DECEMBER, 2019
II Year B.Tech ;Third Semester

Mechanical Engineering
Professional Ethics and Human Values

SOLUTIONS and SCHEME of VALUATION

1.   **10 X 1 = 10 M**

a. Honesty is a virtue, and it is exhibited in two aspects namely, (*a*) Truthfulness and   (*b*) Trustworthiness.

b. Self-confidence means making a statement "I can Do" while the over confidence is " I Only can Do".

c. Delay in time build more pressure and creates lot of trouble some to colleagues which reflects the integrity of the company.

d. Professionalism is the competence or skill expected of a professional.

e. Chartered engineers are important when it comes to getting a clearance for your machinery and other shipments. Clearance is needed in order to facilitate a hassle free import and export of the shipments like old machinery or used plants.

f. Collegiality is the tendency to support and cooperate with the colleagues. It is promoted by (i) Respecting other's Ideas (ii) Commitment to moral Principles (c) Connected ness

g. The major reasons for the analysis of the risk benefit are (i) To know risks and benefits and weigh them each (ii) To decide on designs, advisability of product/project (iii) To suggest and modify the design so that the risks are eliminated or reduced.

h. ASME (American Society of Mechanical Engineers) promotes the art, science & practice of multidisciplinary engineering around the globe

i. Conflict of interest is a situation in which the concerns or aims of two different parties are incompatible.

j. An occupational crime may be committed by (a) wrong actions of a person through one's lawful employment or (b) crime by an employee to promote one's own or employer's interest or (c) theft by an employee.

2.

Self-confidence is positive attitude, wherein the individual has some positive and realistic view of himself, with respect to the situations in which one gets involved. The people with self-confidence exhibit courage to get into action and unshakable faith in their abilities, whatever may be their positions.

Definition – 2 M

The best things you/we can do to build up your self-confidence.
1. Visualize yourself as you want to be.
2. Do one thing that scares you every day
3. Question your inner critic
4. Set yourself up to win
5. Help someone else
6. Care for yourself
7. Create personal boundaries
8. Make Positive statements

List and Explanation – 6 M

The self-confidence in a person develops a sense of partnership, respect, and accountability, and this helps the organization to obtain maximum ideas, efforts, and guidelines from its employees

Explanation – 2 M

3.

Civic virtues are the moral duties and rights, as a citizen of the village or the country or an integral part of the society and environment.

      The duties are:

      1. To pay taxes to the local government and state, in time.

      2. To keep the surroundings clean and green.

      3. Not to pollute the water, land, and air by following hygiene and proper garbage disposal.

For example, not to burn wood, tyres, plastic materials, spit in the open, even not to smoke in the open, and not to cause nuisance to the public, are some of the civic (duties) virtues.

      4. To follow the road safety rules.

<div align="right">Definition and Explanation-4 M</div>

      The Civic virtues are divided into four categories

1. Civic Knowledge : Citizens must understand what the Constitution says about how the government is working, and what the government is supposed to do and what not to do. We must understand the basis of our responsibilities as citizens, besides duties and rights. We must be able to recognize when the government or another citizen infringes upon our rights. It implies that the government requires the participation of the enlightened citizens, to serve and survive.

2. Self-Restraint : For citizens to live in a free society with limited government each citizen must be able to control or restrain himself; otherwise, we would need a police state—that is, a dictatorial government to maintain safety and order. He advocated for morality and declared that happiness is achieved and sustained through virtues and morals. He advocated and demonstrated self-restraint several times in his private and public life, and naturally he was a great leader.

3. Self – Assertion : Self-assertion means that citizens must be proud of their rights, and have the courage to stand up in public and defend their rights. Sometimes, a government may usurp the very rights that it was created to protect. In such cases, it is the right of the people to alter or abolish that government (e.g., voting rights, rights call back).

4. Self-Reliance : Citizens who cannot provide for themselves will need a large government to take care of them. Once citizens become dependent on government for their basic needs, the people are no longer in a position to demand that government act within the confines of the Constitution. Self-reliant citizens are free citizens in the sense that they are not dependent on others for their basic needs. They do not need a large provider-government, which has the potential to become an oppressive government, to meet those needs. Only a strong self-reliant citizenry will be able to enjoy fully the blessings of liberty. These civic virtues, applicable to local, state, and central governments, nourish freedom and civil liberty at the root of democracy.

