

Anna University , Chennai-25
Syllabus
Regulation 2013
GE 6075 - PROFESSIONAL ETHICS IN ENGINEERING

OBJECTIVES:

To enable the students to create an awareness on Engineering Ethics and Human Values, to instil Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES**10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS**9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES**8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS**OUTCOMES :**

Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

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1. Aim & Objective of the subject

- To learn basic concepts of ethics and its principles
- To educate on theories of ethics in engineering
- To identify code of conduct in working places
- To learn the safety and risk in different streams
- To apply the concepts of ethics in globalized.

2. Need & Importance of the subject

- ❖ This subject will be helpful to run their day to day life in ethical manner and also they identify good and bad things of life.
- ❖ This subject will give a basic knowledge in ethics and how it will apply to their work.

3. Industrial Connectivity & Latest Development

- Self Interest and courage towards their work
- Ethical dilemma
- Computer hackers, Internet Cybercrime

SCAD GROUP OF INSTITUTIONS

Department of Electronics and Communication Engineering

Detailed Lesson Plan

**Name of the Subject& Code: GE 6075 -PROFESSIONAL ETHICS IN
ENGINEERING**

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

S.No	Unit	Topics To Be Covered	Hours Planne d	Cumulativ e Hours	Books Referred
UNIT I – HUMAN VALUES					
1.	I	Introduction Morals, values and Ethics	1	1	R2
2.	I	Integrity Work ethic, Service learning	1	2	R2
3.	I	Civic virtue Respect for others	1	3	R2
4.	I	Living peacefully ,Caring & Sharing, Honesty	1	4	R1
5.	I	Courage ,Valuing time	1	5	R1
6.	I	Cooperation Commitment	1	6	R1
7.	I	Empathy , Self confidence	1	7	R1
8.	I	Character ,Spirituality	1	8	R1
9.	I	Introduction to Yoga and meditation for professional excellence	1	9	R2
10.	I	Stress management.	1	10	R2
UNIT II - ENGINEERING ETHICS					
11.	II	Senses of 'Engineering Ethics'	1	11	R1
12.	II	Variety of moral issues	1	12	R1
13.	II	Types of inquiry	1	13	R1
14.	II	Moral dilemmas &Moral Autonomy	1	14	R1
15.	II	Kohlberg's theory	1	15	R1
16.	II	Gilligan's theory	1	16	R1
17.	II	Consensus and Controversy Models of professional roles	1	17	R1
18.	II	Theories about right action Uses of Ethical Theories	1	18	R2
19.	II	Self-interest – Customs and Religion	1	19	R2
UNIT-III - ENGINEERING AS SOCIAL EXPERIMENTATION					
20.	III	Engineering as Experimentation	2	21	R1
21	III	Engineers as responsible Experimenters	2	23	R1
22.	III	Codes of Ethics	3	26	R1
23.	III	A Balanced Outlook on Law.	2	28	R1

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS					
24.	IV	Safety and Risk –Assessment of Safety and Risk	1	29	R1
25.	IV	Risk Benefit Analysis and Reducing Risk	1	30	R1
26.	IV	Respect for Authority, Collective Bargaining	1	31	R2
27.	IV	Confidentiality , Conflicts of Interest	1	32	R1
28.	IV	Occupational Crime	1	33	R1
29.	IV	Professional Rights	1	34	R1
30.	IV	Employee Rights	1	35	R1
31.	IV	Intellectual Property Rights (IPR)	1	36	R2
32.	IV	Discrimination	1	37	R2
UNIT V - GLOBAL ISSUES					
33.	V	Multinational Corporations	1	38	R1
34.	V	Environmental Ethics	1	39	R1
35.	V	Computer Ethics	1	40	R1
36.	V	Weapons Development	1	41	R1
37.	V	Engineers as Managers Consulting Engineers	1	42	R1
38.	V	Engineers as Expert Witnesses and Advisors	1	43	R1
39.	V	Moral Leadership	1	44	R1
40.	V	Code of Conduct Corporate Social Responsibility	1	45	R1

UNIT I HUMAN VALUES

Part -A

1. Define Work Ethics. (April/May '14)

The work ethic is a cultural norm that advocates being personally accountable and responsible for the work that one does and is based on a belief that work has intrinsic value.

2. Define moral values with suitable examples (Apr/May '15)

Moral values, therefore, reside both in the acts a person chooses to do and the results of those acts on the character of the person. There are morally good or bad human acts and morally good or bad persons.

3. Define Professionalism (Apr/May '15)

The term “professionalism” refers to the qualities, competencies, and skills of professional. It has behavioural connotations and refers to the manifestations of a professional.

3. List the factors that enhance the self confidence in a person.

(Nov 15 /May '15)

- Self confident people trust their own abilities
- Self confident people have a general sense of control in their lives
- Self confident people able to do what they wish, plan and expect

5. Define Spirituality (Nov/Dec'15)

Spirituality is a broad term that refers to the way of living. It emphasizes a constant awareness of the spiritual dimension of nature.

6. What are the values? (Apr/May '16)

The term “value” or “worth” seems to have its origin in economics; eventually it was applied analogously to other aspects of life, human values as such. There is much agreement on the definition of value as definition of good.

7. What is meant by self confidence?

(Apr/May '16)

“Success comes to those who dare and act, it seldom comes to the timid”, said our famed Pandit Jawaharlal Nehru. Also we know that faith in oneself is confidence. Confidence gives rise to strength and courage to the mind.

8. What is Engineering Ethics?

The study of moral issues and decisions confronting individuals and organizations engaged in engineering field.

The study of related issues about the moral ideals, characters, policies, and relationships of people and corporations involved in technological activity.

9. What is Empathy?

Empathy is one's ability to recognize and understand the emotion of another.

10. What do you mean by service learning?

It is a teaching method that enriches learning by engaging students in meaningful to their schools.

Part-B

1. Write brief notes on yoga and meditation for professional excellence and stress management. Nov/Dec '15 (16)

Medical research for decades that yoga and meditation, two practices related to mindfulness, are considered a means of activating the body's natural mechanisms for managing stress. Researchers at Johns Hopkins University surveyed over 19,000 studies on meditation and used stringent criteria to identify 47 of the most rigorously controlled studies on which to perform a meta-analysis of the clinical benefits of meditation. The analysis revealed that these programs lowered stress, anxiety, and depression and that "clinicians should be prepared to talk with their patients about the role that a meditation program could have in addressing psychological stress"

Role of meditation in managing stress

The effectiveness of mindfulness programs that use meditation in managing stress can be explained by physiological changes that take place in both the brain and the body. In a recent TED Talk, Harvard-based neuroscientist Dr. Sara Lazar explains that "meditation can literally change your brain" by increasing the size of the hippocampus, which is associated with learning and memory, and the temporal-parietal junction, which is associated with empathy and compassion. Dr. Kelly Brogan, holistic women's health physician, describes those changes as decreased heart rate, blood pressure, rate of breathing, and muscle tension, and she adds that this "relaxation response" can combat stress, a part of "what is actually driving chronic diseases such as auto-immune, cardiovascular, and psychiatric pathology"

Role of yoga in managing stress

Yoga, another practice in mindfulness, is also supported by medical research as a means of helping sufferers manage their stress. Yoga has been shown to have a regulatory effect on two key neurobiological systems: the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS). With repeated exposure to stressors over time, these systems are bombarded by catecholamines like epinephrine and norepinephrine (stress hormones), which can result in their becoming "hyper vigilant" and "dysregulated." The dysfunction of these systems is thought to dispose one to diseases such as "obesity, diabetes, autoimmune disorders, depression, substance abuse, and cardiovascular disease" (Ross & Thomas, 2010). Dr. Bessel Van der Kolk, professor

of psychiatry at Boston Medical School and one of the world's leading authorities on post-traumatic stress disorder(PTSD), has recognized this "down-regulation" benefit of yoga and applied it to his practice with PTSDpatients. Van der Kolk eloquently describes the physiological basis of stress and how yoga practice can help alleviate that stress: "Traumatized people often are terrified of the sensations in their own bodies which makes it hard to take pleasure in the present because the body keeps replaying the past.[Yoga] is a way for people to regulate the core arousal system in the brain and feel safe inside their bodies"

In addition to promoting health and managing stress, research has demonstrated that mindfulness activities can also improve attention and cognition. Dr. Judson Brewer at the Yale School of Medicine, for example, explains that experienced mediators show deactivation of the default mode network (DMN), a region involved in "daydreaming and mind-wandering." His research also shows that meditators show functional changes in different areas of the cingulate and prefrontal cortices, both of which are crucial regions for cognitive control. According to Brewer, "meditation may transform the normal, resting function of the brain into one that more closely resembles a meditative state from that of mind-wandering to one of being centered in the present." Brewer even goes on to weigh in on the clinical significance of these findings vis-à-vis improved stress management: "[Meditation] could certainly be used to help people work through frustration and anxiety so that they don't move into a clinical depression or clinical anxiety disorder, or start using drugs. But at the same time, it can be used when people already have these disorders."

2. a) What is courage? What are salient features of courage? Nov/Dec'15 (8)

b) Write short notes on honesty.

(8)

Courage

Courage is the tendency to accept and face risks and difficult tasks in rational ways. Self-confidence is the basic requirement to nurture courage.

Classifications of courage

Courage is classified into three types, based on the types of risks, namely

- (a) Physical courage,
- (b) Social courage, and
- (c) Intellectual courage.

Physical courage- In physical courage, the thrust is on the adequacy of the physical

strength, including the muscle power and armaments. People with high adrenalin, may be prepared to face challenges for the mere 'thrill' or driven by a decision to 'excel'.

Social courage- The social courage involves the decisions and actions to change the order, based on the conviction for or against certain social behaviors. This requires leadership abilities, including empathy and sacrifice, to mobilize and motivate the followers, for the social cause.

Intellectual courage- The intellectual courage is inculcated in people through acquired knowledge, experience, games, tactics, education, and training. In professional ethics, courage is applicable to the employers, employees, public, and the press.

Look before you leap. One should perform Strengths, Weakness, Opportunities, and Threat (SWOT) analysis. Calculate (estimate) the risks, compare with one's strengths, and anticipate the end results, while taking decisions and before getting into action. Learning from the past helps. Past experience (one's own or borrowed!) and wisdom gained from self-study or others will prepare one to plan and act with self-confidence, succeed in achieving the desired ethical goals through ethical means. Opportunities and threat existing and likely to exist in future are also to be studied and measures to be planned. This anticipatory management will help anyone to face the future with courage.

Facing the criticism, owning responsibility, and accepting the mistakes or errors when committed and exposed are the expressions of courage. In fact, this sets their mind to be vigilant against the past mistakes, and creative in finding the alternate means to achieve the desired objectives. Prof. Sathish Dhawan, Chief of ISRO, was reported to have exhibited his courage and owned responsibility, when the previous space mission failed, but credited Prof. A.P.J. Abdul Kalam (now our revered President), when the subsequent mission succeeded.

Characteristics of Courageous people

The courageous people own and have shown the following characteristics, in their professions:

- (a) Perseverance (sustained hard work),
- (b) Experimentation (preparedness to face the challenges, that is, unexpected or unintended results),
- (c) Involvement (attitude, clear and firm resolve to act), and
- (d) Commitment (willing to get into action and to reach the desired goals by any alternative but ethical means).

2. b) Write short notes on honesty. Nov/Dec'15**(8)**

Honesty is a virtue, and it is exhibited in two aspects namely,

- (a) Truthfulness and
- (b) Trustworthiness.

Truthfulness is to face the responsibilities upon telling truth. One should keep one's word or promise. By admitting one's mistake committed (one needs courage to do that!), it is easy to fix them.

Reliable engineering judgment, maintenance of truth, defending the truth, and communicating the truth, only when it does 'good' to others, are some of the reflections of truthfulness. But trustworthiness is maintaining integrity and taking responsibility for personal performance. People abide by law and live by mutual trust. They play the right way to win, according to the laws or rules (legally and morally). They build trust through reliability and authenticity. They admit their own mistakes and confront unethical actions in others and take tough and principled stand, even if unpopular.

Honesty is mirrored in many ways. The common reflections are:

- (a) Beliefs (intellectual honesty).
- (b) Communication (writing and speech).
- (c) Decisions (ideas, discretion).
- (d) Actions (means, timing, place, and the goals). and
- (e) Intended and unintended results achieved.

As against this, some of the actions of an engineer that leads to dishonesty are:

1. *Lying*: Honesty implies avoidance of lying. An engineer may communicate wrong or distorted test results intentionally or otherwise. It is giving *wrong* information to the *right* people.
2. *Deliberate deception*: An engineer may judge or decide on matters one is not familiar or with insufficient data or proof, to impress upon the customers or employers. This is a self-deceit.
3. *Withholding the information*: It means hiding the facts during communication to one's superior or subordinate, intentionally or otherwise.
4. *Not seeking the truth*: Some engineers accept the information or data, without applying their mind and seeking the truth.
5. *Not maintaining confidentiality*: It is giving *right* information to *wrong* people. The engineers should keep information of their customers/clients or of their employers confidential and should not discuss them with others.

6. Giving professional judgment under the influence of extraneous factors such as personal benefits and prejudice. The laws, experience, social welfare, and even conscience are given a go-bye by such actions. Certainly this is a higher-order crime.

3. Discuss in detail

Apr/May '16

(16)

(a). Building Character in the Workplace

(b). Spirituality in Workplace

(a). Character :

Managers have to influence and employ creative means of stressing the importance of good character in the workplace, in the following ways:

1. Employee Hiring, Training, and Promotion Activities

(a) Institute and adopt an organization policy statement to positive character in the workplace.

For example, commitment to civility pledges. This may be communicated through printing on the back of the business cards of the employees.

(b) Prominently and explicitly include character considerations in recruiting procedures, during interviews and in the hiring deliberations.

(c) Emphasize the importance of character and adherence to the 'six pillars' of character in orientation, initial job training, and during in-service training. The six pillars of character are the ethical values, such as: trustworthiness, respect, responsibility, fairness, caring and citizenship. Respect means showing high regard for self, others, authority, property and country. It includes showing appreciation for cultural diversity by valuing all people as human beings. Responsibility is

(i) being accountable for one's actions,

(ii) being dependable in carrying out obligations and duties,

(iii) being reliable and consistent in word and action, and

(iv) being committed to community development. Integrity or fairness means showing the inner strength and courage to be truthful, trustworthy, fair and honest in all things. It includes acting justly and honorably. Caring means being kind, considerate, courteous, helpful, friendly and generous to others, and being compassionate by treating others as you would like to be treated. Citizenship means accepting and adopting civic rights and duties as a citizen of the country.

