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# Preparing Ethical Engineers for the Future: Integrating Modern Case Studies and Design Fiction in Biomedical Engineering Ethics

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## Abstract

Numerous studies and philosophies underscore the importance of cultivating ethical attitudes and social responsibility in engineering formation. Despite public welfare being central to the Codes of Ethics for most engineering societies (e.g., NSPE, BMES, ASME, ASCE), it comes as a shock that current education practices often diminish engineering undergraduates' sentiments towards serving humanity. Erin Cech's seminal work highlights the 'culture of disengagement' across diverse undergraduate engineering programs, with students deriving less value and identity towards serving the public welfare compared to before entering college. This indicates a pressing need to reform pedagogy to develop more socially aware engineers. Subsequent work continues to stress the deficiency of ethical and social dimensions in engineering graduates.

How we teach ethics to engineers remains a contested question for our community. While this author embraces an embedded ethics model, many universities still rely on a capstone-focused or a stand-alone general engineering ethics class that cover the principal canons of public safety and welfare. General engineering ethics textbooks emphasize professional conduct and risk, with a particular focus on historical case studies that may not share the same relevance to the current generation of engineers. For example, the Ford Pinto case study is heavily discussed in these classes, but current estimates of American teenagers driving sit at under 40 percent compared to 64 percent in 1995, which lowers the relevancy of this scenario to future professional practice. Therefore, it is important to develop relevant case studies in engineering ethics classrooms that acknowledge the complex present and disruptive future that emergent technologies possess.

I have developed a major-specific ethics course in biomedical engineering ethics that covers the foundational philosophical schools of consequentialism, deontology, and virtue ethics directly applied to the discipline. This occurs while adopting modern case studies in biomedical engineering that emphasize the role of ethical foresight in emergent and emerging technologies. Students are confronted with ethical futures in human genome editing and brain-computer interfaces, while facing the emerging technologies of machine learning and artificial intelligence in health care decision making and stem cell technologies. Biomedical engineering students strengthen their argumentative writing skills, as is often emphasized in ethics courses but gain experience in creative expression through an exercise called design fiction. Also known as speculative design, students creatively explore ethical dilemmas by imagining utopian and dystopian technological futures, deepening their understanding of how today's engineering decisions shape tomorrow's world. This paper will address how ethical foresight, design fiction, and modern case studies in emergent biomedical engineering technologies fosters an improved sense of reasoning in past, present, and future ethical dilemmas. Examples of successful strategies in discipline-specific ethics courses augment the need for both general and specific knowledges applied to professional practice, formation of ethical engineers, and an improved awareness of ethical decision making connected to technical knowledge. By incorporating modern case studies and speculative design, this course provides biomedical engineers with the critical thinking and ethical reasoning skills necessary to navigate the challenges of emergent technologies in professional practice and can be adapted to any engineering discipline.

## Introduction

At the core of the National Society for Professional Engineers Code of Ethics is that "Engineering is an important and learned profession" [1]. Thus, it logically follows that the canons, values, and professional obligations of engineers are formally and informally taught to student engineers during their education. However, recent meta-analyses by [2] and [3] of current practices in engineering ethics education have shown a lack of clarity in goals, expertise, and even student reception play a role in diminishing the importance of this education in many universities. Martin, Conon, and Bowe [3] highlight that content choices in engineering ethics classrooms may not properly focus on the "equal value" that allows engineers to connect their technical expertise and content knowledge to the broader ethical, social, and legal implications (ELSI) of their work. Without this deepening connection of the technological advances that promote human flourishing and the potential harms and risks that a professional engineer must balance in their practice, both current and future, engineering educators run afoul of promoting the "culture of disengagement" that Erin Cech highlights is lessened through formal engineering education [4]. Other studies, including Robert McGinn's "Mind the Gaps" study further corroborate the reduced importance of ethics and ethics education in the engineering curricula [5].

