KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING

CENG 291: ENGINEERING IN SOCIETY

BY

DR. DANIEL OPOKU

INTRODUCTION

- Engineers create products and processes to improve food production, shelter, energy, communication, transportation, health, and protection against natural calamities and to enhance the convenience and beauty of our everyday lives.
- Engineering products however have double implications; it creates benefits as well as dangers due To moral challenges.
- Nevertheless, these technological risks should not obscure these benefits.
- The dangers induced as a result of these products are as result of small cases of human error hence, ethics and professionalism.

SCOPE OF ENGINEERING ETHICS OVERVIEW OF THEMES

- Theme literally engulfs the concept of the subject in question. The theme constitutes the normative perspective on engineering and on engineering ethics. They are outlined below.
- Engineering projects are social experiments that generate both new possibilities and risks, and engineers share responsibility for creating benefits, preventing harm, and pointing out dangers.
- Moral values permeate all aspects of technological development, and hence ethics and excellence in engineering go together.

CONT'D SCOPE OF ENGINEERING ETHICS OVERVIEW OF THEMES

- Personal meaning and commitments matter in engineering ethics, along with principles of responsibility that are stated in codes of ethics and are incumbent on all engineers.
- Ethical dilemmas arise in engineering , as elsewhere, because moral values are myriad and can conflict.
- Engineering ethics should explore both micro and macro issues, which are often connected.
- Technological development warrants cautious optimism.

ENGINEERING AS A SOCIAL EXPERIMENT

- When the space shuttle Columbia exploded on February 1, 2003 killing the seven astronauts on board, it was perceived as a terror attack given the post September 11 concerns about terrorism. The working hypothesis quickly emerged that, the cause was a piece of insulating foam from the external fuel tank that struck the left wing 82seconds after launch.
- Technological developments are mostly double-edged. As they create new possibilities, they also generate new dangers. To emphasize the benefit-risk aspects of engineering, a model of engineering as a social experiment is highlighted.

CONT'D ENGINEERING AS A SOCIAL EXPERIMENT

- This model underscores the need for engineers to accept and share responsibility for their work, exercise due care, foresee hazards, conscientiously monitor projects when possible, and alert others of dangers to permit them to give informed consent to risks.
- It also underscores the need for preventive ethics; ethical reflection and action aimed at preventing moral harm and avoidable ethical dilemmas

ETHICS AND EXCELLENCE: MORAL VALUES EMBEDDED IN ENGINEERING

- Moral values are embedded in even the simplest engineering projects. Consider the illustration below. Design a chicken coop that would increase egg and chicken production using materials that were readily available and maintainable by local workers. The end users were to be women of a weaving cooperative who wanted to increase the protein in their children's diet in ways that are consistent with their traditional diet, while not appreciably distracting from their weaving. The above illustration occurred at Mayan cooperative in Guatemala.
- In designing the coop, they had to create safe access for the villagers, including ample head and shoulder room at entrances

CONT'D ETHICS AND EXCELLENCE: MORAL VALUES EMBEDDED IN ENGINEERING

And a safe floor for bare feet. They also had to ensure humane conditions for the chickens, including adequate space and ventilation, comfort during climate changes and protection from local predators among others.

- Moral values are embedded at several junctures in engineering projects, including the basic standards of safety and efficiency, the structure of technological corporations, among others.
- In engineering, excellence and ethics go together. Ethics involves the full range of moral values to which we aspire in guiding our endeavors and in structuring our relationships and communities.

PERSONAL COMMITMENT AND MEANING

- A team of engineers are redesigning an artificial lung marketed by their company. The engineers have little or no contact with the firm's customers. It occurs to the project engineer to invite recipients of the artificial lungs to the plant to talk about the impact of it on them. The workers were energized by concrete evidence that their efforts really did improve lives.
- Engineers motives and commitments are as many and varied as those of all humans. The desire for meaningful work, care for other humans and the need to maintain self respect all combine to motivate excellence in engineering.

CONT'D PERSONAL COMMITMENT AND MEANING

- They are most at times mutually reinforcing in advancing a sense of personal responsibility for one's work.
- The personal commitments of individual engineers need to be aimed at and integrated with these shared responsibilities. However, some responsibilities and sources of meaning are highly personal and cannot be incumbent on every engineer.

PROMOTING RESPONSIBLE CONDUCT AND PREVENTING WRONGDOING.