- (d) Include evaluation of fundamental character values such as honesty, promise keeping, accountability, fairness, and caring, in appraisals/reviews.
- (e) Institute recognition and reward system for the employees who exemplify the positive character. For example, awards and medals.
- (f) Think of your employees, especially the younger ones, as people whose personal and work values will be influenced by what you expect of them and how you treat them.
- (g) Think of your employees as present or future mentors, coaches, and volunteers.

2. Internal Communication

Use internal communication channels to create a friendly environment that praises positive role modeling at the workplace and in the community by encouraging voluntarism, and mentoring, e.g., through

- (a) Internal newsletters,
- (b) Workplace posters in canteens and recreation rooms,
- (c) Mailers, and
- (d) Electronic mails.

3. External Communication

In relations with customers, vendors and others, consciously communicate affirming messages about character and ethics, such as

- (a) Advertise and market honoring consensual values (the six pillars),
- (b) Assure that none of your products and services undermines character building,
- (c) Include positive messages about voluntarism and celebrate, and
- (d) 'Character counts' week in advertising, billings and other mailers.

4. Financial and Human Resources

- (a) Support local and national 'character' projects and the activities of the members by encouraging staff members to get involved. Offer incentives such as paying employees for the time they contribute at a local youth-service organization.
- (b) Sponsor 'character' movement through financial support.

5. Community Outreach

- (a) Use public outreach structures to encourage mentoring and other character-building programs.
- (b) Encourage educational and youth organizations to become active in character building.
- (c) Use corporate influence to encourage business groups (chambers of commerce, conference boards, and Rotary clubs) and other companies to support 'character' building.

(b). Spirituality

- Spirituality is a way of living that emphasizes the constant awareness and recognition of the spiritual dimension (mind and its development) of nature and people, with a dynamic balance between the material development and the spiritual development.
- This is said to be the great virtue of Indian philosophy and for Indians. Sometimes, spirituality includes the faith or belief in supernatural power/God, regarding the worldly events. It functions as a fertilizer for the soil 'character' to blossom into values and morals.
- Spirituality includes creativity, communication, and recognition of the individual as human being (as opposed to a life-less machine), respect to others, acceptance (stop finding faults with colleagues and accept them the way they are), vision (looking beyond the obvious and not believing anyone blindly), and partnership (not being too authoritative, and always sharing responsibility with others, for better returns).
- Spirituality is motivation as it encourages the colleagues to perform better. Remember, lack of motivation leads to isolation. Spirituality is also energy: Be energetic and flexible to adapt to challenging and changing situations. Spirituality is flexibility as well.
- Creativity in spirituality means conscious efforts to see things differently, to break out of habits and outdated beliefs to find new ways of thinking, doing and being. Suppression of creativity leads to violence.
- People are naturally creative. When they are forced to crush their creativity, its energy turns to destructive release and actions. Creativity includes the use of color, humor and freedom to enhance productivity. Creativity is fun. When people enjoy what they do, it is involvement. They work much harder.

Spirituality in the Workplace

Building spirituality in the workplace: Spirituality is promoted in the workplace by adhering to the following activities:

1. Verbally respect the individuals as humans and recognize their values in all decisions and actions.
2. Get to know the people with whom you work and know what is important to them. Know their goals, desires, and dreams too.
3. State your personal ethics and your beliefs clearly.
4. Support causes outside the business.
5. Encourage leaders to use value-based discretion in making decisions.
6. Demonstrate your own self-knowledge and spirituality in all your actions.

7. Do unto others as you would have them do unto you.

Spirituality for Corporate Excellence

The spiritual traits to be developed for excellence in corporate activities are listed as follows:

1. Self-awareness — Realization of self-potential. A human has immense capability but It needs to be developed.
2. Alertness in observation and quickness in decision making, i.e., spontaneity which includes quick reflexes, no delay but also no hasty decisions.
3. Being visionary and value based — This includes an attitude towards future of the organization and the society, with clear objectives.
4. Holism — Whole system or comprehensive views and interconnected with different aspects. Holistic thinking, which means the welfare of the self, family, organization and the society including all other living beings and environment.
5. Compassion — Sympathy, empathy and concern for others. These are essential for not only building the team but also for its effective functioning.
6. Respect for diversity — It means search for unity in diversity i.e., respect others and their views.
7. Moral Autonomy — It means action based on rational and moral judgment. One need not follow the crowd or majority i.e., band-wagon effect.
8. Creative thinking and constant reasoning — Think if we can do something new and if we can improve further?
9. Ability to analyze and synthesize — Refrain from doing something only traditional.
10. Positive views of adversity — Make adversities one's source of power—a typical Karmayogi's outlook! Every threat is converted into opportunity.
11. Humility — The attitude to accept criticism (it requires courage!) and willing to correct. It includes modesty and acknowledging the work of colleagues.
12. Sense of vocation — Treat the duty as a service to society, besides your organization.

4.Explain the importance of self-confidence in ethics. Apr/May '16 (16)

Certainty in one's own capabilities, values, and goals, is self-confidence. These people are usually positive thinking, flexible and willing to change. They respect others so much as they respect themselves. 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. They are not influenced by threats or challenges and are prepared to face them and the natural or unexpected consequences.

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. The people with self-confidence have the following characteristics:

1. A self-assured standing,
2. Willing to listen to learn from others and adopt (flexibility),
3. Frank to speak the truth, and
4. Respect others' efforts and give due credit

On the contrary, some leaders expose others when failure occurs, and own the credit when success comes.

The factors that shape self-confidence in a person are:

1. Heredity (attitudes of parents) and family environment (elders),
2. Friendship (influence of friends/colleagues),
3. Influence of superiors/role models, and
4. Training in the organization (e.g., training by Technical Evangelists at Infosys Technologies).

The following methodologies are effective in developing self-confidence in a person:

1. Encouraging SWOT analysis. By evaluating their strength and weakness, they can anticipate and be prepared to face the results.
2. Training to evaluate risks and face them (self-acceptance).
3. Self-talk . It is conditioning the mind for preparing the self to act, without any doubt on his capabilities. This make one accepts himself while still striving for improvement.
4. Study and group discussion, on the history of leaders and innovators (e.g., Sam Walton of Wal-Mart, USA).

5. Explain with suitable examples how the respect for others religious beliefs enhance the peaceful living. Apr/May '14 (16)

To live peacefully, one should start install peace within (self). Charity begins at home. Then one can spread peace to family, organisation where one works, and then to the world, including the environment. Only who are at peace can spread peace. You cannot gift an article which you do not possess. The essence of oriental philosophy is that one should not fight for peace. It is oxymoron. War or peace can be won only by peace, and not by wars! One should adopt the following means to live peacefully, in the world:

1. Order in one's life (self-regulation, discipline, and duty).
2. Pure thoughts in one's soul (loving others, blessing others, friendly, and not criticizing or hurting others by thought, word or deed).
3. Creativity in one's head (useful and constructive).
4. Beauty in one's heart (love, service, happiness, and peace). Get
5. Good health/body (physical strength for service). Act
6. Help the needy with head, heart, and hands (charity). Service to the poor is considered holier than the service to God.
7. Not hurting and torturing others either physically, verbally, or mentally.

The following are the factors that promote living, with internal and external peace:

1. Conducive environment (safe, ventilated, illuminated and comfortable).
2. Secured job and motivated with 'recognition and reward'.
3. Absence of threat or tension by pressure due to limitations of money or time.
4. Absence of unnecessary interference or disturbance, except as guidelines.
5. Healthy labor relations and family situations.
6. Service to the needy (physically and mentally-challenged) with love and sympathy.

UNIT II
ENGINEERING ETHICS
Part-A

1. Mention the various types of inquires.

(Nov/Dec'15)

- Normative inquires
- Conceptual inquires and
- Factual inquires

2. What is Moral Dilemma?

They may be some situations where two or more clearly applicable moral principles come into conflict or a principle seems to indicate simultaneously two different outcomes, such a problem is called as moral dilemma.

3. Define Moral Autonomy

(Nov/Dec'14)/Nov/Dec'15

Moral Autonomy refers to the ability to think critically and independently about moral issues and apply this normal thinking to situations that arise during the professional engineering practice.

4. What are the models of professional roles?

(Nov/Dec'14)

- Engineers as saviors
- Engineers as Guardians
- Engineers as Bureaucratic servants
- Engineers as social servants
- Engineers as social Enablers and catalysts
- Engineers as Game Players

5. What is Ethical pluralism?

Ethical pluralism is the view that there may be alternative moral perspectives that are reasonable, but no one of which must be accepted completely by all rational and morally concerned persons.

6. What is Moral integrity?

Moral integrity is the unity of character based on the moral concern and honesty. Integrity is a bridge that links the responsibilities between one's personal life and professional life.

7. State Gilligan's theory.

(Apr/May '16)

According to Gilligan, males have tendency to over-ride the importance of moral rules and convictions while resolving moral dilemmas; whereas females have tendency to try hard to preserve personal relationships with all people involved in a situation.

8. What is meant by consensus?

(Apr/May '16)

Consensus means 'agreement'. A general agreement about something. An idea or opinion that is shared by all the people in a group

9. List the methods that can be applied when testing is inappropriate.

1. Scenario Analysis
2. Failure Mode Effect Analysis
3. Fault-tree analysis
4. Even-tree analysis

10. What do you understand by Business ethics?

(Apr/May '15)

Business Ethics is concerned with the rules by which and individual lives his or her personal life.

Part-B

1. Explain the Gillieyan's theory for moral development

Kohlberg Theory

These theories are based on the sorts of reasoning and motivation adopted by individuals with regard to moral questions.

Lawrence Kohlberg's Theory

According to Kohlberg, the people progressed in their moral reasoning through a series of stages. His theory is based on the foundation that morality is a form of reasoning that develops through structural stages.

The three levels of moral development, suggested by Kohlberg, are:

1. Pre-conventional level
2. Conventional level and
3. Post-conventional level.

1. Pre-conventional level

- The pre-conventional level of moral development is based to derive benefits for oneself. In the first level, individuals behave according to socially acceptable norms, which are taught mainly by parents and teachers.
- At this level, individuals are motivated mainly by their interest to avoid punishment, or by their desire to satisfy their own needs, or by the external power exerted on them.
- This is the level of development of all young children and some adults, who are unable to reach beyond a certain limit.

2. Conventional level

- In the second level, the moral thinking and behavior of the individual are determined by the standards of their family, community, and society. That is, the norms or customs of one's family/community/society are accepted and adopted as the ultimate standard of morality.
- At this level, individuals are motivated by the desire to please others and to meet the social units' expectations, without bothering much about their self-interest.
- Thus as per the second level, individuals give more importance to loyalty and close identification with others, than their own self-interest.
- Many studies of Kohlberg reveal that most adults are living at this level only.
- The second level of moral thinking is found in society generally. That's why it is named as 'conventional' level of moral development.

3. Post –Conventional level

- In the post-conventional level, the individuals are guided by strong principles and convictions, not by selfish needs or pressures from society.
- According to Kohlberg, these individuals are called as ‘autonomous’, because they think for/by themselves and also they do not believe that customs are always right.
- The people at this level want to live by general principles that are universally applied to all people. They always desire to maintain their moral integrity, self Kohlberg felt that the majority of adults do not reach the post-conventional level.

Kohlberg Stages of Moral Development		
Approximate Age Range	Stage	Substages
Birth to 9	Preconventional	1) Avoid punishment 2) Gain Reward
Age 9 to 20	Conventional	3) Gain Approval & Avoid Disapproval 4) Duty & Guilt
Age 20+ maybe never	Postconventional	5) Agreed upon rights 6) Personal moral standards

Gilligan Theory

Carol Gilligan, a former student and colleague of Kohlberg, has criticized Kohlberg's theory as male biased.

- She also charged Kohlberg that Kohlberg's studies were concluded with male samples only and also his approach is dominated by a typical preoccupation with general rules and rights.
- According to Gilligan, males have tendency to over-ride the importance of moral rules and convictions while resolving moral dilemmas; whereas females have tendency to try hard to preserve personal relationships with all people involved in a situation.
- Also Gilligan felt that men mostly focus their attention on content of the problem, whereas women focus their attention on the context i.e., situation of the problem.
- Gilligan refers her context-oriented emphasis on maintaining personal relationships as the ethics of care, and contrasts it with Kohlberg's ethics of rules and rights.

Gilligan's Levels Of Moral Development

1. Pre-conventional level

- This is almost the same as Kohlberg's first level.
- That is, in this level an individual is concerned with self-centered reasoning.

2. Conventional level

- This level differs from Kohlberg's second level.
- According to Gilligan, women will not hurt others and have a willingness to sacrifice their own interests in order to help others.

3. Post-conventional level

- This level also differs from Kohlberg's third level.
- In this level, the individual is able to maintain balance between his own needs with the needs of others.
- The balancing can be achieved through context-oriented reasoning i.e., examining all facts, people and circumstances involved, rather than by applying abstract rules ranked in a hierarchy of importance.

Gilligan's Stages of the Ethic of Care		
Approximate Age Range	Stage	Goal
not listed	Preconventional	Goal is individual survival
Transition is from selfishness -- to -- responsibility to others		
not listed	Conventional	Self sacrifice is goodness
Transition is from goodness -- to -- truth that she is a person too		
maybe never	Postconventional	Principle of nonviolence: do not hurt others or self

2. What are the different types of model of professional roles? Nov/Dec'15

The word Professional gets different meanings based on the context. In general Professional relates to any work that a person does for an occupation, especially work which requires a special skill or training. Profession means a type of job that requires special training and that brings a fairly high status, for example — work connected with medicine, law and education. Whatever may be one's profession one should show one's professionalism, qualities that are typical or expected of a person in that profession.

Professional as Independence

Some persuasive definitions straightaway connect professionalism to independence

and freedom from the use of force. Robert L. Whitelaw defines professionalisms and employee status as logically incompatible so long as the individual is looked upon as an employee rather than as a free artisan; to that extent there is no professional status.

Therefore, only consulting engineers are said to be the professionals. The other types of engineers, working as employees in business or governmental bureaucracies can be called professionals only when they are protected by an engineering bill of rights enjoyed already by consulting engineers. The rights are as follows: the rights to freedom from surveillance, psychological manipulation and other job evaluation techniques.

On the basis of the definition given by Robert L. Whitelaw, an engineer can not be a professional engineer if he works on the basis of his employer's orders which are concerning the public good. He further views that professional involves the freedom to act according to his / her own judgment about conduct i.e. free from excessive domination of engineers by the authority of management.