The Accreditation Board for Engineering and Technology (ABET) requires that engineering students "[…]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" [6]. While many accredited programs accomplish this student outcome through a general engineering ethics course that promotes concepts in professional responsibility, macroethics, and safety, these often-broad topics do not resonate with the professional practice of students not in the specific domain. In addition, such topics discussed in these courses rely on a historical context that may be difficult to translate to the current generation of engineering trainees. For example, while the 1970s Ford Pinto case study is classically used to highlight an engineer's role in a capitalistic corporation, cost-benefit analysis for technology development, and engineering constraints at the risk of safety and human lives [7], American teenagers are driving at lower rates of 40% compared to their 1990s counterparts at 65% [8], while fully internal combustion engine cars are on a decline in production and sales given their environmental impacts [9]. Meanwhile, electric vehicle present novel ethical dilemmas with respect to rare earth metals and materials sourcing for batteries [10], increased weight and ineffective guardrails for crashes [11], and levels of autonomy in full self-driving algorithms [12]. These emerging technologies and the dilemmas they present will be paramount to engineers' preparedness for the future responsibilities they may have in the profession. To ensure that this ABET student outcome is achieved, a culture of engineering engagement is promoted, and engineers are prepared for the future challenges ahead in their careers, I argue that **we must develop forward-thinking, modern, and discipline-specific engineering ethics content.**

This paper outlines the foundations for developing a biomedical engineering (BME) discipline-specific ethics course taught as an elective at Duke University that promotes professional ethics along with modern cases in engineering technologies, including human genome editing, brain-computer interfaces, machine learning (ML)/artificial intelligence (AI), and stem cell organoid technologies. Leveraging ethical foresight methods such as design fiction embedded within a writing-based and focused ethics course, I present one option to teaching engineering ethics beyond general engineering ethics courses, capstone or design-based training in ethics, and even an integrated or embedded ethics education model used at some universities and presented previously by the author [13-15].

**Emergent and Emerging Technologies**

Rapid advances in technology development will occur because of our engineering students that shift the paradigm of ethical training when historical case studies are not present. While moral norms and the "Common Morality" [16] may be viewed as a universal concept [17], we must consider the role of futuristic technologies that do not have precedent or even a complete technological understanding on our students' abilities to identify and resolve ethical dilemmas. Presently, these are often referred to as "emergent" or "emerging" technologies. Some definitions for these terms have been provided, with some calling these terms identical in their usage. One of the most clear identifications of emerging technology is presented by Rotolo, Hicks, and Martin [18] as possessing "radical novelty, fast growth, coherence, prominent impact, and uncertainty and ambiguity." In another framing of emerging technologies such as CRISPR/Cas9 and AI, Veluwenkamp *et al.* [19] discuss "socially disruptive technologies" that require us to reflect on the nomenclature and significance of novel technologies that can lead to ethical design practices. Both Rotolo *et al.* and Veluwenkamp *et al.* emphasize the importance of discussing emerging technologies at all stages of innovation to prepare for an ethical future of responsible innovation, development, and deployment.

In this paper, I will refer to emergent technologies as novel, underexplored, and rapidly evolving technologies that are not in common practice but have the potential to be highly disruptive. As a slight contrast, I will discuss emerging technologies as new or newly implemented technologies that are in development and gaining traction in current societal practices. This framework around current and futuristic technology development establishes the foundation of this developed course, as highlighted in Figure 1.

Emergent technologies are such tools that are in their early-stage development and require us as engineers to evaluate the ethical frameworks to responsibly innovate and implement these technologies. In a biomedical engineering context, I frame two emergent technologies of human genome editing (HGE) [20] and brain-computer interfaces (BCI) [21] at early technological readiness levels (TRLs) [22] that require us to critically evaluate the limits of human and cognitive enhancement as a future role of biomedical engineers. Given the innovations of these technologies that are not in practical deployment, students can creatively evaluate the future of these technologies in a low-risk environment without worry of making the "right-or-wrong" decision that often plagues ethics education [23]. One challenge that arises with ethics discussions in emergent technologies is the lack of complete understanding of the tool in question, be it the feasibility of germline human genome editing to result in mosaic offspring [24] or the accuracy of closed-loop systems in BCIs to intervene on a patient's behalf [25]. I argue that the growth of intellectual humility within students in the research of these emergent technologies plays an important role in their ability to responsibly innovate these technologies in the future. This is conjecture at present, but speaks to research that growth in intellectual humility leads to better objectivity and mastery in learning [26]

Likewise, emerging technologies have higher technological readiness and may have more current applications and societal awareness given their present utility. As these technologies are already in use, it is incumbent for engineers to reflect and evaluate on the status of these tools and prepare to predict the potential trajectories they may take in current and future society. Biomedical engineering emerging technologies are often highlighted in the classroom, but given their current clinical and research applications, I focus on ML/AI in clinical decision making and stem cells in medicine as the focus of ethical foresight and reflection. Students may be more connected with these technologies at a technical competency that allows them to not only identify the ethical dilemmas at hand for its responsible implementation but can also create interesting futuristic scenarios of how these tools when regulated will lead to improved health care outcomes aligned with the principle of beneficence. This attains higher levels of critical thinking as highlighted by Bloom's Taxonomy of Learning and is a critical part of pedagogical innovation in this course [27].