- A wave of corporate scandals shook Americans' confidence in corporations in the early 2001. Enron became the largest bankruptcy in U.S. History, erasing about $60 billion in shareholder value. Also, Arthur Andersen, a large and respected accounting firm charged with checking the books of Enron and other corporations was charged with complicity and was forced to dissolve.
- Compliance issues are about making sure that individuals comply to professional standards and avoid wrongdoing. Procedures are needed in all corporations to deter fraud, theft, bribery, incompetence, and a host of other forms of outright immorality.

CONT'D PROMOTING RESPONSIBLE CONDUCT AND PREVENTING WRONGDOING.

- An important part of engineering ethics is preventing wrongdoing in the first place. This calls into mind preventive ethics: the ethical reflection and action aimed at preventing moral harm and unnecessary ethical problems.
- Reinforcing the connection between ethics and excellence, individuals and corporations should primarily be "value-driven" rather than simply preoccupied with "compliance-based" procedures.

MYRIAD MORAL REASONS GENERATE ETHICAL DILEMMAS

- A chemical engineer working in the environment division of a computer manufacturing firms learns that her company might be discharging unlawful amounts of lead and arsenic into the city sewer. The city further processes the sludge into a fertilizer used by local farmers. To ensure safety, it imposes restrictive laws on the discharge of lead and arsenic. The engineer is therefore responsible for doing what promotes the success of her company, but also has the responsibility to the local community that might be harmed by the effluent.

CONT'D MYRIAD MORAL REASONS GENERATE ETHICAL DILEMMAS

- Ethical or moral dilemmas are situations in which moral reasons come into conflict, or in which the applications of moral values are problematic and it is not immediately obvious what should be done.
- In engineering, moral values are myriad and they can come into conflict requiring good judgement about how to reconcile and integrate them.
- Ethical dilemmas thus indicate the presence of moral complexity.

MICRO AND MACRO ISSUES

- Micro issues concern the decisions made by individuals and companies. Macro issues concern more global issues, such as the directions in technological development, the laws that should or should not be passed, and the collective responsibilities of groups such as engineering professional societies and consumer groups.
- During the late 1990s, reports began to multiply about the tread on ford explorer tires separating from the rest of the tire, leading to blowouts and rollovers.

CONT'D MICRO AND MACRO ISSUES

- Ford and Bridgestone/Firestone terminated their century-old business partnership, thus the micro issue.
- The macro issues center on charges that SUVs are among the most harmful vehicles on the road, even the most harmful, given their numbers.
- In addressing these issues, should engineers play a role only as individuals but not as organized groups. Also, should engineers remain uninvolved leaving the issue entirely to consumer groups and lawmakers.

CAUTIOUS OPTIMISM ABOUT TECHNOLOGY

- Pessimists view advanced technology as ominous and often out of our control. They point to pollution, depletion of natural resources, mass death on highways and in high-tech wars, fears of biological and chemical weapons, and the lingering threat of nuclear war. Optimists highlight how technology profoundly improves all our lives.
- Nothing is more central to human progress than sound technology, and no aspect of creative human achievement is less appreciated by the public than engineers' ingenuity.

ENGINEERING ETHICS

- With the overview of themes and the sampling of issues in mind, ethics has several meanings which are highlighted below.
- Engineering ethics consists of the responsibilities and rights that ought to be endorsed by those engaged in engineering, and also of desirable ideals and personal commitments in engineering.
- Also, engineering ethics is the study of the decisions, policies, and values that are morally desirable in engineering practice and research.

CONT'D ENGINEERING ETHICS

- The above two senses of definition are normative. They refer to justified values and choices, to things that are desirable. In one descriptive sense, we speak of henry ford's ethics or the ethics of American engineers referring thereby to what specific individuals or groups believe and how they act without implying that their beliefs and actions are justified.
- In its normative senses, engineering ethics refers to justified moral values in engineering

IMPORTANCE OF ENGINEERING ETHICS

- Engineering ethics contribute to safe and useful technological products and in giving meaning to engineers' career. It is complex in ways that call for serious reflection throughout a career.
- The study of engineering ethics strengthens one's ability to reason clearly and carefully about moral questions. It enables a unifying goal to increase moral autonomy.
- Autonomy means self-determining or independent. Moral autonomy can be viewed as the skill and habit of thinking rationally about ethical issues on the basis of moral concern. Improving the ability to reflect carefully on moral issues can be accomplished by improving various practical skills that will help produce autonomous thought about moral issues. These skills include:

CONT'D IMPORTANCE OF ENGINEERING ETHICS

- Moral awareness: proficiency in recognizing moral problems and issues in engineering.
- Cogent moral reasoning: comprehending, clarifying, and assessing arguments on moral issues.
- Moral coherence: forming consistent and comprehensive viewpoints based on a consideration of relevant facts.
- Moral imagination: discerning alternative responses to moral issues and receptivity to creative solutions for practical difficulties.

