GE6075 PROFESSIONAL ETHICS IN ENGINEERING L T P C
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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

TEXT BOOKS:

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.

GE6075 PROFESSIONAL ETHICS IN ENGINEERING

Corresponding Lab, with code (If any) :NIL

Course Prerequisites: Nil

Course Outcomes

On successful completion of this course, the student will be able to

GE6075.1	Understand the moral and ethical values and to create an awareness of Yoga and meditation for professional excellence.
GE6075.2	Understand the senses of engineering ethics and apply ethical theories for moral development.
GE6075.3	Apply engineering ethics in society
GE6075.4	Realize the responsibilities and rights in the society.
GE6075.5	Discuss the global issues related to engineering in the society

MAPPING BETWEEN CO AND PO, PSO WITH CORRELATION LEVEL 1/2/3

GE6075	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
GE6075.	1	1	1	-	-	3	3	3	2	1	1	2	1	-	-	2
GE6075.	1	1	1	-	-	3	3	3	2	1	1	2	-	2	-	2
GE6075.	1	1	1	-	-	3	3	3	2	1	1	2	1	1	1	2
GE6075.	1	1	1	-	-	3	3	3	2	1	1	2	-	2	1	2
GE6075.	1	1	1	-	-	3	3	3	2	1	1	2	1	2	1	2

UNIT I - GE6075.1

Sl. No.	Course Content	Knowledge level	No. of Hrs to be handled	Books Refered
1	Morals, values and Ethics	U, R &Ap	2	T1& T2
2	Integrity, Work ethic, Service learning, Civic virtue	U, R &Ap	2	T1& R1
3	Respect for other, Living peacefully, Caring, Sharing, Honesty , Courage Valuing time and Cooperation	U, R &Ap	2	T1
4	Commitment , Empathy , Self confidence , Character, Spirituality	U, R &Ap	2	T1
5	Introduction to Yoga and meditation for professional excellence and stress management	U, R &Ap	2	T1

Unit II - GE6075.2

Sl. No.	Course Content	Knowledge level	No. of Hrs to be handled	Books Refered
1	Senses of 'Engineering Ethics and Variety of moral issues	U, R &Ap	1	T1
2	Types of inquiry and Moral dilemmas	U, R &Ap	2	T1& T2
3	Moral Autonomy and Kohlberg's theory, Gilligan's theory	U, R &Ap	3	T1& R3
4	Consensus and Controversy, Models of professional roles, Theories about right action	U, R &Ap	3	T1
5	Self-interest, Customs and Religion, Uses of Ethical Theories	U, R &Ap	1	T1

Unit III - GE6075.3

Sl. No.	Course Content	Knowledge level	No. of Hrs to be handled	Books Refered
1	Engineering as Experimentation	U, R &Ap	3	T1
2	Engineers as responsible	U, R &Ap	2	T1
3	Codes of Ethics	U, R &Ap	2	T1

Sl. No.	Course Content	Knowledge level	No. of Hrs to be handled	Books Refered
4	A Balanced Outlook on Law.	U, R &Ap	3	T1& R4

Unit IV - GE6075.4

Sl. No.	Course Content	Knowledge level	No. of Hrs to be handled	Books Refered
1	Safety and Risk, Assessment of Safety and Risk	U, R &Ap	2	T1& T2
2	Risk Benefit Analysis and Reducing Risk	U, R &Ap	2	T1
3	Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest	U, R &Ap	2	T1
4	Occupational Crime, Professional Rights, Employee Rights	U, R &Ap	2	T1
5	Intellectual Property Rights (IPR) and Discrimination.	U, R &Ap	2	T1

Unit V - GE6075.5

Sl. No.	Course Content	Knowledge level	No. of Hrs to be handled	Books Refered
1	Multinational Corporations Environmental Ethics	U, R &Ap	2	T1
2	Computer Ethics Weapons Development	U, R &Ap	1	T1& T2
3	Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors	U, R &Ap	3	T1
4	Moral Leadership	U, R &Ap	2	T1
5	Code of Conduct and Corporate Social Responsibility.	U, R &Ap	2	T1

R – Remember; Ap – Apply; An – Analyze; U – Understand, E- Evaluate ,C-Create

Sl. No.	Content beyond syllabus	PO Mapping	PSO Mapping
1.	Fukushima nuclear disaster case study	PO3	PSO2,3,4
2.	Missing Malaysian flight MH370 Case Study	PO3	PSO2,3,4

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.

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2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
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4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
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6. World Community Service Centre, “Value Education”, Vethathiri publications, Erode, 2011

Web sources:

1. www.onlineethics.org
2. www.nspe.org

3. www.globalethics.org
4. www.ethics.org

UNIT I-HUMAN VALUES

PART A

1. What are human values? [Nov 2015, April 2016]

Values decide the standard of behaviour. Some universally accepted values are freedom justice and equality. Other principles of values are love, care, honesty, integrity, self-respect.

2. What are ethical values?

Trustworthiness, respect, responsibility, fairness, caring is ethical values.

3. Distinguish values from ethics and culture.

Values are mainly related to individuals and since they are related to justice, they remain the same for everyone. e.g. Truth, honesty, empathy, self-respect. Ethics is mostly based on some code or law and judgment of any action is based on code of conduct or law. Culture commonly refers to conduct of a group. e.g System of worship, marriage It may differ from society to society, nation to nation or religion to religion.

4. What is integrity?

Integrity is the unity of character based on moral values. Consistency in attitudes, emotions and conduct in relations to morally justified actions and values are also the part of integrity of individual. It implies honesty, trustworthiness. Integrity is the bridge between responsibility in private and professional life.

5. Define work ethics.

By one's work one cannot harm others. Any worker cannot escape accountability. Worker has the moral responsibility to see that no other person's right, private or freedom is impaired or transgressed.

6. What is service learning?

Service learning tells that one has moral responsibility to increase the desirable effects and to decrease the harmful effects. Any service should increase the desirable result.

7. Mention some civic virtues. [April 2014]

Good citizen demand civic virtue. It is the principle of not harming the surroundings .it also includes living peacefully, respect for others, protecting the environment and being normally and ethically good.

8. Write short notes on caring and sharing.

Caring is the essence of moral life. Caring involves feelings, relationship, contends with other persons and protecting others and causing least damage to others. Sharing means sharing of feelings, ideas thoughts, resources and profits. Sharing is always mutually beneficial. Sharing morally acceptable feelings, resources and materials is a value.

9. What is honesty?

Any human being should imbibe honesty-honesty in acts, honesty in speech and honesty in beliefs. Honesty is the fundamental virtue in human relationship even though in may be difficult to follow some times.

10. What is courage as a value? [Nov 2015]

Courage implies self-respect and governs confrontations with danger and risk. It is not excessive rashes or cowardice, but it is the middle ground. Taking calculated risks and boldness in facing crises are the hallmarks of courage as a human value. It defines the mental makeup of an individual in taking bold decisions even under adverse situations.

11. Define cooperation.

Co-operation means extending help to others, for a good cause. Co-operation may be through an idea,

a suggestion, an assistance or physical work which extends to others for common benefit.

12. Define empathy.

Empathy means putting self in a position of someone else and thinking as the later and reasoning suitable action.

13. Define spirituality.(NOV 2015)

Spirituality raises a man above the materialistic world into a realm where he seeks peace and real happiness

14. Define compromise.

In a negative sense it means to undetermined integrity by violating one's fundamental moral principles. In a positive sense, however, it means to settle differences by mutual concessions or to reconcile conflicts through adjustments in attitude and conduct.

15. List out any two aspects of honesty [April 2014]
Truthfulness – meeting responsibilities concerning truth-telling.
Trustworthiness – Meeting responsibilities concerning trust.

16. Differentiate Self-respect and Self-esteem? [Dec 2013] Self-respect: It is
a moral concept; refers to the virtue properly valuing oneself.

Self-esteem: It is a psychological concept; means having a positive attitude toward Oneself, even if the attitude is excessive or otherwise unwarranted.

17. Write the Objective of professional ethics and human values.

(i) To understand the moral values to guide the engineering profession.

(ii) Resolve the moral issue. (iii)Justify the moral judgment.
(iv)Develop a set of attitude, belief and habits.

18. Difference between Mortality and Ethics [Dec 2012]

Mortality	Ethics
Based on customs and tradition.	It is a critical reflection of moral
Concerned with wrong action when done	Concerned with right action when not done
Top Priority is given because damage is high	Less priority & less serious
Example: corruption and crime	Example: belief about manners

19. Elements of Work Ethics:

(i)Interpersonal skill (ii) Initiative (iii) Being dependable

(iv)Importance of Civic virtue: Make them understanding the responsibility

(v)It makes them understand the democratic values and bill of rights

(vi)Main goal is to produce responsible citizen and active participants in society

20. Characteristics of service learning:

(i) Links academic content and standard (ii)Promotes skill associated with team work, community involvement & citizen ship (iii)Ability to identify the critical issue in society

21. what is meant by self confidence?(Or)what are the qualities of a self confident people?(May 2016, NOV 2015)

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.

22. What is moral autonomy?

Moral autonomy can be defined as a skill and habit of thinking rationally about the ethical issues, on

the basis of moral concern. Viewing engineering as social experimentation will promote

Autonomous participation and retain one's professional identity. Periodical performance appraisals,

tight-time schedules and fear of foreign competition threatens this autonomy.

23. Distinguish between profession and professionalism.

In general 'Professionalism' relates to any work that a person does for an occupation, especially word which requires a special skill or training." Profession" means a type of job that requires special training and that brings a fairly high status.

PART B

1. Explain some important human values. [April 2014]

The five core human values are: (1) Right conduct, (2) Peace, (3) Truth, (4) Love, and (5) Nonviolence.

1. Values related to RIGHT CONDUCT are:

(*a*) SELF-HELP SKILLS: Care of possessions, diet, hygiene, modesty, posture, self reliance, and tidy appearance

(*b*) SOCIAL SKILLS: Good behavior, good manners, good relationships, helpfulness, No wastage, and good environment, and

(*c*) ETHICAL SKILLS: Code of conduct, courage, dependability, duty, efficiency, ingenuity, initiative, perseverance, punctuality, resourcefulness, respect for all, and responsibility

2. Values related to PEACE are: Attention, calmness, concentration, contentment, dignity, discipline, equality, equanimity, faithfulness, focus, gratitude, happiness, harmony, humility, inner silence, optimism, patience, reflection, satisfaction, self-acceptance, self-confidence, self-control, self-discipline, self-esteem, self-respect, sense control, tolerance, and understanding

3. Values related to TRUTH are: Accuracy, curiosity, discernment, fairness, fearlessness, honesty, integrity (unity of thought, word, and deed), intuition, justice, optimism, purity, quest for knowledge, reason, self-analysis, and sincerity, sprit of enquiry, synthesis, trust, truthfulness, and determination.

4. Values related to LOVE are: Acceptance, affection, care, compassion, consideration, dedication, devotion, empathy, forbearance, forgiveness, friendship, generosity, gentleness, humanness, interdependence, kindness, patience, patriotism, reverence, sacrifice, selflessness, service, sharing, sympathy, thoughtfulness, tolerance and trust

5. Values related to NON-VIOLENCE are:

(*a*) PSYCHOLOGICAL: Benevolence, compassion, concern for others, consideration , forbearance, forgiveness, manners, happiness, loyalty, morality, and universal love(*b*) SOCIAL: Appreciation of other cultures and religions, brotherhood, care of environment, citizenship, equality, harmlessness, national awareness, perseverance, respect for

property, and social justice. PERSEVERANCE is defined as persistence, determination, resolution, tenacity, dedication, commitment, constancy, steadfastness, stamina, endurance and indefatigability. To persevere is described as to continue, carry on, stick at it (in formal), keep going, persist, plug away, (informal), remain, stand firm, stand fast, hold on and hang on. Perseverance builds character. ACCURACY means freedom from mistake or error; conformity to truth or to a standard or model and exactness. Accuracy is defined as correctness, exactness, authenticity, truth, veracity, closeness to truth (true value) and carefulness. The value of accuracy embraces a large area and has many implications. Engineers are encouraged to demonstrate accuracy in their behavior through the medium of praise and other incentives. Accuracy includes telling the truth, not exaggerating, and taking care

over one's work.

DISCERNMENT means discrimination, perception, penetration, and insight. Discernment means the power to see what is not obvious to the average mind. It stresses accuracy, especially in reading character or motives. Discrimination stresses the power to distinguish or select what is true or genuinely excellent. Perception implies quick and often sympathetic discernment, as of shades of feelings. Penetration implies a searching mind that goes beyond what is obvious or superficial. Insight suggests depth of discernment. Definitions of other terms are given in the appropriate pages of this book.

1.2.3 Evolution of Human Values

The human values evolve because of the following factors:

1. The impact of norms of the society on the fulfillment of the individual's needs or desires.
2. Developed or modified by one's own awareness, choice, and judgment in fulfilling the needs.
3. By the teachings and practice of Preceptors (Gurus) or Saviors or religious leaders.
4. Fostered or modified by social leaders, rulers of kingdom, and by law (government).

