MODULE-III

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OBJECTIVE TYPE QUESTIONS & ANSWERS: [Each Carries 01 Mark]

1. A situation in which an engineer's loyalty and obligations may be compromised because of self interests or other loyalties and obligations

A. Conflict of interest

B. Conceptual issue

C. Concern of interest

D. Interaction rules

Ans: A

2. The general and abstract concepts of right and wrong behavior culled from philosophy, theology, and professional societies

A. Ethics

B. Morals

C. Etiquette

D. Law

Ans: Ethics

3. Expected sets of behavior (etiquette, law, morals, and ethics) between the engineer, other individuals and society as a whole

A. Conceptual issue

B. Application issue

C. Legal rights

D. Interaction rules

Ans: D

4. Engineering Ethics are the set of behavioral standards that all engineers are expected to follow.

A. True

B. False

Ans: A

5. Legal rights are

A. The system of rules established by authority, society, or custom

B. The lack of clarity as to whether a particular act violates a law, rule or policy

C. The ”just claims” given to all humans within a government’s jurisdiction

D. The act of informing authorities of harmful, dangerous, or illegal activities

Ans: C

6. The codes of behavior and courtesy

A. Etiquette

B. Law

C. Morals

D. Ethics

Ans: A

7. The primary purpose of employee safety programme is to preserve the employees’

A.Mental health

B.Physical health

C.Emotional health

D. All of the above

Ans: D

8. The visual presentation of the ranking of work sites in a factory based on the number of accidents reported from each site is called

A. Accident Frequency Method

B. Spot Map Method

C. Incidence Rate

D. Severity Rate

Ans: B

9. Which of the following involves redesigning of equipment, machinery and material for the safe performance of the jobs?

A. Safety engineering

B. Safety campaigns

C. Safety committee

D. Safety training

Ans: A

10. The responsibility for maintenance of employee health and safety is with

A. Employees

B. Employers

C. Government

D. All of the above

Ans: D

SHORT QUESTIONS & ANSWER: [Each Carries 02 Marks]

1. Define Engineering Ethics?

Ans: Study of the moral issues and decisions confronting individuals and organizations engaged in engineering / profession. Study of related questions about the moral ideals, character, policies and relationships of people and corporations involved in technological activity. Moral standards / values and system of morals.

2. What are the Senses of Engineering Ethics?

Ans: The senses of engineering ethics are:

- o An activity and area of inquiry.
- o Ethical problems, issues and controversies.
- o Particular set of beliefs, attitudes and habits.
- o Morally correct.

3. What are the three types of Inquiry?

Ans: The three types of Inquiry are:

- Normative Inquiry – Based on values.
- Conceptual Inquiry – Based on meaning.
- Factual Inquiry – Based in facts.

4. What are the senses of Responsibility?

Ans: The senses of Responsibility are:

- a. virtue
- b. obligations
- c. general moral capacities of people
- d. liabilities and accountability for actions
- e. blameworthiness or praiseworthiness

5. What are the general features of morally responsible engineers?

Ans: The general features of morally responsible engineers are:

- a. Conscientiousness.
- b. Comprehensive perspective.
- c. Autonomy.
- d. Accountability.

6. What is the need to view engineering projects as experiments?

Ans: Theneed to view engineering projects as experiments are:

- i. Any project is carried out in partial ignorance.
- ii. The final outcomes of engineering projects, like those of experiments, are generally uncertain.
- iii. Effective engineering relies upon knowledge gained about products before and after they leave the factory – knowledge needed for improving current products and creating better ones.

7. Differentiate scientific experiments and engineering projects?

Ans: Scientific experiments are conducted to gain new knowledge, while “engineering projects are experiments that are not necessarily designed to produce very much knowledge”.

8. Define Risk?
Ans: A risk is the potential that something unwanted and harmful may occur.
Risk = Probability X Consequences.

9. Define a Disaster?
Ans: A DISASTER = A seriously disruptive event + A state of unprepared ness.

10. Give the criteria which helps to ensure a safety design?
Ans: The criteria which helps to ensure a safety design are:
The minimum requirement is that a design must comply with the applicable laws.
An acceptable design must meet the standard of "accepted engineering practice."
Alternative designs that are potentially safer must be explored.
Engineer must attempt to foresee potential misuses of the product by the consumer and must design to avoid these problems.
Once the product is designed, both the prototypes and finished devices must be rigorously tested.