MODELS OF PROFESSIONAL ROLES

The main aim of the profession of engineering is to improve the public safety, wealth and welfare. In order to perform these functions, the engineer has to play various models to channelize his attitudes towards the achievement of objectives. They are as follows:

(1) Savior

The engineers are responsible for creating an utopian society in which everything is possible and can be achieved without much effort — This can only be achieved through technological developments made by the engineers, for safe-guarding the society from poverty, inefficiency, waste and manual labour.

(2) Guardian

Engineers only know the directions through which technology will be developed. So, they should be given position of high authority based on their expertise skills in determining what is in the best interests of the society. They should act as guardians to the technological improvements.

(3) Bureaucratic Servant

Engineers' role in the management is to be the servant who receives and translates the directive of management into better achievements. They have to solve the problems given by the management, within the limits set by the management.

(4) Social servant

The role of engineers is not only providing service to others but also their responsibility to the society. The interests of the society can be expressed to the engineers either directly or

indirectly. So, the engineers, with the co-operation of the management, have the work of receiving society's directives and satisfying the desires of the society.

(5) Social enabler and catalyst

The engineer has to play a role of creating a better society and should be the cause of making social changes. Service given by the engineers to the society includes carrying out the social directives. Engineers are needed to help the management and the society to understand their needs and to create decisions about technological development.

(6) Game Player

We cannot say that engineers are servants or masters of anyone. They are playing the economic game rules which may be effective at a given time. Their aim is to play successfully within the organization enjoying the happiness of technological work and the satisfaction of winning and moving ahead in a competitive world.

3. Discuss three types of inquiry Nov/Dec'14

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. Explain in details about the sense of engineering ethics Apr/May '16 (16)

The word ethics has different meanings but they are correspondingly related to each other. In connection with that, Engineering ethics has also various senses which are related to one another.

Comparison of the senses of Ethics and Engineering Ethics

Ethics	Engineering Ethics
<ol style="list-style-type: none"> 1. Ethics is an activity which concerns with making investigations and knowing about moral values, finding solutions to moral issues and justifying moral issues and justifying moral judgments. 2. Ethics is a means of contrasting moral questions from non-moral problems. 3. Ethics is also used as a means of describing the beliefs, attitudes and habits related to an individual's or group's morality. Eg. : Ethics given in the Bhagavat Gita or the Bible or the Quran. 4. As per the definition of dictionaries 'moral principles' is about the actions and principles of conduct of the people. i.e. ethical or unethical. 	<ol style="list-style-type: none"> 1. Like the ethics, engineering ethics also aims at knowing moral values related to engineering, finding accurate solutions to the moral problems in engineering and justifying moral judgments of engineering. 2. Engineering Ethics gives a total view of the moral problems and how to solve these issues specifically related to engineering field. 3. Engineering ethics is also using some currently accepted codes and standards which are to be followed by group of engineers and engineering societies. 4. Engineering ethics also concerns with discovering moral principles such as obligation, rights and ideals in engineering and by applying them to take a correct decision.

From these senses of Engineering ethics, one can realize that it is the study of morality.

What is morality?

The term 'morality' concerns with (a) what ought or ought not to be done in a given situation, (b) what is right or wrong in handling it, (c) what is good or bad about the persons, policies and principles involved in it.

If an action is said to be morally right or a principle is said to be morally good, then they are said to be had some moral reasons in supporting it.

Moral reasons include respecting others and ourselves, respecting the rights of others, keeping promises, avoiding unnecessary problems to others and avoiding cheating and dishonesty, showing gratitude to others and encourage them to work.

So, if an engineering decision is said to be a good one, it has to meet out all the specifications. These specifications must be covered both the technical and the moral specifications such as safety of the product, reliability, easy maintenance and the product should be user-friendly with environment.

VARIETY OF MORAL ISSUES

There are so many engineering disasters which are greater / heavier than the level of acceptable or tolerable risk. Therefore, for finding and avoiding such cases such as nuclear plant accident at Chernobyl (Russia), Chemical plant at Bhopal (India) where a big disaster of gas leakage, occurred in 1980, which caused many fatal accidents. In the same way, oil spills from some oil extraction plants (the Exxon Valdez plant), hazardous waste, pollution and other related services, natural disasters like floods, earth quake and danger from using asbestos and plastics are some more cases for engineering disasters. These fields should be given awareness of engineering ethics. Hence, it is essential for engineers to get awareness on the above said disasters. They should also know the importance of the system of engineering.

When malfunction of the system is a rapid one, the disaster will be in greater extent and can be noticed immediately. When they are slow and unobserved, the impact is delayed. So, the engineers should not ignore about the functions of these systems.

These cases also explain and make the engineers to be familiar with the outline of the case in future and also about their related ethical issues.

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. The engineers have to tolerate themselves with the everyday problems both from personal and societal point of view.

Where and How do Moral Problems arise in Engineering?

Any product or project has to undergo various stages such as planning, idea, design,

and manufacturing which is followed by testing, sales and services. This has to be done by engineers of various branches like Civil, Mechanical, Electrical, Chemical etc. These engineers may be grouped together as a team or they may be separated from each other with an interconnection or co-ordination.

In spite of the engineers' full attention and care, sometimes the product or project may be unsafe or less useful. This may be due to some reasons 1) The product or project may be designed for early obsolescence or 2) due to under pressure because of running out of time, budgetary etc or 3) by ignorance on the size of the project, or 4) because of the large number of a products sold on the mass market, people may be affected.

Some cases with which different areas covered by engineering ethics:

1. An inspector finds a faulty part in the manufacture of a machine, which prevents the use of that machine for a longer period. But his superior, takes this as a minor mistake and orders that the faulty part to be adjusted so that the delay in the process has to be avoided. But the inspector doesn't want this and so he is threatened by the supervisor.
2. An electronic company applies for a permit to start a Nuclear Power Plant. When the licensing authority comes for visit, they enquire the company authorities on the emergency measures that have been established for safety of the surroundings. The engineers inform them about the alarm system and arrangements have been made in local hospitals for the treatment of their employees and they have no plan for the surrounding people. They also inform that it is the responsibility of the people.
3. A Yarn Dyeing company which dumps its wastes in the nearby river. It causes heavy damage to the people those who are using the river. The plant engineers are aware of this, but they do not change the disposal method because their competitors also doing similarly as it happens to be a cheaper. They also say that it is the responsibility of the local government.

The above given examples clearly explain how the ethical problems arise most often because of wrong judgments and expectations of engineers. These necessitate for establishing some codes of conduct which has to be imposed on engineers' decisions on the basis of ethical view.

5. Explain the theory of human right ethics and its classification Nov/Dec 15

THEORIES ABOUT RIGHT ACTION

There are four types of theories on ethics, which help to create the fundamental principles of obligation suitable and applicable to professional and personal conduct of a person in his everyday life. These theories are essential for cause of right action and morality. They are:

1. *“Golden mean”* ethics (Aristotle, 384 – 322 B.C.). The best solution is achieved through reason and logic and is a compromise or “golden mean” between extremes of excess and deficiency. For example, in the case of the environment, the golden mean between the extremes of neglect and exploitation might be protection.

Problem: Variability from one person to another in their powers of reasoning and the difficulty in applying the theory to ethical problems.

2. *“Rights – based”* ethics (John Locke, 1632 – 1704). Every person is free and equal and has the right to life, health, liberty and possessions (in effect prohibiting capital punishment, medical charges, jails and income taxes).

Problem: One person’s right may be in conflict with another’s rights.

3. *“Duty – based”* ethics (Immanuel Kant, 1724 – 1804). Each person has a duty to follow a course of action that would be universally acceptable for everyone to follow without exception. (Thus we would all be honest, kind, generous and peaceful).

Problem: Universal application of a rule can be harmful.

4. *“Utilitarian”* ethics (John Stuart Mill, 1806 – 1873). The best choice is that which produces the maximum benefit for the greatest number of people (which could endanger minority rights).

Problem: Qualification of the benefits can be difficult. All these theories can be differentiated on the basis of what they provide for moral concept, good results for all, duties and human rights.

6. What is meant by self interest? Relate the term with “Ethical egoism” with suitable examples.Nov/Dec 15

- Self-interest is nothing but one’s personal good. It refers to the goodness of oneself in the long run.
- Each of the ethical theories recognizes the importance of self-respect. Utilitarian considers one’s own good as well as the good of others. Duty ethicists stresses duties to ourselves and for won well-being. Ethicists of rights emphasize our rights to pursue our own good.
- Virtue ethicists accent the importance of self – respect. Each of these theories insists that the pursuit of self – interest must be balanced and kept under control by moral responsibilities to other people. Now let us consider a view called “ethical Egoism” which challenges all the ethical theories and it tries to reduce morality to the pursuit of self-interest. It is called ‘egoism’, because it says that the main duty of us is to maximize our own good.
- According to Thomas Hobbes and Any Rand, moral values are reduced to concern for oneself but always a rational concern which requires consideration of a person’s long-term interests.
- The Supporters of ethical egoism make a differentiation between narrower and wider forms of self-interest.
- When a person who selfishly preoccupies his own private good and disregard for the good of others, will be off from rewarding friendships and love.
- Personal well-being generally requires taking some large interest in others. But the rational egoist insists that the only reason for showing an interest in others is for the sake of oneself.
- Ethical Egoists try to protect their positions by arguing that an ironic importance of everyone rationally pursuing one’s self-interest is that every one get benefited. The society benefits mostly when (i) individuals pursue their private good and (ii) corporations pursue maximum profits in a competitive free market. The main idea here is that leads to the improvement of economy through which benefiting everyone. Because, both the individual and the corporation know very well that what is good for them and how best to pursue that good.

- As per ethical egoism, people should always and only pursue their self – interest in a very cautious manner to value the interest rationally on the basis of facts. Morality essentially needs a willingness on the part of both individuals and corporations to place some restrictions on the pursuit of private self – interests.
 - Accepting these constraints is presupposed in what is meant by moral concern
Engineering Ethics also has one task of exhibiting the moral limits on the pursuit of self interest in the Engineering profession. The above said remarks do not constitute a wrong proof for ethical egoism. Morality stresses that we have to give value and we are concerned for the good of other people.
 - Ethical egoism is not a persuasive or probable theory to state what is morality but it is only a convinced rejection of morality.
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7. Explain the need of tolerance for different customs and ethical pluralism in adverse society with suitable example April /MAY 2014

Customs

- As we live in a society which is of increasingly diverse nature, it is more important to have tolerance for various customs and outlooks. Hence the concept of **ethical pluralism** emerges.
- It views that there may be alternative moral attitudes that are reasonable. But none of the moral perspectives can be accepted completely by all the rational and the morally concerned persons.
- Ethical pluralism allows the customs which plays an important role in deciding how we should act. Moral values are many, varied and flexible. So, these moral values allow considerable variation in how different individuals and groups understand and apply them in their day-to-day activities.
- In other words, to be precise, reasonable persons always have reasonable disagreement on moral issues, including issues in engineering ethics.

Ethical Relativism

- Ethical Relativism, an objectionable view, should not be confused with Ethical Pluralism. As per Ethical relativism says that actions are morally right when they are approved by law or custom and they are said to be wrong when they violate laws or

customs. Ethical relativism tries to reduce moral values to laws, conventions and customs of societies.

What is the necessary for a person to accept ethical relativism?

There are so many reasons for accepting ethical relativism –

I. The laws and customs seem to be definite, real and clear – cut.

- They help to reduce the endless disputes about right and wrong.
- Moreover, laws seem to be an objective way to approach values. The above argument is some what weak.
- This reason underestimates the extent to which ordinary moral reasons are sufficiently objective to make possible criticism of individual prejudice and bias.
- Moreover, moral reasons allow objective criticism of the given laws as morally inadequate.

For example, the apartheid laws (racial segregation) in south Africa. This law violated the human rights are not given any legal protections to the majority of the blacks, but morally ought to be.

II. The second reason for accepting ethical relativism is because it believes the values are subjective at the cultural level.

- They also state that the moral standards are varied from one culture to another. The only kind of objectivity is relative to a given set of laws in a given society. This relativity of morality encourages the virtue of tolerance of difference among societies.
- The above said argument is also confusing one. It assumes that ethical relativism is implied by descriptive relativism. i.e., values and beliefs differ from culture to culture. There is nothing self-certifying about the laws and beliefs. This can be explained by the following illustration. Ethical relativism would allow that Hitler and his followers (Nazis) acted correctly when they killed 6 million Jews, for their laws, customs, and beliefs which were based on anti – Semitism (hostile to Jews).
- So, ethical relativism refers anything but for the tolerant doctrine it pretends to be. But there is nothing tolerant in accepting Nazi beliefs about morality Admitting intolerant anti-Semitic beliefs is not an act of tolerance.
- The supporters of ethical relativism, generally say that an action is right “for cultures” when believe it as the right one .i.e., it is right “for them” though not “for us”. So,

beliefs, however customary or widely shared, are not self-certifying whether we are talking about moral beliefs or scientific beliefs.

III. The third reason is based on the moral relationalism or moral contextualism.

- This states that moral judgments must be made in relation to some factors which vary from case to case. Making simple and absolute rules are impossible in this way. In most of the cases, customs and laws are considered as morally important factors for making judgments.
 - All philosophers accepted this moral relationalism. But contemporary duty and right ethicists like 'Kant' do not accept.
 - The virtue ethicists stress the role of practical wisdom in identifying the facts which are relevant to assessment of conduct based on virtual manner.
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UNIT- III

ENGINEERING AS SOCIAL EXPERIMENTATION

Part-A

1. Differentiate scientific experiments and engineering projects. (Apr/May '16)

Engineering experiments differ from standard experiments highlights the engineer's responsibility. The differences reveals through 2 aspects.

- Experimental Control - Selection of members for 2 different groups.

One may receive special experimental treatment while the member of other group called control group do not receive the special treatment even though they are subjected to same environment.

- Informed Consent - It comprise 2 main elements

Knowledge

Voluntaries

2. What are the conditions are essential for a valid informed consent? Nov/Dec'15)

The informed consent can be called as " valid consent" when the following conditions are met.

- The consent should be given voluntarily and not by any force.
- The consent should be based on all the information needed for a rational person to make a reasonable decision.
- The consent should be competent enough to process the information and to make rational decisions. Here competent in the sense, the consenting should be physically and mentally and fir.

3. List the advantage of industrial standards. (Apr/May '15)

Standards are very useful for manufacturers for production of goods.

