

39. Define a 'right'.
(Entitlement to act in a certain way. Rights serve as a protective barrier, shielding individuals from unjustified infringements. For every right, a complementary *duty* of non-interference exists)

CHAPTER – 3: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation

1. What is engineering experimentation?
2. Why does engineering have to be viewed as experimental process?
(assumed model is uncertain, final outcomes are uncertain, material behavior is uncertain and not constant, nature of user environment is uncertain, and unintended side effects in use)
3. List the responsibilities of engineers to society OR What are the elements that should make an engineer a responsible experimenter?
(commitment to moral values, comprehensive perspective on relevant information, Unrestricted personal involvement in all steps, in product development and accountable for results of project)
4. Name two aspects for comparing engineering work as experiment.
(Experimental control, Informed consent)
5. Explain the term 'learning from the past', in engineering experimentation.
(learning not only from their own work but also from work & results of others)
6. Give the principles of experimental control.

Codes of Ethics

7. What does the 'codes of ethics' exhibit?
(Rights, duties, and obligations of the professional)
8. Name the roles of codes of ethics.
(Inspiration and guidance, Support to engineers, Deterrence and Discipline, Education and mutual understanding, Create good public image, and protects status quo)
9. What are the limitations of codes of ethics?
(vague wordings, not applicable to all situations, have internal conflicts, they can not be treated as final authority, only a few enroll as members in professional society and non-members can not be compelled, different societies have different codes, codes are said to be coercive)
10. Distinguish between the *codes of ethics* and *codes of conduct*?
Codes of ethics are aspirational the codes of conduct are more oriented to professional and one's attitudes.
11. Give two conditions, essential for valid informed consent.
(Consent is voluntary, all relevant information shall be presented in a clearly understandable form, and consenters shall be capable of processing information and make rational decisions)

12. What is meant by 'informed consent' when bringing an engineering product to market?
(Let the customer know about the product, risks and benefits of use, and all relevant information on product, such as how to use and how not to use)
13. Define relevant factual information.
(all available information related to fulfillment of one's moral obligations, including intended and unintended impact of the product, on society)
14. What is meant by conscientiousness?
(Being sensitive to full range of moral values and responsibilities and willingness to develop the skill and put efforts needed to reach best balance possible among those considerations)

Standards and Law

15. What is the importance of Industrial Standards?
(Specification for interchangeability. Standardisation to reduce production costs but with better quality)
16. What does the 'balanced outlook on law' stress in engineering practice?
(It stresses the necessity of laws and regulations and their limitations in directing and controlling the engineering practice)
17. List a few factual issues, conceptual issues and moral/normative issues in the space shuttle challenger incident.

CHAPTER – 4: SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk

1. State the definition of 'Safety'.
(risks would be judged to be acceptable)
2. Name the factors that influence the perception of risk.
(Probability of risk, consequence of the risk, proximity, and method of information dissemination on risk)
3. What is the use of knowledge of risk acceptance to engineers?
(Designer can redesign product to include safety measures, to allow product fail safely, abandon it safely, and provide for safe escape from product to minimize the loss)
4. Compare 'safety' and 'risk'.
(Safety means that the risk is known and judged as acceptable. Risk is a potential that something unwanted and harmful may occur. $\text{Risk} = 1 - \text{safety}$)
5. Mention two ways to determine the risk (testing for safety).
(testing on the functions of the safety system components, destructive testing, prototype testing, simulation testing)
6. List two analytical methods of testing for safety of a product/project.
(scenario analysis, FME analysis, fault-tree analysis, event-tree analysis)

7. List the positive uncertainties in determining the risk.
(restricted access to knowledge on risk, behavior of materials, behavior of environment, use or misuse of materials, newer applications of old technologies, and unexpected and unintended outcomes)
8. List the factors that affect the risk acceptability.
(lack of knowledge of product/process outcomes, estimating probability of rare events, incorrect and unacceptable assumptions and data, magnitude and proximity and voluntariness)
9. List two advantages of fault-tree analysis.
10. Compare the fault-tree and event-tree analysis for risk assessment.
11. What is meant by 'safe exit', in the study of safety?
(conditions are: (1) product, when it fails, should fail safely, (2) product, when it fails, can be abandoned safely, (3) The user can safely escape the product)