11. What are the factors for safety and risk?
Ans: The factors for safety and risk are:
- Voluntary and Involuntary risk
- Short-term and Long-term risk
- Expected probability
- Reversible effects
- Threshold levels to risk
- Delayed or Immediate risk etc

12. What are the drawbacks in the definition of Lawrence?
Ans: The drawbacks in the definition of Lawrence are:
Underestimation of risks
Overestimation of risks
No estimation of risks

13.. Give the categories of Risk?
Ans: The Categories of Risk are:
Low consequence, Low probability (which can be ignored)
Low consequence, High probability
High consequence, Low probability
High consequence, High probability

14. What are the factors that affect Risk Acceptability?
Ans: The Factors that affect Risk Acceptability are:
Voluntarism and control
Effect of information on risk assessment
Job related pressures
Magnitude and proximity of the people facing risk

15. What is the knowledge required to assess the risk?
Ans: The Knowledge required to assess the risk are:
Data in design
Uncertainties in design
Testing for safety

- Analytical testing
- Risk-benefit analysis

16. What are the analytical methods?

Ans: The analytical methods are:

- o Scenario analysis
- o Failure modes & effect analysis
- o Fault tree analysis
- o Event tree analysis etc.

17. How will an engineer assess the safety?

Ans:

- The risks connected to a project or product must be identified.
- The purposes of the project or product must be identified and ranked in importance.
- Costs of reducing risks must be estimated.
- The costs must be weighed against both organizational goals and degrees of acceptability of risks to clients and the public.
- The project or product must be tested and then either carried out or manufactured.

18. What are the reasons for Risk-Benefit Analysis?

Ans: The Reasons for Risk-Benefit Analysis are:

i. Risk-benefit analysis is concerned with the advisability of undertaking a project.
ii. It helps in deciding which design has greater advantages.
iii. It assists the engineers to identify a particular design scores higher with that of the another one.

19. Define Safety?

Ans: In the definition stated by William W. Lawrence safety is defined, as a thing is safe if its risks are acceptable. A thing is safe with respect to a given person or group, at a given time, if its risk is fully known, if those risks would be judged acceptable, in light of settled value principles. In the view of objective, safety is a matter of how people would find risks acceptable or unacceptable.

20. What is the definition of risks?

Ans: A risk is the potential that something unwanted and harmful may occur. Risk is the possibility of suffering harm or loss. It is also defined as the probability of a specified level of hazardous consequences, being realized. Hence Risk (R) is the product of Probability (P) and consequence(C) (i.e) R=P*C

21. Define Acceptability of risks?

Ans: A risk is acceptable when those affected are generally no longer apprehensive about it. Doubtfulness depends mainly on how the people take the risk or how people perceive it.

22. What are the safety measures an engineer must know before assessing a risk of any product?

Ans: The factors are:

- a. Does the engineer have the right data?
- b. Is he satisfied with the present design?
- c. How does he test the safety of a product?
- d. How does he measure and weigh the risks with benefits for a product.

23. What is the use of knowledge of risk acceptance to engineers?

Ans: Though past experience and historical data give better information about safety of products designing there are still inadequate. The reasons are

a. The information is not freely shared among industries

b. There also new applications of old technologies that provides available data, which are less useful.

c. So, in order to access the risk of a product, the engineers must share their knowledge and information with others in a free manner.

24. What is meant by Disaster? Give an example.

Ans: A disaster does not take place until a seriously disruptive event coincides with a state of insufficient preparation. Example: The Titanic collision with an iceberg constituted an emergency, which turned into a disaster because there were too few lifeboats.

25. What are the positive uncertainties in determining risks?

Ans: There are three positive uncertainties. They are:

a. Purpose of designing

b. Application of the product

c. Materials and the skill used for producing the product.

26. What is the use of Risk-Analysis? What are the three factors involved here?

Ans: Risk Analysis is used for the assessment of the hazardous associated with an industrial or commercial activity. It involves identifying the causes of unwanted hazardous events and estimating the consequences and likelihood of these events. Three factors involved in this are:

a. Hazard Identification

b. Consequences analysis

c. Probability estimation.