2. Write a detailed note on work ethics.

Industry and Society are the two systems which interact with each other and are interdependent. Society requires industry/business system which provides manufacturing, distribution and consumption activities.It needs investment (capital input), labor (input), supply (raw materials), production (industries, business organizations), marketing and distribution (transport), and consumption (public, customer). A lot of transactions (and interactions) between these sub-systems involving people are needed for the welfare of the society. It is here, the work ethics plays an essential role. Work ethics is defined as *a set of attitudes concerned with the value of work, which forms the motivational orientation*. The 'work ethics' is aimed at ensuring the economy (get job, create wealth, earn salary), productivity (wealth, profit), safety (in workplace), health and hygiene (working conditions), privacy (raise family), security (permanence against contractual, pension, and retirement benefits), cultural and social development (leisure, hobby, and happiness), welfare (social work), environment (anti-pollution activities), and offer opportunities for all, according to their abilities, but without discrimination.

Many complex social problems exist in the industrial/business scenario, because:

1. The people desire to be recognized as individuals and treated with dignity, as living human beings. Work is intrinsically valuable so far as it is enjoyable or meaningful in allowing personal expression and self-fulfillment. Meaningful work is worth doing for the sense of personal identity and the self-esteem it holds.

2. Economic independence: Work is the major instrumental good in life. It is the main source of providing the income needed to avoid economic dependence on others, for obtaining desired materials and services, and for achieving status and recognition from others.

3. Pay as well as the pace of work should be in commensurate with the expertise required, acquired, and utilized in the persons. Exploitation and bargained pay should be discouraged.

4. Privacy (personal freedom) of the employee, including women, is to be protected. At the same time, confidentiality of the employer is also to be protected. Mutual trust and loyalty both ways play major roles in this aspect.

5. Security during job and upon retirement: This concept is being accepted only in government jobs, public limited companies, and corporate organizations. The western thought has influenced the Indian private industries and multinationals in a paradigm shift from 'lifelong employment' to policies such as 'merit only', 'hire and fire', 'pay and use' etc. This situation has no doubt created tension in the Indian scene.

6. Recognition to non-work activities, such as leisure, paid holiday on the day of visit of a dignitary, social service, and other developmental activities. The workers in prosperous countries are less willing to consider 'work' as their prime interest in life. They claim that such service activities give them *peace of mind* and *happiness*. However, such a trend is likely to decline the work ethics.

7. Hard work and productivity are very essential for the success of an industry. The quality of work life deserves to be improved. Hard labor, undignified jobs (human-drawn *rikshaw*, people carrying night soil), and hazardous jobs are to be made less straining, dignified, and safer. Automation and CNC systems to a large extent have been successful in lessening the human burden. Still, many a hard work cannot be replaced by 'virtual work', in the near future.

8. Employee alienation: Absence of or inadequate 'recognition and reward system' and 'grievance redressal system', lack of transparency in policy implementation, factions in trade unions etc. lead to ethical problems, affecting the work ethics. Participative management, quality circles, job rotation, and flexible working hours are some of the measures to counter this situation.

9. A different view of work ethics: Work is considered as a necessary evil. It is a thing one must do in order to avoid worse evils, such as dependency and poverty. That is a major source of anxiety and unhappiness.

10. As per the Protestant Work Ethics, the financial success is a sign that is favored by God. It means making maximal profit is a duty mandated by God. It is to be obtained rationally, diligently, and without compromising with other values such as spending time with one's family and not exploiting or harming others1

To work (job), is not for monetary considerations only. Human beings believe that it is good to

work. Work is good for the body and mind. It promotes self-respect, self-esteem, good for the family, and obligation to the society and allow the world to prosper. Work lays a moral and meaningful foundation for life. That is why, work ethics affirm s that, the work *per se* is worthy, admirable and valuable at personal and social levels. It improves the quality of life and makes life purposeful, successful, and happy. By work ethics, duties to the self, family, society, and nation are fulfilled. Rights of the individuals are respected and nourished. Values and virtues are cultivated and enjoyed by all human beings. Further, the quality of life is improved and the environment protected. On the other hand, unemployment and under-employment lead to frustration, social tensions, and occasional

militancy. For a developing economy and society, like ours, we need to *promote work ethics*, at all levels, to flourish as developed nation.

3. Explain integrity and honesty in ethics. [Nov 2015] Integrity

Integrity is defined as the unity of thought, word and deed (honesty) and open mindedness. It includes the capacity to communicate the factual information so that others can make well-informed decisions.

It yields the person's 'peace of mind', and hence adds strength and consistency in character, decisions, and actions. This paves way to one's success. It is one of the self-direction virtues. It enthuse people not only to execute a job well but to achieve excellence in performance. It helps them to own the responsibilityand earn self-respect and recognition by doing the job. Moral integrity is defined as a virtue, which reflects a consistency of one's attitudes, emotions, and conduct in relation to justified moral values.

Honesty

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.

4. Explain the importance of self confidence in ethics. (April/May 2016)
SELF-CONFIDENCE

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. List important time wasters. How can one manage time properly?

Time is rare resource. Once it is spent, it is lost for ever. It can not be either stored or recovered. Hence, time is the most perishable and most valuable resource too. This resource is continuously spent, whether any decision or action is taken or not. The history of great reformers and innovators have stressed the importance of time and valuing time. The proverbs, 'Time and tide wait for nobody' and 'Procrastination is the thief of time' amply illustrate this point.

An anecdote to highlight the 'value of time' is as follows: To realize the value of one year, ask the student who has failed in the examinations;. To realize the value of one month, ask the mother who has delivered a premature baby; to realize the value of one week, ask the editor of weekly; to realize the value of one day, ask the daily-wage laborer; to realize now the value of one hour, ask the lovers longing to meet; to realize the value of one minute, ask a person who has missed the train; to realize the value of one second, ask the person who has survived an accident; to realize the value one milli second, ask the person who has won the bronze medal in Olympics; to realize the value of one micro second, ask the NASA team of scientists; to realize the value of one nano-second, ask a Hardware engineer!; If

You have still not realized the value of time, wait; are you an Engineer?

5. Explain caring, sharing and living peacefully.[Nov 2015]
CARING

Caring is feeling for others. It is a process which exhibits the interest in, and support for, the welfare of others with fairness, impartiality and justice in all activities, among the employees, in the context of professional ethics. It includes showing respect to the feelings of others, and also respecting and preserving the interests of all others concerned. Caring is reflected in activities such as friendship, membership in social clubs and professional societies, and through various transactions in the family, fraternity, community, country and in international councils.

In the present day context, caring for the environment (including the *fauna and flora*) has become a necessity for our very survival. If we do not care for the environment, the environment will scare us.

SHARING

Primarily, caring influences 'sharing'. Sharing is a process that describes the transfer of knowledge (teaching, learning, and information), experience (training), commodities (material possession) and facilities with others. The transfer should be genuine, legal, positive, voluntary, and without any expectation in return. However, the proprietary information it should not be shared with outsiders. Through this process of sharing, experience, expertise, wisdom and other benefits reach more people faster. Sharing is voluntary and it can not be driven by force, but motivated successfully through ethical principles. In short, sharing is 'charity' for the humanity, 'sharing' is a *culture*. The 'happiness and wealth' are multiplied and the 'crimesand sufferings' are reduced, by sharing. It paves the way for peace and obviates militancy. Philosophically, the sharing maximizes the happiness for all the human beings. In terms of psychology, the fear, divide, and distrust between the 'haves' and 'have-nots' disappear. Sharing not only paves the way to prosperity, early and easily, and sustains it. Economically speaking, benefits are maximized as there is no wastage or loss, and everybody gets one's needs fulfilled and satisfied. Commercially speaking, the profit is maximized. Technologically, the productivity and utilization are maximized by sharing. In the industrial arena, code-sharing in airlines for bookings on air travels and the common Effluent Treatment Plant constructed for small-scale industries in the industrial estates, are some of the examples of sharing. The co-operative societies for producers as well as consumers are typical examples of sharing of the goods, profit and other social benefits. Here is an anecdote that illustrates the benefits of sharing, for the young minds! The shouting...the screaming…the fighting. That was the breaking point for me as I poured out my woes to my mother. "How can I get them to *share* as well as we did as kids?", I pleaded. Laughter was her reply. "Well, thanks a lot, mom," I said. "I'm sorry," she chuckled, "but you didn't always share." She went on to explain about the "Box of Misbehaved Toys." Every time we fought over a toy, she would quietly take that and put it into the box. Yes, I did remember that box. I also remember it wasn't always fair since one person may have caused all the commotion. But my mother was consistent. No matter what the reason for the struggle was, the toy disappeared into the box for one week. No questions asked, and no chance of parole. My siblings and I soon learned that sharing a toy was better than losing it. Often, one person would decide to just wait for a time when no one else was playing with the toy, rather than fight and lose it. It was not a perfect system, but I tried it anyway That box was a shock to my kids and it was close to full, within a few days…..As the weeks

progressed, I noticed the box was emptier and the arguing was less. Today, I heard quiet music to my ears as my son said to his sister, "That's OK, you can play with it." This story illustrates the worthy joy of sharing as compared to the pain of losing.

LIVING PEACEFULLY

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 can not 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:

Nurture

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.

7. Explain commitment and empathy.
COMMITMENT

Commitment means *alignment to goals and adherence to ethical principles during the activities*. First of all, one must believe in one's action performed and the expected end results (confidence). It means one should have the conviction without an iota of doubt that one will succeed. Holding sustainedinterest and firmness, in whatever ethical means one follows, with the fervent attitude and hope that one will achieve the goals, is commitment. It is the driving force to realize success. This is a basic requirement for any profession. For example, a design engineer shall exhibit a

sense of commitment, to make his product or project designed a beneficial contribution to the society. Only when the teacher (Guru) is committed to his job, the students will succeed in life and contribute 'good' to the society. The commitment of top management will naturally lead to committed employees, whatever may be their position or emoluments. This is bound to add wealth to oneself, one's employer, society, and the nation at large.

EMPATHY

Empathy is social radar. Sensing what others feel about, without their open talk, is the essence of empathy. Empathy begins with showing concern, and then obtaining and understanding the feelings of others, from others' point of view. It is also defined as the ability to put one's self into the psychological frame or reference or point of view of another, to know what the other person feels. It includes the imaginative projection into other's feelings and understanding of other's background such as parentage, physical and mental state, economic situation, and association. This is an essential ingredient for good human relations and transactions. To practice 'Empathy', a leader must have or develop in him, the following characteristics

1. *Understanding others*: It means sensing others feelings and perspectives, and taking active interest in their welfare.

2. *Service orientation*: It is anticipation, recognition and meeting the needs of the clients or customers.

3. *Developing others*: This means identification of their needs and bolstering their abilities. In developing others, the one should inculcate in him the 'listening skill' first. Communication = 22% reading and writing + 23% speaking + 55% listening One should get the feed back, acknowledge the strength and accomplishments, and then coach the individual, by informing about what was wrong, and giving correct feedback and positive expectation of the subject's abilities and the resulting performance.

4. *Leveraging diversity* (opportunities through diverse people): This leads to enhanced organizational learning, flexibility, and profitability.

5. *Political awareness*: It is the ability to read political and social currents in an organization. The benefits of empathy include:
1. Good customer relations (in sales and service, in partnering).
2. Harmonious labor relations (in manufacturing).

3. Good vendor-producer relationship (in partnering.) Through the above three, we can maximize the output and profit, as well as minimizing the loss. While dealing with customer complaints, empathy is very effective in realising the unbiased views of others and in admitting one's own limitations and failures. According to Peter Drucker, purpose of the business is not to *make a sale*, but to *make and keep a customer*. Empathy assists one in developing
Courage leading to success!

8. Explain character and spirituality and their importance in ethics. (April/May 2016)
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, 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. One should not be too dominating. Make space for everyone and learn to recognize and accept people the way they are. Variety is the order of the day. But one can influence their mind to think and act together. Spirituality is also fun. Working is okay, but you also need to have fun in office to keep yourself charged up. Tolerance and empathy are the reflections of spirituality. Blue and saffron colors are said to be associated with spirituality. 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.

UNIT II- ENGINEERING ETHICS

PART A

1. Define Ethics.

(i)Study of right or wrong (ii) Good and evil. (iii) Obligations & rights. (iv) Justice.

(v) Social & Political deals.

2. Define Engineering Ethics. [Dec 2013]

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

3. What is the need to study Ethics?

(i)To responsibly confront moral issues raised by technological activity.

(ii) To recognize and resolve moral dilemma. (iii)To achieve moral autonomy.

4. Differentiate Moral and Ethics
MORAL:

(i)Refers only to personal behaviour. (ii)Refers to any aspect of human action. (iv)Social conventions about right or wrong conduct.

ETHICS:

(i)Involves defining, analyzing, evaluating and resolving moral problems and developing moral criteria to guide human behaviour. (ii)Critical reflection on what one does and why one does it. (iii)Refers only to professional behaviour.

5. What is the method used to solve an Ethical problem?
(i)Recognizing a problem or its need.

(ii) Gathering information and defining the problem to be solved or goal to be achieved.
(iii) Generating alternative solutions or methods to achieve the goal.

(iv) Evaluate benefits and costs of alternate solutions. (v)Decision making & optimization. (vi)Implementing the best solution.

6. What are the Senses of Engineering Ethics? [April 2014]

(i)An activity and area of inquiry. (ii)Ethical problems, issues and controversies.