**Developing a Biomedical Engineering-Specific Ethics Course**

First offered in 2023, I developed a BME elective course entitled Ethics in Bioengineering to all Duke University BME students, with 11 enrolled students. In 2024, this course increased to 20 students and was expanded beyond the BME department to ensure a broader audience of students could participate in such necessary conversations. In 2025 there are 13 students enrolled, including Ph.D. engineering students interested in a more rigorous ethics education beyond their undergraduate training or Responsible Conduct in Research (RCR) education. This recent modification to the course addresses previously established concerns with the inadequacy of RCR training for Ph.D. students, particularly in how to apply such training to their education when power dynamics, the 'publish-or-perish' model, and shifting research priorities may restrict or diminish ethical responsibility for these students [28]. This course is intended for students who have not had prior ethics or philosophy training, with the only necessary pre-requisites being an introductory writing course and knowledge of biology and/or physiology. It is also important to note that the instructor (the author) has a Ph.D. in Bioengineering instead of a philosophy, ethics, or social sciences degree.

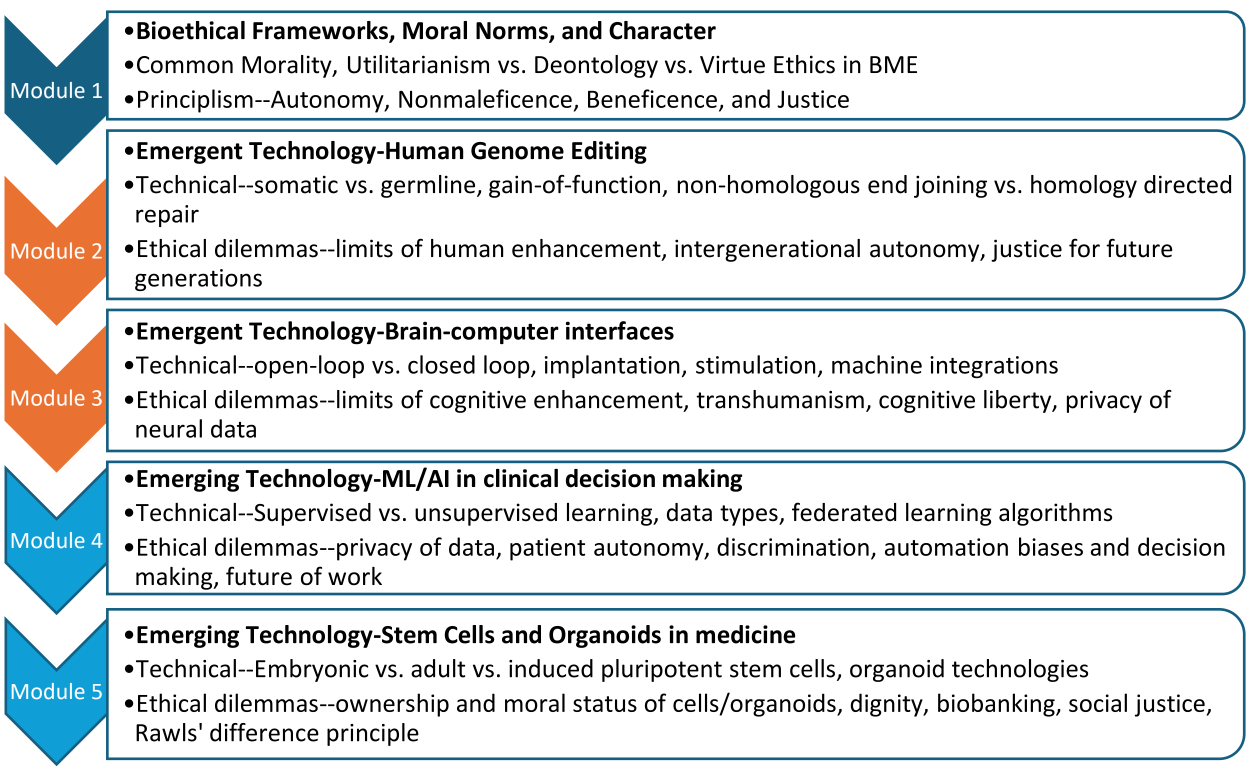


*Figure 1:Roadmap of BME290: Ethics in Bioengineering course. Module 1 (teal) is the foundational introduction to ethics for biomedical engineering, Modules 2 and 3 (orange) focus on emerging technologies and what are the limits of enhancement we should allow, and Modules 4 and 5 (light blue) highlight emerging technologies that impact medicine for engineers and clinicians and how to protect patients with bioethical principles at the outset.*

The course was developed with five modules that can be categorized into three key themes: 1) Introduction to bioethical frameworks, including moral norms, character, and a deeper dive into the core principles of bioethics as established by Beauchamp and Childress [16]; 2) Emergent technologies and human enhancement limits from biomedical engineers; and 3) Emerging technologies and how privacy, cost, and the future of engineering and medical work with new technology. Figure 1 outlines the roadmap used in the development of this course.

This course was approved by the Duke University Trinity College of Arts and Sciences Writing Curriculum Committee as a writing-intensive course, which is emphasized in the course deliverables. Students are asked to write eight 500-word reflections, two 5,000-word argumentative and perspectives essays, accompanied annotated bibliography and outline assignments, and a final presentation on a biomedical technology not discussed in class in depth. Writing feedback is provided at numerous points to improve both technical and argumentation knowledge, in line with current research that improved writing skills lead to improved engineering literacy and communication [29].