27. Define Risk-Benefit Analysis?

Ans: Risk benefit analysis is a method that helps the engineers to analyze the risk in a project and to determine whether a project should be implemented or not. In risk benefit analysis, the risks and benefits of a product are allotted to money amounts, and the most benefit able ratio between risks and benefits is calculated.

28. Explain the two types of Risk?

Ans: The two types of Risk are:

i. Personal Risk: An individual, who is given sufficient information, will be in a position to decide whether to take part in a risky activity or not. They are more ready to take on voluntary risks than involuntary risks.

ii. Public Risks: Risks and benefits to the public are more easily determined than to individuals, as larger number of people is taken into account. Involuntary risks are found here.

29. Give the reasons for the Three Mile Island disaster?

Ans: The Reasons for the Three Mile Island Disaster are:

i. Inadequate training to the operators.

ii. Use of B & W reactors.

30. What was the problem in the Chernobyl reactor?

Ans: The problem was that, the output was maintained to satisfy an unexpected demand. The control device was not properly reprogrammed to maintain power at the required level. Instead of leaving fifteen control rods as required, the operators raised almost all control rods because at the low power level, the fuel had become poisoned.

LONG QUESTIONS & ANSWERS:

1. How can engineer become a responsible experimenter? Highlight the code of ethics for Engineers. [10Marks]

Ans: The engineers have so many responsibilities for serving the society.

1. 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. Having a clear awareness of the experimental nature of any project, thoughtful forecasting of its possible side effects, and an effort to monitor them reasonably.
   [A comprehensive perspective or relative information].
3. Unrestricted free personal involvement in all the steps of a project. [Autonomy]
4. Being accountable for the results of a project [Accountability]
5. Exhibiting their technical competence and other characteristics of professionalism.

Conscientiousness:- It implies consciousness (sense of awareness). 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, knowhow, person who is involved or affected, Engineers should have open eyes, open ears and open mind.

Engineering as social experimentation brings into light not only to the person concerned but also to the public engineers as guardians of the public interest i.e.,to safeguard the welfare and safety of those affected by the engineering projects. This view helps to ensure that this safety and welfare will not be affected by the search for new knowledge, the hurry to get profits, a small and narrow follow up of rules or a concern over benefits for the many and ignoring the harm to the few.

Relevant Information :-Without relevant factual information, conscientious is not possible. For showing moral concern there should be an obligation to obtain and assess properly all the available information related to the fulfillment of one's moral obligations. This can be explained as:

1) To understand and grasp the circumstance of a person's work, it is necessary to know about how that work has a moral importance. For example, A person is trying to design a good heat exchanger. There is nothing wrong in that. But at the same time, if he forgets the fact that the heat exchanger will be used in

the manufacture of an illegal product, then he is said to be showing a lack of moral concern. So a person must be aware of the wider implication of his work that makes participation in a project.

2) Blurring the circumstance of a person's work derived from his specialization and division of labour is to put the responsibilities on someone else in the organization. For example if a company produces items which are out of fashion or the items which promotes unnecessary energy wastage, then it is easy to blame sales department.

So, while giving regard to engineering as social experimentation, points out the importance of circumstances of a work and also encourage the engineers to view his specialized activities in a project as a part of a large social impact.

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. They cannot be agreed formally and adhered to merely verbally. So, the individual principles are not passively absorbed from others. When he is morally autonomous and also his actions are not separated from himself.

When engineering have seen as a social experimentation, it helps to keep a sense of autonomous participation in a person's work. An engineer, as an experimenter, is undergoing training which helps to form his identity as a professional.

Accountability:- The people those who feel their responsibility, always accept moral responsibilities for their actions. It is known as accountable. In short, 'accountable' means being culpable 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. It comprises a desire to present morally convincing reasons for one's conduct when called upon in specific circumstances.

CODES OF ETHICS

The codes of ethics have to be adopted by engineering societies as well as by engineers. These codes exhibit the rights, duties, and obligations of the members of a profession. Codes are the set of laws and standards. A code of ethics provides a framework for ethical judgment for a professional. A code cannot be said as totally comprehensive and cover all ethical situations that an engineer has to face. It serves only as a starting point for ethical decision-making. A code expresses the circumstances to ethical conduct shared by the members of a profession. It is also to be noted that ethical codes do not establish the new ethical principles. They repeat only the principles and standards that are already accepted as responsible engineering practice. A code defines the roles and responsibilities of professionals.
The following engineering societies have published codes of ethics.

