **Stakeholder Analysis Report -** based on a team analysis of all stakeholder perspectives
3. **Ethics Evaluation Report** - based on full ethics analysis of an emerging medical technology

Grading: Each module of the 3-credit course will be assessed separately based on satisfactory completion of all assignments and experiential learning activities. The course grade assignment will follow be based on percentage of points earned:

A+ ≥97% A ≥93% A- ≥90% B+ ≥87% B ≥83% B - ≥80% C+ ≥77% C ≥73% C- ≥70% D ≥60% F = below 59%

Assignments – all are required		
Module on ethical issues analysis:	**Points**	**Due Dates***
Participation with in-class discussions, online posting, and learning activities	15	Mondays
Ethical Issues Analysis - Case 1	15	Feb 2
Ethical Issues Analysis - Case 2	15	Feb 23
Interview a medical device developer	15	March 22
Ethical Issues Analysis Report: Team written analysis of ethical issues of an emerging medical product or assistive technology (draft / final)	20	March 8/ April 19
Module on engineering empathy:	**Points**	**Due Dates**
Participation with in-class discussions, online posting, and learning activities	15	Wednesdays
Empathic Awareness Activity Reflection 1	15	Feb 11
Empathic Awareness Activity Reflection 2	15	March 10
Interview a medical or assistive device user (long-term)	15	April 7
Stakeholder Analysis Report: Team written stakeholder report of emerging medical product or assistive technology (draft / final)	20	March 24/ April 21
Module on ethical reasoning:	**Points**	**Due Dates**
Participation with in-class discussions, online posting, and learning activities	15	Fridays
Ethical reasoning diagram	15	Feb 6
Case study report 1: team-based reasoning, decision & justification	15	Feb 27
Case study report 2: team-based reasoning, decision & justification	15	March 26
Ethics Evaluation Report: Team written ethics evaluation of emerging medical product or assistive technology (draft / final)	20	April 2/ April 23
Additional course components		
Individual Professional Code of Ethics and Strategic Plan	25	April 30
Mid-term course and peer evaluations and Final course and peer evaluations	5 5	March 12 May 8
Total Points	275	

NOTE: Late assignments will lose 1 point per day unless previously arranged extension exists.

***dates from 2020 Spring syllabus.**

Scholarly Reference List* (Required Readings in **Bold**):