**Modern case studies in biomedical technologies integrated with technical competency**

With an emphasis on emergent and emerging technologies, the course was developed with the following course objectives:

1. Define the four principles of bioethics (justice, autonomy, beneficence, and non-maleficence)
2. Apply ethical frameworks for decision-making in emergent biomedical engineering technologies
3. Analyze different perspectives and value-based viewpoints concerning contemporary issues in bioethics
4. Identify ethical dilemma and assess benefits and risks of harm to multiple stakeholders
5. Construct written arguments that integrate ethical, societal, and technological ideas into engineering design

As emphasized in Course Objective 3, I wanted to highlight contemporary issues in bioethics as it applies to a biomedical engineer's professional and personal role in technology development. Therefore, I highlight recent examples in Modules 2-5 that allow students to connect the importance of technical knowledge with ELSI research. I will also share alternative cases that have been implemented for Module 5 to inspire additional ideas among the Engineering Ethics community in Appendix A.

<u>Module 2—He Jiankui's CRISPR babies:</u> Students explore the technical elements of He Jiankui's embryo editing to knock out the *CCR5* gene that could confer HIV resistance within the germline. Students learn about the difference between non-homologous end joining and homology-directed repair on what types of edits are possible in human and other genomes. Students compare how germline genome editing can create heritable alterations that impact future generations, particularly compared to somatic genome editing approaches used in current gene editing technologies such as Casgevy® and Lyfgenia™ to treat sickle cell disease and beta-thalassemia [30]. Legal arguments are raised on the beneficial gain of such edits, unknown consequences of

the edits in future generations, establishing the limits of genetic enhancement versus therapy, and in which scenarios is it morally permissible or obligatory to edit the human genome. [24, 31]

Module 3—Elon Musk's Neuralink BCIs: Students learn how BCIs are developed and implanted, how invasive versus noninvasive BCIs differ, and what stimulation technologies are possible with current BCIs. Closed-loop BCIs are highlighted as an adaptive system that interprets neural information and causes stimulation without user input [25]. Elon Musk's Neuralink BCI is discussed on its technological advances, including their surgical robot used for implantation, what are the current limits of BCI technology, and what forms of cognitive enhancement are permissible [32]. Concepts in transhumanism are discussed and what does it mean to be human when the brain is a privileged organ protected by additional neuro-rights [33]. Students also discuss how privacy work when such data is uploaded and potentially manipulated by a company for advertising or criminal purposes.