Risk- Benefit Analysis

12. List two reasons for the Risk-Benefit Analysis.
(to know risks and benefits and weigh them each, to decide on designs, advisability of product, and to suggest and modify the design so that the risks are eliminated or reduced.
13. Name two ethical implications (limitations) of risk-benefit analysis.
(benefits and risks may go to different groups, units for comparison are not same, is there any violation of rights for those who are exposed to maximum risks and get only minimum benefits? Both risks and benefits lie in the future. The discounted present value, may not be correct, and both risk and benefits may have uncertainties)
14. List two methodologies adopted to assess 'personal risk'.
(assess the voluntary activities, assess the degree of occupational hazard, and loss of senses or limbs, loss of earning capability)
15. List the factors required to assess 'public risk'.
(loss of future income, costs of treatment, and cost of welfare and rehabilitation)

Reducing Risk

16. Name a few techniques (steps) to reduce risks.
(apply safety concepts in design, use redundancy principle in instrument design, monitor and test safety system, train operating personnel and audits, and well-designed emergency plan for evacuation)
17. What is meant by voluntary risk?
(involvement of people in risky actions knowing that these actions are unsafe)
18. When is testing 'inappropriate'?
(in destructive testing, test duration is long, if components failing by tests are very costly. Use then design of experiments, accelerated testing and computer simulations)

Collegiality and Loyalty

19. What is meant by *commitment*?
(sharing of loyalty to moral principles)
20. What is 'collegiality'?
(tendency to support and cooperate with the colleagues)
21. List various aspects of collegiality.
(respect to work of others, commitment to moral principles, and connectedness)

Authority and Loyalty

22. Name two senses of loyalty.
(Agency loyalty, an obligation, attitude (identification) loyalty, a virtue)
23. Define 'institutional authority' with an example.
(authority within the organization. It is the right of the employer to exercise power on the employees and force them to achieve their goals. Ex.: resource allocation, policy decisions, recommendation, supervision, issue orders on subordinates. line managers)
24. What is 'expert authority'?
(Possession of special knowledge, skills and competence to perform a job thoroughly and advice on jobs. They direct others, e.g., Advisers, Experts)

Collective Bargaining

25. Define 'collective bargaining'.
(bargain by the union for improving economic interests of the worker members, through negotiation, threatening verbally, and declaration of 'strike')
26. What is meant by 'proprietary information'?
(information owned by the organization, including knowledge and procedures established)

Confidentiality

27. What is meant by 'confidentiality'?
(Keeping the information on the employer and clients, as secrets is confidentiality)
28. How do the ethical theories justify confidentiality?
 - (1. *Right based*: Right of stakeholders, Right to IP of the company.
 2. *Duty based*: Employees and employers have duty to keep up mutual trust.
 3. *Utilitarian based*: Rule utilitarian thy. holds good when confidentiality produces most good to most people. Act utilitarian thy. focuses on each situation, when the employer decides on a matter as confidential)
29. List factors/principles to justify 'confidentiality'.
(Respect for autonomy, for promises, and for public)

Conflict of Interests

30. What is 'moonlighting'?
(An employee working for two different companies)
31. What is the difference between 'bribe' and 'gift'?
(Test criteria: timing, cost, quality of product, is giver a friend? and motive)
32. What is meant by apparent conflict of interest?