<div align="right">List and Explanation on each point -6 M</div>

4.

a. Dilemmas are situations in which moral reasons come into conflict, or in which the application of moral values are problems, and one is not clear of the immediate choice or solution of the problems. Moral reasons could be rights, duties, goods or obligations. These situations do not mean that things had gone wrong, but they only indicate the presence of moral complexity. This makes the decision making complex. For example, a person promised to meet a friend and dine, but he has to help his uncle who is involved in an accident — one has to fix the priority. There are some difficulties in arriving at the solution to the problems, in dilemma. The three complex situations leading to moral dilemmas are:

1. The problem of *vagueness*: One is unable to distinguish between good and bad (right or wrong) principle. Good means an action that is obligatory. For example, code of ethics specifies that one should obey the laws and follow standards. Refuse bribe or accept the gift, and maintain confidentiality

2. The problem of *conflicting reasons*: One is unable to choose between two good moral solutions. One has to fix priority, through knowledge or value system.

3. The problem of *disagreement*: There may be two or more solutions and none of them mandatory. These solutions may be better or worse in some respects but not in all aspects. One has to interpret, apply different morally reasons, and analyze and rank the decisions. Select the best suitable, under the existing and the most probable conditions.

<div align="right">Explanation – 5 M</div>

b. Moral autonomy is defined as, decisions and actions exercised on the basis of moral concern for other people and recognition of good moral reasons. Alternatively, moral autonomy means 'self determinant or independent'. The autonomous people hold moral beliefs and attitudes based on their critical reflection rather than on passive adoption of the conventions of the society or profession. Moral autonomy may also be defined as a skill and habit of thinking rationally about the ethical issues, on the basis of moral concern. Periodical performance appraisals, tight-time schedules and fear of foreign competition threatens this autonomy. Engineers are compelled to seek the support from their professional societies and outside organizations for moral support. It appears that the blue-collar workers with the support of the union can adopt better autonomy than the employed professionals. Only recently the legal support has been obtained by the professional societies in exhibiting moral autonomy by professionals in this country as well as in the West.

The engineering skills related to moral autonomy are listed as follows:

1. Proficiency in recognizing moral problems in engineering and ability to distinguish as well as relate them to problems in law, economics, and religion,

2. Skill in comprehending, clarifying, and critically-assessing arguments on different aspects of moral issues,

3. Ability to form consistent and comprehensive view points based on facts,

4. Awareness of alternate responses to the issues and creative solutions for practical difficulties,

5. Sensitivity to genuine difficulties and subtleties, including willingness to undergo and tolerate some uncertainty while making decisions,

6. Using rational dialogue in resolving moral conflicts and developing tolerance of different perspectives among morally reasonable people.

Explanation – 5 M

5.

Moral Issues :

The reasons for Moral issues among people including the employer and employees, behaving unethically may be classified into three categories.

(a) Resource Crunches : Due to pressure, through time limits, availability of money or budgetary constraints, and technology decay or obsolescence. Pressure from the government to complete the project in time (e.g., before the elections), reduction in the budget because of sudden war or natural calamity (e.g., Tsunami) and obsolescence due technology innovation by the competitor lead to manipulation and unsafe and unethical execution of projects.

(b) Opportunity :

(i) Double standards or behavior of the employers towards the employees and the public. The unethical behaviors of World Com (in USA), Enron (in USA as well as India) executives in 2002 resulted in bankruptcy for those companies,

(*ii*) Management projecting their own interests more than that of their employees. Some organizations over-emphasize short-term gains and results at the expense of themselves and others,

(*iii*) Emphasis on results and gains at the expense of the employees

This is best encountered by developing policies that allow 'conscience keepers' and whistle blowers and appointing ombudsman, who can work confidentially with people to solve the unethical problems internally.

(c)Attitude

Poor attitude of the employees set in due to

(i)Low morale of the employees because of dissatisfaction and downsizing,

(*ii*) Absence of grievance redressal mechanism,

(*iii*) Lack of promotion or career development policies or denied promotions,

(*iv*) Lack of transparency,

(v) Absence of recognition and reward system,

To get firm and positive effect, ethical standards must be set and adopted by the senior management, with input from all personnel.