Module 4—ML/AI in clinical decision making: ML/AI is used in various medical practice, including oncology, radiology, and even as psychiatric "Chatbots" [34]. However, one potential benefit of ML/AI is to reduce costs for patients by better predicting necessary health care outcomes. Students learn about different ML algorithms used in patient decision making, including supervised, unsupervised, and deep learning. Students also discuss how bias in the training data can lead to adverse outcomes (i.e., the 'garbage-in, garbage-out' phenomenon) [35]. The future of work is discussed as ML/AI can be leveraged to reduce the dependency on nurses and doctors in clinical decision making. Students read a paper entitled "Dissecting racial bias in an algorithm used to manage the health of populations" [36] and assess what changes need to be made to either the data or algorithm to better support social justice and patient autonomy to improve health care outcomes.

Module 5—Stem cells and organoids in medicine and research: Students learn about the use of stem cells in medicine and research, with a particular focus on organoids that are used in personalized medicine and better mimic human body systems. Building off of stem cell technologies, organoids, and genome editing technologies, students are asked to explore what happens when stem cells can be induced into a totipotent state, which potentially makes them viable to produce germ cells (e.g., egg, sperm) [37]. Given that these germ cells could be fertilized *in vitro*, this takes the current state of stem cell technologies to a different realm of possibilities. Students are asked to think critically about what regulations should be in place for such a technology, including revisions to the 14-day rule on embryonic stem cell research.

**Interventions to explore student curiosities in emerging technologies**

A key part of building better ethical foresight into the emerging technologies is an ability to creatively explore the possible "futures" that may exist for a certain positive or negative outcome. In this, I leverage a technique used by futurists and foresight experts called design fiction, or speculative fiction, defined as the "practice of creating tangible and evocative prototypes from possible near futures to help discover and represent the consequences of decision making" [38]. This work can take the form of a story, thought experiment, newspaper headlines, or other media that enables students to combine both their technical knowledge of a technology with an almost-science fiction element to exploring their "utopia" and their "dystopia" with the deployment of an emerging technology. Design fiction has been implemented within other technical ethics classes including in computer science [39], but has only been loosely explored in STEM ethics pedagogy [40].

In the second large-format perspectives essay, students are asked to develop a set of fictional stories or thought experiments that explore their utopia and dystopia of a particular technological application of ML/AI in clinical care or stem cells in medicine. Appendix B includes the full prompt of this essay, but the section of interest emphasizes how this writing technique can assist engineers in preparing for ethical futures:

> *"Your perspectives essay should outline the current state of affairs in your field with respect to technology advancement, what ethical dilemmas have arisen and strategies to responsibly innovate in this sector, and a personal reflection on what steps engineers can take to promote the 'utopia' version of an ethical future within this space vs. what wrong mis-steps will have occurred that lead us to 'dystopia' and how we can avoid this. <u>This is often called design fiction or speculative design. and can take the form of a story, newspaper headline, or a thought experiment (German: gedankenexperiment).</u> Support your identified ethical dilemmas and futuristic explorations with ethical principles, real-world examples, and potential implications for society, healthcare, and individual progress."*

In the Spring 2024 class, 16 of 20 students completed a thought experiment format, three wrote fiction stories, and one wrote a set of newspaper headlines that depict the differences between the utopia and dystopia scenarios of their selected technology. While design fiction is a novel format to most engineering undergraduates, students who engaged with this narrative style wrote with a science fiction lens that highlights the integration of technical engineering content with creativity and an inside look at the societal dilemmas with new technologies [41, 42]. As the design fiction assignment is embedded within a perspectives essay, students can present the technical background, ethical dilemmas, and suggestions for responsible innovation without practice as a narrative writer, all of which is graded under a holistic writing rubric found in Appendix C.

Student output has demonstrated a remarkable blend of technical understanding and speculative imagination. In the Spring 2024 iteration, students explored ideas such as fully autonomous diagnostic AI in radiology, cerebral organoids to explore the etiology of neurodivergence, and the use of chatbots in psychiatric care and therapy. These narratives not only explored potential risks and benefits but also forced students to confront nuanced ethical trade-offs involving privacy, justice, autonomy, and consent. Importantly, many students reflected that this was the first time they had been asked to combine engineering knowledge with storytelling.

