**HVPE UNIT-5**

**Technology and Society-Engineering as Social Experimentation**

* Engineering is the application of science and math concerned with the design, building, and use of engines, machines, and structures.
* Engineers figure out how things work and find practical uses for scientific discoveries. • To solve real world problems that improve the world around us.
* Engineering & Experimentation – Experimentation (Preliminary tests or Simulations) plays a vital role in the design of a product or process(Engineering). – Engineering is inherently a risk activity. – So Engineering should be viewed as a experimental process. – Engineering involves people,Environment,Nature.
* Engineering Process: Even though various tests and experiments are conducted at various stages, the engineering project as a whole in its totality can be viewed as an experiment involve technology development, human,Environment.
* Similarities to Standard Experiments:Any project is carried out in partial ignorance due to – The uncertainties in the abstract model used for the design calculations, – The uncertainties in the precise characteristics of the materials purchased, – The uncertainties caused by variations in processing and fabrication of materials and – The uncertainties about the nature of stresses the finished product will encounter.definitely, Engineer’s success lies in the ability to accomplish tasks with only a complete knowledge of scientific laws about nature and society. If an engineer wants to overcome uncertainties ,he must have a practical knowledge of scientific laws about nature and society.
* To Overcome these aspects… First Solution: Monitoring⎫ Monitoring is an essential part of experimentation. This monitoring is done by making periodic observations and tests by looking at for the successful performance and the side effects of the jobs
* To Overcome these aspects… • Second Solution: Learning from the past • Engineers should learn not only from their own earlier design and operating results, but also from other engineers.
* ENGINEERS AS RESPONSIBLE EXPERIMENTERS • In the engineering project, the engineers are the main technical enablers(or) facilitators. • Their responsibility is shared with management, public, and others. • The engineers have so many responsibilities for serving the society.
* Social Responsibilities of engineers in experimentation are… 1.Conscientiousness: A primary duty is to protect the safety of human beings and respect their right of consent. [A conscientious commitment to live by moral values]. 2.Moral Autonomy: Unrestricted free personal involvement in all the steps of a project. 3.Relevant information: A constant awareness of the experimental nature of any project, imaginative forecasting of its possible side effects and a reasonable effort to monitor them. [comprehensive perspective or relative information]. 4.Accountability: Being accountable for the results of a project.
* **CONSCIENTIOUSNESS** – Conscientiousness implies consciousness (sense of awareness). Conscientiousness implies a desire to do a task well. Conscientious people are efficient and organized as opposed to easy-going and disorderly. – As holding the responsible profession with maintaining full range moral ethics and values which are relevant to the situation. – In order to understand the given situation, its implications, know-how, person who is involved or affected, Engineers should have open eyes, open ears and open mind. – One who thinks of oneself and one’s benefits alone cannot be moral agents. • Example: [Should not involve in…]The small negative duties such as altering data by fraud, violating patent right and breaking confidentiality.
* **MORAL AUTONOMY** :This refers to the personal involvement in one’s activities. People are morally autonomous only when their moral conduct and principles of actions are their own i.e., genuine in one’s commitment to moral values. • Moral beliefs and attitudes must be integrated into an individual’s personality which leads to a committed action.
* **Relevant information** :Without relevant factual information, conscientious is not possible. Moral concern involves a commitment (dedication) to obtain and assess all available relevant information. Another dimension to factual information is the consequences of what one does.
* **Accountability(Answerability)** : An engineer is always answerable for what he had undertaken. He must observe care and caution at every stage of his experiment, monitor it by his best capacity and skills and ultimately produce the outcome in the expected manner. If there be failures or errors ,he must accept them with grace. The people those who feel their responsibility, always accept moral responsibilities for their actions. It is known as accountable. In short, ‘accountable’ means being liable and hold responsible for faults. In general and to be proper, it means the general tendency of being willing to consider one’s actions to moral examinations and be open and respond to the assessment of others.