(iii)Particular set of beliefs, attitudes and habits. (iv)Morally correct.

7. What are the steps in confronting Moral Dilemma?
(i)Identify the relevant moral factors and reasons.
(ii) Gather all available facts that are pertinent to the moral factors involved.

(iii) Rank the moral considerations in order of importance as they apply to the situation.

(iv) Consider alternative courses of actions as ways of resolving dilemma, tracing the full implications of each.

8. What is Moral Autonomy? [Nov 2015]

(i)Self-determining (ii)Independent (iii)Personal Involvement

(iv)Exercised based on the moral concern for other people and recognition of good moral reasons

9. Give the importance of Lawrence Kohlberg's and Carol Gilligan's theory?(May 2016)
Kohlberg gives greater emphasis to recognizing rights and abstract universal rules.

Gilligan stresses the importance of maintaining personal relationships based on mutual caring.

10. Define Moral dilemmas. [Nov 2015]

Moral dilemmas are situations in which 2 or more moral obligation and ideas come into conflict with each other. Moral principles cannot be fully respected in a given situation. Solving 1 moral principle can create 2 or more conflicting applications

11. What are the types of Theories about Morality?

(i)Virtue ethics – Virtues and vices (ii) Utilitarianism – Most good for the most people
(iii)Duty ethics – Duties to respect people (iv) Rights ethics – Human rights

12. State Rawl's principles?

Each person is entitled to the most extensive amount of liberty compatible with an equal amount for others. Differences in social power and economic benefits are justified only when they are likely to benefit everyone, including members of the most disadvantaged groups.

13. Give the drawbacks of Utilitarianism?

Sometimes what is best for the community as a whole is bad for certain individuals in the community.

It is often impossible to know in advance which decision will lead to the most good.

14. Differentiate Ethical Relativism and Ethical Egoism? [Nov 2015]

Ethical egoism – The view that right action consist in producing one's own good.

Ethical relativism – The view that right action is merely what the law and customs of one's society require.

15. Define 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.

16. Give the uses of Ethical Theories?

(i)In understanding moral dilemmas. (ii)Justifying professional obligations and ideals.

(iii)Relating ordinary and professional morality.

17. What do you mean by normative ethics?

Normative ethics deals with the professional codes of ethics that specify role norms or obligations that

professions attempt to enforce. It is the recommendations of standards and guidelines for morally right or good behaviour.

18. What is moral autonomy?

Moral autonomy can be viewed as the skill and habit of thinking rationally about ethical issues on the basis of moral concern.

19. What are the attributes to a profession?

(i)Knowledge (ii)Organization (iii)Public good

20. What is descriptive ethics or non-normative ethics?

Descriptive ethics deals with the factual investigation of moral behaviour and beliefs i.e., the study not of what people ought to do but how they reason and how they act.

21.What is meant by consensus?(May 2016)

Literally, consensus means agreement and controversy means disagreement**.** When an individual exercise moral autonomy, he may not be able to attain the same results as other people obtain in

practicing their moral autonomy. Here there might be some differences in the practical application of moral autonomy.

22.What are the major limitations of codes of ethics? [Nov 2015] (i)They cannot serve as the final moral authority for professional conduct..

(ii) Engineering codes often have internal conflicts. (iii)Codes can be reproduced in a very rapid manner.(iv) Codes are said to be coercive.

23.What are the types of Industrial Standards?

(i) Quality (ii) Quality related to service. (iii) Safety (iv) Acceptance in procedures for usage
Physical properties and functions.

24. What the various types are of inquires? [Nov 2015]

(i)Normative Inquiry – Based on values. (ii)Conceptual Inquiry – Based on meaning.

(iii)Factual Inquiry – Based in facts.

PART B

1. (a). Explain the scope of Engineering Ethics. Highlight the importance of Ethics.
Scope:

Engineering is transforming science into useful products for human comfort.Engineering is something that engineers do, and what they do has profound effects on others. Ethics in engineering then is the ability as well as responsibility of an engineer to judge his decisions from the context of the general wellbeing of the society. It is the study of moral issues that confront engineers and engineering organizations when some crucial decisions are taken. Engineering research and practice requires that the task being performed considers all the pros and cons of a certain action and its implementation. Professional engineering bodies like IEEE, ASME, IEI etc., have evolved omprehensive ethics codes relevant to their respective professions, based on the rich experience of their members. Independent organizations like NSPE have prepared value based ethical codes applicable to all engineering professions. Teaching engineering ethics in academic institutions is undertaken largely through many case studies for creating awareness interactively among engineering students of all disciplines. By studying engineering ethics, the students develop awareness and assessment skill of the likely impact of their future decisions on moral and ethical grounds. Ethical standards in engineering are influenced by many factors: 1.Engineering as an experimentation for the good of mankind is a notable factor involving far reaching consequence, 2. Ethical dilemmas make engineering decisions relatively difficult to make. 3. Risk and safety of citizens as a social responsibility is a prime concern of an engineer, 4. Technological

advancement can be very demanding on the engineering skill in the global context, 5. Moral values and responsible conduct will play a crucial role in decision making.

The study of engineering ethics within an engineering program helps students prepare for their professional lives. A specific advantage for engineering students who learn about ethics is that they develop clarity in their understanding and thought about ethical issues and the practice in which they arise. The study of ethics helps students to develop widely applicable skills in communication, reasoning and reflection. These skills enhance students' abilities and help them engage with other aspects of the engineering program such as group work and work placements. Professional ethics Profession is a commitment to a designated and organized occupation by virtue of being an authority over a body of knowledge with requisite skills acquired through specialized training. An occupation becomes a profession when a group of people sharing the same occupation work together in a morally acceptable way with members setting and following a certain ethics code. A professional is a practitioner belonging to a specific profession. Professional ethics, as opposed to personal values and morality, is a set of ethical standards and values a practicing engineer is required to follow. It sets the standards for professional practice, and is only learned in a professional school or while practicing ones own profession. Today, it is an essential part of professional education because it helps students deal with issues they will face. The scope of engineering ethics envelopes diverse activities like

1. Engineering as a social experimentation
2. Engineers responsibility for safety
3. Role of engineers, managers, consultants etc.

4. Rights of engineers

5. Moral reasoning and ethical theories
6. Responsibility to employers
7. Global issues and concerns

The best way to teach engineering ethics is by using case studies—not just the disaster cases that make the news, but the kinds of cases that an engineer is more likely to encounter. Many real time cases are available or some hypothetical cases can be constructed and there are methods for analyzing them. Engineering ethics can be taught in a free-standing course, but there are strong arguments for introducing ethics in technical courses as well. If the subject of professional ethics is how members of a profession should, or should not, affect others in the course of practicing their profession, then engineering ethics is an essential aspect of engineering itself and education in professional responsibilities should be part of professional education in engineering, just as it is in law and medicine.

(b). Explain in details about the senses of Engineering Ethics.(April/May 2016)

SENSES OF ENGINEERING ETHICS

There are two different senses (meanings) of engineering ethics, namely the Normative and the

Descriptive senses. The normative sense include:

(*a*) Knowing moral values, finding accurate solutions to moral problems and justifying moral judgments in engineering practices,

(*b*) Study of decisions, policies, and values that are morally desirable in the engineering practice and research, and

(*c*) Using codes of ethics and standards and applying them in their transactions by engineers. The descriptive sense refers to what specific individual or group of engineers believe and act, without justifying their beliefs or actions.

2. (a).Discuss in detail the various types of Moral issues
(b). Specify the various types of Ethical inquiries available.[April 2014]

VARIETY OF MORAL ISSUES

It would be relevant to know why and how do moral issues (problems) arise in a profession or why do people behave unethically? The reasons for people including the employer and employees, behaving unethically may be classified into three categories:

1. Resource Crunch

Due to pressure, through time limits, availability of money or budgetary constraints, and technology decay or obsolescence. Pressure from the government to complete the project in time (e.g., before the elections), reduction in the budget because of sudden war or natural calamity (e.g., Tsunami) and

obsolescence due technology innovation by the competitor lead to manipulation and unsafe and unethical execution of projects.

Involving individuals in the development of goals and values and developing policies that allow for individual diversity, dissent, and input to decision-making will prevent unethical results.

2. Opportunity

(*a*) Double standards or behavior of the employers towards the employees and the public. The unethical behaviors of World Com (in USA), Enron (in USA as well as India) executives in 2002 resulted in bankruptcy for those companies, (*b*) Management projecting their own interests more than that of their employees. Some

organizations over-emphasize short-term gains and results at the expense of themselves and others, (*c*) Emphasis on results and gains at the expense of the employees, and (*d*) Management by objectives, without focus on empowerment and improvement of the infrastructure.

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

3. Attitude

Poor attitude of the employees set in due to

(*a*) Low morale of the employees because of dissatisfaction and downsizing, (*b*) Absence of grievance redressal mechanism,

(*c*) Lack of promotion or career development policies or denied promotions, (*d*) Lack of transparency,

(*e*) Absence of recognition and reward system, and

(*f*) Poor working environments.

Giving ethics training for all, recognizing ethical conduct in work place, including ethics in performance appraisal, and encouraging open discussion on ethical issues, are some of the directions

to promote positive attitudes among the employees9. To get firm and positive effect, ethical standards must be set and adopted by the senior management, with input from all personnel.

TYPES OF INQUIRIES

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

1. Normative Inquiry

It seeks to identify and justify the morally-desirable norms or standards that should guide individuals and groups. It also has the theoretical goal of justifying particular moral judgments. Normative questions are about what ought to be and what is good, based on moral values. For example,

1. How far does the obligation of engineers to protect public safety extend in any given situation?

2. When, if ever, should engineers be expected to blow whistle on dangerous practices of their employers?

3. Whose values ought to be primary in making judgment about acceptable risks in design for a public transport system or a nuclear plant? Is it of management, senior engineers, government, voters or all of them?

4. When and why is the government justified in interfering with the organisations?

5. What are the reasons on which the engineers show their obligations to their employees or clients or the public?

2. Conceptual Inquiry

It is directed to clarify the meaning of concepts or ideas or principles that are expressed by words or by questions and statements. For example,

(*a*) What is meant by safety?

(*b*) How is it related to risk?

(c) What is a bribe?

(*d*) What is a profession?

When moral concepts are discussed, normative and conceptual issues are closely interconnected.

3. Factual or Descriptive Inquiry

It is aimed to obtain facts needed for understanding and resolving value issues. Researchers conduct factual inquiries using mathematical or statistical techniques. The inquiry provide important information

on business realities, engineering practice, and the effectiveness of professional societies in fostering moral conduct, the procedures used in risk assessment, and psychological profiles of engineers. The facts provide not only the reasons for moral problems but also enable us to develop alterative ways of resolving moral problems. For example,

a. How were the benefits assessed?
b. What are procedures followed in risk assessment?
c. What are short-term and long-term effects of drinking water being polluted? and
d. Who conducted the tests on materials?

3. Discuss in detail about the concept of
(a).Moral Dilemmas.

MORAL DILEMMA
Definition

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

complex situations leading to moral dilemmas are:

1. The problem of *vagueness*: One is unable to distinguish between good and bad (right or wrong) principle. Good means an action that is obligatory. For example, code of ethics specifies that one should obey the laws and follow standards. Refuse bribe or accept the gift, and maintain confidentiality
2. The problem of *conflicting reasons*: One is unable to choose between two good moral solutions. One has to fix priority, through knowledge or value system.

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

2.4.2 Steps to Solve Dilemma

The logical steps in confronting moral dilemma are:

1. Identification of the moral factors and reasons. The clarity to identify the relevant moral values from among duties, rights, goods and obligations is obtained (conceptual inquiry). The most useful resource in identifying dilemmas in engineering is the professional codes of ethics, as interpreted by the professional experience. Another resource is talking with colleagues who can focus or narrow down the choice of values.

2. Collection of all information, data, and facts (factual inquiry) relevant to the situation.

3. Rank the moral options i.e., priority in application through value system, and also as obligatory, all right, acceptable, not acceptable, damaging, and most damaging etc. For example, in fulfilling responsibility, the codes give prime importance to public safety and protection of the environment, as compared to the individuals or the employers (conceptual inquiry).

4. Generate alternate courses of action to resolve the dilemma. Write down the main options and sub-options as a matrix or decision tree to ensure that all options are included.

5. Discuss with colleagues and obtain their perspectives, priorities, and suggestions on various alternatives.

6. Decide upon a final course of action, based on priority fixed or assumed. If there is no ideal solution, we arrive at a partially satisfactory or ‘satisficing’ solution.

(b).Moral Autonomy.

MORAL AUTONOMY

Moral autonomy is defined as, decisions and actions exercised on the basis of moral concern for other people and recognition of good moral reasons. Alternatively, moral autonomy means 'self determinant or independent'. The autonomous people hold moral beliefs and attitudes based on their critical reflection rather than on passive adoption of the conventions of the society or profession. Moral autonomy may also be defined as a skill and habit of thinking rationally about the ethical issues, on the basis of moral concern.