**Insights on Implementing a Future-Looking Engineering Ethics Class**

Implementing a future-oriented ethics course calls for a mindset shift in how we, as engineers and educators, view ethics within the profession. At the heart of this transformation is a fundamental belief that <u>engineering ethics should not be outsourced to other disciplines</u>. Instead, it must be pioneered and owned by engineers who understand both the technical nuances and the societal stakes of their work. This belief underpins the design of this course, where ethics is not treated as an ancillary subject but as a core professional competency integrated with technical education in biomedical technologies.

To prepare engineers for disruptive technologies that don't yet exist or are just emerging, we must train students to imagine possible futures. The use of design fiction has proven to be a powerful pedagogical tool, enabling students to explore the cascading effects of technological decisions through creative expression. Framing ethics as a space of curiosity and foresight helps students move beyond fear of "right vs. wrong" answers and toward meaningful engagement with complexity and ambiguity.

While philosophers and social scientists bring invaluable perspectives, students benefit greatly from ethics education led by instructors who share their disciplinary language and technical expertise. As an engineer trained in bioengineering, I have found that framing ethical dilemmas within the technical detail and constraints of our field increases student receptivity and deepens their understanding. Engineers should be empowered to lead ethics education not in isolation from philosophy or social science, but in collaboration with it. My collaborators in social sciences, ethics, and philosophy have augmented this course and promote the importance of interdisciplinary approaches and teaming in engineering education [43].

Replacing outdated case studies with discipline-specific, contemporary, and forward-looking content (e.g., CRISPR babies, AI in mental health, stem cell-based reproductive technologies) fosters greater engagement. Students report that these scenarios feel more "real," and thus more urgent. When they see themselves as future actors in these ethical narratives, the importance of foresight and responsibility becomes personal.

As we face increasingly complex challenges from brain-machine interfaces to AI in care settings, it is imperative that ethics education evolves to meet the moment. Future-ready engineers must be able to integrate creativity, humility, technical excellence, and ethical reasoning into their work. The course presented here is one model that shows how engineers can—and should—lead that charge.

**Conclusions and Future Directions**

I argue that one of the key responsibilities of an engineer is to predict the future—it just so happens to be very difficult. Leveraging foresight and design fiction as tools to teach ethics in a BME-specific ethics class allows students to better apply their technical understanding of a technology to creative scenarios in responsible innovation and deployment of emergent and emerging technologies. I believe this will extend beyond one BME classroom, as has been developed in our ethics-across-the-curriculum model [15].

Continued work to assess differences between student writings on ethical foresight, how the act of creative fiction writing improves overall writing skills, and how to assess the different foresight lenses used by students will play a role in continuously improving this course for future iterations. Other emerging technologies that have been considered for this course include telemedicine and surgical robotics, point-of-care diagnostics, and cellular therapies using patient-derived cells.

## Appendix

### Appendix A: Additional variations for Module 5 that have been explored in the course

Alternative 1: Module 5—Diagnostic technologies for human health: Students learn about diagnostic development and the importance of sensitivity and specificity in creating accurate measurements. Cost, access, and speed of diagnostics are evaluated in creating new diagnostics and recognizing the concerns for false positives or false negatives in human health. Students read *Bad Blood*: *Secrets and Lies in a Silicon Valley Startup* by John Carreyrou which tells the story of Elizabeth Holmes and Theranos to recognize the impact such diagnostic tools have and what should be the fundamental ethical responsibilities for scientists and engineers (FERSEs) when working in an engineering start-up [44].

Alternative 2: Module 5—Surgical robotics and telemedicine: Robotic-assisted surgery is seeing a large increase in use, with around 15% of general surgeries leveraging these technologies [45]. Students learn about the modalities required for a surgical robot, such as a console, stereoscopic vision, haptic feedback, and tool arms. Students explore the rising interest in semi-autonomous surgery and the cost-benefit analysis to determine when a surgery should be robotic-assisted. Students explore stakeholder mapping, such as power-influence maps, to identify the roles that clinicians, nurses, hospital administrators, and robot manufacturing companies play in the ethical and responsible implementation of such tools. Students also discuss the wicked problems found in deploying such surgical robots for telemedicine in the Global South.