1. **Battarbee, K., Fulton Suri, J., & Gibbs Howard, S. (2014). Empathy on the edge: Scaling and sustaining a human-centered approach in the evolving practice of design. IDEO. https://www.ideo.com/news/empathy-on-the-edge**
2. **Beauchamp, T. L. (2007) "The Four Principles Approach to Health Care Ethics." *Principles of Health Care Ethics, Second Edition*: 3-10. Ed. R.E. Ashcroft, A. Dawson, H. Draper, and J.R. McMillan. New York: Wiley.**
3. **Blot, W. J., Ibrahim, M. A., Ivey, T. D., Acheson, D. E., Brookmeyer, R., Weyman, A., ... & Harrison, D. (2005). Twenty-five–year experience with the Björk-Shiley convexoconcave heart valve: a continuing clinical concern. *Circulation*, *111*(21), 2850-2857.**
4. **Brightman, Beever, Hiles (2019) Next Generation Ethical Development of Medical Devices: Considering Harms, Benefits, Fairness, and Freedom in *Next Generation Ethics: Engineering a Better Society.***
5. **Beever and Brightman. (2016) "Reflexive Principlism as an Effective Approach for Developing Ethical Reasoning in Engineering." *Science and Engineering Ethics* 22: 275-291.**
6. **Chameau, J. L., Ballhaus, W. F., & Lin, H. (Eds.). (2014). *Emerging and readily available technologies and national security: A framework for addressing ethical, legal, and societal issues*. National Academies Press.**
7. Citron, P. (2012) Ethics Considerations for Medical Device R&D *Progress in Cardiovascular Diseases* 55 307–315.
8. **Davis, Michael. (1991). "Thinking Like an Engineer: The Place of a Code of Ethics in the Practice of a Profession." *Philosophy & Public Affairs* 20(2): 150-167.**
9. **Herkert, J. R. (2005). Ways of thinking about and teaching ethical problem solving: Microethics and macroethics in engineering. *Science and Engineering Ethics*, *11*(3), 373–385**.
10. **Hersh, M. A. (2016). Engineers and the other: the role of narrative ethics. *AI & society*, *31*(3), 327-345.**
11. **Hersh, M. (2015). Ethical Engineering: Definitions, Theories and Techniques. In *Ethical Engineering for International Development and Environmental Sustainability* (pp. 15-62). Springer, London.**
12. Hofmann, B. (2017) Toward a Method for Exposing and Elucidating Ethical Issues with Human Cognitive Enhancement Technologies. *Sci Eng Ethics* 23:413–429.
13. **Howard, A., & Borenstein, J. (2018). The ugly truth about ourselves and our robot creations: the problem of bias and social inequity. *Science and engineering ethics*, *24*(5), 1521-1536.**
14. Ross et al. (2008) Ethical Issues Associated With the Introduction of New Surgical Devices, or Just Because We Can, Doesn't Mean We Should. J Obstet. Gynaecol. Canada 2008:30(6):508–513.
15. Sedrakyan, A., Campbell, B., Merino, J. G., Kuntz, R., Hirst, A., & McCulloch, P. (2016). IDEAL-D: a rational framework for evaluating and regulating the use of medical devices. *BMJ: British Medical Journal (Online)*, *353*.
16. **Schultz, et al. (2008). New surgical devices and ethical challenges: a collection of perspectives and panel discussion. *Cleveland Clinic Journal of Medicine*, *75*, S74.**
17. Strong, V. E., Forde, K. A., MacFadyen, B. V., Mellinger, J. D., Crookes, P. F., Sillin, L. F., & Shadduck, P. P. (2014). Ethical considerations regarding the implementation of new technologies and techniques in surgery. *Surgical endoscopy*, *28*(8), 2272-2276.
18. Stutchbury, K., & Fox, A. (2009). Ethics in educational research: introducing a methodological tool for effective ethical analysis. *Cambridge Journal of Education*, *39*(4), 489-504.
19. **Tuana, N. (2007). Conceptualizing moral literacy. *Journal of Educational Administration*, *45*(4), 364-378.**
20. **Walther, J., Miller, S. E., & Sochacka, N. W. (2017). A model of empathy in engineering as a core skill, practice orientation, and professional way of being. *Journal of Engineering Education*, *106*(1), 123-148.**
21. **Whitbeck, C. (1996). Ethics as Design: Doing Justice to Moral Problems. *The Hastings Center Report*, *26*(3), 9–16.**
22. **Williams, D., Edelman, E. R., Radisic, M., Laurencin, C., & Untereker, D. (2017). The Engagement of the Medical Technology Sector with Society at Large. *Science translational medicine*, *9*(385).**
23. Williamson, L. (2014). Patient and citizen participation in health: the need for improved ethical support. *The American Journal of Bioethics*, *14*(6), 4-16.

*This list may be updated as other literature is identified as relevant.

How to succeed in this course:

- Ask questions if anything is unclear and be willing to "speak up" if problems arise
- Accept challenging content, critical thinking, and collaborative discussions and decision-making as part of the learning process
- Actively build trusting relationships with classmates
- Be curious about the material and also about what you can learn as well as contribute to the course
- Be thoughtful, clear, and well supported in your written responses
- Be willing to engage with the activities in class and outside even if they are unfamiliar
- Communicate as clearly as you can and be respectful at all times both in class and online with classmates, instructors, and guest presenters
- Commit the time necessary to do readings ahead of class and prepare to discuss in class
- Complete all assignments on time and to the best of your ability

Engaging with the Instructors:

For most questions, we will be available via email and will respond as soon as available (generally within 24-48) hours. When emailing us, please place in the subject line: **BME Ethics Course** and the topic of the email (i.e. Assignment 2 Question) and include your full name at the end of the text. This will help us tremendously in locating your emails quicker when we scan the hundreds of emails that seem to make it into our inboxes each day. If you need to speak with an instructor in person, Dr. Brightman will have open office hours on Monday and Wednesdays from 11 AM - 12 noon and you can make an appointment for other meeting times by email. When there are online discussions, we will check in at least 3 times per week. Keep in mind that it is not possible for us to respond to every single posting every week (nor is it pedagogically appropriate), but we will be sure to respond to a variety of postings and students each week and attempt to assure equality in terms of responses to students. If you feel you are being neglected in any way, please alert one of us immediately before or after class.