AAES - American Association of Engineering Societies
ABET - Accreditation Board for Engineering and Technology (USA)
NSPE - National Society of Professional Engineer (USA)
IEEE - Institute of Electrical and Electronics Engineering (USA)
AICTE - All India Council for Technical Education (India)

2. Compare and contrast engineering experiments with standard experiments. [10 Marks]
Ans: **Similarities to Standard Experiments**
There are so many aspects, which are of virtual for combining every type of engineering works to make it suitable to look at engineering projects as experiments. The main three important aspects are:

1) Any engineering project or plan is put into practice with partial ignorance because while designing a model there are several uncertainities occurred. The reason to the fact that engineers don't have all the needed facts available well in advance before starting the project. At some point, both the theoretical examining and the laboratory testing must be by-passed for the sake of completing the project. Really, the success of an engineer is based on the his talent which is exactly being the ability to succeed in achieving jobs with only a partial knowledge of scientific laws about the nature and society.

2) The final outcomes of engineering projects are generally uncertain like that of experiments what we do.
In engineering, in most of the cases, the possible outcomes may not be known and even small and mild projects itself involve greater risks.
The following uncertainities occur in the model designs
1. Model used for the design calculations
2. Exact characteristics of the material purchased.
3. Constancies of materials used for processing and fabrication.
4. About the nature of the pressure the finished product will encounter.
For instance, a reservoir may cause damage to the surroundings and affect the ecosystem. If it leaks or breaks, the purpose will not be served. A special purpose fingerprint reader may find its application in the identification and close observation on the disagreeing persons with the government. A nuclear reactor may cause unexpected problems to the surrounding population leading to a great loss to the owners. A hair dryer may give damage to the unknowing or wrong users from asbestos insulation from its barrel.

3) Good and effective engineering depends upon the knowledge possessed about the products at the initial and end stages.

This knowledge is very useful for increasing the effectiveness of the current products as well as for producing better products in future. This can be achieved by keenly observing on the engineering jobs by the way 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. The tests of the product's efficiency, safety, cost-effectiveness, environmental impact and its value that depends upon the utility to the society should also be monitored. It also extends to the stage of client use.

Comparisons with standard Experiments

Engineering is entirely different from standard experiments in few aspects. Those differences are very much helpful to find out the special responsibilities of engineers and also help them in knowing about the moral irresponsibilities which are involved in engineering.

1. Experimental Control:- Members for two groups should be selected in a standard experimental control, i.e Group A and Group B. The members of the group 'A' should be given the special experimental treatment. The group 'B' do not receive the same though they are in the same environment. This group is called the 'control group'. Though it is not possible in engineering but for the projects which are confirmed to laboratory experiments. Because, in engineering the experimental subjects are human beings who are out of the control of the experimenters. In engineering, the consumers have more control as they are the selecting authority of a project. So in engineering it is impossible to follow a random selection. An engineer has to work only with the past data available with various groups who use the products. So engineering can be viewed as a natural experiment which uses human subjects.

2. Informed Consent :- Engineering is closely related to the medical testing of new drugs and techniques on human beings as it also concerned with human beings.

When new medicines have been tested, it should be informed to the persons who undergo the test. They have moral and legal rights to know about the fact which is based on "informed consent" before take part in the experiment. Engineering must also recognize these rights. When a producer sells a new product to a firm which has its own engineering staff, generally there will be an agreement regarding the risks and benefits form that testing. Informed consent has two main principles such as knowledge and voluntariness.

First, the persons who are put under the experiment has to be given all the needed information to make an appropriate decision.

Second, they must enter into the experiment without any force, fraud and deception. The experimenter has also to consider the fundamental rights of the minorities and the compensation for the harmful effects of that experiment.

In both medicine and engineering there may be a large gap between the experimenter and his knowledge on the difficulties of an experiment. This gap can be filled only when it is possible to give all the relevant information needed for drawing a responsible decision on whether to participate in the experiment or not.

In medicine, before prescribing a medicine to the patient, a responsible physician must search for relevant information on the side effects of the drug.

The following conditions are essential for a valid informed consent

a. The consent must be given voluntarily and not by any force.

b. The consent must be based on the relevant information needed by a rational person and should be presented in a clear and easily understandable form.

c. The consenter must be capable of processing the information and to make rational decisions in a quick manner.

d. The information needed by a rational person must be stated in a form to understand without any difficulty and has to be spread widely.

e. The experimenter's consent has to be offered in absentia of the experimenter by a group which represents many experiments.