Occupational Crime

33. What is meant by 'occupational crime'?
(Wrong actions of a person through one's lawful employment, Crime committed by employee to promote his interest, and theft by the employee)
34. What is a white-collared crime?
(violation of laws regulating work activities, when committed by office workers or professionals occupational crime is called a white-collared crime. Antonym: blue-collared crime)
35. Define 'price fixing'.
(fixing the bidding rate by companies, in collusion with other companies, for the contract / services. It is an occupational crime, prevalent in electrical industries)
36. What is 'bootlegging'?
(Manufacturing selling or transporting liquor and narcotics that are prohibited by law. In engineering practice, it refers to working on projects which are not properly authorized)

Rights

37. List various provisions under 'human rights'.
(right to pursue legitimate personal interest, right to make a living, right to privacy, right to property)
38. List the provisions under professional rights.
(right to form and express professional judgment, right to refuse to participate in unethical activities, right to warn the public about dangers, right to fair recognition and remuneration for profnl. services, right to talk publicly about the job and right to engage in the activities of professional societies.
39. What is meant by 'right of conscientious refusal'?
(right to refuse to engage in unethical acts e.g., falsifying data, forging documents, altering test results, lying, giving or taking bribe)
40. List the features of the employee rights.
(Professional rights, Basic human rights, Institutional rights/Contractual employee rights, and Non-contractual rights)
41. List a few non-contractual employee rights.
(right to choose outside activities, right to privacy, right to due process from employer, right to equal opportunity)

42. List the situations when 'right to choose outside activities' can be curbed.
(when the activities lead to violating or detrimental to the duties, as in moonlighting, and when the interest of the employer is damaged)
43. What is the 'right to due process'?
(right to fair process or procedures in firing, demotion and in taking any disciplinary actions against the employees. Fairness is in terms of the process rather than the outcomes)

Intellectual Property Rights

44. What is meant by 'intellectual property'?
(information and original expression that derives its original value from creative ideas, and has commercial value. It is an intangible asset)
45. Differentiate between 'Patent' and 'Trade secret'.
(Patents protect legally specific products from being manufactured or sold by others, without permission of the patent holder. TS are on designs, technical processes, plant facilities, and methods. Limited legal protection, against abuse by the employee or contractor)
46. What is the validity and territory for the patents?
(20 years from the date filing the application for the patent. It is territorial right and needs registration)
47. What is meant by 'utility patent'?
(granted to one who invents or discovers any new and useful process, machine, manufacture or chemical composition of any manner or any useful improvement. Utility time is 20 years)
48. What is meant by 'industrial design patent'?
(idea or conception regarding features of shape, configuration, and pattern, ornamental with lines or colors applied to any article, two or three dimensional, made by industrial process. Patent has a term of 14 years from the date of filing the application, e.g., design applied to shoes, T.V., textiles)
49. What is meant by 'copyright'?
(specific and exclusive right for reproduction of original work, i.e., literary material, music, film, sound recording, broadcasting, software and multimedia. No need for registration and no need to seek lawyer's help for settlement. Life of copyright protection is the life of author plus 50 years)
50. What is meant by 'trademark'?
(identity of specific good and services. It is a territorial right, which needs registration, but without any time limit. It may be registered in the form of words, designs, sounds, and symbols)

Discrimination

51. What is meant by 'discrimination'?
(making difference in one's treatment of people or giving preference on the basis of sex, race, and religion)

52. What is meant by 'preferential treatment'?
(giving preference to a group of people, e.g., the reservation is provided for the minority and women in employment opportunities, as a social prop)
53. List three arguments favoring preferential treatment.
(based on compensatory justice, compensate for sexism and racism and reverse preferential treatments)
54. List three arguments against preferential treatment.
(violates the rights to equal opportunity, lowers economic productivity, destroys their self-confidence)
55. What is meant by 'sexual harassment'?
(continuous annoying and attacks on women, on the basis of sexual considerations. Includes physical and psychological attack, coercion, misuse of authority or any undesirable and indecent actions)

Whistle Blowing

56. What is meant by 'whistle blowing'?
(process by which an employee conveys information about a significant moral problem to a person in a position to take action on the problem, outside the approved organizational channel)
57. List four aspects of 'whistle blowing'.
(disclosure, topic, agent, and recipient)