Viewing engineering as social experimentation will promote autonomous participation and retain one's professional identity. Periodical performance appraisals, tight-time schedules and fear of foreign competition threatens this autonomy. The attitude of the management should allow latitude in the judgments of their engineers on moral issues. If management views *profitability* is more important than *consistent quality and retention of the customers* that discourage the moral autonomy, engineers are compelled to seek the support from their professional societies and outside organizations for moral support. It appears that the blue-collar workers with the support of the union can adopt better autonomy than the employed professionals. Only recently the legal support has been obtained by the professional societies in exhibiting moral autonomy by professionals in this country as well as in the West. The engineering skills related to moral autonomy are listed as follows: 1. Proficiency in recognizing moral problems in engineering and ability to distinguish as well

as relate them to problems in law, economics, and religion,

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

3. Ability to form consistent and comprehensive view points based on facts,
4. Awareness of alternate responses to the issues and creative solutions for practical difficulties,

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

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

7. Maintaining moral integrity. Autonomy which is the independence in making decisions and actions, is different from authority. Authority provides freedom for action, specified within limits, depending on the situation. Moral autonomy and respect for authority can coexist. They are not against each other. If the authority of the engineer and the moral autonomy of the operator are in conflict, a consensus is obtained by the two, upon discussion and mutual understanding their limits.

4. **Discuss in details about[Nov 2015]**
(b) Kohlbergs Theory

1. Kohlberg Theory

Moral development in human being occurs overage and experience. Kohlberg suggested there are three levels of moral development, namely pre-conventional, conventional, and post-conventional, based on the type of reasoning and motivation of the individuals in response to moral questions. In the pre-conventional level, right conduct for an individual is regarded as whatever directly benefits oneself. At this level, individuals are motivated by obedience or the desire to avoid punishment or to

satisfy their own needs or by the influence by power on them. All young children exhibit this tendency. At the conventional level, people respect the law and authority. Rules and norms of one's family or group or society is accepted, as the standard of morality. Individuals in this level want to please or satisfy, and get approval by others and to meet the expectations of the society, rather than their self interest (e.g., good boy, good girl). Loyalty is regarded as most important. Many adults do not go beyond this level.

At the post-conventional level, people are called *autonomous*. They think originally and want to live by universally good principles and welfare of others. They have no self-interest. They live by principled conscience. They follow the golden rule, 'Do unto others as you would have them do unto you'. They maintain moral integrity, self-respect and respect for others. Kohlberg believed that individuals could only progress through these stages, one stage at a time.He believed that most of the moral development occurs through social interactions.

(a) Gilligans Theory

2. Gilligan's Theory

Carol Gilligan found that Kohlberg's theory had a strong male bias. According to Gilligan's studies, men had a tendency to solve problems by applying abstract moral principles. Men were found to resolve moral dilemma by choosing the most important moral rule, overriding other rules. In contrast,women gave importance to preserve personal relationships with all the people involved. The context oriented emphasis on maintaining personal relationships was called the *ethics of care*, in contrast with the *ethics of rules and rights* adopted by men. Gilligan revised the three levels of moral development of Kohlberg, as stages of growth towards

ethics of caring. The pre-conventional level, which is same as that of Kohlberg's first one, right conduct, is viewed in a selfish manner solely as what is good for oneself. The second level called *conventional level*, the importance is on not hurting others, and willing to sacrifice one's own interestand help others. This is the characteristic feature of women. At the post-conventional level, a reasoned balance is found between caring about others and pursuing the self-interest. The balance one's own need and the needs of others, is aimed while maintaining relationship based on mutual caring. This is achieved by context-oriented reasoning, rather than by hierarchy of rules.

The difference in these two theories is explained through the well-known example, *Heinz's dilemma*1. Heinz being poor and a debtor could not buy the costly medicine for his sick wife, at ten times the normal cost. Initially he begged the Pharmacist to sell at half the price or allow him to pay for it later. Pharmacist refused to oblige him either way. Finally he forcibly entered the Pharmacy and stole the drug. According to Kohlberg study, men observed that the theft was morally 'wrong' at the conventional level, because the property right was violated. But men at the post-conventional level, concluded that the theft was 'right', as the life of the human being was in danger. But women observed that Heinz was wrong. They observed that instead of stealing he could have tried other solutions (threatening or payment in installments?) to convince the Pharmacist. Gilligan however attributed the decision bywomen as context-oriented and not on the basis of rules ranked in the order of priority

7. Discuss in details the various theories about right action. (April/May 2016)

THEORIES ABOUT RIGHT ACTION (ETHICAL THEORIES)
Uses and Criteria

The ethical theories are useful in many respects.

1. In understanding moral dilemma. They provide clarity, consistency, systematic and comprehensive understanding.
2. It provides helpful practical guidance in moral issues towards the solution.
3. Justifying professional obligations and decisions, and
3. In relating ordinary and professional morality.

Different *criteria* may be applied for evaluating various ethical theories and deciding upon the best.

1. The theory must be clear and (coherent) formulated with concepts that are logically connected.
2. It must be internally consistent, i.e., none of its principles conflicts with any other
3. The theory and its defense must depend, only upon facts.

4. It must organize basic moral values in systematic and comprehensive manner. It is to fix priority of values and provide guidance in all situations

5. It must provide guidance compatible with our moral convictions (judgments) about concrete situations. For example, if an ethical theory says that it is all right for engineers to make explosive devices without the informed consent of the public, we can conclude that the theory is inadequate.

Theories and judgments are continually adjusted to each other until we reach a reflective equilibrium. Most of the theories converge towards the welfare of the humanity. The duty ethics and right ethics differ in great extent on their emphasis. But they remain complementary always.

Ethical Theories/Approaches

Several ethical theories have been developed over different times, each of them stressing certain ethical principles or features. Each stresses a view and many a times, we find that these theories converge and reinforce the ethics, in deciding upon the actions and justifying the results.

1. Utilitarian Theory
The term Utilitarianism was conceived in the 19th century by **Jeremy Bentham** and **John Stuart**

Mill

to help legislators determine which laws were morally best. They suggested that the standard of right conduct is maximization of good consequences. Good consequences mean either ‘utilities’ or the ‘balance of good over evil’. This approach weighs the costs and benefits. Right actions are the ones that produce the greatest satisfaction of the preferences of the affected persons. In analyzing an issue in this approach, we have to:

(*a*) Identify the various courses of action available to us.

(*b*) Ask who will be affected by each action and what benefits or harms will be derived from each.

(*c*) Choose the action that will produce the greatest benefits and the least harm. The ethical action is the one that provides the greatest good for the greatest number.

The ACT UTILITARIAN theory proposed by **J.S. Mill** (1806-73) focuses on actions, rather than on general rules. An action is right, if it generates the most overall good for the most people involved. The RULE UTILITARIAN theory, developed by **Richard Brandt** (1910-97), stressed on the rules, such as 'do not steal', 'do no harm others', 'do not bribe', as of primary importance. He suggested that individual actions are right when they are required by set of rules which maximizes the public good.The act utilitarian theory permitted a few immoral actions. Hence, there was need to develop rule *utilitarian theory to* establish morality and justice, in the transactions. For example, stealing an old computer from the employer will benefit the employee more than the loss to the employer. As per Act, utilitarian this action is right. But rule utilitarian observes this as wrong, because the employee should act as 'faithful agent or trustee of the employees'. In another example, some undisciplined engineers are terminated with the blame for the mistakes they have not committed. The process is unfair although this results in promotion of overall good.

2. Duty Ethics

A. The duty ethics theory, proposed by **Immanuel Kant** (1724-1804) states, that actions are consequences of performance of one's duties such as, 'being honest', 'not cause suffering of others', 'being fair to others including the meek and week', 'being grateful', 'keeping promises' etc. The stress is on the universal principle of respect for autonomy i.e., respect and rationality of persons. As per Kant we have duties to ourselves, as we are rational and autonomous beings. We have a duty not to commit suicide; a duty to develop our talents and

a duty to avoid harmful drugs. Kant insisted that moral duties are categorical imperatives. They are commands that we impose on ourselves as well as other rational beings. For example, we should be honest because honesty is required by duty. A businessman is to be honest because honesty pays — in terms of profits from customers and from avoiding jail for dishonesty.

B. On the other hand, the DUTY ethics theory, as enunciated by **John Rawl**, gave importance to the actions that would be voluntarily agreed upon by all persons concerned, assumingimpartiality. His view emphasized the autonomy each person exercises in forming agreements with other rational people. Rawl proposed two basic moral principles;

(1) each person is entitled to the most extensive amount of liberty compatible with an equal amount for others,

and (2) differences in social power and economic benefits are justified only when they are likely to benefit everyone, including members of the most disadvantaged groups. The first principle is of prime importance and should be satisfied first. Without basic liberties other economic or social benefits can not be sustained for long. The second principle insists that to allow some people with great wealth and power is justified only when all other groups are benefited. In the business scenario, for example, the free enterprise is permissible so far it

provides the capital needed to invest and prosper, thereby making job opportunities to the public and taxes to fund the government spending on the welfare schemes on the poor people.

C.W.D. Ross, the British philosopher introduced the term *prima facie duties*, which means duties might have justified exceptions. In fact, most duties are prima facie ones; some may have obligatory or permissible exceptions. Ross assumed that the prima facie duties are intuitively obvious (self-

evident), while fixing priorities among duties. He noted that the principles such as 'Do not kill' and 'protect innocent life' involve high respect for persons than other principles such as, 'Do not lie' (less harmful). This theory is criticized on the fact, that the intuitions do not provide sufficient guideline for moral duty. He has listed various aspects of Duty Ethics that reflect our moral convictions, namely: 1. Fidelity : duty to keep promises.

2. Reparation : duty to compensate others when we harm them.

3. Gratitude : duty to thank those who help us.

4. Justice : duty to recognize merit.

5. Beneficence : duty to recognize inequality and improve the condition of others.

6. Self-improvement : duty to improve virtue and intelligence.

7. Non-malfeasance : duty not to injure others.

3. Rights Theory

Rights are entitlement to act or to have another individual act in a certain way. Minimally, rights serve as a protective barrier, shielding individuals from unjustified infringement of their moral agency by others. For every right, we have a corresponding duty of non interference. A. The RIGHTS approach to ethics has its roots in the 18th century philosopher **Immanuel Kant**, who focused on the individual's right to choose for oneself. According him, what makes human beings different from mere things is, that people have dignity based on their ability to choose freely what they will do with their lives, and they have a fundamental moral right to have these choices respected. People are not objects to be manipulated; it is aviolation of human dignity to use people in ways they do not freely choose. Other rights he advocated are:

1. *The right to access the truth*: We have a right to be told the truth and to be informed about matters that significantly affect our choices.

2. *The right of privacy*: We have the right to do, believe, and say whatever we choose in our personal lives so long as we do not violate the rights of others.

3. *The right not to be injured*: We have the right not to be harmed or injured unless we freely and knowingly do something to deserve punishment or we freely and knowingly choose to risk such injuries.

4. *The right to what is agreed*: We have a right to what has been promised by those with whom we have freely entered into a contract or agreement.

B. In deciding whether an action is moral or immoral, we must ask, does the action respect the moral rights of everyone? Actions are wrong to the extent that they violate the rights of individuals; the more serious is the violation, the more wrongful is the action. The RIGHTS theory as promoted by **John Locke** states that the actions are right, if they respect human rights of every one affected. He

proposed the three basic human rights, namely *life, liberty,* and *property*. His views were reflected in the modern American society, when Jefferson

declared the basic rights as life, liberty, and pursuit of happiness. C. As per **A.I. Melden's**theory based on rights, nature mandates that we should not harm others' life, health, liberty or property.

Melden allowed welfare rights also for living a decent human life. He highlighted that the rights should be based on the social welfare system.

D. *Human rights*: Human rights are explained in two forms, namely liberty rights and welfare rights. Liberty rights are rights to exercise one's liberty and stresses duties on other people not to interfere with one's freedom. The four features of liberty rights (also called *moral rights*), which lay the base for Government Administration, are:

1. Rights are natural in so far as they are not invented or created by government.

2. They are universal, as they do not change from country to country.

3. They are equal since the rights are the same for all people, irrespective of caste, race, creed or sex.

4. They are inalienable i.e., one cannot hand over his rights to another person such as selling oneself to slavery.

4. The Virtue Theory

This emphasizes on the character rather than the rights or duties. The character is the pattern of virtues (morally-desirable features). The theory advocated by Aristotle, stressed on the tendency to act at proper balance between extremes of conduct, emotion, desire, attitudes to find the golden mean between the extremes of 'excess' or 'deficiency'. The examples shown below illustrate the theory: On the other hand, the Virtue Theory proposed by **Mac Intyre**, highlighted on the actions aimed at achieving common good and social (internal) good such as social justice, promotion of health, creation of useful and safe technological products and services. Five types of virtues that constitute responsible professionalism, namely public-spirited virtues, proficiency virtues, team-work virtues,self-governance virtues, and cardinal virtues are discussed in # 2.10.3.

5. Self-realisation Ethics

Right action consists in seeking self-fulfillment. In one version of this theory, the self to be realized is defined by caring relationships with other individuals and society. In another version called *ethical egoism,* the right action consists in always promoting what is good for oneself. No caring and society relationships are assumed.

6. Justice (Fairness) Theory

The justice or fairness approach to ethics has its roots in the teachings of the ancient Greek philosopher

Aristotle, who said that "equals should be treated equally and unequals unequally." The basic moral question in this approach is: How fair is an action? Does it treat everyone in the same way, or does it show favoritism and discrimination?