CONT'D OF IMPORTANCE OF ENGINEERING ETHICS

- Moral communication: precision in the use of a common ethical language.
- Moral reasonableness: the willingness and ability to be morally reasonable
- Respect for persons: genuine concern for the well-being of others.
- Tolerance of diversity: within a broad range, respect for ethnic and religious differences, and acceptance of reasonable differences in moral perspectives.
- Integrity: maintaining moral integrity and integrating one's professional life and personal convictions.

ACCEPTING AND SHARING RESPONSIBILITY

- The core idea around which responsibility revolves are obligations, accountability, conscientious, and praiseworthy.

OBLIGATIONS

- Responsibilities are obligations; types of actions that are morally mandatory. Some obligations are incumbent on each of us , such as to be honest, fair and decent.
- Thus a safety engineer might have responsibilities for making regular inspections at a building site, or an operations engineer might have responsibilities for identifying potential benefits and risks of one system as compared to another.

ACCOUNTABILITY

- Being responsible means being accountable. This means having the general capacities for moral agency, including the capacity to understand and act on moral issues.
- Its also means being answerable for meeting particular obligations, that is liable to be held to account by other people in general or by specific individuals in positions of authority.

CONSCIENTIOUS

- Morally admirable engineers accept their obligations and are conscientious in meeting them. They diligently try to do the right time and they largely succeed in doing so even under difficult circumstances.

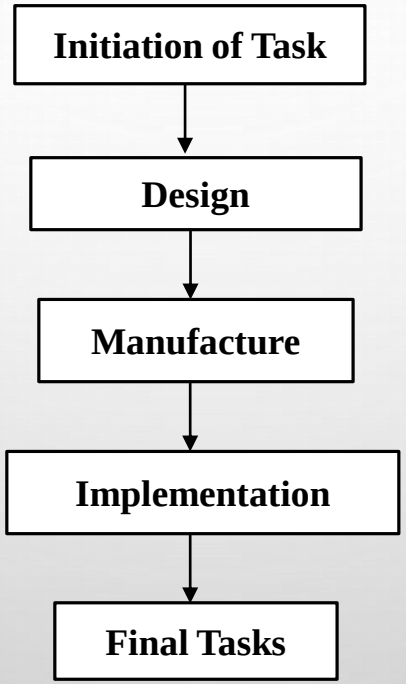
PRAISEWORTHY

- Responsible is a synonym for praiseworthy. Thus, the question “who is responsible for designing the antenna tower?” Might be used to ask who is blameworthy for its collapse or who deserves credit for its success in withstanding a severe storm.

CONT'D ACCEPTING AND SHARING RESPONSIBILITY

- The meanings of the core ideas revolving responsibility engulfs moral responsibility. Moral responsibility overlaps with, but is distinguishable from casual, job, and legal responsibility.
- Casual responsibility consists simply in being a cause of some event
- Job responsibility consists of one's assigned tasks at the place of employment.
- Legal responsibility is whatever the law requires; legal obligations and accountability for meeting them.
- Within large domains, the casual, job, and legal responsibilities of engineers overlap with their moral responsibilities, but not completely.

DIMENSIONS OF ENGINEERING



RESPONSIBLE PROFESSIONALS AND ETHICAL CORPORATIONS

- The nature of engineering both in its goal of producing economical and safe products for the marketplace clearly distinct itself from the other craft since engineering has been embedded in corporations.
- Engineer and historian Edwin T Layton, Jr, Identified two main stages in the development of engineering as a profession during the 19th century.
- First, the growth of public resources during the first half of the century made possible the extensive building of railroads, canals, among others.

CONT'D RESPONSIBLE PROFESSIONALS AND ETHICAL CORPORATIONS

- Secondly, the demand for engineers exploded increasing their worth. Along with this, the dominance of independent consulting engineers began to fade , as engineering became increasingly tied to corporations.
- The corporate control of engineering underlies the primary ethical dilemmas confronted by engineers; the conflict between professional independence and bureaucratic loyalty.
- Today, all professions are interwoven with corporations, including medicine, law, journalism and science. Professional ethics and business ethics should be connected but by no means equated.