Attendance and participation:

This course is heavily participation dependent. Almost Twenty percent of the grade is based on participation in discussions in class and online as well as weekly written responses submitted online. Every student will be required to post on discussion board in BBL at least once a week and read and respond briefly to at least two of others' posting. You will start the semester with full credit for participation and will lose points based on unexcused absences, lack of participation in discussions, or disrespectful communication or behaviors of any type. The class will not meet on several dates (announced in advance) and there will be activities assigned outside of class for those sessions for which full participation is expected just as if you are in class. Students participating at a distance will also have out of class activities, e.g. online discussions or postings or email contributions to compensate for not being in the classroom. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, or by contacting the main

office that offers the course. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, the student or the student's representative should contact the Office of the Dean of Students.
The link to the complete policy and implications can be found at:
http://www.purdue.edu/studentregulations/regulations_procedures/classes.html

On-Campus video recording:

If you are a distance learning student or an on-campus student who has to miss a class we provide you with access the streaming videos for the course in BrightSpace. The intent is to allow you a method to view lectures and catch up on the material you have missed.

Please contact us if you have any questions regarding this access.

Accessibility and Accommodations:

As educators of Purdue University, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Nondiscrimination statement:

As educators of Purdue University, we are committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of a goal of academic excellence we, along with the University, seek to develop and nurture diversity. We believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. We, along with the University, attempt to view, evaluate, and treat all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Purdue's Equal Opportunity, Equal Access and Affirmative Action policy which provides specific contractual rights and remedies. Additionally, the University promotes the full realization of equal employment opportunity for women, minorities, persons with disabilities and veterans through its affirmative action program.
For further information, please read Purdue's nondiscrimination statement:
http://www.purdue.edu/purdue/ea_eou_statement.html

Academic Dishonesty:

This class on ethical engineering aspires to prepare students for ethical professional practice. Any acts of dishonesty will not be tolerated and subject to failing the assignment, failing the class, or reporting to the Dean of Students for potential expulsion from the University. Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

Please review the following resource page on plagiarism:
http://www.education.purdue.edu/discovery/research_integrity.html.

You may also want to refer students to Purdue's student guide for academic integrity:
https://www.purdue.edu/odos/academic-integrity

The Purdue Honor Pledge:
"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

Emergency Statement:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructors' control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Disclaimer:

This syllabus is subject to change during the semester with advance notice on BrightSpace or by email and with consultation with the class participants.

Spring 2020 Schedule: (subject to change with advance notice).