Standards also benefit user and public.

Standards will give equal opportunities to all manufacturers.

Standards ensure quality and hence facilitate more realistic trade-decision.

4. What are the limitations of code of ethics? (Nov/Dec'14)

- Code of ethics is broad guidelines, restricted to general and vague wordings/phrases. The codes cannot be applied directly all situations.
- Engineering codes often have internal conflicts, which may result in moral dilemmas. That is several entries in codes overlap with each other.
- The codes cannot serve as the final moral authority for professional conduct.
- The proliferation of codes of ethics for different branches of engineering gives a feeling that ethical codes are relative.

5. What are the features of Engineering Experimentation? (Nov/Dec'14)

A conscientious commitment to live by moral values: The primary duty of morally responsible engineers is to protect the safety of human subjects and respect their right of consent

6. What is learning from the past? (April/May '14)

Engineer should not learn not only from their own result but also from other engineer's results. But because of misplaced pride in not asking for information, fear of litigation and simple negligence usually impede the flow of information and leads to repetitive mistakes. Engineer's should not always rely on handbooks alone but should remain alert and informed at every stage of project or experimentation.

7. What is agency loyalty? (April/May '14)

Agency Loyalty is to fulfil one's contractual duties to an employer. The contractual duties may include particular tasks for which one is paid, general activities of cooperating with colleagues, and following lawful authority within the organization.

Eg: People may not like the job do and hate their employer. But still they would perform their duty as long as they are employers.

8. Define 'informed consent' (Apr/May '15)

When a medicine or an engineering product is to tested on a person, then the moral and legal rights is to get informed consent from him. In other words the experimenters whose experiments involve human subjects have moral and legal obligations to inform about all relevant facts about the experiments to the person who participates in experiments.

9. Define 'collegiality'. What are its elements? (Apr/May '15)

Collegiality defines as “ a kind of connectedness grounded in respect for professional expertise and in a commitment to the goals and values of the profession”.

The elements are

- Respect
- Commitment
- Connectedness

10. What are the general responsibilities of engineers to society?

- Engineers are primarily as technical enablers or facilitators, rather than being the sole experiments.
 - Engineers responsibility is shared with management the public and others.
 - The other unique responsibilities of engineers include monitoring projects, identifying risks, providing customers and clients required information to make reasonable decisions.
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Part-B

Unit III

1. What are the different roles and function of 'code of ethics'? Nov/Dec'15

Definition

Codes of ethics state the moral responsibilities of engineers as seen by the profession and as represented by a professional society

Codes of ethics play at least eight essential roles: serving and protecting the public, providing guidance, offering inspiration, establishing shared standards, supporting responsible professionals, contributing to education, deterring wrongdoing, and strengthening a profession's image.

1. Serving and protecting the public.

Engineering involves advanced expertise that professionals have and the public lacks, and also considerable dangers to a vulnerable public.

2. Guidance.

Codes provide helpful guidance by articulating the main obligations of engineers. Because codes should be brief to be effective, they offer mostly general guidance.

3. Inspiration.

Because codes express a profession's collective commitment to ethics, they provide a positive stimulus (motivation) for ethical conduct.

4. Shared standards.

The diversity of moral viewpoints among individual engineers makes it essential that professions establish explicit standards, in particular minimum (but hopefully high) standards.

5. Support for responsible professionals.

Codes give positive support to professionals seeking to act ethically.

6. Education and mutual understanding.

Codes can be used by professional societies and in the classroom to prompt discussion and reflection on moral issues.

7. Deterrence and discipline.

Codes can also serve as the formal basis for investigating unethical conduct. Where such investigation is possible, a deterrent for immoral behaviour is thereby provided.

8. Contributing to the profession's image.

Codes can present a positive image to the public of an ethically committed profession. Where warranted, the image can help engineers more effectively serve the public.

Abuse of Codes

- When codes are not taken seriously within a profession, they amount to a kind of window dressing that ultimately increases public cynicism about the profession. Worse, codes occasionally stifle dissent within the profession and are abused in other ways.
- Probably the worst abuse of engineering codes is to restrict honest moral effort on the part of individual engineers to preserve the profession's public image and protect the status quo. Preoccupation with keeping a shiny public image may silence healthy dialogue and criticism. And an excessive interest in protecting the status quo may lead to a distrust of the engineering profession on the part of both government and the public.
- The best way to increase trust is by encouraging and helping engineers to speak freely and responsibly about public safety and well-being. This includes a tolerance for criticisms of the codes themselves, rather than allowing codes to become sacred documents that have to be accepted uncritically.

Limitations of Codes

- Codes are no substitute for individual responsibility in grappling with concrete dilemmas. Most codes are restricted to general wording, and hence inevitably contain substantial areas of vagueness. Thus, they may not be able to straightforwardly address all situations.
- At the same time, vague wording may be the only way new technical developments and shifting social and organizational structures can be accommodated. Other uncertainties can arise when different entries in codes come into conflict with each other.
- Usually codes provide little guidance as to which entry should have priority in those cases. For example, as we have noted, tensions arise between stated responsibilities to employers and to the wider public.
- Again, duties to speak honestly—not just to avoid deception, but also to reveal morally relevant truths—are sometimes in tension with duties to maintain confidentiality.

Ethical Relativism

- Does a professions code of ethics create the obligations that are incumbent on members of the profession, so that engineers' obligations are entirely relative to their code of ethics? Or does the code simply record the obligations that already exist?
- One view is that codes try to put into words obligations that already exist, whether or not the code is written. As Stephen Unger writes, codes "recognize" obligations that already exist: "A code of professional ethics may be thought of as a collective recognition of the responsibilities of the individual practitioners"; codes cannot be "used in cookbook fashion to resolve complex problems," but instead they are "valuable in outlining the factors to be considered."
- Notice the word "imposes," as distinct from "recognizing" an obligation that already exists. To violate the code is wrong because it creates an unfair advantage in competing with other professionals in the marketplace.

Justification of Codes

- If codes of ethics do not merely state conventions, as ethical relativists hold, what does justify those responsibilities that are not mere creations of convention? A code, we might say, specifies the (officially endorsed) "customs" of the professional "society" that writes and promulgates it as incumbent on all members of a profession (or at least members of a professional society).
- When these values are specified as responsibilities, they constitute role responsibilities—that is, obligations connected with a particular social role as a professional. These responsibilities are not self certifying, any more than other customs are.
- To conclude, any set of conventions, whether codes of ethics or actual conduct, should be open to scrutiny in light of wider values. At the same time, professional codes should be taken very seriously.
- They express the good judgment of many morally concerned individuals, the collective wisdom of a profession at a given time.
- Certainly codes are a proper starting place for an inquiry into professional ethics; they establish a framework for dialogue about moral issues; and more often than not, they cast powerful light on the dilemmas confronting engineers.

2. With a case study explain the “learn from the past” in engineering experimentation. Nov/Dec15 (8)

Learning from the Past

Usually engineers learn from their own earlier design and operating results, as well as from those of other engineers, but unfortunately that is not always the case. Lack of established channels of communication, misplaced pride in not asking for information, embarrassment at failure or fear of litigation and plain neglect often impede the flow of such information and lead to many repetitions of past mistakes. Here are a few examples:

1. The Titanic lacked a sufficient number of lifeboats decades after most of the passengers and crew on the steamship Arctic had perished because of the same problem.
2. “Complete lacks of protection against impact by shipping caused Sweden’s worst ever bridge collapse on Friday as a result of which eight people were killed.” Thus reported the New Civil Engineer on January 24, 1980. Engineers now recommend the use of floating concrete bumpers that can deflect ships, but that recommendation is rarely heeded as seen by the 1993 collapse of the Bayou Canot Bridge that cost 43 passengers of the Sunset Limited their lives.
3. Valves are notorious for being among the least reliable components of hydraulic systems. It was a pressure relief valve, and a lack of definitive information regarding its open or shut state, which contributed to the nuclear reactor accident at Three Mile Island on March 28, 1979. Similar malfunctions had occurred with identical valves on nuclear reactors at other locations. The required reports had been filed with Babcock and Wilcox, the reactor’s manufacturer, but no attention had been given to them
4. NASA uses the metric system while Lockheed Martin uses the English system when building a satellite

Courtesy of NASA

Cost of the lost orbiter: \$125 million

Inflation-adjusted: \$165.6 million

In 1999 a team of Lockheed Martin engineers used the English system of measurement, while the rest of the team used the metric system for a Mars orbiter.

The use of two different measurement systems prevented the spacecraft's navigation coordinates from being transferred from a spacecraft team in Denver to a lab in California. The orbiter was then lost in space, and NASA was out \$125 million.

These examples illustrate why it is not enough for engineers to rely on handbooks and computer programs without knowing the limits of the tables and algorithms underlying their

favorite tools. They do well to visit shop floors and construction sites to learn from workers and testers how well the customers' wishes were met. The art of back-of-the-envelope calculations to obtain ballpark values with which to quickly check lengthy and complicated computational procedures must not be lost. Engineering demands practitioners who remain alert and well informed at every stage of a project's history and who exchange ideas freely with colleagues in related departments.

3. How can engineer become a responsible experimenter? Highlight the code of ethics for engineer. Apr/May 16

Engineering as Social Experimentation

What are the responsibilities of engineers to society? Viewing engineering as social experimentation does not by itself answer this question. Although engineers are the main technical enablers or facilitators, they are far from being the sole experimenters. Their responsibility is shared with management, the public, and others.

- Yet their expertise places them in a unique position to monitor projects, to identify risks, and to provide clients and the public with the information needed to make reasonable decisions.
- From the perspective of engineering as social experimentation, four features characterize what it means to be a responsible person while acting as an engineer: a conscientious commitment to live by moral values, a comprehensive perspective, autonomy, and accountability.

Or, stated in greater detail as applied to engineering projects conceived as social experiments:

1. A primary obligation to protect the safety of human subjects and respect their right of consent
2. A constant awareness of the experimental nature of any project, imaginative forecasting of its possible side effects, and a reasonable effort to monitor them
3. Autonomous, personal involvement in all steps of a project
4. Accepting accountability for the results of a project

Codes of ethics

Definition

Codes of ethics state the moral responsibilities of engineers as seen by the profession and as represented by a professional society

Codes of ethics play at least eight essential roles: serving and protecting the public, providing guidance, offering inspiration, establishing shared standards, supporting responsible professionals, contributing to education, deterring wrongdoing, and strengthening a profession's image.

1. Serving and protecting the public.

Engineering involves advanced expertise that professionals have and the public lacks, and also considerable dangers to a vulnerable public.

2. Guidance.

Codes provide helpful guidance by articulating the main obligations of engineers. Because codes should be brief to be effective, they offer mostly general guidance.

3. Inspiration.

Because codes express a profession's collective commitment to ethics, they provide a positive stimulus (motivation) for ethical conduct.

4. Shared standards.

The diversity of moral viewpoints among individual engineers makes it essential that professions establish explicit standards, in particular minimum (but hopefully high) standards.

5. Support for responsible professionals.

Codes give positive support to professionals seeking to act ethically.

6. Education and mutual understanding.

Codes can be used by professional societies and in the classroom to prompt discussion and reflection on moral issues.

7. Deterrence and discipline.

Codes can also serve as the formal basis for investigating unethical conduct. Where such investigation is possible, a deterrent for immoral behavior is thereby provided.

8. Contributing to the profession's image.

Codes can present a positive image to the public of an ethically committed profession. Where warranted, the image can help engineers more effectively serve the public.

4. Explain the responsibilities of engineers to society

1. Conscientiousness

- People act responsibly to the extent that they conscientiously commit themselves to live according to moral values, instead of a consuming preoccupation with a narrowly conceived self-interest. By conscientious moral commitment we mean sensitivity to the full range of moral values and responsibilities relevant to a given situation, and the willingness to develop the skill and expend the effort needed to reach a reasonable balance among those considerations.
- Conscientiousness implies consciousness: open eyes, open ears, and an open mind. The contemporary working conditions of engineers tend to narrow moral vision solely to the obligations that accompany employee status. More than 90 percent of engineers are salaried employees, most of who work within large bureaucracies under great pressure to function smoothly within the organization.
- There are obvious benefits in terms of prudent self-interest and concern for one's family that make it easy to emphasize as primary the obligations to one's employer. Gradually the minimal negative duties, such as not falsifying data, not violating patent rights, and not breaching confidentiality, may come to be viewed as the full extent of moral aspiration

2. Comprehensive Perspective

- Conscientiousness is blind without relevant factual information. Hence showing moral concern involves a commitment to obtain and properly assess all available information that is pertinent to meeting moral obligations.
- This means, as a first step, fully grasping the context of one's work, which makes it count as an activity having a moral import. For example, in designing a heat exchanger, if I ignore the fact that it will be used in the manufacture of a potent, illegal hallucinogen, I am showing a lack of moral concern.

3. Moral

- **Autonomy** People are morally autonomous when their moral conduct and principles of action are their own, in a special sense derived from Kant: Moral beliefs and attitudes should be held on the basis of critical reflection rather than passive adoption of the particular conventions of one's society, church, or profession.

- This is often what is meant by “authenticity” in one’s commitment to moral values. Those beliefs and attitudes, moreover, must be integrated into the core of an individual’s personality in a manner that leads to committed action.
- It is a comfortable illusion to think that in working for an employer, and thereby performing acts directly serving a company’s interests, one is no longer morally and personally identified with one’s actions.

4. Accountability

- Finally, responsible people accept moral responsibility for their actions. Too often “accountable” is understood in the overly narrow sense of being culpable and blameworthy for misdeeds.
- But the term more properly refers to the general disposition of being willing to submit one’s actions to moral scrutiny and be open and responsive to the assessments of others. It involves willingness to present morally cogent reasons for one’s conduct when called on to do so in appropriate circumstances.

5. A Balanced Outlook on Law

Hammurabi, as king of Babylon, was concerned with strict order in his realm, and he decided that the builders of his time should also be governed by his laws. In 1758 BCE he decreed: “If a builder has built a house for a man and has not made his work sound, and the house which he has built has fallen down and so caused the death of the householder, that builder shall be put to death . . .

If a builder has built a house for a man and does not make his work perfect and the wall bulges, that builder shall put that wall into sound condition at his own cost.” What should be the role of law in engineering, as viewed within our model of social experimentation? The legal regulations that apply to engineering and other professions are becoming more numerous and more specific all the time.