Explanation – 5 M

Types Of Inquiries
The three types of inquiries, in solving ethical problems are: normative inquiry, conceptual inquiry, and factual or descriptive inquiry. The three types of inquiries are discussed below to illustrate the differences and preference.

(a) Normative Inquiry : It seeks to identify and justify the morally-desirable norms or standards that should guide individuals and groups. It also has the theoretical goal of justifying particular moral judgments. Normative questions are about what ought to be and what is good, based on moral values. For example,
1. How far does the obligation of engineers to protect public safety extend in any given situation?
2. When, if ever, should engineers be expected to blow whistle on dangerous practices of their employers?

(b) Conceptual Inquiry : It is directed to clarify the meaning of concepts or ideas or principles that are expressed by words or by
questions and statements. For example,
(*a*) What is meant by safety?
(*b*) How is it related to risk?
(c) What is a bribe?

(c) Factual or Descriptive Inquiry : It is aimed to obtain facts needed for understanding and resolving value issues. Researchers conduct
factual inquiries using mathematical or statistical techniques. The inquiry provide important information on business realities, engineering practice, and the effectiveness of professional societies in fostering moral conduct, the procedures used in risk assessment, and psychological profiles of engineers. The facts provide not only the reasons for moral problems but also enable us to develop alterative ways of resolving moral problems. For example,
1. How were the benefits assessed?
2. What are procedures followed in risk assessment?
3. What are short-term and long-term effects of drinking water being polluted?..etc

Explanation – 5 M

6.

Before manufacturing a product or providing a project, we make several assumptions and trials, design and redesign and test several times till the product is observed to be functioning satisfactorily. We try different materials and experiments. From the test data obtained we make detailed design and retests. Several redesigns are made upon the feedback information on the performance or failure in the field or in the factory. Besides the tests, each engineering project is modified during execution, based on the periodical feedback on the progress and the lessons from other sources. Hence, the development of a product or a project as a whole may be considered as an experiment

Explanation – 3 M

We can now compare the two activities (Projects and Experiments), and identify the similarities and contrasts

Similarities :
1. Partial ignorance: The project is usually executed in partial ignorance. Uncertainties exist in the model assumed. The behavior of materials purchased is uncertain and not constant (that is certain!). They may vary with the suppliers, processed lot, time, and the process used in shaping the materials (e.g., sheet or plate, rod or wire, forged or cast or welded). There may be variations in the grain structure and its resulting failure stress. It is not possible to collect data on all variations. In some cases, extrapolation, interpolation, assumptions of linear behavior over the range of parameters, accelerated testing, simulations, and virtual testing are resorted.
2. *Uncertainty*: The final outcomes of projects are also uncertain, as in experiments. Some times unintended results, side effects (bye-products), and unsafe operation have also occurred. Unexpected risks, such as undue seepage in a storage dam, leakage of nuclear radiation from an atomic power plant, presence of pesticides in food or soft drink bottle, an new irrigation canal spreading water-borne diseases, and an

unsuspecting hair dryer causing lung cancer on the user from the asbestos gasket used in the product have been reported.

3. *Continuous monitoring*: Monitoring continually the progress and gaining new knowledge are needed before, during, and after execution of project as in the case of experimentation. The performance is to be monitored even during the use (or wrong use!) of the product by the end user/beneficiary.

4. *Learning from the past*: Engineers normally learn from their own prior designs and infer from the analysis of operation and results, and sometimes from the reports of other engineers. But this does not happen frequently. The absence of interest and channels of communication, ego in not seeking information, guilty upon the failure, fear of legal actions, and mere negligence have caused many a failure, e.g., the Titanic lacked sufficient number of life boats—it had only 825 boats for the actual passengers of 2227, the capacity of the ship being 3547! In the emergent situation, all the existing life boats could not be launched. Forty years back, another steamship Arctic met with same tragedy due to the same problem in the same region. But the lesson was learned. In most of the hydraulic systems, valves had been the critical components that are least reliable. The confusion on knowing whether the valve was open or closed, was the cause of the Three-Mile Island accident in 1979. Similar malfunctioning of valves and mis-reading of gauges have been reported to have caused the accidents else where in some power plants. But we have not learnt the lesson from the past. The complacency that it will not happen again and will not happen 'to me' has lead to many disasters