Issues create controversies simply because we do not bother to check the fairness or justice. Favoritism gives benefits to some people without a justifiable reason for singling them out; discrimination imposes burdens on people who are no different from those on whom burdens are not imposed. Both favoritism and discrimination are unjust and wrong.

8. Explain in detail the traits of Self Interest, Customs and Religions.

SELF-INTEREST

Self-interest is being good and acceptable to oneself. It is pursuing what is good for oneself. It is very ethical to possess self-interest. As per utilitarian theory, this interest should provide for the respect of others also. Duty ethics recognizes this aspect as duties to ourselves. Then only one can help others.Right ethicist stresses our rights to pursue our own good. Virtue ethics also accepts the importance of self-respect as link to social practices.In Ethical Egoism, the self is conceived in a highly individualistic manner. It says that every one of us should always and only promote one's own interest. The ethical egoists do not accept the well being of the community or caring for others. However this self interest should not degenerate into egoism or selfishness, i.e., maximizing only own good in the pursuit of self-interest. The ethical egoists hold that the society benefits to maximum when (a) the individuals pursue their personal good and (b) the individual organizations pursue maximum profit in a competitive enterprise. This is claimed to improve the economy of the country as a whole, besides the individuals. In such pursuits, both individuals and organizations should realize that independence is not the only important value. We are also interdependent, as much as independent. Each of us is vulnerable in the society. Self-respect includes recognition of our vulnerabilities and interdependencies. Hence, it is compatible with caring for ourselves as well as others. Self-interest is necessary initially to begin with. But it should be one of the prime motives for action; the other motive is to show concern for others, in the family as well as society. One's self-

interest should not harm others. The principles of 'Live and let (others) live', and 'reasonably fair competition' are recommended to professionals by the ethicists.

CUSTOMS

Ethical Pluralism: Various cultures in our pluralistic society lead to tolerance for various customs, beliefs, and outlooks. Accordingly ethical pluralism also exists. Although many moral attitudes appear to be reasonable, the rational and morally concerned people can not fully accept any one of the moral perspectives. There are many varied moral values, which allow variation in the understanding and

application of values by the individuals or groups in their everyday transactions. It means that even reasonable people will not agree on all moral issues and professional ethics.

Ethical Relativism: According to this principle, actions are considered morally right when approved by law or custom, and wrong when they violate the laws or customs. The deciding factor is the law or the customs of the society. Should we accept the principle of relativism or not? A few reasons to accept this are explained in the following paragraphs:

1. Laws appear to be objective ways for judging values. The laws and customs tend to be definite, clear and real, but not always. Further moral reasons allow objective criticism of laws, as being morally lacking. For example, the Apartheid laws of South Africa violated the human rights of the

native Africans. No legal protection was available for native citizens for a long time. Now, of course, these laws have been repealed.

2. Ethical relativism assumes that the values are subjective at the cultural level. Moral standards also vary from culture to culture. The objectivity is supported by the existing laws of that society. The relative morality accepted, supports the virtue of tolerance of differences among societies. This argument is also not fully acceptable. As per ethical relativism, the actions and laws of the Nazis and Hitler who vowed on Anti-Semitism and killed several million Jews would be accepted as right.

3. Moral relationalism or moral contextualism: According to this, the moral judgments must be made in relation to certain factors, which may vary from case to case. The morally important factors for making judgments include the customs and laws. The virtue ethicists hold that the practical wisdom should prevail upon assessing the facts and in the judgment. This principle was accepted by the early anthropologists because they had a specific tendency to over-stress the scope of moral difference between cultures. The human sacrifices and cannibalism were accepted. But the modern anthropologists insist that all cultures shall exhibit the virtue of social welfare and safety against needless death or physical or mental harm. Moral differences were based on the circumstances and facts and not on the difference

in moral attitudes. For example, the pharaohs buried the live attendants along with their dead king with the belief that they would continue to serve the king in his after life.

RELIGION

Religions have played major roles in shaping moral views and moral values, over geographical regions. Christianity has influenced the Western countries, Islam in the Middle-East countries, Buddhism and Hinduism in Asia, and Confucianism in China. Further, there is a strong psychological link between the moral and religious beliefs of people following various religions and faiths. Religions support moral responsibility. They have set high moral standards. Faith in the religions provides trust and this trust inspires people to be moral. The religions insist on tolerance and moral concern for others. Many professionals who possess religious beliefs are motivated to be morally responsible. Each religion lays stress on certain high moral standards. For example, Hinduism holds polytheistic (many gods) view, and virtues of devotion and surrender to high order. Christianity believes in one deity and emphasizes on virtues of Love, Faith, and Hope. Buddhism is non-theistic and focuses on compassion and Islam on one deity and adherence of ishan (piety or pursuit of excellence) and prayer. Judaism stresses the virtue of ‘tsedakah’ (righteousness). But many religious sects have adopted poor moral standards, e.g., many religious sects do not recognize equal rights for women. The right to worship is denied for some people. People are killed in the name of or to promote religion. Thus, conflicts exist between the ‘secular’ and religious people and between one religion and another. Hence, religious views have to be morally scrutinized.

9. Explain in detail about Professional and Professionalism.[April 2014]

2.8 PROFESSION

2.8.1 Definitions

A. PROFESSION is defined as any occupation/job/vocation that requires advanced expertise (skills and knowledge), self-regulation, and concerted service to the public good. It brings a high status, socially and economically. The characteristics of a profession are:

1. *Advanced expetise*: Many professions require sophisticated skills (do-how) and theoretical knowledge (know-how and why). Formal education, training, continuing education, updating are needed.
2. *Self regulation*: Professional societies play important role in setting standards for admission to profession, drafting codes of ethics, enforcing standards of conduct, and representing the profession before the public and the government.
3. *Public good*: The occupation provides some important public good, by concerted efforts to maintain ethical standards. For example, a physician promotes health, a lawyer protects the legal rights, an engineer provides a product or a project for use by the public towards their health, welfare, and safety. Teaching is also claimed as a profession as it helps shaping and training the minds of the students, young as well as old.

Some argue that jobs such as carpenter, barbers, porters, and drivers are to be recognized as professions. It is open for discussion. Such things can not be decided by referring to dictionary alone. A thorough analysis of the activities expected of these jobs is to be made and checked with explanation of the requirements of a profession before deciding it as profession. For example, having been engaged for driving one's vehicle is not a profession. But an ace driver who is engaged by a travel agency to drive different types of cars for tourists extends courtesy to the customers, requires education, expertise (a valid driving license), and respect to the public. His job may be termed as a profession. A mercenary is not a professional as he acts against public good

B. PROFESSIONAL relates to a person or any work that a person does on profession, and which requires expertise (skills and knowledge), self regulation and results in public good. The term professional means a 'person' as well as a 'status'.

C. PROFESSIONALISM: It is the status of a professional which implies certain attitudes or typical qualities that are expected of a professional. According to **Macintyre**, professionalism is defines as the *services related to achieving the public good, in addition to the practices of the knowledge of moral ideals.*

The *criteria* for achieving and sustaining professional status or professionalism are:

1. *Advanced expertise*: The expertise includes sophisticated skills and theoretical knowledge in exercising judgment. This means a professional should analyse the problem in specific known area, in an objective manner.

2. *Self-regulation*: One should analyse the problem independent of self-interest and direct to a decision towards the best interest of the clients/customers. An autonomous judgment (unbiased and on merits only) is expected. In such situations, the codes of conduct of professional societies are followed as guidance.

3. *Public good*: One should not be a mere paid employee of an individual or a teaching college or manufacturing organization, to execute whatever the employer wants one to do. The job should be recognised by the public. The concerted efforts in the job should be towards promotion of the welfare, safety, and health of the public.

UNIT III-ENGINEERING AS SOCIAL EXPERIMENTATION

PART A

1. What are the conditions required to define a valid informed consent? [April 2013,Nov 2015]
(i)The consent was given voluntarily.

(ii) The consent was based on the information that rational person would want, together with any other information requested, presented to them in understandable form.

(iii) The consenter was competent to process the information and make rational decisions.

2. What are the two main elements which are included to understand informed consent? Informed Consent is understood as including two main elements:

(i) Knowledge [Subjects should be given not only the information they request, but all the information needed to make a reasonable decision].

(ii) Voluntariness [Subjects must enter into the experiment without being subjected to force, fraud, or deception].

3. What are the general features of morally responsible engineers?
(i)Conscientiousness. (ii)Comprehensive perspective. (iii)Autonomy. (iv)Accountability.

4. What is the purpose of various types of standards?
(i)Accuracy in measurement, interchangeability, ease of handling.
(ii) Prevention of injury, death and loss of income or property.

(iii) Fair value of price. (iv)Competence in carrying out tasks.(v)Sound design, ease of communications. (vi) Freedom from interference.

5. Define Code?
Code is a set of standards and laws.

6. Enumerate the roles of codes? [April 2014]

(i)Inspiration and Guidance (ii) Support (iii)Deterrence and Discipline (iv)Education and Mutual Understanding (v)Contributing to the Profession's Public Image (vi)Protecting the Status Quo vii)Promoting Business Interests

7. Give the limitations of codes?(May 2016)
(i)Codes are restricted to general and vague wording.

(ii) Codes can't give a solution or method for solving the internal conflicts.
(iii) Codes cannot serve as the final moral authority for professional conduct. (iv) Codes can be reproduced in a very rapid manner.

8. What are the problems with the law in engineering?
a. Minimal compliance b. Many laws are without enforceable sanctions.

9. What is the need to view engineering projects as experiments? (i)Any project is carried out in partial ignorance.

(ii) The final outcomes of engineering projects, like those of experiments, are generally uncertain.

(iii) Effective engineering relies upon knowledge gained about products before and after they leave the factory – knowledge needed for improving current products and creating better ones.

10. Differentiate scientific experiments and engineering projects?(May 2016)

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

11. What are the uncertainties occur in the model designs? [Nov 2015]

(i)Model used for the design calculations. (ii)Exact characteristics of the materials purchased.

(iii)Constancies of materials used for processing and fabrication.

(iv)Nature of the pressure, the finished product will encounter.

12. Comment on the importance of learning from the past, using Titanic disaster, as an Example?

The Titanic lacked a sufficient number of lifeboats.

13. Comment on the importance of learning from the past, using the nuclear reactor accident at Three Mile Island, as an example?

Values are notorious for being among the least reliable components of hydraulic systems. It was a pressure relief valve, and lack of definitive information regarding its open or shut state. Similar Malfunctions had occurred with the identical values on nuclear reactors because of the same reasons at other locations, but no attention had been given to them.

14. Give any two prominent features of contemporary engineering practice that differentiate casual influence and moral accountability in engineering?
(i) Large-scale engineering projects involve fragmentation of work.

(ii) Due to the fragmentation of the work, the accountability will spread widely within the organization

(iii) There is frequently pressure to move on to a new project before the current one has been operating long enough to be observed carefully.

(iv) The contagion of malpractice suits currently afflicting the medical profession is carrying over into engineering.

15. Define Whistle Blowing. [Nov 2015]

This is an act by an employee of informing the public or higher management of unethical or illegal behaviour by an employee or supervisor.

16. What is meant by Engineering Experimentation?

(i)Engineers involve in research experimentation and testing of new products.

(ii) Appling various experimental producers is called experimentation.
(iii) Every stage of product development, experiments are conducted.
(iv) One can view Engineering work & project as experiment.

17. State the importance of Ethical codes. [Nov 2015] (i)To provide framework for ethical judgment.

(ii) Express the ethical principles and standards in an understanding manner.
(iii) It defines the role of responsibilities of professions.
(iv) Applying moral ethical principles in critical situation.
(v) Codes are well established and widely accepted in society.

18. State General features of morally responsible engineers.

(i)A conscientious commitment to live by moral values: protect the safety of human respect.

(ii) A Comprehensive perspective: Constant awareness of the experimental nature.
(iii) Autonomy: Personally motivated to have dedicated involvement in the project.
(iv) Accountability: Accountable for the results of the project.

19. What are the two elements of two informed consent?

Knowledge: Person who participates in the experiments should be given all the information to make a reasonable decision.

Voluntariness: Person should not be forced and he should have willingness to volunteer himself.

20. In what ways engineering experiment differs from standard experiments.

Final outcomes of engineering projects may also lead to unexpected problems that may endanger life. Similar to Standards experiment, engineering experiments requires knowledge about the product at the pre-production& post production stages.

PART B

1. How can engineer become a responsible experimenter? Highlight the code of ethics for Engineers. (April/May 2016)

Although the engineers facilitate experiments, they are not alone in the field. Their responsibility is shared with the organizations, people, government, and others. No doubt the engineers share a greater responsibility while monitoring the projects, identifying the risks, and informing the clients and the public with facts. Based on this, they can take decisions to participate or protest or promote.

The engineer, as an experimenter, owe several responsibilities to the society, namely,

1. A conscientious commitment to live by moral values.
2. A comprehensive perspective on relevant information. It includes constant awareness of the progress of the experiment and readiness to monitor the side effects, if any.
3. Unrestricted free-personal involvement in all steps of the project/product development (autonomy).
4. Be accountable for the results of the project (accountability).