6. Industrial Standards

There is one area in which industry usually welcomes greater specificity, and that is in regard to standards. Product standards facilitate the interchange of components, they serve as readymade substitutes for lengthy design specifications, and they decrease production costs. Standards consist of explicit specifications that, when followed with care, ensure that stated criteria for interchangeability and quality will be attained. Examples range from automobile tire sizes and load ratings to computer protocols

5. Describe the concept of**(i) Fault Tree Analysis****Apr/May 15****(8)**

- Fault Tree Analysis (FTA), as an example of a popular traditional analysis method, and reconstruct what we believe to be the basis for judging the adequacy of fault trees.
- The subsequent section demonstrates that the same grounds for confidence do not currently exist for MBSA and that the justification of the adequacy of novel models poses significant new challenges.
- It is important to stress that we do not argue that the current basis for 'trusting' traditional techniques and artefacts they generate is adequate.
- However, we suggest that confidence in any new proposed techniques should at least match that in FTA.
- The remaining sections of the paper discuss how these challenges can be pragmatically addressed through improved methodological guidance and approaches to simulation-based model review together with explicit arguments of model adequacy.
- In a fault tree analysis, we begin with an undesirable event, such as a car not starting or the loss of electrical power to a nuclear power plant's safety system. We reason back to the events that might have caused this undesirable event.
- Fault trees are often used to anticipate hazards for which there is little or no direct experience, such as nuclear meltdowns. They enable an engineer to analyze systematically the various failure modes attendant to an engineering project.
- A failure mode is a way in which a structure, mechanism, or process can malfunction.
- For example, a structure can rip apart in tension, crumble to pieces in compression, crack and break in bending, lose its integrity because of corrosion (rusting), explode because of excessive internal pressure, or burn because of excessive temperature

6. What are the safety lessons that can be learned from Bhopal disaster? Discuss the role of Governments regulator's in reducing the risk.(16)Apr/May 16

Safety lessons that can be learned from Bhopal disaster:

- Union Carbide in 1984 operated in 37 host countries in addition to its home country, the United States, ranking 35th in size among U.S. corporations. On December 3, 1984, the operators of Union Carbide's plant in Bhopal, India, became alarmed by a leak and overheating in a storage tank.

- The tank contained methyl isocyanate (MIC), a toxic ingredient used in pesticides. As a concentrated gas, MIC burns any moist part of bodies with which it comes in contact, scalding throats and nasal passages, blinding eyes, and destroying lungs. Within an hour the leak exploded in a gush that sent 40 tons of deadly gas into the atmosphere.
- The result was the worst industrial accident in history: 500,000 persons exposed to the gas, 2,500 to 3,000 deaths within a few days, 10,000 permanently disabled, 100,000 to 200,000 others injured (the exact figures will always be disputed).
- The government of India required the Bhopal plant to be operated entirely by Indian workers. Hence Union Carbide at first took admirable care in training plant personnel, flying them to its West Virginia plant for intensive training.
- It also had teams of U.S. engineers make regular on-site safety inspections. But in 1982, financial pressures led Union Carbide to relinquish its supervision of safety at the plant, although it retained general financial and technical control.
- One source of the erosion was personnel: high turnover of employees, failure to properly train new employees, and low technical preparedness of the local labor pool. The other source was the move away from U.S. standards (contrary to Carbide's written policies) toward lower Indian standards. By December 1984, there were several extreme hazards, including overloading of the tanks storing the MIC gas and lack of proper cooling of the tanks.
- According to the official account, a disgruntled employee unscrewed a pressure gauge on a storage tank and inserted a hose into it. He knew and intended that the water he poured into the tank would do damage but did not know it would cause such immense damage. According to another account, a relatively new worker had been instructed by a new supervisor to flush out some pipes and filters connected to the chemical storage tanks.
- Apparently the worker properly closed valves to isolate the tanks from the pipes and filters being washed, but he failed to insert the required safety disks to back up the valves in case they leaked. Either way, by the time the workers noticed a gauge showing the mounting pressure and began to feel the sting of leaking gas, they found their main emergency procedures unavailable. The primary defense against gas leaks was a vent-gas scrubber designed to neutralize the gas.
- It was shut down (and was turned on too late to help), because it was assumed to be unnecessary during times when production was suspended. The second line of defence

was a flare tower that would burn off escaping gas missed by the scrubber. It was inoperable because a section of the pipe connecting it to the tank was being repaired.

- As was common in India, desperately poor migrant labourers had become squatters—by the tens of thousands—in the vacant areas surrounding the plant. They had come with hopes of finding any form of employment, as well as to take advantage of whatever water and electricity was available.
- Virtually none of the squatters had been officially informed by Union Carbide or the Indian government of the danger posed by the chemicals being produced next door to them. The scope of the disaster was greatly increased because of total unpreparedness.

7. Explain in detail the powerful support and the proper role of law in engineering.

Nov/Dec'15

(8)

- We should also mention the role of law in engineering ethics. The practice of engineering is governed by many laws on the international, federal, state, and local levels. Many of these laws are based on ethical principles, although many are purely of a practical, rather than a philosophical, nature.
- There is also a distinction between what is legal and what is ethical. Many things that are legal could be considered unethical. For example, designing a process that releases a known toxic, but unregulated, substance into the environment is probably unethical, although it is legal.
- Conversely, just because something is illegal doesn't mean that it is unethical. For example, there might be substances that were once thought to be harmful, but have now been shown to be safe, that you wish to incorporate into a product. If the law has not caught up with the latest scientific findings, it might be illegal to release these substances into the environment, even though there is no ethical problem in doing so.
- As an engineer, you are always minimally safe if you follow the requirements of the applicable laws. But in engineering ethics, we seek to go beyond the dictates of the law. Our interest is in areas where ethical principles conflict *and* there is no legal guidance for how to resolve the conflict.

Proper Role of Law In Engineering

- It is wrong to write off rule-making and rule following as futile. Good laws, effectively enforced, clearly produce benefits.

- It also provides a self-interested motive for most people and corporations to comply.
 - They also serve as powerful support and defense for those who wish to act ethically in situations where ethical conduct might not be welcome.
 - Viewing engineering as social experimentation provides engineers with a better perspective on laws and regulations.
 - Precise rules and enforceable sanctions are appropriate in cases of ethical misconduct that involve violations of well established and regularly reexamined procedures that have as their purpose the safety of public.
 - In areas of experimentation, rules must not attempt to cover all possible outcomes of an experiment, nor must they force the engineer to adopt a rigidly specified course of action.
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UNIT- IV

SAFETY, RESPONSIBILITIES AND RIGHTS

Part-A

1. What are employee rights?

Employee rights are the rights that apply or refer to the status or position or employee. Employee rights also include fundamental human rights relevant to the employee situation.

2. Define the term Risk (Nov/Dec'14)

The term 'risk' is synonymously used with adverse effect or harm. The term 'harm' may be defined as an invasion or limitation of a person's freedom of well-being.

3. What is the difference between bribe and gift? (Nov/Dec'14)

Gifts from clients, customers, suppliers and bidders are a particularly sticky issues because they are sometimes part of accepted practice and it is expected that token gifts may be exchanged.

Bribe could be loosely defined as anything of value given with intent to extract a favourable action from an individual. Bribes are made in secret.

4. What do you mean by risk reduction?

Risk reduction refers to the reduction or elimination of all aspect of accidental loss that lead to wastage of an organization's assets.

5. Define risk-benefit analysis (Nov/Dec'15)

Risk –benefit analysis is a technique, similar to cost-benefit analysis", used to-analyze the risk in a project and to determine whether the project should be carried out or not.

Risk-benefit analysis answers the following questions:

- What are the benefits of the project /product?
- Is the project/product worth the risks connected with its use? And
- Do benefits outweigh the risks?

6. What is meant by whistle blowing? (Nov/Dec'15)/ (Nov/Dec'14)

Whistle blowing is alerting relevant persons to some moral or legal corruption, where 'relevant persons' are those in a position to act in response, if only by registering protest.

7. Differentiate Copyright and Patent.

A copyright is the right to copy and make use of literary, dramatic, musical , artistic works, cinematographic films, records and broadcasts. The copyrights protect the expression of the idea, not the idea themselves.

Patents are the legal rights approved for new investments involving scientific and technical knowledge.

8. What is intellectual property right? (Apr/May '16)

- Intellectual property (IP) is a property that results from mental labor.
- The intellectual property is origination mainly from the activates of the human intellect.

9. What is Discrimination?

Discrimination is the unequal treatment of an individual intentionally on unintentionally. Discrimination refers to treating people unfairly because of one's sex, race, skin color, age or religious outlook.

10. List any four fundamental human rights adopted by UN.

- Right to life
- Right to liberty
- Right to security of person
- Right not to be held in slavery
- Right not be tortured or subjected to inhuman or degrading punishment.

Part-B

1. Describe the concept of Risk Benefit Analysis Apr/May 2015 (8)

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. It is very much closer to cost-benefit analysis. In risk-benefit analysis, the risks and benefits of a product are allotted to money amounts, and the most benefitable ratio between risks and benefits is calculated. But it is a very difficult job, as the risks are much harder to quantify and more difficult to put a realistic price tag on. But when used objectively, this analysis will be a useful technique as a part of a larger analysis. When applying the risk-benefit analysis, a person must consider who takes the risks and who harvests the benefits.

REASONS FOR RISK-BENEFIT ANALYSIS

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

ETHICAL IMPLICATIONS OF RISK-BENEFIT ANALYSIS

Risk-benefit analysis is also helpful to find answers to the following questions in an ethical way.

- i) When is a person given a right to impose a risk on another in view of a supposed benefit to others?
- (ii) How do we consider the worst case scenarios of persons exposed to maximum risks while they are receiving only minimum benefits? Are their rights violated?
- (iii) Are they provided with safer alternatives?

So engineers should keep in mind that risks to known persons are perceived differently from statistical risks and they have no control over the grievance redressal.

Types of Risk

1. 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. Individuals are more ready to take on voluntary risks than involuntary risks even if the voluntary risks are more dangerous.

There are so many difficulties in assessing personal risks particularly in case of involuntary risks. It is very difficult to assess the involuntary personal risks.

To overcome these difficulties in assessing personal risks is that analysts should have all the available quantitative measures such as (i) Assessing voluntary activities - e.g., Life Insurance taken (ii) Assessing dangerous or risky job-worker can demand for increased wages to carry out the job. On the basis of the above assessments, we have to adopt a procedure to assess personal risks that have been overseen by trained arbiters.

2. Public Risk and Public Acceptance

Risks and benefits to the public are more easily determined than to individuals, as larger number of people are taken into account.

National Highway Traffic Safety Administration [NHTSA] of USA, suggested a value for human life based on the loss of future income and other costs associated with an accident. It also provides an estimate of quantifiable losses in social welfare resulting from a fatality and not on the basis for determining the maximum expenditure allocated to saving a life.

2. Discuss the concept of safe exit in the Chernobyl case study Apr/May 2015

Chernobyl Case Study

Introduction

The April 1986 Disaster at Chernobyl nuclear power plant in Ukraine was the product of a flawed Soviet reactor coupled with serious mistakes made by the plant operators in the context of a system where training was minimal. It was a direct consequence of Cold war isolation and the resulting lack of any safety culture.

The accident destroyed the Chernobyl -4 reactor and killed 30 people , including 28 from radiation exposure. A further 20 on site were treated for acute radiation poisoning and among these, 134 cases were confirmed (all of women recovered). Nobody off-site suffered from acute radiation effects.

This incident was a unique event and the only accident in the history of commercial nuclear power where radiation –related fatalities occurred.

What Happened

At 1:24 AM on April 26, 1986, there was an explosion at the Soviet nuclear power plant at Chernobyl. One of the reactors overheated, igniting a pocket of hydrogen gas. The explosion blew the top off the containment building, and exposed the molten reactor to the air. Thirty-one power plant workers were killed in the initial explosion, and radioactive dust and debris spewed into the air.

It took several days to put out the fire. Helicopters dropped sand and chemicals on the reactor rubble, finally extinguishing the blaze. Then the Soviets hastily buried the reactor in a sarcophagus of concrete. Estimates of deaths among the clean-up workers vary widely. Four thousand clean-up workers may have died in the following weeks from the radiation.

The countries now known as Belarus and Ukraine were hit the hardest by the radioactive fallout. Winds quickly blew the toxic cloud from Eastern Europe into Sweden and Norway. Within a week, radioactive levels had jumped over all of Europe, Asia, and Canada. It is estimated that seventy-thousand Ukrainians have been disabled, and five million people were exposed to radiation. Estimates of total deaths due to radioactive contamination range from 15,000 to 45,000 or more.

To give you an idea of the amount of radioactive material that escaped, the atomic bomb dropped on Hiroshima had a radioactive mass of four and a half tons. The exposed radioactive mass at Chernobyl was fifty tons.

In the months and years following, birth defects were common for animals and humans. Even the leaves on the trees became deformed.

Today, in Belarus and Ukraine, thyroid cancer and leukemia are still higher than normal. The towns of Pripyat and Chernobyl in the Ukraine are ghost towns. They will be uninhabitable due to radioactive contamination for several hundred years. The worst of the contaminated area is called "The Zone," and it is fenced off. Plants, meat, milk, and water in the area are still unsafe. Despite the contamination, millions of people live in and near The Zone, too poor to move to safer surroundings.

Further, human genetic mutations created by the radiation exposure have been found in children who have only recently been born. This suggests that there may be another whole generation of Chernobyl victims.

Recent reports say that there are some indications that the concrete sarcophagus at Chernobyl is breaking down.

3. What are occupational crimes? Explain anyone in detail. Nov/Dec 15

Occupational crime refers to a crime committed by someone during the course of his or her employment. Also known as workplace crime, occupational crime encompasses a wide variety of criminal acts including theft (or embezzlement), money laundering, and the misuse of company property or information.

The illegal conduct in occupational crimes originates in the employee's **access** to company data, property, or funds. For example, if an accountant at a large manufacturing business purposefully withholds information about company revenue from the Internal Revenue Service, the accountant has committed corporate tax fraud. In this scenario, the accountant has committed an occupational crime-- he has used his access to sensitive company information (i.e., revenue reports) to defraud the IRS.

The most common form of occupational crime is **white-collar crime**. White-collar crimes differ from traditional crimes in that white-collar crimes are financial crimes committed by business professionals. White-collar crime is nonviolent in nature, and often arises in circumstances where business professionals misuse company information for financial gains.