Date - Class	Topics and in-class activities:	Preparation: Readings, watchings, and activities to prepare for class – due by the date listed until otherwise noted	Assignments: - due dates (all due by midnight)
BME 395	Ethical Issues Analysis		
BME 495	Engineering Empathy		
BME 595	Ethical Reasoning		
1/13 – Week 1 Class 1	Discussion of course, syllabus, documentaries, and experiential learning projects / in-class participation in discussions and activities / assignments		Weekly Discussion Forum postings are due by Sunday. Prompts for online postings will be sent in weekly announcements.
1/15 – Class 2	Introduce Instructors - tell my story / Introduce human-centered, universal engineering design Empathic Awareness Exercise 1		
1/17 – Class 3	Dr. Hiles – tells his story of becoming an engineer / discuss learning documentation		
1/20 – Week 2 Class 4	No class – MLK Jr. Holiday	Watch documentary – *The Bleeding Edge* –	
1/22 – Class 5	Discuss – The Bleeding Edge – and Empathic perspective-taking – Discuss Moral Literacy for Technology developers – Tuana 2007	Read: Tuana (2007)	Extra credit: Attend ENE Seminar on Ethics Training for Engineers Using Role Play (Dr. A/. Kerr) – extra credit – Jan 23, 3:30 – 4:30 PM
1/24 – Class 6	Guest Speaker – Dr. Kerr – Ethics Training for Engineers Introduce Online Module 1: Reflexive Principlism as a Framework for Ethical Decision-Making		
1/27 – Week 3 Class 7	Ethical Engineering of medical devices: Views from FDA, Industry, and Medicine - Shultz et al. 2008 Introduce Ethics Matrix	Read: Shultz et al. 2008 Work on identifying articles about AI in medical technology	
1/29 – Class 8	Empathic perspective-taking: How do we understand the values and perspectives of others? Empathic Awareness Exercise 2	Complete part 1 of Online Module 1: Reflexive Principlism	
1/31 – Class 9	No class meeting	Optional - Attend Poster Session at Indiana CTSI Retreat (MJIS Atrium) 12-1 PM on Jan. 31	
2/3 – Week 4 Class 10	Discuss Case 1 issues analysis reports and Beever and Brightman 2016 Discuss new technologies selected to analyze for case 2	Read: Beever and Brightman (2016)	Ethical Issues Analysis - Case 1 due Feb 2
2/5 Class 11	Ethics in Action: The role of empathy in engineering design and development - How do we effectively cultivate empathy? Discuss - Battarbee et al. (2014)	Read: Battarbee et al. (2014)	Extra credit: Attend ENE Seminar on Ethics Training for Engineers (Dr. Herkert Feb 6, 3:30 – 4:30 PM
2/7 Class 12	Discuss Ethical Reasoning Diagrams		Ethical reasoning diagram – due Feb 6
2/10 Week 5 Class 13	Micro- and Macro-ethical issues in engineering medical technologies – Herkert (2005)	Read: Herkert, J. R. (2005)	
2/12 Class 14	Empathic perspective-taking – How do we understand the values and perspectives of others?		Empathic Awareness Activity Reflection 1 – due Feb 11

	Discuss - Empathic Awareness Activity Reflection 1 Empathic Awareness Exercise 3		
2/14 Class 15	Start Online Module 2: Case Study 1 - How a Diagnostic Device Became a Disease –		
2/17 Week 6 Class 16	Identifying Ethical Issues: Where to look for issues? Codes, Cases, Committees, Conversations, or Crises – Davis (1991)	Read: Hersh et al. 2015 Pages 3-6 "A Hitman's approach to ethics" and Read: Davis, (1991)	
2/19 Class 17	Engineering Empathy: How does narrative ethics analysis help us as engineers? Stakeholder Analysis Matrix		
2/21 Class 18	In-class discussion: Case Study 1 - How a Diagnostic Device Became a Disease		
2/24 Week 7 Class 19	Discuss ethics issues analysis – case 2 A brief history of engineering ethics – Dayoung Kim		Ethical Issues Analysis - Case 2 - due Feb 23
2/26 Class 20	Engaging stakeholders views and values in ethical reasoning - Discuss Chameau et al. (2014) and Williams et al. (2017)	Read: Chameau, Ballhaus & Lin (2014) –summary (pages 1-13) Read: Williams et al. (2017)	
2/28 Class 21	Discussion of Case Study 1 Team Reports - How a Diagnostic Device Became a Disease Discuss final report = team evaluation of an emerging medical technology		Online Module Ethics Case Study – Team report 1 – due Feb 27
3/2 Week 8 Class 22	Engineering ethical issues analysis: Discuss Case Study The Incident of the faulty Bjork-Shiley Heart Valve	Read: Blot et al. (2005)	
3/4 Class 23	Ethics in Action: Empathy and Inter-subjectivity – How do we cultivate it? Discuss Walther et al. (2017) Empathic Awareness Exercise 4	Read: Walther et al. (2017)	
3/6 Class 24	Start Case Study 2 - Designing a Tissue-Engineered Pediatric Heart Valve Making an ethical argument – Dayoung Kim		
3/9 Week 9 Class 25	Identifying Ethical Issues: Where to look for issues? Codes, Cases, Committees, Conversations, or Crises - Discuss: Hersh et al. 2015 Intro and Chapter 2 (pgs 15-27)	Read: Hersh et al. 2015 Intro and Chapter 2 (pgs 15-27)	Ethical Issues Analysis Report - DRAFT due March 8
3/11 Class 26	Ethics in Action: Stress and empathy – how does stress change our empathic responses? Discuss stakeholder analysis report-draft due March 24		
3/13 Class 27	Discuss Case Study 2 - Designing a Tissue-Engineered Pediatric Heart Valve	Read: Merryman (2008) Complete 1.1 & 1.2	Mid-term course and peer evaluations – due March 15
3/16	SPRING BREAK		
3/18	SPRING BREAK		
3/20	SPRING BREAK		
3/23 Week 10 Class 28	CLASS CANCELLED – Team work online for assignments Recorded Video Discussion of Case Study 2 with Dr. Hiles		Interview a medical device developer – due March 22
3/25 Class 29	Recorded Video Discuss: Interviews of a medical device developers / Discussion of mid-course evaluation and rest of semester logistics		
3/27 Class 30	Live WebEx/Zoom – Class Discussion of Case Study 2 Report - Designing a	Please join live if you can at 12:30 PM	Case study report 2 – due March 26