Conscientiousness

Conscientious moral commitment means: (a) Being sensitive to full range of moral values and responsibilities relevant to the prevailing situation and (b) the willingness to develop the skill and put efforts needed to reach the best balance possible among those considerations. In short, engineers must possess open eyes, open ears, and an open mind (i.e., moral vision, moral listening, and moral reasoning).

This makes the engineers as social experimenters, respect foremost the safety and health of the affected, while they seek to enrich their knowledge, rush for the profit, follow the rules, or care for only the beneficiary. The human rights of the participant should be protected through voluntary and informed consent.

Comprehensive Perspective

The engineer should grasp the context of his work and ensure that the work involved results in only moral ends. One should not ignore his conscience, if the product or project that he is involved will result in damaging the nervous system of the people (or even the enemy, in case of weapon development)

A product has a built-in obsolete or redundant component to boost sales with a false claim. In possessing of the perspective of factual information, the engineer should exhibit a moral concern and not agree for this design. Sometimes, the guilt is transferred to the government or the competitors. Some organizations think that they will let the government find the fault or let the fraudulent competitor be caught first. Finally, a full-scale environmental or social impact study of the product or project by individual engineers is useful but not possible, in practice.

Moral Autonomy

A detailed discussion is available in # 2.5. Viewing engineering as social experimentation, and anticipating unknown consequences should promote an attitude of questioning about the adequacy of the existing economic and safety standards. This proves a greater sense of personal involvement in one's work.

Accountability

The term Accountability means:

1. The capacity to understand and act on moral reasons

2. Willingness to submit one's actions to moral scrutiny and be responsive to the assessment of others. It includes being answerable for meeting specific obligations, i.e., liable to justify (or give reasonable excuses) the decisions, actions or means, and outcomes (sometimes unexpected), when required by the stakeholders or by law.

The tug-of-war between of causal influence by the employer and moral responsibility of the employee is quite common in professions. In the engineering practice, the problems are:

(*a*) The fragmentation of work in a project inevitably makes the final products lie away from the immediate work place, and lessens the personal responsibility of the employee.

Further the responsibilities diffuse into various hierarchies and to various people.

(*b*) Nobody gets the real feel of personal responsibility.

(*c*) Often projects are executed one after another. An employee is more interested in adherence of tight schedules rather than giving personal care for the current project.

More litigation is to be faced by the engineers (as in the case of medical (*d*) practitioners).

This makes them wary of showing moral concerns beyond what is prescribed by the institutions. In spite of all these shortcomings, engineers are expected to face the risk and show up personal responsibility as the profession demands.

2. What is the important code of ethics? Give brief account on '4'canons of codes of ethics quoted by international standard or association

CODES OF ETHICS

The codes of ethics have to be adopted by engineering societies as well as by engineers. These codes exhibit the rights, duties, and obligations of the members of a profession. Codes are the set of laws and standards. A code of ethics provides a framework for ethical judgment for a professional. A code cannot be said as totally comprehensive and cover all ethical situations that an engineer has to face. It serves only as a starting point for ethical decision-making. A code expresses the circumstances to

ethical conduct shared by the members of a profession. It is also to be noted that ethical codes do not establish the new ethical principles. They repeat only the principles and standards that are already accepted as responsible engineering practice. A code defines the roles and responsibilities of professionals.

Roles of codes and its functions

1. Inspiration and Guidance

Codes give a convinced motivation for ethical conduct and provide a helpful guidance for achieving the obligations of engineers in their work. Codes contribute mostly general guidance as they have to be brief. Specific directions may also be given to apply the code in morally good ways. The following engineering societies have published codes of ethics. AAES - American Association of Engineering Societies

ABET - Accreditation Board for Engineering and Technology (USA)

NSPE - National Society of Professional Engineer (USA)

IEEE - Institute of Electrical and Electronics Engineering (USA)

AICTE - All India Council for Technical Education (India)

Most of the technological companies have established their own codes such as pentagon (USA), Microsoft etc. These codes are very much helpful to strengthen the moral issues on the work of an engineer.

2. Support

Codes always support an engineer who follows the ethical principles. Codes give engineers a positive, a possible good support for standing on moral issues. Codes also serve as a legal support for engineers.

3. Deterrence and Discipline

Codes act as a deterrent because they never encourage to act immorally. They also provide discipline among the Engineers to act morally on the basis of codes does not overrule the rights of those being investigated.

4. Education and Mutual Understanding

Codes have to be circulated and approved officially by the professionals, the public and government organizations which concern with the moral responsibilities of engineers and organizations.

5. Contributing to the profession's Public Image

Codes help to create a good image to the public of an ethically committedprofession. It helps the engineers in an effective manner to serve the public. They also gives self-regulation for the profession itself.

6. Protecting the Status Quo

Codes determine ethical conventions which help to create an agreed upon minimum level of ethical conduct. But they can also suppress the disagreement within the profession.

7. Promoting Business Interests

Codes help to improve the business interests. They help to moralize the business dealings to benefit

those within the profession.

Limitations of Codes

1.Codes are restricted to general and vague wordings. Due to this limitation they cannot be applicable to all situations directly. It is also impossible to analyze fully and predict the full range of moral problems that arises in a complex profession.

2.Engineering codes often have internal conflicts. So they can't give a solution or method for resolving the conflict.

3.They cannot be treated as the final moral authority for any professional conduct. Codes represent a compromise between differing judgments and also developed among heated committee disagreements.

4.Only a few practicing engineers are the members of Professional Societies and so they can not be compelled to abide by their codes.

5.Many engineers who are the members of Professional Societies are not aware of the existence of the codes of their societies and they never go through it.

6.Codes can be reproduced in a very rapid manner.

7.Codes are said to be coercive i.e., implemented by threat or force.

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 an 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.

3. Discuss on the roles played by the codes of ethics set by professional societies. (April/May 2016)

The 'codes of ethics' exhibit, rights, duties, and obligations of the members of a profession and a professional society. The codes exhibit the following essential roles:

1.*Inspiration and guidance*. The codes express the collective commitment of the profession toethical conduct and public good and thus inspire the individuals. They identify primary responsibilities and provide statements and guidelines on interpretations for the professionals

and the professional societies.

2.*Support to engineers*. The codes give positive support to professionals for taking stands onmoral issues. Further they serve as potential legal support to discharge professional obligations.

3.*Deterrence (discourage to act immorally)* and discipline (regulate to act morally). The codes serve as the basis for investigating unethical actions. The professional societies sometimes revoke membership or suspend/expel the members, when proved to have acted unethical. This sanction along with loss of respect from the colleagues and the society are bound to act as deterrent.

4.*Education and mutual understanding*. Codes are used to prompt discussion and reflection on moral issues. They develop a shared understanding by the professionals, public, and the government on the moral responsibilities of the engineers. The Board of Review of the professional societies *encourages moral discussion for educational purposes*.

5.*Create good public image.* The codes present positive image of the committed profession tothe public, help the engineers to serve the public effectively. They promote more of self regulation and lessen the government regulations. This is bound to raise the reputation of the profession and the organization, in establishing the trust of the public.

6.*Protect the status quo*. They create minimum level of ethical conduct and promotes agreementwithin the profession. Primary obligation namely the safety, health, and welfare of the public, declared by the codes serves and protects the public.

7.*Promotes business interests*. The codes offer inspiration to the entrepreneurs, establish sharedstandards, healthy competition, and maximize profit to investors, employees, and consumers.

4. Compare and contrast engineering experiments with standard experiments. 3.0.1 Engineering Projects VS. Standard Experiments

We shall now compare the two activities, and identify the similarities and contrasts.

A. Similarities

1. *Partial ignorance*: The project is usually executed in partial ignorance. Uncertainties exist in

   the model assumed. The behavior of materials purchased is uncertain and not constant (that is certain!). They may vary with the suppliers, processed lot, time, and the process used in

   shaping the materials (e.g., sheet or plate, rod or wire, forged or cast or welded). There may be variations in the grain structure and its resulting failure stress. It is not possible to collect

   data on all variations. In some cases, extrapolation, interpolation, assumptions of linear behavior over the range of parameters, accelerated testing, simulations, and virtual testing

   are resorted.

2. *Uncertainty*: The final outcomes of projects are also uncertain, as in experiments. Some times unintended results, side effects (bye-products), and unsafe operation have also occurred. Unexpected risks, such as undue seepage in a storage dam, leakage of nuclear radiation from an atomic power plant, presence of pesticides in food or soft drink bottle, an new irrigation

   canal spreading water-borne diseases, and an unsuspecting hair dryer causing lung cancer on the user from the asbestos gasket used in the product have been reported.

3. *Continuous monitoring*: Monitoring continually the progress and gaining new knowledgeare needed before, during, and after execution of project as in the case of experimentation.

   The performance is to be monitored even during the use (or wrong use!) of the product by the end user/beneficiary.

4. *Learning from the past*: Engineers normally learn from their own prior designs and inferfrom the analysis of operation and results, and sometimes from the reports of other engineers.

   But this does not happen frequently. The absence of interest and channels of communication, ego in not seeking information, guilty upon the failure, fear of legal actions, and mere negligence have caused many a failure, e.g., the Titanic lacked sufficient number of life

boats—it had only 825 boats for the actual passengers of 2227, the capacity of the ship being 3547! In the emergent situation, all the existing life boats could not be launched. Forty years back, another steamship Arctic met with same tragedy due to the same problem in the

same region. But the lesson was learned. In most of the hydraulic systems, valves had been the critical components that are least reliable. The confusion on knowing whether the valve was open or closed, was the cause of the Three-Mile Island accident in 1979. Similar

malfunctioning of valves and mis-reading of gauges have been reported to have caused the accidents else where in some power plants. But we have not learnt the lesson from the past. The complacency that it will not happen again and will not happen 'to me' has lead to many disasters.

B. Contrasts

The scientific experiments in the laboratory and the engineering experiments in the filed exhibit several

contrasts as listed below:

1.*Experimental control*: In standard experiments, members for study are selected into two groups namely A and B at random. Group A are given special treatment. The group B is given no treatment and is called the 'controlled group'. But they are placed in the same environment as the other group A.

This process is called the *experimental control*. This practice is adopted in the field of medicine. In engineering, this does not happen, except when the project is confined to laboratory experiments. This is because it is the clients or consumers who choose the product, exercise the control. It is not possible to make a random selection of participants from various groups. In engineering, through random sampling, the survey is made from among

the users, to assess the results on the product. .

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

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

1. *Knowledge*: The subject should be given all relevant information needed to make thedecision to participate.

2. *Voluntariness*: Subject should take part without force, fraud or deception. Respect forrights of minorities to dissent and compensation for harmful effect are assumed here.

1. Consent must be voluntary

2. All relevant information shall be presented/stated in a clearly understandable form

3. Consenter shall be capable of processing the information and make rational decisions.

4. The subject's consent may be offered in proxy by a group that represents many subjects of like-interests

Informed consent when bringing an engineering product to market, implies letting the customer know the following: (*a*) the knowledge about the product (*b*) risks and benefits of using the product and (*c*) all relevant information on the product, such as how to use and how not to use (do's and don'ts). The relevant factual information implies, that the engineers are obliged to obtain and assess all the available information related to the fulfillment of one's moral obligations (i.e., wrong or immoral use of a product one designs), including the intended and unintended impacts of the product, on the society. Still there exists a possibility of a large gap of understanding between the experimenter and the subjects (public). Sometimes, the managements have not been willing to disseminate the full information about the project or product beyond the legal requirements, because of the fear of potential competitions and likely exposure to potential litigation.

People object to *involuntary risks* wherein the affected individual is neither a direct participant nor a decision maker. In short, we prefer to be the subjects of our own experiments rather than those of somebody else. If it is an asbestos plant or nuclear plant to be approved, affected parties expect their consent to be obtained. But they are ready to accept *voluntary* risks as in the case of stunts and amazing races.

In case of Koodangulam power project as well as the Sethusamudram Canal Project, Tamil Nadu, several citizen groups including Fishermen Forums have responded. The Central government was able contain many harsh apprehensions and protracted legal and political battles, by providing all relevant information.

4. *Knowledge gained*: Not much of new knowledge is developed in engineering experiments as

in the case of scientific experiments in the laboratory. Engineering experiments at the most help us to (*a*) verify the adequacy of the design, (*b*) to check the stability of the design parameters, and (*c*) prepare for the unexpected outcomes, in the actual field environments.

From the models tested in the laboratory to the pilot plant tested in the field, there are differences in performance as well as other outcomes.

5.Explain with help of examples of that engineers would learn not only from their Earlier design and operating results, but also from those of those of engineers of other engineers.

What happened?

The orbiter of the Challenger had three main engines fuelled by liquid hydrogen. The fuel was carried in an external fuel tank which was jettisoned when empty. During lift-off, the main engines fire for about nine minutes, although initially the thrust was provided by the two booster rockets. These booster rockets are of the solid fuel type, each burning a million pound load of aluminum, potassium chloride, and iron oxide.

The casing of each booster rocket is about 150 feet long and 12 feet in diameter. This consists of cylindrical segments that are assembled at the launch site. There are four-field joints and they use seals

consisting of pairs of O-rings made of vulcanized rubber. The O-rings work with a putty barrier made of zinc chromate.