**Engineering Ethics:**

It is the field of [applied ethics](https://en.wikipedia.org/wiki/Applied_ethics) and system of moral principles that apply to the practice of [engineering](https://en.wikipedia.org/wiki/Engineering). The field examines and sets the obligations by [engineers](https://en.wikipedia.org/wiki/Engineer) to [society](https://en.wikipedia.org/wiki/Society), to their clients, and to the profession. As a scholarly discipline, it is closely related to subjects such as the [philosophy of science](https://en.wikipedia.org/wiki/Philosophy_of_science), the [philosophy of engineering](https://en.wikipedia.org/wiki/Philosophy_of_engineering), and the [ethics of technology](https://en.wikipedia.org/wiki/Ethics_of_technology). The general principles of the codes of ethics are:

* Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.
* Engineers shall perform services only in areas of their competence.
* Engineers shall issue public statements only in an objective and truthful manner.
* Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
* Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
* Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.
* Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

The responsibility of engineers are: The engineer recognizes that the greatest merit is the work and exercises his profession committed to serving society, attending to the welfare and progress of the majority. It is an inescapable duty of the engineer to uphold the prestige of the profession, to ensure its proper discharge, and to maintain a professional demeanor rooted in ability, honesty, fortitude, temperance, magnanimity, modesty, honesty, and justice; with the consciousness of individual well-being subordinate to the social good. The engineer and his employer must ensure the continuous improvement of his knowledge, particularly of his profession, disseminate his knowledge, share his experience, provide opportunities for education and training of workers, provide recognition, moral and material support to the school where he studied, thus returning the benefits and opportunities he and his employer have received. It is the responsibility of the engineer to carry out his work efficiently and to support the law. In particular, he must ensure compliance with the standards of worker protection as provided by the law. As a professional, the engineer is expected to commit himself to high standards of conduct.

**Engineers Responsibility for Safety**

* Process Safety management is a subject that we feel is a vital part of the education of chemical engineers. The field of engineering practice is changing rapidly driven by many factors such as globalization, the breakdown of old hierarchical structures of management as a result of enormous increases in collaboration, and the rapid changeis the skills and knowledge required of our graduating proto engineers.
* The modern civilization is totally dependent on the process industries whether they are OIL and Gas, Chemical(which of course includes the bio option),Pharmaceuticals and so on. By the very nature of these industries one often must deal will significant potential hazard such as fire and explosion, toxic release and many other similar situations?
* The process industries have by and large made a significant effort to mitigate these risks, however they still will exist because of the various materials and processes involved.There are many instances where disasters occurred because of poor design, unsafe operating conditions and errors in judgement.
* Bhopal Tragedy: An insecticide plant in India suffered an accidental release of methyl isocyanate. This plant jointly owned by Union Carbide and local investors was essentiallyshut down at the time because of a labour dispute.Because theplant had been designed to receive shipments of MIC from another unit where it was produced there was a fairly large storage tank for the material. MIC will react slowly and exothermically with water and the MIC will boil if not adequately cooled. Somehow water was injected into this tank, some believe it was sabotage by a disgruntled operator;
* however the result was that the tank boiled over. The vapours popped the pressure relief valve and under normal conditions would have been divertedsafely
* into a scrubber and flare system. Unfortunately this equipment was out of service and
* an estimate of some 25 tons of extremely toxic vapour escaped, killing some 2,000
* people living in the shanty village surrounding the plant and injuring some 20,000 others.
* Safety begins at the design stage, and is an integral part of operations and maintenance procedures. While most of these principles have been recognized far
* many years in the industry, it is now called Green Engineering. The primary objective of any process design is to design a unit that is inherently safe.
* In any chemical process it is vital that one is aware of the properties of all the materials
* and mixtures thereof that are involved in the system. Although there are many situations where the presence of a toxic material is unavoidable, every effort should be made to find alternate chemistry or alternate processes to
* minimize any hazard.
* The process selection is very important as well. High operatingtemperatures and pressures and corrosive environments increase the risk associated with the unit. The introduction of advanced catalysts often permitsoperating at reduced pressure and temperature without sacrificing yield and selectivity. Selection of the appropriate materials of construction can be very important as corrosion can lead to catastrophic equipment failure. Before any process design is approved for construction it should be subjected to a rigorous Process
* Hazards Analysis (PHA) such as a fault tree analysis or a Hazards and Operability Studies (HAZOP) These are a rigorous review of the process design in order to anticipate wherever possible potential risks and to do whatever is possible to minimize these. Process Control systems are very important as well since in most units these systems are the main tool for operating the plant in a safe manner. It is not possible to go into much detail at this point but appropriate control strategies are essential to safe operation.
* The primary philosophy of instrumentation should be that all systems are essentially “fail safe”.
* Safety training for all operating personnel, operators and technical staff is imperative. Maintenance procedures are critical as well.
* **Conclusion**: Process Safety Management is a vitally important aspect of ChemicalEngineering whether involved in design, operation or maintenance. We believe that we have a responsibility to our students to make them fully aware of the importance of this issue. The practice of engineering is changing very rapidly and we as educators are being challenged to adapt to this. The problems we face in order to effectively deliver a programme of Process Safety Management are certainly not unique to this