PROFESSIONS

- A profession is any occupation that provides a means by which to earn a living. In the sense intended here, professions are those forms of work involving advanced expertise, self-regulation, and concerted service to the public good.
- Professions require sophisticated skills and theoretical knowledge in exercising judgement that is not entirely susceptible to mechanization. Preparation to engage in the work typically requires extensive formal education, including technical studies.
- Well established societies of professionals are allowed by the public to play a major role in setting standards for admission to the profession, drafting codes of ethics, enforcing standards of conduct and representing the profession before the public.

CONT'D PROFESSIONS

- The attempt to distinguish professions from other forms of work is an elitist attempt to elevate the prestige and income of certain groups of workers. Innumerable forms or work contribute to the public good, even though they do not require advanced expertise: hair cutting, selling real estate, garbage collection, among others.
- In conclusion, these valuable forms of work and that professionalism should not be primarily about social status.
- Nevertheless, high ethical standards together with a sophisticated level of required skill and the requisite autonomy to do so needs to be maintained to warrant the recognition traditionally associated with the word profession

MORALLY COMMITTED CORPORATIONS

- The beginning of 2001 had a wave of corporate scandals shaking the confidence Americans had in corporations. Enron became the largest bankruptcy in U.S. history about $60 million in shareholder value. Created in 1985, Enron grew rapidly selling natural gas and wholesale electricity in a new era of government deregulation. In the 1990s, it began using fraudulent accounting practices, partly indulged by auditors from Arthur Andersen, a major accounting frim that collapsed in the aftermath of the Enron scandal.
- Enron created “special purpose entities,” nicknamed raptors after the dinosaurs portrayed in the movie JURASSIC PARK, an off-balance sheet partnerships designed to conceal hundreds of millions in debt and to inflate reported profits.

CONT'D MORALLY COMMITTED CORPORATIONS

- Other unethical practices included price manipulation in sales of electricity to California resulting in massive financial losses to the state.
- Fortunately, most corporations are not like Enron since they place a high priority on concern for worthwhile products and ethical procedures.
- Larger corporations characterized by more intense competition and profit making pressures face a greater challenge in maintaining an ethical climate of which many of them are finding ways to deal with these pressures.

SOCIAL RESPONSIBILITY MOVEMENT

- A social responsibility movement raised attention to products quality, the well- being of workers, the wider community, and the environment yielding the stakeholder theory where corporations have responsibilities to all groups that have a vital stake in the corporation, including employees, customers, dealers, suppliers, local communities, and the general public.
- Many corporations are genuinely concerned about what happens to a product once it leaves the factory of which others have ready excuses that contain at most partial truths.
- The social responsibility movement in business is not without its critics who contend that corporations should concentrate solely on maximizing profits for stockholders and that there are no additional responsibilities to society, customers and employees.

CONT'D SOCIAL RESPONSIBILITY MOVEMENT

- In ensuring the confluence of good engineering, good business, and good ethics, it is essential for engineering and corporations, in their major dimensions to be morally aligned.
- Like journalism and genetic science, engineering is periodically subjected to extreme marketplace forces that threaten professional standards. Most corporations respond to those forces responsibly, but some do not.

SENSES OF CORPORATE RESPONSIBILITY

- The senses of corporate responsibility are as outlined below:

❖Corporations have responsibility. Corporations are communities of individuals structured within legal frameworks. Corporations also have internal structures consisting of policy manuals and flowcharts assigning responsibilities to individuals. Thus, when these individuals act in accordance with their assigned responsibilities, the corporation as a unit can be said to have act.

❖Corporations are accountable to the general public, employees, customers and stockholders just as individuals are accountable. Corporations also have the capacity for morally responsible agency because it is intelligible of the corporations as acting.

CONT'D SENSES OF CORPORATE RESPONSIBILITY

❖Corporations manifest the virtue of responsibility when they routinely meet their obligations just as humans. In general, it makes sense to ascribe virtues such as honesty, fairness and public spiritedness to certain corporations and not to others.

❖In contexts where it is clear that accountability for wrongdoing is at issue, "responsible" becomes a synonym for blameworthy, and in contexts where it is clear that right conduct is at issue, "responsible" is a synonym for praiseworthy. This is true for corporations as it is for individuals.

- These moral meanings are distinct from casual responsibility, which consists simply in being a cause of some event. Engineering firms can be held legally responsible for harm that was so unlikely and unforeseeable that little or no moral responsibility is involved.