The engineers were employed with Rockwell International (manufacturers for the orbiter and main rocket), **Morton-Thiokol** (maker of booster rockets), and they worked for NASA. After many postponements, the launch of Challenger was set for morning of Jan 28, 1986. **Allan J. McDonald** was an engineer from Morton-Thiokol and the director of the Solid Rocket Booster Project. He was skeptic about the freezing temperature conditions forecast for that morning, which was lower than the previous launch conditions. A teleconference between NASA engineers and MT engineers was arranged by Allan.

Arnold Thompson and **Roger Boisjoly**, the seal experts at MT explained to the other engineershow the booster rocket walls would bulge upon launch and combustion gases can blow past the O-rings of the field joints (Fig. 3.2).

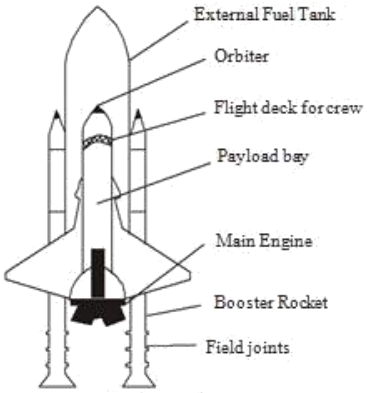

Fig. 3.2 a Challenger

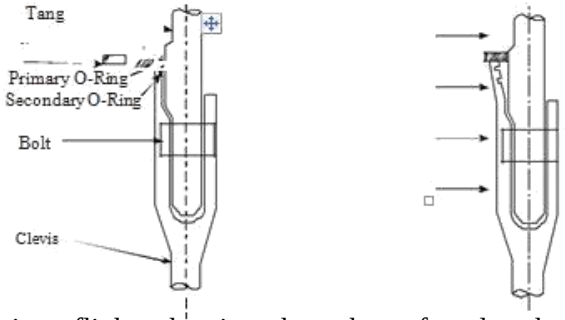

Fig. 3.2 b Field joint before ignition Fig. 3.2 c Field joint after ignition

On many of the previous flights the rings have been found to have charred and eroded. In freezing temperature, the rings and the putty packing are less pliable. From the past data gathered, at temperature less than 65 $^{\circ}$F the O-rings failure was certain. But these data were not deliberated at that conference as the launch time was fast approaching.

The engineering managers **Bob Lund** and **Joe Kilminster** agreed that there was a safety problem. Boisjoly testified and recommended that no launch should be attempted with temperature less than 53 $^{\circ}$F. These managers were annoyed to postpone the launch yet again. The top management of MT was planning for the renewal of contract with NASA, for making booster rocket. The managers told Bob Lund "to take-off the engineering hat and put on your management hat". The judgment of the engineers was not given weightage. The inability of these engineers to substantiate that the launch would be unsafe was taken by NASA as an approval by Rockwell to launch.

At 11.38 a.m. the rockets along with Challenger rose up the sky. The cameras recorded smoke coming out of one of the filed joints on the right booster rocket. Soon there was a flame that hit the external fuel tank. At 76 seconds into the flight, the Challenger at a height of 10 miles was totally engulfed in a fireball. The crew cabin fell into the ocean killing all the seven aboard.

Some of the factual issues, conceptual issues and moral/normative issues in the space shuttle challenger incident, are highlighted hereunder for further study.

3.5.2 Moral/Normative Issues

1. The crew had no escape mechanism. Douglas, the engineer, designed an abort module to allow the separation of the orbiter, triggered by a field-joint leak. But such a 'safe exit' was rejected as too expensive, and because of an accompanying reduction in payload.

2. The crew were not informed of the problems existing in the field joints. The principle of informed consent was not followed.

3. Engineers gave warning signals on safety. But the management group prevailed over and ignored the warning.

3.5.3 Conceptual Issues

1. NASA counted that the probability of failure of the craft was one in one lakh launches. But it was expected that only the 100000th launch will fail.

2. There were 700 criticality-1 items, which included the field joints. A failure in any one of them would have caused the tragedy. No back-up or stand-bye had been provided for these criticality-1 components.

3.5.4 Factual/Descriptive Issues

1. Field joints gave way in earlier flights. But the authorities felt the risk is not high.

2. NASA has disregarded warnings about the bad weather, at the time of launch, because they wanted to complete the project, prove their supremacy, get the funding from Government continued and get an applaud from the President of USA.

The inability of the Rockwell Engineers (manufacturer) to prove that the lift-off was unsafe. This was interpreted by the NASA, as an approval by Rockwell to launc

6. Explain in detail about engineers as responsible experimenters

ENGINEERS AS RESPONSIBLE EXPERIMENTERS

The engineers have so many responsibilities for serving the society.

2. A primary duty is to protect the safety of human beings and respect their right of consent. [A conscientious commitment to live by moral values].

3. Having a clear awareness of the experimental nature of any project, thoughtful forecasting of its possible side effects, and an effort to monitor them reasonably. [A comprehensive perspective or relative information].

4. Unrestricted free personal involvement in all the steps of a project. [Autonomy]

5. Being accountable for the results of a project [Accountability]

6. Exhibiting their technical competence and other characteristics of professionalism.

Conscientiousness

Conscientiousness implies consciousness (sense of awareness). As holding the responsible profession with maintaining full range moral ethics and values which are relevant to the situation. In order to understand the given situation, its implications, know-how, person who is involved or affected, Engineers should have open eyes, open ears and open mind.

The present working environment of engineers, narrow down their moral vision fully with the obligations accompanied with the status of the employee. More number of engineers are only salaried employees, so, they have to work within large bureaucracies under great pressure to work smoothly within the

company. They have to give importance only to the obligations of their employers. Gradually, the small negative duties such as not altering data by fraud, not violating patent right and not breaking confidentiality, may be viewed as the full extent of moral desire.

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

The social experimentation that involved in engineering should be restricted by the participants consent.

Relevant Information

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

8. To understand and grasp the circumstance of a person's work, it is necessary to know about how that work has a moral importance. For example, A person is trying to design a good heat exchanger. There is nothing wrong in that. But at the same time, if he forgets the fact that the heat exchanger will be used in the manufacture of an illegal product, then he is said to be showing a lack of moral concern. So a person must be aware of the wider implication of his work that makes participation in a project.

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

The above said means, neglecting the importance of a person's works also makes it difficult in acquiring a full perspective along a second feature of factual information i.e., consequence of what one does.

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

Moral Autonomy

This refers to the personal involvement in one's activities. People are morally autonomous only when their moral conduct and principles of actions are their own i.e., genuine in one's commitment to moral values.

Moral beliefs and attitudes must be integrated into an individual's personality which leads to a committed action. They cannot be agreed formally and adhered to merely verbally. So, the

individual principles are not passively absorbed from others. When he is morally autonomous and also his actions are not separated from himself.

When engineering have seen as a social experimentation, it helps to keep a sense of

autonomous participation in a person's work. An engineer, as an experimenter, is undergoing training

which helps to form his identity as a professional. It also results in unexpected consequence which helps to inspire a critical and questioning attitudes about the current economic and safety standards.

This also motivates a greater sense of personal involvement in a person's work.

Accountability

The people those who feel their responsibility, always accept moral responsibilities for their

actions. It is known as accountable. In short, 'accountable' means being culpable and hold responsible

for faults. In general and to be proper, it means the general tendency of being willing to consider

one's actions to moral examinations and be open and respond to the assessment of others. It comprises a desire to present morally convincing reasons for one's conduct when called upon in specific

circumstances. The separation of causal influence and moral accountability is more common in all business and professions and also in engineering. These differences arising from several features of modern engineering practices are as follows:

3) Large – scale engineering projects always involve division of work. For each and every piece of work, every person contributes a small portion of their work towards the completion of the project. The final output us transmitted from one's immediate work place to another causing a decrease in personal accountability.

4) Due to the fragmentation of work, the accountability will spread widely within an organization. The personal accountability will spread over on the basis of hierarchies of authority.

5) There is always a pressure to move on to a different project before finishing the current one. This always leads to a sense of being accountable only for fulfilling the schedules.

6) There is always a weaker pre-occupation with legalities. In other words this refers to a way a moral involvement beyond the laid down institutional role. To conclude, engineers are being always blamed for all the harmful side effects of their projects. Engineers cannot separate themselves from personal responsibilities for their work.

7. Explain detail about balanced outlook on law.

A BALANCED OUTLOOK ON LAW

A balanced outlook on laws stresses the necessity of laws and regulations and their limitations in directing engineering practice.In order to live, work and play together in harmony as a society, there must be a balance between individual needs and desires against collective needs and desires. Only ethical conduct can provide such a balance. This ethical conduct can be applied only with the help of laws. Laws are important as the people are not fully responsible and because of the competitive nature of the free enterprise systemwhich does not encourage moral initiative.The model of engineering as social experimentation allows for the importance of clear laws to be effectively enforced.Engineers ought to play an effective role in promoting or changing enforceable rules of engineering as well as in enforcing them. So the codes must be enforced with the help of laws. The following are the two best examples.

1. Babylon's Building Code: (1758 B.C.)

This code was made by Hammurabi, king of Babylon. He formed a code for builders of his time and all the builders were forced to follow the code by law. He ordered"If a builder has built a house for a

man and has not made his work sound, and the house which he has built was fallen down and so caused the death of the householder, that builder shall be put to death. If it causes the death of the house holder's son, they shall put that builder's son to death. If it causes the death of the house holder's slave, he shall give slave to the householder. If it destroys property he shall replace anything it has destroyed; and because he has not made the house sound which he has built and it has fallen down, he shall rebuild the house which has fallen down from his own property. 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 in to sound condition at his own cost".The above portion of Babylon's building code was respected duly. But the aspects find only little approval today. This code gives a powerful incentive for self-regulation.

2. The United States Steamboat Code: [1852 A.D]

Steam engines in the past were very large and heavy. James Watt, Oliver Evans and Richard Trevethik modified the old steam engines by removing condensers and made them compact. Beyond careful calculations and guidelines, explosions of boiler happened on steam boats, because of the high speed of the boats. The safety valves were unable to keep steampressure up causing explosion. During that period in 18th century, more than 2500 people were killed and 2000 people were injured because of the explosion of boilers in steam boats.Due to this, the ruling congress in USA passed a law which provided for inspection of the safety aspects of ships and their boilers and engines. But his law turned out to be ineffective due to the corruptions of the inspectors and also their inadequate training regarding the safety checking. Then Alfred Guthiro, an engineer of Illinoise had inspected about 200 steam boats on his own cost and found out the reasons for the boiler explosions and made a report. His recommendations were published by a Senator Shields of Illinoise and incorporated in senate documents. With the help of this, another law was passed. Now it is in the hands of the American Society of Mechanical Engineers who formulated the standards for producing steam boats.

8. Explain detail about industrial standards
INDUSTRIAL STANDARDS

Industrial standards are important for any industry. Specification helps in achieving interchangeability. Standardization reduces the production costs and at the same time, the quality is achieved easily. It helps the manufacturer, customers and the public, in keeping competitiveness and ensuring quality simultaneously. Industrial standards are established by the Bureau of Indian Standards, in our country in consultation with leading industries and services.

International standards have become relevant with the development of the world trade. The International Standards Organization has now detailed specifications for generic products/services with procedures that the manufacturers or service providers should follow to assure the quality of their products or service. ISO 9000-2000 series are typical examples in this direction.

Table 3.1 gives a list of some types of standards with a few examples.

Table. 3.1 Industrial standards

Aspects	***Purpose***	***Examples***
1. Quality	Value appropriate to price	Surface finish of a plate, life of a motor

2. Quality of service	Assurance of product to ISO procedures	Quality of degrees According institutions by educational Institutions
3. Safety	To safeguard against injury or damage to property	Methods of waste disposal
4. Uniformity of physical properties and functions	Interchangeability, ease of assembly	Standard bolts and nuts, standard time

9.Explain detail about engineering as experimentation

ENGINEERING AS EXPERIMENTATION

Experimentation plays an important role in the process of designing the product. When it is decided to change a new engineering concept into its first rough design, preliminary tests or simulation should be conducted. Using formal experimental methods, the materials and methods of designing are tried out. These tests may be based on more detailed designs. The test for designing should be evolved till the final product produced. With the help of feedback of several tests, further modification can be made if necessary. Beyond these tests and experiments, each engineering project has to be viewed as an experiment.

Similarities to Standard Experiments

There are so many aspects, which are of virtual for combining every type of engineering works to make it suitable to look at engineering projects as experiments. The main three important aspects are:

iii. Any engineering project or plan is put into practice with partial ignorance because while designing a model there are several uncertainities occurred.

The reason to the fact that engineers don't have all the needed facts available well in advance before starting the project. At some point, both the theoretical examining and the laboratory testing must be by-passed for the sake of completing the project. Really, the success of an engineer is based on the his talent which is exactly being the ability to succeed in achieving jobs with only a partial knowledge of scientific laws about the nature and society.

iv. The final outcomes of engineering projects are generally uncertain like that of experiments what we do.

In engineering, in most of the cases, the possible outcomes may not be known and even small and mild projects itself involve greater risks.

The following uncertainities occur in the model designs

4. Model used for the design calculations

5. Exact characteristics of the material purchased.

6. Constancies of materials used for processing and fabrication.

4. About the nature of the pressure the finished product will encounter.

For instance, a reservoir may cause damage to the surroundings and affect the eco-system. If it leaks or breaks, the purpose will not be served. A special purpose fingerprint reader may find its application in the identification and close observation on the disagreeing persons with the government. A nuclear reactor may cause unexpected problems to the surrounding population leading to a great loss to the owners. A hair dryer may give damage to the unknowing or wrong users from asbestos insulation from its barrel.