### Appendix B: Writing Prompt for Ethical Reflection and Design Fiction in Emerging Technology

While the technology of human genome editing and brain-computer interfaces are "the technology" we grappled with and its ethical dilemmas in future deployment, the emerging tools of ML/AI in medicine and stem cells/organoids become domain-specific in their technical and ethical challenges that are present today. In class, we've taken broad looks at how ML/AI work in medicine and stem cells can be used for technological study and therapeutic intervention. Now you will take a deeper dive into a particular domain of biomedical engineering where these tools are motivating the next wave of advancement. Some examples may be 'ML/AI in psychiatry medicine,' 'Personalized organoids-to-organ transplantation,' and 'Cerebral organoids for biocomputing' or 'Elucidating autism spectrum disorder through brain organoids.'

Your perspectives essay should outline the current state of affairs in your field with respect to technology advancement, what ethical dilemmas have arisen and strategies to responsibly innovate in this sector, and a personal reflection on what steps engineers can take to promote the 'utopia' version of an ethical future within this space vs. what wrong mis-steps will have occurred that lead us to 'dystopia' and how we can avoid this. This is often called design fiction or speculative design. and can take the form of a story, newspaper headline, or a thought experiment (German: gedankenexperiment). Support your identified ethical dilemmas and futuristic explorations with ethical principles, real-world examples, and potential implications for society, healthcare, and individual progress.

Your essay should be no more than 5,000 words (approximately 10 pages of 12-point single-spaced or 20 pages of 12-point font double-spaced) and include relevant in-text citations, block quotes, tables, and occasionally figures that are germane to your essay. You may use footnotes as needed, but please use them cautiously as you will be reading these essays aloud. Please include a bibliography (not an annotated form) and a consistent citation format (IEEE preferred).

## Appendix C: Holistic Writing Rubric

| Criterion | Level | Description | Points |
|---|---|---|---|
| **Quality of narrative or presentation of events or information** | Strong | Writer tells a vivid story or presents information in an engaging fashion that makes it seem unique to the individual. Subject seems deliberately chosen and not just grabbed from convenience or stereotype. | 10–9 |
| | Good | Writer presents a clear account or set of information in a way that meets the task. Writing may be standard but presents some uniqueness in content that is informative, if slightly derivative. | 9–8 |
| | Adequate | Writer presents a clear account or set of information that meets the task but may be standard or common enough that many students could have generated it. | 8–6 |
| | Fair | The narrative or presentation is very short or general (as if going through the motions), unclear, or off-topic. | 6–0 |
| **Quality of analysis; quality of insights drawn from events or information presented** | Strong | Analysis goes beyond the obvious to show keen insights and reflective skills. The writer includes sustained discussion, developing points with nuance. | 10–9 |
| | Good | Analysis is explained and includes insights, though may lack deeper value or be superficial. | 9–8 |
| | Adequate | Analysis is present but basic or obvious. Development may rely on repetition or cliché. | 8–6 |
| | Fair | Analysis is missing, very brief, or disconnected from the narrative or information. | 6–0 |
| **Quality of voice, personality, or style** | Strong | The writer has flair and presents themselves with an engaging personality, wit, or other qualities that stand out. | 10–9 |
| | Good | Voice is effective and shows conviction, though personal style may be inconsistent. | 9–8 |
| | Adequate | Language is effective, but personality is indistinct. Risk-taking is minimal but competence is clear. | 8–6 |
| | Fair | Voice or style is flat, overly quirky, or shows poor control of language. | 6–0 |
| **Integrity of the writing: how the parts fit together** | Strong | Structure is organic and coherent, reflecting the subject. Surprises or risks are effectively used. | 10–9 |
| | Good | Writing is well organized and logical, though style may be formulaic. | 9–8 |
| | Adequate | Organization is safe and predictable (e.g., generalization, anecdote, commentary). | 8–6 |
| | Fair | Writing appears disorganized; elements could be rearranged with little effect. | 6–0 |
| **Quality of editing and proofreading** | Strong | Grammar, usage, and punctuation are flawless and do not distract. | 10–9 |
| | Good | Minor errors are present but control of language is clear. | 9–8 |
| | Adequate | Some syntactical or diction errors disrupt flow; could be corrected with proofreading. | 8–6 |
| | Fair | Frequent or distracting grammar, usage, or punctuation errors. | 6–0 |

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