CHAPTER – 5: GLOBAL ISSUES

1. What are the forms or senses of relative values/relativism?
(ethical relativism, descriptive relativism, moral relationalism or contextualism)
2. List the features of 'international human rights'.
(freedom of movement of people, ownership of properties, freedom from torture, fair trial on the products, freedom from discrimination on the basis of race or sex, physical security, freedom of speech, have minimum education, political participation, to live and exist)
3. Define 'technology transfer'.
(process of moving technology to a new setting and implementing it there. Technology includes hardware and techniques (technical, organizational, and managerial skills and procedures), i.e., moving from lab to the field/factory or one country to another)
4. Define 'appropriate technology'.
(identification, transfer, and implementation of most suitable technology for a set of new situations. Appropriate is value based and it should ensure fulfillment of the human needs and protection of the environment)

Environmental Ethics

5. Define 'environmental ethics'.
(Study of moral issues concerning the environment, and the moral perspective, belief, or attitude concerning those issues)
6. What are the duties of an engineer as an experimenter, in environmental ethics?
(Study how industry and technology affect environment, how to fix tolerable and actual pollution levels, protective measures for immediate implementation, and how to educate people)

Computer Ethics

7. Define 'computer ethics'.
(Study and analysis of nature and social impact of computer technology, and formulation and justification of policies, for ethical use of computers)
8. What is meant *conceptual framework* in computer ethics?
(Computer program: Is it an IP? Is copyright applicable to this? Or is it a process protected by a patent? Is it proprietary information? Here, guidelines are needed)
9. Name different types of problems in 'computer ethics'?
(Computer as the instrument of unethical act, computer as the object of unethical act, problems connected with autonomous nature of computer)
10. List the issues in 'computer ethics'.
(Computer in workplace, computer crime, privacy and anonymity, IP, professional responsibility)
11. List the ethical problems by computers in workplace.
(elimination of manual jobs, creation of high-skilled and ITES jobs, and health and safety)
12. List the ethical features involved in computer crime.
(physical security, logical security)
13. What are the merits/demerits of anonymity, in the computer communication?
(seeking medical or psychological counseling or discussion on AIDS, abortion, gay rights, the anonymity offers protection. It is misused by some for money laundering, drug trafficking and preying upon the vulnerable)
14. Give the reasons for an engineer to involve in weapons development.
(gives high-profile job, helps to guard the nation, engineer reduces the risk of enemy weapons by research)
15. List two characteristics of 'engineers as managers'.
(promotes ethical climate, resolving conflicts, social responsibility to stakeholders, customers and employers)
16. List the principles of *conflict resolution*.
(people, interests, options, evaluation).
17. List the ethical responsibilities of consulting engineers.
(proper advertising, incompetent bidding, fixing contingency fee, and the safety of clients)

18. List the provision in NSPE codes on the advertisement by consultant.
(following are prohibited: statement containing misrepresentation or omission of a necessary fact, statement likely to create an unjustified expectation, statement containing prediction of future success, and Statement likely to attract clients, by the use of slogans)
19. Differentiate between *eye witness* and *expert witness*.
(What was seen and, What could have caused and happened)
20. List various abuses of engineers as 'expert witnesses'.
(hired guns, prejudiced for monetary considerations, ego bias, sympathy bias)

Engineers as Advisors

21. Highlight the issues for engineers as 'advisors'.
(study the costs and benefits of all alternatives in objective manner, study economic viability, technical feasibility, operational feasibility and social acceptability, follow honesty, and technical complicity leading to moral complicity)
22. List various roles or models of engineers as 'advisors'.
(hired gun, value-neutral analyst, value-guided advocates)
23. List different characteristic of engineers as public planner and policy makers.
(honesty, competence, diligence, loyalty)
24. Define the concept of 'moral leadership'.
(leading people to achieve goals and objectives, motivate them to move through morally desirable ways, leading creatively in application, extension and putting values into practice and sustain professional interest among social diversity and cross disciplinary complexity)
25. How does the code of ethics achieve its goals?
(Creates an ethical environment in a profession, guides the person as to how to act, in any given situation, supports the individual, who is pressurized by a superior to behave unethically)
26. What is the meaning of the statement, 'When in Rome do as Roman do'?
(actions of corporation and individuals that are accepted by law, custom and values of a society can be morally right in that society. It is morally false, if it is illogical. So, corporation and the engineers functioning in other countries must understand their law, customs, and beliefs and act in line with those prevailing in that country)