Knowledge Gained:- Scientific experiments have been conducted to acquire new knowledge. Whereas engineering projects are conducted as experiments not for getting new knowledge. Suppose the outcomes of the experiment is best, it tells us nothing new, but merely affirms that we are right about something. Mean while, the unexpected outcomes put us search for new knowledge.

3. What do you mean by Inquiry? Explain briefly the different types of inquiry? [10 Marks]

Ans: Inquiry means an investigation. Like general ethics, Engineering ethics also involves investigations into values, meaning and facts. These inquiries in the field of Engineering ethics are of three types.

1. Normative Inquiries
2. Conceptual Inquiries
3. Factual or Descriptive Inquiries

Normative Inquiries:- These inquiries are mostly helpful to identify the values which guide the individuals and groups in taking a decision. These are meant for identifying and justifying some norms and standards of morally desirable nature for guiding individuals as well as groups. In most of the cases, the normative questions are given below:

1. How do the obligations of engineers protect the public safety in given situations?
2. When should an engineer have to alarm their employers on dangerous practices?
3. Where are the laws and organizational procedures that affect engineering practice on moral issues?
4. Where are the moral rights essential for engineers to fulfill their professional obligations?

From these questions, it is clear that normative inquiries also have the theoretical goal of justifying moral judgments.

Conceptual Inquiries :- These are meant for describing the meaning of concepts, principles, and issues related to Engineering Ethics. These inquiries also explain whether the concepts and ideas are expressed by single word or by phrases. The following are some of the questions of conceptual inquiries:

1. What is the safety and how it is related to risk?
2. What does it mean when codes of ethics say engineers should protect the safety, health and welfare of the public?
3. What is a ‘bribe’?
4. What is a ‘profession’ and ‘professional’?

Factual / Descriptive Inquiries :- These help to provide facts for understanding and finding solutions to value based issues. The engineer has to conduct factual inquiries by using scientific techniques. These help to provide information regarding the business realities such as engineering practice, history of engineering profession, the effectiveness of professional societies in imposing moral conduct, the procedures to be adopted when assessing risks and psychological profiles of engineers. The information about these facts provide understanding and background conditions which create moral problems. These facts are also helpful in solving moral problems by using alternative ways of solutions. These types of inquiries are said to be complementary and interrelated.

Suppose an engineer wants to tell a wrong thing in an engineering practice to his superiors, he has to undergo all these inquiries and prepare an analysis about the problem on the basis of moral values and issues attached to that wrong thing. Then only he can convince his superior. Otherwise his judgment may be neglected or rejected by his superior.

4. Define concept of Engineering Ethics? Explain the various approaches of it. Also state the reasons for studying engineering ethics? [10 Marks]

Ans: Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. As a scholarly discipline, it is closely related to subjects such as the philosophy of science, the philosophy of engineering, and the ethics of technology.

Senses of expression of engg. Ethics

- Ethics is an activity and area of inquiry. It is the activity of understanding moral values, resolving moral issues and the area of study resulting from that activity.
- When we speak of ethical problems, issues and controversies, we mean to distinguish them from non moral problems.
- Ethics is used to refer to the particular set of beliefs, attitudes and habits that a person or group displays concerning moralities.
- Ethics and its grammatical variants can be used as synonyms for „morally correct".

Approaches to Engineering Ethics:

i. Micro-Ethics: This approach stresses more about some typical and everyday problems which play an important role in the field of engineering and in the profession of an engineer.

ii. Macro-Ethics: This approach deals with all the social problems which are unknown and suddenly burst out on a regional or national level.

So, it is necessary for an engineer to pay attention on both the approaches by having a careful study of how they affect them professionally and personally.

Reasons to study Engineering Ethics

ENGINEERING ETHICS is a means to increase the ability of concerned engineers, managers, citizens and others to responsibly confront moral issues raised by technological activities.

5. Define the term Risk and Safety. How we an engineer assess the safety? [10 Marks]

Ans: Risk is a key element in any engineering design. RISK is the potential that something unwanted and harmful may occur. A risk is the potential that something unwanted and harmful may occur. Risk is the possibility of suffering harm or loss. It is also defined as the probability of a specified level of hazardous consequences, being realized. Hence Risk (R) is the product of Probability (P) and consequence(C) (i.e) R = P * C.