Types of occupational crimes

Herbert Edelhertz (1970: 73-75) has suggested the following four types of occupational crimes on the basis of motivation of the perpetrators:

1. Crimes committed by persons on an individual basis, e.g., income-tax evasion, bankruptcy frauds, credit purchases or taking loans with no intention to pay, and insurance fraud.
2. Crimes committed in the course of occupations by those operating in business, government, or other establishments, in violation of their duty of loyalty to the employer or client; e.g., bribery, kickbacks, embezzlement, and pilfering.
3. Crimes incidental to and in furtherance of business operations but not central to business purposes; e.g., food and drug violations, misrepresentation in advertising, and prescription fraud.
4. Crime as a business or as the central activity of a business; e.g., medical fraud schemes, lottery fraud schemes, mutual fund fraud schemes, land and real estate frauds, charity and religious frauds and music pirating.

4. What is Intellectual Property Rights? Explain the various elements of IPR in detail (10)

Intellectual Property

Intellectual property (IP) is a legal field that refers to creations of the mind such as musical, literary, and artistic works; inventions; and symbols, names, images, and designs used in commerce, including copyrights, trademarks, patents, and related rights. Under intellectual property law, the holder of one of these abstract "properties" has certain

exclusive rights to the creative work, commercial symbol, or invention by which it is covered.

The term "intellectual property" denotes the specific legal rights described above, and not the intellectual work itself.

The importance of intellectual property in India is well established at all levels- statutory, administrative and judicial. India ratified the agreement establishing the World Trade Organization (WTO).

Essential Elements of Intellectual Property Rights

IPR is a broad term for covering -

- 1) Patents for inventions
- 2) Copyrights for material
- 3) Trademarks for brand identity and
- 4) Trade secrets.

In general these properties are termed as "Intellectual Property". Intellectual Property is an asset that can be bought or sold, licensed and exchanged. But of course unlike other properties, intellectual property is intangible; rather it cannot be identified by its specific parameters. These properties are protected on a national basis.

PATENTS

This refers to innovations – new or improved product and processes which are meant for industrial applications. This is a territorial right which requires registration for a limited time. Patent is a contract between an inventor as an individual and the society as a whole. The inventor has exclusive right to prevent anybody making use of and/or selling a patented invention. Of course, this is only for a specific duration till the inventor discloses the details of invention to the public.

Types of patents

- i) Utility patents
- ii) Design patents
- iii) Plant patents

i) Utility patents

It can be granted to anyone who invents or discovers any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereof. Utility period is of 20 years.

"Process" refers to industrial and manufacturing (production) method. "Manufacture" refers to articles manufactured. "Composition of matter" refers to chemical compositions and may include mixtures of ingredients as well as new chemical compounds.

ii) Design patents

It can be granted to any one who invents a new, original ornamental design for an article of manufacture. A design patent protects the ornamental design (i.e. appearance) of the article. A design patent has duration of 14 years from the date of filing.

iii) Plant patents

Plant patent can be granted to any one who invents or discovers and reproduces a new variety of plant. A plant patent has a term of 20 years from the date of filing

COPY RIGHTS

A copyright is a very particular and exclusive right even for reproduction of an original work. This is for material, aesthetic material, literacy, music, film, sound recording, broad casting, software and multimedia. This offers automatic right for safeguarding any original creation, which is not in need of registration but with limited time. It does not require the lawyer's help for settlement.

Protection to copy right does not give any procedure, principle, concept or method or operation, irrespective of the format in which it is explained. Copyright is sanctioned to prevent others from:

- a) Copying the work
- b) Publishing and selling copies commercially
- c) Renting or lending the work in a free market
- d) Doing or demonstrating the work in public

TRADE MARKS

Trademark is for broad identity of specific goods and services allowing differences to be made among different trades. This is a territorial right, which requires registration, but without any time limit. Lawyers are needed for guidelines.

A trademark is an identification symbol which is used in the course of trade to enable the purchasing people (buyers) to distinguish one trader's goods from the similar goods of other traders. These marks also symbolize distinctly the quality of the products. These marks are in the form of certain 'wordings' or can be in the format of logos, designs, sounds, etc. Examples: NIIT, Kodak.

The TRIPS agreement offers the same type of protection for trademarks. Registration of trademark is issued for definite period of time. However, in order to avoid confusion, encourage competitions and protect the inventor's good will, the registration may be renewed. With reference to intellectual property area, trademarks are national in origin and should comply with provision of TRIPS agreement.

TRADE SECRETS

A trade secret means information, which is kept confidential as a secret. This is generally not known in the relevant industry, offering an advantage to its owner over other competitors. Unlike other types of Intellectual property, this trade secret is fundamentally a "do-it-yourself" type of protection. For engineers, inventors, and designers, the trade secrets are to be maintained secretly. Such trade secrets include some formulae, programmes, methods, progresses or data collections etc. If there is any improper disclosure or use of the trade secret by another person, the inventor may claim and recover damages resulting from illegal use.

NEED FOR PROTECTION TO IPR

The protection of intellectual property rights is an essential element of economic policy for any country. Only such protection can stimulate research, creativity and technological innovations by giving freedom to individual inventors and companies to gain the benefits of their creative efforts.

It is a very important issue to plan to protect the intellectual property rights. The major needs are to

- * Prevent plagiarism.
- * Prevent others using it.
- * Prevent using it for financial gains.
- * Fulfill obligation to funding agency.
- * Support income generation strategy.

IMPORTANCE OF IPR

- a) Give the inventors exclusive rights of dealing.
- b) Permit avoiding of competitors and increase entry barriers.
- c) Allow entry to a technical market
- d) Generate steady income by issuing license.

5. Discuss the following Apr/May 15, Nov/Dec14

(i) Human rights (ii) Professional rights (iii) employee rights

Human Rights

Human Rights are the rights possessed by virtue of being people or moral agents.

Some of the Fundamental Human Rights are

- Right to life
- Right to liberty
- Right to security of person
- Right not to be held in slavery
- Right not to be tortured or subjected to inhuman or degrading punishment.
- Right to marriage
- Right to education
- Right to freedom of movement
- Right to freedom of thought
- Right to non-discrimination
- Right to minimal standard of living

Professional Rights

Professional Rights are the rights possessed by virtue of being professionals having special more responsibilities

Some of the Professional Rights are

- Right to exercise one's professional judgement on the basis of his conscience
- Right to refuse to involve in unethical activities
- Right to warn the public about harms and dangers
- Right to express one's professional judgement including his right to disagree
- Right to fair recognition and remuneration for professional services.

Employee Rights

Employment law covers all rights and obligations within the employer-employee relationship -- whether current employees, job applicants, or former employees. Because of the complexity of employment relationships and the wide variety of situations that can arise, employment law involves legal issues as diverse as discrimination, wrongful termination, wages and taxation, and workplace safety. Many of these issues are governed by applicable federal and state law.

Some of the Fundamental Employee Rights are

- Pay you at least the minimum wage
 - Provide you with annual leave
 - Provide or compensate you for public holidays if you work, or normally work the day the public holiday falls on
 - Provide you with a written employment agreement
 - Not deduct money from your wages, without your agreement in writing
 - Provide a safe workplace for you to work in
 - Not discriminate against you.
-

6. Define Collective bargaining. Explain the roles of collective bargaining in workplace rights and responsibilities (12) Nov/Dec 2014

What is 'Collective Bargaining?'

Collective bargaining is the process of negotiating the terms of employment between an employer and a group of workers. The terms of employment are likely to include items such as conditions of employment, working conditions and other workplace rules, base pay, overtime pay, work hours, shift length, work holidays, sick leave, vacation time, retirement benefits and health care benefits.

Roles and Responsibilities

Unions can play an important role in preventing and responding to workplace bullying in at least four ways:

- **Negotiate CBA Provisions** — Unions should bargain for collective bargaining agreement provisions that protect their members against abusive supervision.
- **Use Existing Contract Provisions** — Even in the absence of specific protections against abusive supervision, the general substantive and procedural rights in an agreement may provide legal protections for a bullied union member.
- **Educate Members and Resolve Disputes** – Effective shop stewards can be trained to help to identify and resolve bullying situations, including those between union members. Unions can encourage a culture of safety and respect among their members.
- **Support Legal Reform** – Unions can back the enactment of anti-bullying legislation such as the Healthy Workplace Bill.

Process of Collective Bargaining

The process of collective bargaining consists of 3 steps.

1. Presenting the character of demands by the union on the behalf of the constituent elements
 2. Negotiations at the beginning table
 3. Reaching an agreement
-

7. Explain the concept of safety. How the same differs with the standard of living of countries Apr/May 2014 (16)

Safety is the state in which the risk of harm by accident to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management. Safety should be an integral part of any engineering design. A thing is safe if its risks are justified to be acceptable designer thing is said to be safe if for the person who judges the perceived risk is less and it is unsafe if the perceived risk is high .In short, safety means an acceptable risk.

But the definition of Lawrence has some drawbacks as follows:

Under Estimation of Risks: An unsafe product may be considered to be safe, because of wrong judgement of a person who has not known anything about the product.

Eg: Buying an ill-designed iron box in a sale only because of low price offered. (ii)

Over estimation of Risks: A product whose risks are comparatively less may be considered unsafe because of extraordinary safety concern of a person .

Eg: Judging fluoride in water can kill lot of people.

No estimation of risks: For the person who does not judge the risks, the product may be either safe or unsafe.

Eg: Hiring a car without knowing its safety.

By keeping all these things in mind it is necessary to find the modified notion of safety.

A thing is safe with respect to given person or group at a given time if its risks were fully known if those risks would be judged acceptable in light of settled value principles.

Other concepts of safety:

Safety can be objective and also subjective .In view of objective safety is a matter of how people would find risks acceptable or unacceptable if they knew the risks and based their judgements on their most settled and values perspectives.

When the value perspectives differ safety becomes objective .so safety is an acceptable risk.

Relative safety can be understood by making comparisons.eg: comparing the safety of a distance travelled bt Air,train and bus.

For Engineers safety would extend to safe operation of products and systems, prevention of natural or human caused disasters.

8. Write a Brief note on Discrimination**(8) Apr/May 2015**

Discrimination can be interpreted in several ways. Discrimination means to make an unfair difference in one's treatment of people. It also means giving preference on the basis of sex, race, religion etc. In other words it can also be explained morally unjustified treatment of people on random or irrelevant basis. It is a kind of —reverse preferential treatment. Reverse preferential treatment means one who gives different treatments to equal standard of two different groups.

The following are some of the examples of discrimination.

(i) In a large automobile company a vacancy arises for the post of AGM. Generally these positions are filled by the virtue of promotion from the existing seniors within the company. As per the rules, the management has to make a review among the employees. The members find one suitable person who has lot of experience and training in the company. Unfortunately, the selected person does not belong to the community of the majority people of the company. The management fears if the person is given appointment there may be less employees' cooperation for smooth running of the company. So the management decides to promote and transfer another person who belongs to the same community of the majority from another plant.

(ii) A company has appointed more number of women engineers in its sales division. But their pay is not at par with that of men.

Anti discrimination laws

In our country discrimination against women is controlled by many of the Laws such as Factories Act, Labor Laws, Acts relating to wages etc.

In U.S, the discrimination of public as well as private employers is prohibited legally under the civil Rights Act of 1964, the equal employment opportunity Act of 1972 etc. These acts protect the weaker, minorities and women from discrimination by race, color, religion, sex or national origin. The age discrimination is also prohibited by age discrimination in employment Act of 1967.

Preferential treatments

Preferential treatment means giving preference for the minorities and women in employment opportunities. It has 2 types

(i) Weak Preferential Treatment

It implies giving a benefit or preference to the members of traditionally discriminated against groups over equally qualified applicants who are the members of other groups.

(ii) Strong Preferential Treatment

Strong Preferential Treatment involves giving preference to women and minority applicant over better-qualified applicants from the other groups.

Sexual Harassment

Sexual Harassment may be defined as

- (i) when applied to women, —any sexual oriented practice which endangers a woman's job, that undermines her job performance and threatens her economic livelihood.¶
- (ii) —It is the unwanted imposition of sexual requirements in the context of relationship of unequal power¶.

In the field of engineering, the woman may be an engineer, a technician, or secretary and the male who harasses the women may be her manager or her colleague.

Forms of Sexual Harassment

- (i) In an interview for the post of a secretary a woman is told that the job will be given to her only when she is ready to give sexual favors to the interviewer.
- (ii) A woman is told by her superior that she will be given first priority for receiving a promotion if she is ready to —adjust¶ him by means of sexual contacts. When she refuses to do so, she is not given promotion and is assigned less category of job.
- (iii) A male colleague of a woman continuously looks at her and makes sexual comment and suggestions about her dress and body.
- (iv) A male engineer enjoys telling unwanted sex jokes to his secretary who is not interested to listen.

So, sexual harassment may be in the form of threats of penalties, offers of rewards, assaults and annoyance.

Sexual harassment may take place anywhere, such as work place, public place, schools, colleges etc. In a work place it involves lowering the economic status of women. It is an assault on the dignity of the victim.

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UNIT – V

GLOBAL ISSUES

Part- A

1. Define the term ‘honesty’

(Apr/May '15)

Honesty

Honesty means expressing your true feelings. To be able to be emotionally honest we must first be emotionally aware. This emotional awareness is related to our emotional intelligence.

2. What do you understand by ‘business ethics’? (Apr/May '15)

Business ethics is the study of proper business policies and practices regarding potentially controversial issues, such as corporate governance, insider trading, bribery, discrimination, corporate social responsibility and fiduciary responsibilities.

3. What is meant by moral leadership? (Nov/Dec'15)

Engineers provide a many forms of leaderships as they play variety of roles such as managers, consultants, expert witness, abusers, entrepreneurs, etc. Also there is an ongoing need for moral leadership in engineering, as in other professions. Let us discuss few current activities that illustrate leadership within the profession.

4. What is technology transfer? (Nov/Dec'15)

Technology transfer is the process of moving technology to a quite new set of conditions and implementing if there. Transfer of technology may be conducted by a variety of agents such as governments , universities, volunteer service organizations, consulting companies and MNC's.

5. What is meant by globalization? (Apr/May '16)

Globalization referred as the process by which businesses or other organizations develop international influence or start operating on an international scale. The worldwide movement of goods towards economic, financial, trade, and communications integration. Globalization implies the opening of local and nationalistic perspectives to a broader outlook of an interconnected and interdependent world with free transfer of capital, goods, and services across national frontiers.