subject;however it is quite illustrative of the fact that the traditional “Sage on the Stage” approach simply isn’t good enough. Active learning in the context of application is an excellent motto but how does one achieve this.

**Self Plagirism**:

* Scientific writing can be a complex and arduous process, for it simultaneously
* demands clarity and conciseness; two elements that often clash with each other. In addition, accuracy and integrity are fundamental components of the scientific enterprise and, therefore, of scientific writing. Thus, good scientific writing must be characterized by clear expression, conciseness, accuracy of what is being reported, and perhaps most importantly, honesty. Unfortunately, writing, or for that matter the entire scientific process,
* often occurs within the constraints of tight deadlines and other competing pressures. As a result of these constraints, scientific papers, whether generated by science students or by seasoned professionals, will at times be deficient in one or more of the above components. n scientific writing, perhaps the most widely recognized unethical lapse is plagiarism.
* Plagiarism can occur in many forms and some of the more subtle instances,
* while arguably unethical in nature, may not be classified as scientific misconduct
* here are other questionable writing practices, some of which may be quite
* common in professional scientific writing.
* One example is reporting anddiscussing results of one‟s research in the context of literature that is supportive of our conclusions while at the same time ignoring evidence that is contrary to our findings.
* Another writing „malpractice‟ occurs when another author‟s review of a lite
* rature is used, yet the reader is led to believe that the current author has conducted the actual review
* Ethical Writing: A general principle underlying ethical writing is the notion that the written work of an author, be it a manuscript for a magazine or scientific journal, a research paper submitted for a course, or a grant proposal submitted to a funding agency, represents an implicit contract between the author of that work and its readers. According to this implicit contract, the reader assumes that the author is the sole originator of the written work, that any text or ideas borrowed from others are clearly identified as such by established scholarly conventions, and that the ideas conveyed therein are accurately represented to the best of the author‟s abilities. In sum, as Kolin (2002) points out “Ethical writing is clear, accurate, fair, and honest”. It also conveys to the reader that we strive for ethical conduct as well as ethical practice.
* Plagiarism is typically defined as stealing the work of another and presenting it as if it were one’s own
* Self-Plagiarism is defined as a type of plagiarism in which the writer republishes a work in its entirety or reuses portions of a previously written text while authoring a new work. Writers often maintain that because they are the authors, they can use the work again as they wish; they can’t really plagiarize themselves because they
* are not taking any words or ideas from someone else. But while the discussion continues on whether self-plagiarism is possible, the ethical issue of self-plagiarism is significant, especially because
* self-plagiarism can infringe upon a publisher’s copyright. Traditional definitions of plagiarism do not account for self-plagiarism, so writers may be unaware of the ethics and laws involved in reusing or repurposing text.

**Ethics Standards and Bench marking:**

Global Ethics & Integrity Benchmarks is a tool for helping multinational organizations assess and measure their progress in making a formal and transparent commitment to ethics and integrity in the workplace. Business conditions and attitudes can vary greatly worldwide. These benchmarks have worldwide and incremental applicability. They address the need for a universal approach to workplace ethics and integrity. Though legal standards and expectations for businesses differ (within a predictable range), the fundamentals of workplace ethics should transcend national boundaries and legal systems. These Global Ethics & Integrity Benchmarks focus on how individuals treat each other in the workplace, and how their organizations treat them as individuals.

They include:

**1. Vision and Goals** covers the organization's overall concept of and approach to ethics and integrity, including its formal articulation of the organization's underlying philosophy about ethical and moral conduct, and how these expectations are embedded in the fabric of the organization. This benchmark includes how organizations identify and define their core ethical values or principles, as well as how organizations integrate those values into everyday business conduct.