A thing is safe if its risks are judged to be acceptable. Safety are tactily value judgments about what is acceptable risk to a given person or group. In the definition stated by William W. Lawrence safety is defined, as a thing is safe if its risks are acceptable.

Stepwise, Risk Analysis will include:

• Hazards identification

• Failure modes and frequencies evaluation from established sources and best practices.

• Selection of credible scenarios and risks.

• Fault and event trees for various scenarios.

• Consequences - effect calculations with work out from models.

• Individual and societal risks.

• ISO risk contours superimposed on layouts for various scenarios.

• Probability and frequency analysis.

• Established risk criteria of countries, bodies, standards.

• Comparison of risk against defined risk criteria.

• Identification of risk beyond the location boundary, if any.

• Risk mitigation measures.

The steps followed are need based and all or some of these may be required from the above depending upon the nature of site/plant.

Similarly, An engineer can assess the safety as :
* The risks connected to a project or product must be identified.
* The purposes of the project or product must be identified and ranked in importance.
* Costs of reducing risks must be estimated.
* The costs must be weighed against both organizational goals and degrees of acceptability of risks to clients and the public.
* The project / product must be tested and then either carried out / manufactured.

6. Define Risk Benefit analysis. Why it is conducted?.What are the limitation of RBA? [10 Marks]

Ans: Risk-benefit analysis is the comparison of the risk of a situation to its related benefits.

For research that involves more than minimal risk of harm to the subjects, the

investigator must assure that the amount of benefit clearly outweighs the amount of risk. Only if there is favorable risk benefit ratio, a study may be considered ethical.

Risk-benefit Analysis is conducted for the following reasons:

1. Identify assets and their values: Risk analysis provides a cost/benefit comparison, which compares the annualized cost of safeguards to protect against threats with the potential cost of loss. A safeguard, in most cases, should not be implemented unless the annualized cost of loss exceeds the annualized cost of the safeguard itself. This means that if a facility is worth $100,000, it does not make sense to spend $150,000 trying to protect it. The value placed on assets (including information) is relative to the parties involved, what work was required to develop it, how much it costs to maintain, what damage would result if it were lost or destroyed, and what benefit another party would gain if it were to obtain it. If a company does not know the value of

the information and the other assets it is trying to protect, it does not know how much money and time it should spend on protecting them.

2. Identify vulnerabilities and threats: Once the assets have been identified and assigned values, all of the vulnerabilities and associated threats need to be identified for each asset or group of assets. The IRM team needs to identify the vulnerabilities that could affect each asset's integrity, availability or confidentiality requirements. All of the relevant vulnerabilities need to be identified and documented so that the necessary countermeasures can be implemented.

3. Quantify the probability and business impact of these potential threats: The team carrying out the risk assessment needs to figure out the business impact for the identified threats. To estimate potential losses posed by threats, answer the following questions:

- What physical damage could the threat cause, and how much would that cost?
- How much productivity loss could the threat cause, and how much would that cost?
- What is the value lost if confidential information is disclosed?
- What is the cost of recovering from a virus attack?
- What is the cost of recovering from a hacker attack?
- What is the value lost if critical devices were to fail?
- What is the single loss expectancy (SLE) for each asset and each threat?

This is just a small list of questions that should be answered. The specific questions will depend upon the types of threats the team uncovers.

4. Identify countermeasures and determine cost/benefit: The team then needs to identify countermeasures and solutions to reduce the potential damages from the identified threats.

A security countermeasure must make good business sense, meaning that it is cost-effective and that its benefit outweighs its cost.

Limitations of RBA

A key criticism associated with RBA are:

Calculation of risk levels: These probabilities or fractions cannot simply be arbitrary and require analyses of available data or historical studies. However, any such analyses suffer from some of the same key limitations related to data gathering which impact other forms of CBA.

Missing data, or a lack of data: Missing data, or a lack of data on the risk associated with certain projects or activities, is a major concern. If a project is the first of its kind it would not be easy to calculate an accurate risk level associated with certain outcomes in the same way an insurance company can use the vast amount of data available on drivers to generate an appropriate risk indicator and therefore premium for a driver. Data availability is therefore a particular concern when calculating risk, just as it is when calculating values for costs and benefits in more standard forms of CBA.