	Tissue-Engineered Pediatric Heart Valve / Discuss Ethics Evaluation Report		
3/30 Week 11 Class 31	Recorded Video Engineering Ethics – Definitions, Theories, and Techniques – Part 2 Discuss: Hersh pgs 27-48	Read: Hersh et al. 2015 Chapter 2 (pgs 27 - 48)	
4/1 Class 32	CLASS CANCELLED – Team work online for assignments		Stakeholder Analysis Report – DRAFT due April 1
4/3 Class 33	Recorded Video – with Guest Speakers – Dr. Dan Foti and Ms. Keisha Novak – research on early detection of psychosis	Watch Implicit Bias videos and Complete two Implicit bias tests online with response by Sunday night	
4/6 Week 12 Class 34	Recorded Video - Engineering Ethics – Definitions, Theories, and Techniques – Part 3 Discuss: Hersh et al. (2015) end of chapter	Read: Hersh et al. (2015) end of chapter 2 (pgs 48-59).	
4/8 Class 35	Live WebEx/Zoom - How do we understand and include others who are different from us? Discuss Implicit Bias test results and medical device user reports		Interview a medical device user – due April 7
4/10 Class 36	Recorded Videos Ethical technology development – a clinical entrepreneur's view – Dr. Bill Clarke		
4/13 Week 13 Class 37	Recorded Video Discussion of ethical issues analysis and good design - Discuss Whitbeck (1996)	Read: Whitbeck, C. (1996)	
4/15 Class 38	Recorded Video Ethics in Action: Ethical Awareness activity and Accessibility, Usability, and Empathy	Watch videos on Empathy in Usability Evaluation	Empathic Awareness Activity Reflection 2 – due April 14
4/17 Class 39	No Class – teamwork on reports due next week		
4/20 Week 14 Class 40	Recorded Video – Conflicts of Interest Issues in Collaborations between Clinicians and Medical Device Companies		Ethical Issues Analysis Report – final due April 19
4/22 Class 41	No Class – teamwork on reports due this week		Stakeholder Analysis Report – final due April 21
4/24 Class 42	Recorded Video - Discussion of Creating a personal professional ethical code or creed		Ethics Evaluation Report – final due April 23
4/27 Week 15 Class 43	Recorded Video - Understanding Ethics in Engineering: Considering ethical analysis approaches in Biomedical Engineering – Discuss reading- Brightman et al. (2019)	Read: Brightman, Beever, and Hiles (2019)	
4/29 Class 44	Recorded Video - Ethics in Action: Ethical Blindness and bounded ethicality– what keeps us from doing the right thing? Watch the Palazzo and Bazerman videos listed	Watch Palazzo videos on Ethical Blindness Watch Bazerman video on Bounded Awareness	
5/1 Class 45	Live WebEx/Zoom - Discuss the final ethics evaluation team report and - Discuss Theranos case, ethical blindness, and whistleblowers	Watch videos about Theranos Whistleblower	Professional Code of Ethics and Strategic Plan – due May 1
5/4	No Class		

Finals week			
5/6	**No Class**		
5/8	**No Class**		**Final course and peer evaluations – due May 7**