6. What do you mean by global issues? (April/May '14)

Global problems are not just important problems, or problems that affect many people. Rather they are those problems that affect the whole of the planet, and potentially all of the people who live on it. Climate change is one clear example that springs to mind quickly. Global issue referred to something that affects a number of countries and populations. It is an issue that impacts upon or is important to the global community,

7. What are the International rights listed by Donaldson? (Nov/Dec'14)

1. The right to freedom of physical movement.
2. The right to ownership of property
3. The right to freedom from torture.
4. The right to a fair trial.
5. The right to non-discriminatory
6. The right to physical security.
7. The right to freedom of speech and association.
8. The right to minimal education.
9. The right to political participation.
10. The right to subsistence

8. What do you mean by conflict of interest? Give examples.

Professional conflicts of interest are situations where professionals have an interest, if pursued, could keep them from meeting one of their obligations to their employers.

Ex: an employee working in a company depositing a substantial investment in a competitors' company.

9. What is embezzlement?

The process of committing computer crimes such as stealing or cheating clients or consumers and conspiracy in the fraudulent uses of computer network is called embezzlement.

10. What is meant by ethical climate ?

A favorable working atmosphere required to achieve a morally responsible conduct is called as ethical climate.

Part-B

1(a). Explain the basic concepts of environmental ethics through case studies

Apr/May 14, Apr/May 15

Environmental ethics is the study of (a) moral issues concerning the environment, and (b) moral perspectives, beliefs, or attitudes concerning those issues. Engineers in the past are known for their negligence of environment, in their activities. It has become important now that engineers design eco-friendly tools, machines, sustainable products, processes, and projects. These are essential now to (a) ensure protection (safety) of environment (b) prevent the degradation of environment, and (c) slow down the exploitation of the natural resources, so that the future generation can survive.

The American Society of Civil Engineers (ASCE) code of ethics, has specifically requires that “engineers shall hold paramount the safety, health, and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of professional duties” The term sustainable development emphasizes on the investment, orientation of technology, development and functioning of organizations to meet the present needs of people and at the same time ensuring the future generations to meet their needs. Global Issues Compaq Computer Corporation (now merged with HP) was the leader, who exhibited their commitment to environmental health, through implementation of the concept of ‘Design for environment’ on their products, unified standards all over the world units, and giving priority to vendors with a record of environmental concern.

Engineers as experimenters have certain duties towards environmental ethics, namely:

1. Environmental impact assessment: One major but sure and unintended effect of technology

is wastage and the resulting pollution of land, water, air and even space. Study how the industry and technology affects the environment.

2. Establish standards: Study and to fix the tolerable and actual pollution levels.

3. Counter measures: Study what the protective or eliminating measures are available for immediate implementation

4. Environmental awareness: Study on how to educate the people on environmental practices, issues, and possible remedies.

Disasters

1. Plastic Waste Disposal

In our country, several crores of plastic bottles are used as containers for water and oil, and plastic bags are used to pack different materials ranging from vegetables to gold ornaments. Hardly any of these are recycled. They end up in gutters, roadsides, and agricultural fields.

2. e-Waste Disposal

The parts of computers and electronic devices which have served its useful life present a major environmental issue for all the developing countries including India. This scrap contains highly toxic elements such as lead, cadmium, and mercury. Even the radioactive waste will lose 89% of its toxicity after 200 years, by which time it will be no more toxic than some natural minerals in the ground. It will lose 99% of its remaining toxicity over the next 30,000 years.

3. Industrial Waste Disposal

There has been a lot of complaints through the media, on (a) against the Sterlite Copper Smelting Plant in Tuticorin (1997) against its pollution, and (b) when Indian companies imported the discarded French Warship Clemenceau for disposal, the poisonous asbestos compounds were expected to pollute the atmosphere besides exposing the labor to a great risk, during the disposal.

4. Depletion of Ozone Layer

The ozone layer protects the entire planet from the ill-effects of ultraviolet radiation and is vital for all living organisms in this world. But it is eaten away by the Chloro-fluorocarbons (CFC) such as Freon emanating from the refrigerators, air conditioners, and aerosol can spray. This has caused also skin cancer to sun-bathers in the Western countries. Further NO and NO₂ gases were also found to react with the ozone. Apart from engineers, the organizations, laws of the country and local administration and market mechanisms are required to take up concerted efforts to protect the environment.

5. Global Warming

Over the past 30 years, the Earth has warmed by 0.6 °C. Over the last 100 years, it has warmed by 0.8 °C. It is likely to push up temperature by 3°C by 2100, according to NASA's studies. The U.S. administration has accepted the reality of global climate change, which has been associated with stronger hurricanes, severe droughts, intense heat waves and the melting of polar ice. Greenhouse gases, notably carbon dioxide emitted by motor vehicles and coal-fired power plants, trap heat like the glass walls of a greenhouse, cause the Earth to warm up.

6. Acid Rain

Large emissions of sulphur oxides and nitrous oxides are being released in to the air from the thermal power stations using the fossil fuels, and several processing industries. These gases form compounds with water in the air and precipitates as rain or snow on to the earth. The acid rain in some parts of the world has caused sufficient damage to the fertility of the land and to the human beings.

1.(b)Discuss in detail Weapons Development.

Military activities including the world wars have stimulated the growth of technology. 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.

2. Discuss the ethical issues related to computer ethics.(10) Nov/Dec 15

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. The use of computers have raised a host of moral concerns such as free speech, privacy, intellectual

property right, and physical as well as mental harm. There appears to be no conceptual framework available on ethics, to study and understand and resolve the problems in computer technology.

Types of Issues

Different types of problems are found in computer ethics.

1. Computer as the Instrument of Unethical Acts

(a) 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.

(b) Breaking privacy. Information or data of the individuals accessed or erased or the ownership changed.

(c) Defraud a bank or a client, by accessing and withdrawing money from other's bank account.

2. Computer as the Object of Unethical Act

The data are accessed and deleted or changed.

(a) Hacking: The software is stolen or information is accessed from other computers. This may cause financial loss to the business or violation of privacy rights of the individuals or business. In case of defense information being hacked, this may endanger the security of the nation.

(b) Spreading virus: Through mail or otherwise, other computers are accessed and the files are erased or contents changed altogether. 'Trojan horses' are implanted to distort the messages and files beyond recovery. This again causes financial loss or mental torture to the individuals. Some hackers feel that they have justified their right of free information or they do it for fun. However, these acts are certainly unethical.

3. Problems Related to the Autonomous Nature of Computer

(a) Security risk: Recently the Tokyo Stock Exchange faced a major embarrassment. A seemingly casual mistake by a junior trader of a large security house led to huge losses including that of reputation. The order through the exchange's trading system was to sell one share for 600,000 Yen. Instead the trader keyed in a sale order for 600,000 shares at the rate of one Yen each.

(b) Loss of human lives: Risk and loss of human lives lost by computer, in the operational control of military weapons. There is a dangerous instability in automated defense system. An unexpected error in the software or hardware or a conflict during

interfacing between the two, may trigger a serious attack and cause irreparable human loss before the error is traced.

(c) In flexible manufacturing systems, the autonomous computer is beneficial in obtaining continuous monitoring and automatic control.

Various issues related to computer ethics are discussed as follows:

Computers In Workplace

The ethical problems initiated by computers in the workplace are:

1. Elimination of routine and manual jobs. This leads to unemployment, but the creation of skilled and IT-enabled service jobs are more advantageous for the people. Initially this may Global Issues require some upgradation of their skills and knowledge, but a formal training will set this problem right. For example, in place of a typist, we have a programmer or an accountant.

2. Health and safety: The ill-effects due to electromagnetic radiation, especially on women and pregnant employees, mental stress, wrist problem known as Carpel Tunnel Syndrome, and backpain due to poor ergonomic seating designs, and eye strain due to poor lighting and flickers in the display and long exposure, have been reported worldwide. Over a period of long exposure, these are expected to affect the health and safety of the people. The computer designers should take care of these aspects and management should monitor the health and safety of the computer personnel.

3. Computer failure: Failure in computers may be due to errors in the hardware or software. Hardware errors are rare and they can be solved easily and quickly. But software errors are very serious as they can stop the entire network. Testing and quality systems for software have gained relevance and importance in the recent past, to avoid or minimize these errors.

3. (a)Write briefly Engineers used as expert witness Nov/Dec 15&14 (8)

(b) Engineers as advisors. Nov/Dec15 (8)

Expert Witness

Frequently engineers are required to act as consultants and provide expert opinion and views in many legal cases of the past events. They are required to explain the causes of accidents, malfunctions and other technological behavior of structures, machines, and instruments, e.g., personal injury while using an instrument, defective product, traffic accident, structure or building collapses, and damage to the property, are some of the

cases where testimonies are needed. The focus is on the past. The functions of eye-witness and expert-witness are different as presented below

Eye-witness

1. Eye-witness gives evidence on only what has been seen or heard actually (perceived facts)

Expert-witness

1. Gives expert view on the facts in their area of their expertise
2. Interprets the facts, in term of the cause and effect relationship
3. Comments on the view of the opposite side
4. Reports on the professional standards, especially on the precautions when the product is made or the service is provided

The engineers, who act as expert-witnesses, are likely to abuse their positions in the following manners:

1. Hired Guns

Mostly lawyers hire engineers to serve the interest of their clients. Lawyers are permitted and required to project the case in a way favorable to their clients. But the engineers have obligations to thoroughly examine the events and demonstrate their professional integrity to testify only the truth in the court. They do not serve the clients of the lawyers directly. The hired guns forward white lies and distortions, as demanded by the lawyers. They even withhold the information or shade the fact, to favor their clients.

2. Money Bias

Consultants may be influenced or prejudiced for monetary considerations, gain reputation and make a fortune.

3. Ego Bias

The assumption that the own side is innocent and the other side is guilty, is responsible for this behavior. An inordinate desire to serve one's client and get name and fame is another reason for this bias.

4. Sympathy Bias

Sympathy for the victim on the opposite side may upset the testimony. The integrity of the consultants will keep these biases away from the justice. The court also must obtain the balanced view of both sides, by examining the expert witnesses of lawyers on both sides, to remove a probable bias.

5.7.1 Duties

1. The expert-witness is required to exhibit the responsibility of confidentiality just as they do in the consulting roles. They can not divulge the findings of the investigation to the opposite side, unless it is required by the court of law.

2. More important is that as witness they are not required to volunteer evidence favorable to the opponent. They must answer questions truthfully, need not elaborate, and remain neutral until the details are asked for further.

3. They should be objective to discover the truth and communicate them honestly.

4. The stand of the experts depends on the shared understanding created within the society. The legal system should be respected and at the same time, they should act in conformance with the professional standards as obtained from the code of ethics.

5. The experts should earnestly be impartial in identifying and interpreting the observed data, recorded data, and the industrial standards. They should not distort the truth, even under pressure. Although they are hired by the lawyers, they do not serve the lawyers or their clients. They serve the justice. Many a time, their objective judgments will help the lawyer to put up the best defense for their clients.

ENGINEERS AS ADVISORS IN PLANNING AND POLICY MAKING

Advisors

The engineers are required to give their view on the future such as in planning, policy-making, which involves the technology. For example, should India expand nuclear power options or support traditional energy sources such as fossil fuels or alternative forms like solar and wind energy? In the recent past, this topic has created lot of fireworks, in the national media.

Various issues and requirements for engineers who act as advisors are:

1. Objectivity

The engineers should study the cost and benefits of all possible alternative means in objective manner, within the specified conditions and assumptions.

2. Study All Aspects

They have to study the economic viability (effectiveness), technical feasibility (efficiency), operational feasibility (skills) and social acceptability, which include environmental and ethical aspects, before formulating the policy.

3. Values

Engineers have to possess the qualities, such as (a) honesty, (b) competence (skills and expertise), (c) diligence (careful and alert) (d) loyalty in serving the interests of the

clients and maintaining confidentiality, and (e) public trust, and respect for the common good, rather than serving only the interests of the clients or the political interests.

4. Technical Complexity

The arbitrary, unrealistic, and controversial assumptions made during the future planning that are overlooked or not verified, will lead to moral complexity. The study on future is full of uncertainties than the investigations on the past events. On the study of energy options, for example, assumptions on population increase, life style, urbanization, availability of local fossil resources, projected costs of generating alternative forms of energy, world political scenario, world military tensions and pressures from world organizations such as World Trade Organisation (W.T.O.) and European Union (EU) may increase the complexity in judgment on future.

5. National Security

The proposed options should be aimed to strengthen the economy and security of the nation, besides safeguarding the natural resources and the environment from exploitation and degradation. For the advisors on policy making or planning, a shared understanding on balancing the conflicting responsibilities, both to the clients and to the public, can be effected by the following roles or models:

1. Hired Gun

The prime obligation is shown to the clients. The data and facts favorable to the clients are highlighted, and unfavorable aspects are hidden or treated as insignificant. The minimal level of interest is shown for public welfare.

2. Value-neutral Analysts

This assumes an impartial engineer. They exhibit conscientious decisions, impartiality i.e., without bias, fear or favor, and absence of advocacy.

3. Value-guided Advocates

The consulting engineers remain honest (frank in stating all the relevant facts and truthful in interpretation of the facts) and autonomous (independent) in judgments and show paramount importance to the public (as different from the hired guns).

4. Explain the roles of Engineers as consultants. Nov/Dec 15 (8)

The consulting engineers work in private. There is no salary from the employers. But they charge fees from the sponsor and they have more freedom to decide on their projects. Still they have no absolute freedom, because they need to earn for their living. The consulting engineers have ethical responsibilities different from the salaried engineers, as follows:

1. Advertising

The consulting engineers are directly responsible for advertising their services, even if they employ other consultants to assist them. But in many organisations, this responsibility is with the advertising executives and the personnel department. They are allowed to advertise but to avoid deceptive ones. Deceptive advertising such as the following are prohibited:

(a) By white lies.

(b) Half-truth, e.g., a product has actually been tested as prototype, but it was claimed to have been already introduced in the market. An architect shows the photograph of the completed building with flowering trees around but actually the foundation of the building has been completed and there is no real garden.

(c) Exaggerated claims. The consultant might have played a small role in a well-known project. But they could claim to have played a major role.

(d) Making false suggestions. The reduction in cost might have been achieved along with the reduction in strength, but the strength details are hidden.

(e) Through vague wordings or slogans.

2. Competitive Bidding

It means offering a price, and get something in return for the service offered. The organizations have a pool of engineers. The expertise can be shared and the bidding is made more realistic. But the individual consultants have to develop creative designs and build their reputation steadily and carefully, over a period of time. The clients will have to choose between the reputed organizations and proven qualifications of the company and the expertise of the consultants. Although competent, the younger consultants are thus slightly at a disadvantage.