In accurately calculating perceived risk: While statistical risk and projected risk can be obtained by analysing data, albeit with a reliance on the quality of the data used in these calculations, for perceived risk it may prove more difficult to generate an accurate estimate of risk.

7. Discuss briefly the issues involved in Engineering ethics? [10 Marks]

Ans: Here, some of the issues considering many kinds of engineering products are:

1. Conceptualization:- This stage involves developing an idea into a conceivable product. A dam is conceived to be built for power generation or irrigation. It is a creative stage and the full ramifications of the project may not be known. However, the idea can be abandoned even at this stage if there are very obvious obstacles or cost-benefit factors that make it unviable.
2. Investigation:- For this, investigation is required to collect data. For a dam project, one has to study the topography, geology, best location, social and environmental impact, etc. Similarly, for a manufactured product, one conducts a market survey and analysis to optimally locate the product in terms of utility and cost.
3. Product specification and costing:- The concept takes shape here in terms of its size, materials, organization and specifications. A rough cost estimate can be prepared at this stage for the purpose of approvals and sanctions. Time frames can be established for realization based on investigative reports and past experiences.
4. Analysis and design:- Analysis and design are iterative processes. In small projects, this may not be a long-drawn affair; but there may be many mega projects where elaborate analysis and design processes are involved.
5. Bidding and contracting:- The contracting may be for the procurement of materials and components which is common in the manufacturing industry. The contracting may also be for the implementation of the project as a whole, as in the case of infrastructural projects. There are generally two types of bids- technical bids and financial bids.
6. Implementation of design:- This refers to the realization of the product in the physical form. Implementation requires complete adherence to the specifications and design data. It involves ensuring complete reliability of the processes used by verifying them frequently.
7. Installation and use:- In the case of many engineering products, while the implementation is done in the factory, the product has to be installed, commissioned and made fit for use at the customer's premises. The customer has to be informed of the complete details of the product.
8. Maintenance:- The responsibility of the engineer does not end with the supply of the product. It has to be maintained in good conditions during its life time. Sometimes, annual maintenance contracts are available and sometimes only warranty period maintenance is done free.
9. Product recall and decommissioning:- The main producer subcontracts the production of some components to another party after ensuring that the quality and safety of the products are

satisfying their requirements. When this procedure is adopted, the company cannot ensure that the component parts maintain the same standards of quality all the time.

Decommissioning is another important aspect, particularly while dealing with processes involving toxic and dangerous wastes such as nuclear material or chemical factories.

8. Write short notes on: [05 Marks Each]

a) Underestimating the risk
b) Overestimating the risk
c) Safe exit

Ans:

a) Underestimating the risk:- In many small construction sites in our country, temporary structures are placed arbitrarily without proper design. Temporary structure include scaffoldings and formworks used in construction. The rickety bamboo poles and platforms prepared from not-so-strong wooden planks are an indication that we underestimated the risks involved. Poles are not properly enchored on the ground and are tied with ropes that do not give a strong joint. People work in very hazardous conditions on these scaffoldings. On a rainy or windy day, the structure may sway and workers may fall and break their limbs. This in fact a very common occurrence in our country. This is due to the underestimation of the dangers involved in using such materials and methods.
b) Overestimating the risk:- Consider the following incident. A man was driving his car when he noticed fire coming from its bonnet. Such incidents do not happen everyday as modern automobiles have in-built safety feature. If someone decides that he/she will no longer drive an automobile because of such incidents, he/she is overestimating the risks involved.
c) Safe exit:- It is almost impossible to build a completely safe product or one that will never fail. When there is a failure of the product SAFE EXIT should be provided.

Safe exit is to assure that

i) when a product fails, it will fail safely,
ii) that the product can be abandoned safely and
iii) that the user can safely escape the product.

More than the questions of who will build, install, maintain and pay for a safe exit, the most important question is who will recognize the need for a safe exit. This responsibility should be an integral part of the experimental procedure.

Some examples of providing 'SAFE EXIT':

•Ships need lifeboats with sufficient spaces for all passengers and crew members.
•Buildings need usable fire escapes
•Operation of nuclear power plants calls for realistic means of evacuating nearby communities
• Provisions are needed for safe disposal of dangerous materials and products.