**2. Leadership** covers the responsibilities of the organization's leadership in shaping, guiding, and supporting the organization's ethics and integrity initiatives. It examines how leaders and managers are held accountable for promoting ethics and integrity. This category includes an assessment of the organization's "Tone from the Top" at both the senior executive and governance levels.

**3. Infrastructure** explores the way the organization structures or organizes its ethics and integrity function so that it can carry out its goals effectively. This category covers how the ethics function is structured, staffed, and resourced, as well as its formal and informal reporting relationships. This category also includes the roles and responsibilities of those individuals who are assigned to implement the ethics and integrity function.

**4. Legal Compliance, Policies, and Rules** includes the core laws, policies, rules, and guidance that comprise the legal framework for the organization's ethics and integrity systems. This category assesses the internal framework that provides the floor for ethical behavior. It also includes compliance with the external legal framework, established by the multiple jurisdictions and legal frameworks within which the organization operates. This category includes the systems and controls used to ensure and demonstrate that employees and the organization are legally compliant. What is essential is that the organization has translated its legal commitments into concrete actionable guidance that is enforceable.

**5. Organizational Culture** addresses the overall organizational culture and how it promotes ethical conduct in the context of the organization's mission, vision, structure, and strategy. This category explores the degree to which an organization focuses on shaping its organizational culture (both the written and unwritten rules that dictate how work is performed and goals reached) and whether that culture actively promotes ethical conduct. This category addresses how culture is defined (the history and traditions of the organization), who "owns" and shapes culture, how culture is measured, and the degree to which employees find the culture supportive of ethics and integrity.

**6. Disciplinary and Reward Measures** describes how the organization sets and enforces its standards for ethical conduct and behaving with integrity. This category addresses rewards and punishments, incentives that promote ethical behavior, and disciplinary action taken to limit or punish unethical work conduct. This category includes how the organization promotes ethical conduct through its performance appraisal process, and whether ethical conduct is linked to compensation and/or other types of non-monetary benefits.

**7. Whistleblowing** explores how the organization encourages individuals (both internal and external to the entity) to speak up and make reports of questionable conduct. This category explores the methods and protections offered to individuals who wish to make the organization aware of possible unethical behavior, misconduct, or illegal actions. It includes the making of both confidential and anonymous reports, and the systems used by the organization to protect whistleblowers from retaliation or retribution.

**8. Measurement, Research, and Assessment** evaluates how ethics and integrity are measured, whether the organization undertakes research to support ethics strategies that create a culture of ethics and integrity, and the organization's assessment processes around ethics, integrity and organizational culture. This category includes the organization's commitment to continuous improvement, based on benchmarking and other evaluation methodologies.

**9. Confidential Advice and Support** describes how the organization provides confidential, neutral, professional, and independent ethics advice to employees, supervisors, managers, executives, members of governing bodies, and other stakeholders.

**10. Ethics Training and Education** explores ethics and integrity awareness, skill-building training and education, and the integration of such training into the overall development of all employees. This category includes the provision of ethics-related training and skill building throughout the life cycle of staff members, and the degree to which these initiatives are integrated into other organization-wide training commitments.

**11. Ethics Communications** describes how the ethics and integrity initiative is articulated and promoted, both internally and externally. This category covers how the organization defines its stakeholders and how it gears its key messages to distinct audiences.

**12. Corporate Social Responsibility** covers the organization's efforts to establish links with and invest in the communities and stakeholders with which it interacts. This category also covers government relations, environmental consciousness, sustainability, and community impact.

These categories may resonate with any number of legislative or regulatory approaches, but do not reflect the legal environment of any single sovereign nation.

Global values are at the foundation of the Global Ethics & Integrity Benchmarks. Global values, including integrity, can be found in all religions, texts on moral philosophy down through the ages, and in the United Nations Universal Declaration of Human Rights and its resulting rights-related conventions and principles. Though there is significant "play" in how global values (such as integrity) can be defined and their scope of application, there is little doubt that what unites us as human beings is this ethical dimension. Different cultures, nations, and societies may differ about how to prioritize specific moral values. Nevertheless, all human societies seem to accept that a set of basic human values exists and that these values tend to unite—rather than divide—us.