3. Contingency Fee

This is the fee or commission paid to the consultant, when one is successful in saving the expenses for the client. A sense of honesty and fairness is required in fixing this fee. The NSPE Code III 6 (a) says that the engineers shall not propose or accept a

commission on a contingent basis where their judgment may be compromised. The fee may be either as an agreed amount or a fixed percentage of the savings realized. But in the contingency fee-agreements, the judgment of the consultant may be biased. The consultant may be tempted to specify inferior materials or design methods to cut the construction cost. This fee may motivate the consultants to effect saving in the costs to the clients, through reasonably moral and technological means.

4. Safety and Client's Needs

The greater freedom for the consulting engineers in decision making on safety aspects, and difficulties concerning truthfulness are the matters to be given attention. For example, in design-only projects, the consulting engineers may design something and have no role in the construction. Sometimes, difficulties may crop-up during construction due to non-availability of suitable materials, some shortcuts in construction, and lack of necessary and adequate supervision and inspection.

4. Explain the moral obligations of an engineer as per the code of ethics.

Apr/May 14 (16)

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the higher standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of then public health, safety, and welfare. Engineer must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I Fundamental Canons

Engineers in the fulfillment of their professional duties shall,

1. hold paramount the safety, health, and welfare of the public.
2. perform services only in areas of their competence.
3. issue public statements only in objective and truthful manner.
4. act for each employer or client as faithful agents or trustees.
5. avoid deceptive acts.
6. conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

II Rules of Practice

1. Engineers shall hold paramount the safety, health, and welfare of the public.
 - (a) If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
 - (b) Engineers shall approve only those engineering documents that are in conformity with applicable standards.
 - (c) Engineers shall not reveal facts, data, or information without prior consent of the client or employer except as authorized or required by law or this code.
2. Engineers shall perform services only in the areas of their competence.
 - (a) Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.
 - (b) Engineers shall not affix their signatures to any plans or documents dealing with the subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.
3. Engineers shall issue public statements only in an objective and truthful manner.
 - (a) Engineers shall be objective and truthful in professional reports, statements, or testimony.

They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.
 - (b) Engineers may express publicly technical options that are founded upon knowledge of the facts and competence in the subject matter.
4. Engineers shall at for each employer or client as faithful agents or trustees
 - (a) Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services.
 - (b) Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties.
5. Engineers shall avoid deceptive acts
 - (a) Engineers shall not falsify their qualifications or permit misrepresentation of their or their associate's qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent

pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

III Professional Obligations

1. Engineers shall be guided in all their relation by the highest standards of honesty and integrity.
2. Engineers shall at all times strive to serve the public interest.
3. Engineers shall avoid all conduct or practice that deceives the public.
4. Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.

6. Explain the role of engineers as managers.

Nov/Dec14

(8)

Characteristics:

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.

Managing Conflicts:

In solving conflicts, force should not be resorted. In fact, the conflict situations should be tolerated, understood, and resolved by participation by all the concerned. The conflicts in case of project managers arise in the following manners:

- (a) Conflicts based on schedules: This happens because of various levels of execution, priority and limitations of each level.

- (b) Conflicts arising out of fixing the priority to different projects or departments. This is to be arrived at from the end requirements and it may change from time to time.
- (c) Conflict based on the availability of personnel.
- (d) Conflict over technical, economic, and time factors such as cost, time, and performance level.
- (e) Conflict arising in administration such as authority, responsibility, accountability, and logistics required.
- (f) Conflicts of personality, human psychology and ego problems.
- (g) Conflict over expenditure and its deviations.

Most of the conflicts can be resolved by following the principles listed here:

1. People

Separate people from the problem. It implies that the views of all concerned should be obtained. The questions such as what, why, and when the error was committed is more important than to know who committed it.

2. Interests

Focus must be only on interest i.e., the ethical attitudes or motives and not on the positions (i.e., stated views). A supplier may require commission larger than usual prevailing rate for an agricultural product. But the past analysis may tell us that the material is not cultivated regularly and the monsoon poses some additional risk towards the supply. Mutual interests must be respected to a maximum level. What is right is more important than who is right!

3. Options

Generate various options as solutions to the problem. This helps a manager to try the next best solution should the first one fails. Decision on alternate solutions can be taken more easily and without loss of time.

4. Evaluation

The evaluation of the results should be based on some specified objectives such as efficiency, quality, and customer satisfaction. More important is that the means, not only the goals, should be ethical.

UNIVERSITY QUESTIONS

Question Paper Code : 52133

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2014

Fifth Semester

Mechanical Engineering

GE 2025 -PROFESSIONAL ETHICS IN ENGINEERING

(Common to Mechanical Engineering

(Regulations 2009/10)

Part- A

1. Define Work Ethics.
2. How character and values are related?
3. When dilemma occupies the centre stage in an individual's activity?
4. Give 2 examples of customs followed in your area.
5. Write the 2 reasons that prevented safe exit for passengers and crew of the Titanic Ship.
6. What is learning from the past?
7. What is agency loyalty?
8. What is the prime objective of intellectual property rights legislation?
9. What do you mean by global issues?
10. Name any 2 weapons of mass destruction.

Part- B

11(a) Explain with suitable examples the need of courage in maintaining honesty and character

Refer IQA: Page No: 12-14

(or)

(b). Explain with suitable examples how the respect for others religious beliefs enhance the peaceful living

Refer IQA: Page No: 19

12(a). Why the integrity should be maintained in private and professional responsibilities? Explain with suitable examples.

(or)

(b). Explain the need of tolerance for different customs and ethical pluralism in adverse society with suitable example

13(a). Explain in briefly four cases where plain neglect to learn from the past mistakes leads to repetition of accidents

Refer IQA: Page No: 39-41

(or)

(b). Explain the responsibilities of engineers to society

14(a). Explain the concept of safety. How the same differs with the standard of living of countries

Refer IQA: Page No: 60-61

(or)

(b). Explain with case studies where the employers expose their employees

15(a). Explain the basic concepts of environmental ethics through case studies

Refer IQA: Page No: 66-68

(or)

(b). Explain the moral obligations of an engineer as per the code of ethics

Refer IQA: Page No: 76-78

Question Paper Code : 91508

B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014

Fifth Semester

Mechanical Engineering

GE 2025 -PROFESSIONAL ETHICS IN ENGINEERING

(Common to Mechanical Engineering

(Regulations 2009/10)

Part- A

1. Define Moral Autonomy
2. What are the models of professional roles?
3. What are the limitations of code of ethics?
4. What are the features of Engineering Experimentation?
5. Define the term Risk
6. List the methods that can be applied when testing is inappropriate.
7. What is the difference between bribe and gift?
8. What does whistle blowing mean?
9. What are the International rights listed by Donaldson?
10. Explain the meaning of 'moral leadership'.

Part-B

11(a). (i) How did Gilligan view the three levels of moral development initiated by Kohlberg?

(12)

Refer IQA: Page No: 21-23

(ii) Discuss three types of inquiry. (4)

Refer IQA: Page No: 25-26

(or)

(b). (i) Discuss the different models of Professional roles. (8) **Refer IQA: Page No: 23-25**

(ii). Explain the skills needed to handle problems about moral issues in engineering ethics (8)

12(a). (i) Discuss on the roles played by the codes of ethics set by professional societies. (10)

(ii). Compare and contrast engineering experiments with standard experiments (6)

(or)

(b) (i) Explain in detail the Challenger accident. What are the ethical problems involved in this (12)

(ii). Discuss Research ethics (4)

13(a). (i) Discuss the concept in Risk benefit analysis.(8)**Refer IQA: Page No: 50-52**

(ii) Explain in detail the effect of information on risk assessment with an example (8)

(or)

(b). Discuss the concept of safety exists in the Chernobyl case studies (16)

Refer IQA: Page No: 52-53

14(a) (i). What is Intellectual Property Rights? Explain the elements of IPR in detail (10)

Refer IQA: Page No: 54-57

(ii). Discuss human rights and professional rights in an engineering field (6)

Refer IQA: Page No: 58-59

(or)

(b) (i). Define Collective bargaining. Explain the roles of collective bargaining in workplace rights and responsibilities (12)

Refer IQA: Page No: 59-60

(ii). Discuss on collegiality and loyalty (4)

15(a). (i) Discuss the ethical issues related to computer ethics and internet (10)

Refer IQA: Page No: 69-71

(ii). Write briefly on environmental ethics and weapon development (6).

(or)

(b) (i). Explain the role of engineers as managers.(8)**Refer IQA: Page No: 78-80**

(ii). Write briefly Engineers used as expert witness (8) **Refer IQA: Page No: 71-73**

Question Paper Code : 27266

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015

Fifth Semester

Mechanical Engineering

GE 2025-PROFESSIONAL ETHICS IN ENGINEERING

(Common to Mechanical Engineering

(Regulations 2009/10)

Part-A

1. Define moral values with suitable examples.
2. Define Professionalism
3. Why engineers are considered as responsible experiments
4. List the advantage of industrial standards.
5. Define 'informed consent'
6. What is the use of risk-analysis?
7. Define 'collegiality'. What are its elements?
8. List the factors that enhance the self confidence in a person.
9. Define the terms 'honesty' and 'moral leadership'.
10. What do you understand by 'business ethics'?

Part-B

- 11(a). (i) Describe Kohlberg and Giligan's theories on moral autonomy (10)

Refer IQA: Page No:21-23

- (ii). Write a brief note on the types of inquiries(6)

Refer IQA: Page No:25-26

(or)

- (b). Discuss in detail the uses and limitation of ethical theories

- 12(a). Discuss the ethical issues involved in challenger case study.

(or)

- (b) (i). Explain how the code of ethics guide an engineer in the professional behaviour.(8)

- (ii). Discuss briefly the role of Industrial Standard(8)

- 13(a). Describe the concept of

- (ii) Risk Benefit Analysis

(8)

Refer IQA: Page No: 50-51

(iii) Fault Tree Analysis (8) **Refer IQA: Page No: 45-46**

(or)

(b). What are the safety lessons that can be learned from Bhopal disaster? Discuss the role of Governments regulator's in reducing the risk. **Refer IQA: Page No:46-47**

14(a). (i) Discuss the significance of loyalty and collegiality in team work (8)

(ii) Distinguish between employee rights and professional rights (8)

Refer IQA: Page No: 58-59

(or)

(b) Write a brief note on:

(i) Institutional Authority

(ii) Discrimination

Refer IQA: Page No: 61-63

15(a). What is environmental ethics ? Explain its significance. Give some of the environmental issues of concern to engineers? **Refer IQA: Page No: 66-68**

(or)

(b). Discuss the various global issues that have an impact on business.

Question Paper Code : 27266

B.E/B.Tech. DEGREE EXAMINATION, NOVEMEER/DECEMBER 2015

Fifth Semester

Mechanical Engineering

GE 6075 -PROFESSIONAL ETHICS IN ENGINEERING

(Common to Mechanical Engineering

(Regulations 2009/10)

Part A

1. Define spirituality
2. What are the qualities of a self confident people?
3. What is meant by moral autonomy?
4. Mention the various types of inquires.
5. What are the limitations of code of ethics?
6. What are the conditions are essential for a valid informed consent?
7. Define risk-benefit analysis
8. What is meant by whistle blowing?
9. What is meant by moral leadership?
10. What is technology transfer?

Part B

11(a). Write brief notes on yoga and meditation for professional excellence and stress management (16)

Refer IQA: Page No: 9-10

(b).(i)What is courage?What are salient features of courage?(8) **Refer IQA: Page No: 11-12**

(ii) Write short notes on honesty.(8)

Refer IQA: Page No: 12-13

12. (a)(i) Explain the Gilligan's theory for moral development (8)

Refer IQA: Page No: 21-23

(ii)What are the different types of model of professional roles? (8)

Refer IQA: Page No: 24-26

(b) (i)Explain the theory of human right ethics and its classifications.(8)

Refer IQA: Page No: 29-30

(ii)What is meant by self interest? Relate the term with "Ethical Egoism" with suitable examples. (8)

Refer IQA: Page No: 30-32

13(a). What are the different roles and function of “Code of Ethics”? (16)

Refer IQA: Page No: 36-39

(b). (i) Explain in detail the powerful support and proper role of law in engineering experimentation . (8)

Refer IQA: Page No: 47-48

(ii) With a case study explain the concept of “Learn from the Past” in Engineering Experimentation.

Refer IQA: Page No: 39-41

14(a). Discuss the concept of safe exit in the Chernobyl case study. (16)

Refer IQA: Page No: 52-53

(or)

(b) (i) What is intellectual property rights (IPR)? Explain any one essential element of an IPR. (8)

Refer IQA: Page No: 54-58

(ii) What are occupational crimes? Explain any one in detail. (8)

Refer IQA: Page No: 53-54

15 (a). Discuss the ethical issues related to computer ethics. (16)

Refer IQA: Page No: 69-71

(b). Discuss the following (i) Engineering as consultants. (8)

Refer IQA: Page No: 75-76

I) Engineers as expert witness and advisors. (8)

Refer IQA: Page No: 71-74

Question Paper Code : 52133

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2016

Fifth Semester

Mechanical Engineering

GE 6075 -PROFESSIONAL ETHICS IN ENGINEERING

(Common to Mechanical Engineering

(Regulations 2009/10)

Part-A

1. What are the values?
2. What is meant by self confidence?
3. State Gilligan's theory.
4. What is meant by consensus?
5. Differentiate scientific experiments and engineering projects.
6. Give the limitations of codes.
7. Differentiate between risk analysis and risk benefit analysis.
8. What is intellectual property right?
9. What is moral leadership?
10. What is meant by globalization?

11(a). Explain character and spirituality and their importance in ethics. (16)

(or)

Refer IQA: Page No: 15-18

(b). Explain the importance of self confidence in ethics. (16)

Refer IQA: Page No: 17-19

12(a). Explain in details about the scenes of engineering ethics. (16)

Refer IQA: Page No: 27-29

(or)

(b). Discuss in details the various ethical theories and their uses. (16)

13(a). How can engineer become responsible experimenter? Highlight the code of ethics for engineers.

Refer IQA: Page No: 41-44

(16)

(or)

(b).Discuss on roles played by the codes of ethics set by ethics by professional societies(16)

14(a). What are the factors that affect risk acceptability? What is the use of knowledge of risk acceptance to engineer? 16)

(or)

(b). Discuss the significance of intellectual property rights. Also explain the legislation covering IPR in India. (16)

15(a). Describe in details about the global issues of weapons development. (16)

(or)

(b).Justify engineers as expert witness and advisors with suitable examples (16)