21. Justify the safety and other obligations of professional engineers.
 1. Moral obligations through laws and enforced codes of conduct.
 2. Through membership of professional society.
 3. Contractual agreement with employers.
 4. By entry into career as engineer by graduation from Schools of Engg., and
 5. By special employment agreements or agreement with profnl societies.

CHAPTER – 3: ENGINEERING AS SOCIAL EXPERIMENTATION

1. Compare the engineering experiments with standard experiments.
2. Discuss the problems with law in engineering practice.
3. What is the proper role of law in engineering?
4. What engineering aspects make it appropriate to view engineering projects as experiments?
5. What are the general features of morally-responsible engineers?
Explain each with appropriate examples.
6. In the case of *challenger* disaster, examine if the principal actors behaved as responsible experimenters. .
7. What are the safety lessons one can learn in the *Challenger* case?
8. What are the steps in confronting the ‘moral dilemma’?
 1. Identify factors and reasons, competing rights, and clashing ideals etc.
 2. Gather relevant facts
 3. Rank the considerations
 4. Consider alternate solutions
 5. Discussion with colleagues
 6. Arrive at a reasoned judgment by weighing all relevant moral factors
9. What are the main elements included in ‘informed consent’? Enumerate the conditions that would define valid consent.

CHAPTER – IV: SAFETY, RESPONSIBILITIES, AND RIGHTS

1. Explain in detail about the effect of information on risk assessments.
2. Discuss in detail testing strategies for safety.
3. Discuss in detail the ‘risk benefit analysis’ and reducing risk.
4. Would knowledge of risk help you to have better safety standards or safe products?
Substantiate your argument with suitable case studies.
5. How to account publicly for benefits and risks?
6. Discuss on the notion of ‘safe exit’.
7. List some faulty assumptions about safety and their realities.
 - (a) Faulty assumptions and realities, discussion

- (b) Following examples show that safety need not rest on elaborate contingency features:
- (i) The magnetic door latch in the refrigerator permits the door to be opened from inside with out much effort, putting children caught inside, at ease and with a cheaper locking system.
 - (ii) The dead man handle for the rail engine driver is used to control the speed of the train and to the stop the train automatically, if handle is not held in position.
 - (iii) The fail safe design of semaphores actuated by cables stays in 'stop' position when the cable snaps accidentally.
 - (iv) A relay switch trips automatically whenever the voltage supply goes above limits, avoiding costly burn-out situations.
8. Write a brief report on the 'Three-Mile Island' and 'Chernobyl' accidents.

1. Three-Mile island, U.S.A. Mar. 1979

A block in the feedwater line—PORV was opened for a long time—steam generator went dry—pumps were started to refill water reactor core—now too much of water in the reactor—reactor fuel rods began to break into pieces—chemical reaction between steam and the Zinc alloy fuel elements produced Hydrogen—accumulation of Hydrogen caused the explosion of the structure.

Radiation levels in the building increased and sound alarm blew—nobody was there to take actions to quench—somehow people escaped without any loss of human lives—after 13 hours, reactor was put under control.

2. Chernobyl, Russia (April 1986)

RBMK reactors were graphite moderated and they use water tubes. A test on the turbine generator was planned to be conducted during a scheduled plant shut down maintenance—power plant output reduced to 700 MW—on sudden demand, the output was raised--for the test, the reactor operators had already disconnected the emergency core-cooling system—test was conducted at 200 MW power output, which is very low for the test—reactor should have been shut down—they blocked all emergency signals and automatic shut down controls—all safety systems were disconnected.