Contrasts :

The scientific experiments in the laboratory and the engineering experiments in the filed exhibit several contrasts as listed below:

1. *Experimental control*: In standard experiments, members for study are selected into two groups namely A and B at random. Group A are given special treatment. The group B is given no treatment and is called the 'controlled group'. But they are placed in the same environment as the other group A. This process is called the *experimental control*. This practice is adopted in the field of medicine. In engineering, this does not happen, except when the project is confined to laboratory experiments. This is because it is the clients or consumers who choose the product, exercise the control. It is not possible to make a random selection of participants from various groups. In engineering, through random sampling, the survey is made from among the users, to assess the results on the product. .

2. *Humane touch*: Engineering experiments involve human souls, their needs, views, expectations, and creative use as in case of social experimentation. This point of view is not agreed by many of the engineers. But now the quality engineers and managers have fully realized this humane aspect.

3. *Informed consent*: Engineering experimentation is viewed as Societal Experiment since the subject and the beneficiary are human beings. In this respect, it is similar to medical experimentation on human beings. In the case of medical practice, moral and legal rights have been recognized while planning for experimentation. Informed consent is practiced in medical experimentation. Such a practice is not there in scientific laboratory experiments.

4. *Knowledge gained*: Not much of new knowledge is developed in engineering experiments as in the case of scientific experiments in the laboratory. Engineering experiments at the most help us to (*a*) verify the adequacy of the design, (*b*) to check the stability of the design parameters, and (*c*) prepare for the unexpected outcomes, in the actual field environments.

Explanation by citing Examples and Covering various parameters – 7 M

7.

Intellectual Property Rights :

It is the information and Original Expression that derives its original value from creative Idea and with Commercial Value.

Definition – 1 M

Need for Protection of IP

IP plays an essential role to stabilize and develop the economy of a nation. This protection actually stimulates creativity, research, and innovation by ensuring freedom to individuals and organizations to benefit from their creative intellectual investments. The IP serves many purposes, namely

(*a*) it prevents others using it,

(*b*) prevent using it for financial gain,

(*c*) prevent plagiarism

(*d*) fulfill obligation to funding agency. ICICI Bank has advanced loan against IP as security to Shopper's Stoppe, New Delhi, and

(*e*) provides a strategy to generate steady income.

<div align="right">Importance of IPR – 3 M</div>

Types and Norms

(a) Patents : Patent is a contract between the individual (inventor) and the society (all others). Patents protect legally the specific products from being manufactured or sold by others, without permission of the patent holder. Patent holder has the legally-protected monopoly power as one's own property. The validity is 20 years from the date filing the application for the patent. It is a territorial right and needs registration. The Patent (Amendment) Act 2002 guarantees such provisions.

Patent is given to a product or a process, provided it is entirely new, involving an inventive method and suitable for industrial application. While applying for a patent, it is essential to submit the documents in detail regarding the problem addressed, its solution, extent of novelty or innovation, typical applications, particulars of the inventor, and the resources utilized. Inventions are patentable and the discoveries are not.

(b) Copy Right : The copyright is a specific and exclusive right, describing rights given to creators for their literary and artistic works. This protects literary material, aesthetic material, music, film, sound recording, broadcasting, software, multimedia, paintings, sculptures, and drawings including maps, diagrams, engravings or photographs. There is no need for registration and no need to seek lawyer's help for settlement. The life of the copyright protection is the life of the inventor or author plus 50 years.

Copyright gives protection to particular expression and not for the idea. Copyright is effective in (*a*) preventing others from copying or reproducing or storing the work, (*b*) publishing and selling the copies, (*c*) performing the work in public, commercially (*d*) to make film (*e*) to make translation of the work, and (*f*) to make any adaptation of the work. Copying the idea is called 'plagiarism' and it is dealt with separately.

(c) Trade Mark : Trademark is a wide identity of specific good and services, permitting differences to be made among different trades. It is a territorial right, which needs registration. Registration is valid initially for 10 years, and renewable. The trademark or service mark may be registered in the form of a device, a heading, a label, a ticket, a letter, a word or words, a numeral or any combination of these, logos, designs, sounds, and symbols. Trademark should not be mistaken for a design, e.g., the shape of a bottle in which a product is marketed, can not be registered as a trademark.

(e) Trade Secret : A trade secret is any practice or process of a company that is generally not known outside of the company. Information considered a trade secret gives the company an economic advantage over its competitors and is often a product of internal research and development.

<div align="right">Explanation – 6 M</div>

8.

a. The characteristics of engineers as managers are:

1. Promote an ethical climate, through framing organization policies, responsibilities and by personal attitudes and obligations.

2. Resolving conflicts, by evolving priority, developing mutual understanding, generating various alternative solutions to problems.

3. Social responsibility to stakeholders, customers and employers. They act to develop wealth as well as the welfare of the society. Ethicists project the view that the manager's responsibility is only to increase the profit of the organization, and only the engineers have the responsibility to protect the safety, health, and welfare of the public. But managers have the ethical responsibility to produce safe and good products (or useful service), while showing respect for the human beings who include the employees, customers and the public. Hence, the objective for the managers and engineers is to produce valuable products that are also profitable.

<div align="right">Explanation – 5 M</div>

b.

Military activities including the world wars have stimulated the growth of technology. The growth of Internet amply illustrates this fact. The development of warfare and the involvement of engineers bring out many ethical issues concerned with engineers, such as the issue of integrity in experiments as well as expenditure in defense research and development, issue of personal commitment and conscience, and the issues of social justice and social health.

Engineers involve in weapons development because of the following reasons:

1. It gives one job with high salary.
2. One takes pride and honor in participating in the activities towards the defense of the nation (patriotic fervor).
3. One believes the he fights a war on terrorism and thereby contribute to peace and stability of the country. Ironically, the wars have never won peace, only peace can win peace!
4. By research and development, the engineer is reducing or eliminating the risk from enemy weapons, and saving one's country from disaster.
5. By building-up arsenals and show of force, a country can force the rogue country, towards regulation. Engineers can participate effectively in arms control negotiations for surrender or peace, e.g., bombing of Nagasaki and Hiroshima led to surrender by the Japanese in 1945.
Many engineers had to fight and convince their personal conscience. The scene such as that of a Vietnamese village girl running wild with burns on the body and horror in the face and curse in her mind has moved some engineers away from their jobs.

<div align="right">Explanation – 5 M</div>

9.

a. IEEE Code of Ethics
We the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:
1. to accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose prompt factors that might endanger the public or the environment.
2. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist.
3. to be honest and realistic in stating claims or estimates based on available data.
4. to reject bribery in all its forms.
5. to improve the understanding of technology, its appropriate application, and potential consequences.
6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations.
7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others.
8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin.
9. to avoid injuring others, their property, reputation, or employment by false or malicious action.
10. to assist colleagues and co-workers in their professional development and to support them in following code of ethics.

<div align="right">Explanation – 5 M</div>

b. Computer ethics
Computer Ethics is defined as (*a*) study and analysis of nature and social impact of computer technology, (*b*) formulation and justification of policies, for ethical use of computers. This subject has become relevant to the professionals such as designers of computers, programmers, system analysts, system managers, and operators.

<div align="right">Definition and Importance : 2 M</div>

Different types of problems are found in computer ethics
(i) Computer as the Instrument of Unethical Acts : The usage of computer replaces the job positions. This has been overcome to a large extent by readjusting work assignments, and training everyone on computer applications such as word processing, editing, and graphics.
(ii) Computer as the Object of Unethical Act : Hacking , Spreading Virus and Helath Hazard are coming into this category.
(iii) Problems Related to the Autonomous Nature of Computer : *Security risk*: , *Loss of human lives and in* flexible manufacturing systems, the autonomous computer is beneficial in obtaining continuous monitoring and automatic control.
Computer Crimes:

(i) Physical Security : The computers are to be protected against theft, fire, and physical damage. This can be achieved by proper insurance on the assets.

(ii) Logical security : The aspects related are (*a*) the privacy of the individuals or organizations, (*b*) confidentiality, (*c*) integrity, to ensure that the modification of data or program are done only by the authorized persons, (*d*) uninterrupted service. This is achieved by installing appropriate uninterrupted power supply or back-up provisions, and (*e*) protection against hacking that causes dislocation or distortion In addition the above mentioned points , The computer ethics include Some issues concerned with the privacy.

<div align="right">Explanation – 3 M</div>

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