The operators raised control rods to increase output and continued the test--made the reactor unsafe—temperature of RBMK reactor increased and the fission rate increased--reactor core melted and due to the Hydrogen accumulation, the reactor caught fire and the radioactive waste spread out—people living around were informed after a few hours and were evacuated 12 hours after the explosion. More than 30 workers lost their lives, while 200 sustained burns. 8000 people lost their lives—agricultural products were affected due to contaminated radioactive water, for several years

9. What are the safety lessons we learn from 'Three-Mile Island' and 'Chernobyl' safe exits?
10. Explain the basic attitudes toward responsibility.

1. Minimalist

The minimalist view of responsibility holds that engineers have a duty to conform to the standard operating procedures of their profession and to fulfill the basic duties of

their job as defined by the terms of employment. They are accountable for the harms caused by their failure to fulfill these responsibilities.

2. Reasonable Care

The minimalist view is directly concerned with what will happen to those who cause harm (those who will be held liable, legally or morally). But the 'reasonable care' view is directly concerned with those who are at risk of being harmed and trying to prevent that harm. This implies that the engineer possesses the required skill and ability and will exercise and apply the skill, ability, judgment and taste reasonably and without neglect. Reasonable care implies that the professional does not cause harm intentionally, negligently or recklessly.

3. Good Works

This responsibility is accepted 'above and beyond the call of duty'. No one has a right to expect this from them. If they did not do these, no one would fault them, e.g., A design engineer devoting many hours after regular working hours to see, if safety of the product can be improved, even though the current design more than satisfies the legal requirements.

11. How are 'conflicts of interest' solved? Explain with examples.
12. Discuss in detail about the employee rights.
13. What is the importance of 'loyalty' and 'collegiality' in team work?
14. What are the procedures to be followed in 'whistle blowing'? How are the risks avoided?
15. Discuss on the ways and means of reducing occupational crimes in industries.
16. List some grey areas of confidentiality, and how management policies influence the maintenance of confidentiality.
17. What is institutional authority? How do you correlate institutional authority, expert authority, and power?
18. Discuss on the right of conscientious refusal.
19. Discuss on the right to recognition.
20. Discuss on the 'intellectual property rights'.
21. What is meant by 'respect to authority'? How far it should be recognized by salaried professionals as morally justified?

CHAPTER – 5: GLOBAL ISSUES

1. Does globalization solve the global issues? Why or why not?
2. Explain the role of engineers as managers.
3. Discuss on the philosophical views of nature.

Nature is abundant, gives all resources such as energy (solar, wind, electromagnetic waves), air (hydrogen, oxygen, ozone), heat, water (hydro-power, and oil), and solid resources such as minerals, fossil fuels, chemicals.

Humans have knowledge power. They work, earn, enjoy, but pollute the nature, including the land, water, air, space, self, and other's mind, nurture and support family (micro-society).

Society regulates human to some extent.

Government laws are enacted and enforced. Security provided but crimes continue.

Corporate organisations serve to *generate and distribute wealth*, and thus activate the society.

Spirituality should be practiced by one and all. Protection and nurture of mind as well as the environment are essential part of spirituality. Promotes *health, happiness, and finally peace for all*

4. Explain the meaning and relevance of environmental ethics.
5. Explain the term 'computer ethics'.
6. Discuss on the pros and cons of multinational companies from the point of view of ethics.

Cons

1. Mixing of the foreign nationals with locals, may attract and influence the people, especially the young, towards free exchange of ideas and more freedom for women etc, sometimes leading to decline of culture or discipline.
2. Economic disparity between those employed by MNC and those employed by locals, might lead to social conflicts.

Pros

1. The MNC might spend money on projects for the social development of people, and to eradicate health and safety problems.
2. Increased employment opportunities to the people will reduce the ethical conflicts/problems.
7. Explain the role of engineers as 'expert witness' and 'advisors'.
8. Discuss on the engineer's role in weapon development.
9. Discuss on the participation in professional societies.
10. Write a brief account on 'consulting engineering'.