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

This knowledge is very useful for increasing the effectiveness of the current products as well as for producing better products in future. This can be achieved by keenly observing on the

engineering jobs by the way of experimentation. This monitoring is done by making periodic observations and tests by looking at for the successful performance and the side effects of the jobs. The tests of the product's efficiency, safety, cost-effectiveness, environmental impact and its value that depends upon the utility to the society should also be monitored. It also extends to the stage of client use.

Learning from the past

It has been expected that the engineers have to learn not only form their own design and the production system but also the results of others. Due to lack of communication, prejudiced in not asking for clarification, fear of law and also mere negligence, these things can happen to the continuation of past mistakes. The following are some of the examples:

5. The tragedy of 'Titanic' happened because of the sufficient number of life boats. The same disaster took place in the steamship "the Arctic" some years before, because of the same problem.

6. The fall down of "the Sunshine Skyline Bridge" in the bay of Thamba at

   Sweden in 1980, on a moving ship due to improper matching of horizontal

   impact forces in mind. This could have been avoided of the engineers had known about the striking of the ships with the Maracaibo Bridge at Venezulea in 1964 and the Tasman Bridge of Australia in 1975.

7. The nuclear reactor accident at Three Mile Island on March 1979, was due to malfunctioning of the valves. Valves though minute items, are being among the least reliable components of hydraulic systems. It was a pressure relief valve and lack of information about its opening or closing state contributed to a nuclear reactor accident at Three Mile Island. This malfunction was already happened because of the same reasons at other locations.

5. The disaster of Tettron Dam in Los Angles was due to rapid flow of water and sudden break down. The builder didn't consider the case of the Fontenelle

   Dam, which was also collapsed due to the same problem.

So, to say that engineers should not fully depend on handbooks and they should have some review of the past cases relating to their current task.

Comparisons with standard Experiments

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

1. Experimental Control

Members for two groups should be selected in a standard experimental control, i.e Group A and Group B. The members of the group ‘A’ should be given the special experimental treatment. The group ‘B’ do not receive the same though they are in the same environment. This group is called the

‘control group’

Though it is not possible in engineering but for the projects which are confirmed to laboratory experiments. Because, in engineering the experimental subjects are human beings who are out of the

control of the experimenters. In engineering, the consumers have more control as they are the selecting authority of a project. So in engineering it is impossible to follow a random selection. An engineer has to work only with the past data available with various groups who use the products.

So engineering can be viewed as a natural experiment which uses human subjects. But today, most of the engineers do not care for the above said Experimental Control.

2. Informed Consent

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

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

Informed consent has two main principles such as knowledge and voluntariness.

First, the persons who are put under the experiment has to be given all the needed information to make an appropriate decision. Second, they must enter into the experiment without any force, fraud and deception. The experimenter has also to consider the fundamental rights of the minorities and the compensation for the harmful effects of that experiment.

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

In medicine, before prescribing a medicine to the patient, a responsible physician must search for relevant information on the side effects of the drug. The hospital management must allow him to undergo different treatments to different patients and finally the patient must be ready to receive that information from the physician. Similarly it is possible for an engineer to give relevant information about a product only when there is a better co-operation by the management and quick acceptance from the customers.

The following conditions are essential for a valid informed consent

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

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

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

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

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

Knowledge Gained

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

9. State the various problems of law in Engineering

1.General and vague wordings. Many statements are general in nature and hence unable to solve all problems.

2.Not applicable to all situations. Codes are not sacred, and need not be accepted without criticism. Tolerance for criticisms of the codes themselves should be allowed.

3.Often have internal conflicts. Many times, the priorities are clearly spelt out, e.g., codes forbid public remarks critical of colleagues (engineers), but they actually discovered a major bribery, which might have caused a huge loss to the exchequer.

4.They can not be treated as final moral authority for professional conduct. Codes have flaws by commission and omission. There are still some grey areas undefined by codes. They can not be equated to laws. After all, even laws have loopholes and they invoke creativity in the legal practitioners.

5.Only a few enroll as members in professional society and non-members can not be compelled.

6.Even as members of the professional society, many are unaware of the codes

7.Different societies have different codes. The codes can not be uniform or same! Unifying the codes may not necessarily solve the problems prevailing various professions, but attempts are still made towards this unified codes.

8.Codes are said to be coercive. They are sometimes claimed to be threatening and forceful.

3.4.3 Proper Role of Laws

Good laws when enforced effectively produce benefits. They establish minimal standards of professional conduct and provide a motivation to people. Further they serve as moral support and defense for the people who are willing to act ethically.

Thus, it is concluded that:

1. The rules which govern engineering practice should be construed as of responsible experimentation rather than rules of a game. This makes the engineer responsible for the safe conduct of the experiment.

2. Precise rules and sanctions are suitable in case of ethical misconduct that involves the violation of established engineering procedures, which are aimed at the safety and the welfare of the public.

3. In situations where the experimentation is large and time consuming, the rules must not try to cover all possible outcomes, and they should not compel the engineers to follow rigid courses of action.

4. The regulation should be broad, but make engineers accountable for their decisions, and

5. Through their professional societies, the engineers can facilitate framing the rules, amend wherever necessary, and enforce them, but without giving-in for conflicts of interest.

UNIT IV-SAFETY, RESPONSIBILITIES AND RIGHTS

PART A

1. What do you understand by collegiality? [Nov 2009] [Nov 2013]

Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers, nor untruthfully criticize other engineers‟ work. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for proper action.

2. What does Loyalty mean?

Loyalty means being truthful to one's person. For engineer's loyalty should not to be equated with

merely obeying, one is immediate superior, but to do good for the company and people. It is an important virtue. There are two sense of loyalty namely Agency Loyalty and Identification Loyalty.

3. Explain misguided loyalty.

Employee sometimes with over enthusiasm and loyalty will be misled to act on own and unknowingly exceed legal commitments to gain or profit for his employer, which may backfire sometime. Hence, this defines as Misguided Loyalty or inappropriate Loyalty.

4. What does authority mean?

Authority is an assignment of the resources needed to complete a task one should have leadership quality and a good motivator, to execute his authority to get work done. Hence, authority is necessary. Authority provides a way for identifying the areas of responsibility and accountability.

5. List the classifications of Authority. [Nov 2011] The classifications of Authority are

(i)Institutional Authority (ii)Morally Justified Authority (iii)Accepting Authority

6. Explain institutional authority.

Institutional Authority is acquired, exercised, and defined within institutions. It may be defined as the institutional right given to a person to exercise power based on the resources of the institutions. It is

given to individuals in order for them to meet their institutional duties, that is, their assigned tasks within an organization.

7. What are the paramount obligations of an engineer?

Recent Code of ethics typically states that engineer's paramount obligations are to protect the public health, safety and welfare rather than the obligations of loyalty and faithful service to employers. Paramount is to mean "chief in importance or deserving primary emphasis"

8. What is meant by collective bargaining? [April 2014]

Unions are Collective bargaining agents that sometimes place the economic interests of the members ahead of those of the clients or employer. A number of professional societies have also held that loyalty to employers and the public is incompatible with any form of collective bargaining.

9. What is N.S.P.E code?

NSPE – National Society of Professional Engineers (USA), National Society of Professional Engineers has given their codes of ethics that the engineers shall not actively participate in strikes and other collective forcing action against their employers.

10. Explain the term confidentiality.

Keeping confidence is one of the most central and widely acknowledged duties of any professional. In this context, Confidential Information (Privileged Information) is information deemed desirable to keep secret. Keep secret is relational information.

11. What is duty ethics? [Nov 2009]

Kant explains the duty ethics based on three interwoven theories namely each expresses respect for persons, each is a universal principle and each expresses an unqualified command for autonomous moral agents.

12. What is meant by utilitarianism? [May 2009]

In the view of Utilitarianism, it is to produce most good for most people, giving equal consideration to everyone affected. The best meaning is that it produces maximum benefit for the greatest number of people. The standard of this theory is maximization of goodness. It is not so easy to achieve it. Goodness means happiness that is believed to be internal good. All good things are instrumental goods, which provide happiness for the people. For example people go dentist if it is solved the people become happy.

13. Explain professional rights.

Engineers have fundamental rights to live and freely pursue their legitimate interests. They have a human right to pursue their work and not to be fairly discriminated `against in employment based on sex, race, or age.

14. What is patenting?

Patents differ from trade secrets. Patents legally protect specific products from being manufactured and sold by competitors without the express permission of the patent holder. Trade secrets have no such protections. Patents are protected by statute laws passed in order to provide incentives for creativity.

15. Explain industrial espionage.

Industrial espionage means industrial spying. It has increased in the recent years due to a large amount of competitions in the world, so the people started cheating other persons for their improvement. For example the case of Peter Gopal at Silicon Valley.

16. What is meant by price fixing?

Companies join together and fix prices before going for auction or government tenders, thus take chances in rotation in getting the tender in their favour, which is an illegal act. However, there is an argument that the public is benefited because the price is stabilized.

17. What is IPR and explain its main clauses? [Nov 2015]

Intellectual Property Rights (IPR) will have wide range of socio economic technological and political impacts. Intellectual Property is the information and original expression that derives its original value from creative ideas with a commercial value. Intellectual property permits the people to have fully independent ownership for their innovations and creativity like that for their own physical property.

18. What is meant by discrimination in professionalism? [Nov 2010]

Discrimination is being bias or doing unfairness. Discrimination means to make an unfair difference in ones treatment of people. The other way of defining giving preference based on sex, race, religion, etc. so the type of Discrimination behaviour is said to be "**Reverse Preferential Treatment.**" In general, we can say **"Morally unjustified treatment of people on irrelevant grounds."**

19. List some example for
Discrimination. Some examples are

i. An opening arises for a chemical engineer plant. Normally such positions are filled by promotions. However, there was not proper person so they thought of an African person. Management believed that the most of the whites working would not accept a black person as their boss. So the interest among the workers will decrease hence the efficiency of the workers will also reduce, so they appointed a white person by promotion.

ii. An electronics company has more number of women in their sales section. However, they are paid less than the men working of the same cadre are. When the company enquired said that the amount paid to women becomes as a second income.

iii. Due to the economic activities to a agriculture company the management has decided to give retirement to the engineers who are verge of retirement within 10 years, because they can't give layoff to the company.

20. What does whistle blowing mean? [Nov 2015]

Whistle blowing is alerting relevant persons to some moral or legal corruption. It is something defined as making public accusations about misconduct or corruption. In this sense, an individual need not be an member of an organization in order to blow the whistle, even the journalists, politicians and the consumer group can blow the whistle.

21. What is employee's bill of rights?

No public or private organization shall discriminate against an employee for criticizing the ethical, moral, or legal policies and practices of the organization discriminate against an employee to engaging in outside activities of his choice or for objecting to a directive that violates common norms of morality.

22. What is the right to due process"?

Right to fair process or procedures in firing, Demotion and in taking any disciplinary actions against the employees. Fairness is in terms of the process rather than the outcomes.

23. What is meant by "industrial design patent"? [Nov 2014]

Idea or conception regarding features of shape, configuration, and pattern, ornamental with lines or colors applied to any article, two or three dimensional, made by industrial process. Patent has a term of 14 years from the date of filing the application, e.g., design applied to shoes, T.V., textiles.

24. List the factors that shape the self confidence in a person. [Nov 2013]

Home: Relationships with your parents, grandparents, brothers, sisters, etc. influence your self esteem this is because you 'copy' their attitudes and reactions when you are still young and this influences the way you think of yourself and others

School: Relationships with classmates, teachers, administrators and counsellors influence your self esteem, due to the result of you learning from others. Experiences with schoolwork, extracurricular activities, sports, discipline, etc. can also play an important role in shaping the kind of person you are going to be in the future

Society: Relationships with members of different cultures, races and religions can influence your self esteem, as you learn from them and cope through different times will shape your characteristics. Experiences with standards and images created by others can also influence you. The nature of your community helps shape you.

25. What is meant by Occupational Crime? [April 2014]

Gary Green (1997 [1990], 2001) has promoted the case for replacing the term 'white collar crime 'which he regards as conceptually incoherent—with his particular conception of occupational crime. He defines such crimes 'any act punishable by law that is committed through opportunity created in the course of an occupation that is legal' (Green, 1997 [1990]:15). The core argument here is that it is the

structuring of crime opportunities, as a consequence of having a legitimate occupation that most fully and effectively distinguishes what has traditionally been characterized as white collar crime from other forms of criminal behaviour, and most especially conventional crime. Gerald Robin (1974) is credited with first having called for replacement of the term 'white collar crime' with 'occupational crime'. As Green puts it, 'The concept of occupational crime seeks only to identify a general type of opportunity' (2001: 406).

26. **Differentiate between Risk analysis and Risk benefit analysis.[May 2016]**

A risk analysis is the process of identifying hazards and then assessing their potential for causing harm or loss. It also includes an evaluation of the consequences of a risk if it materialises and suggests what needs to be done to avoid or minimise the risk.

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

27. Define risk - benefit analysis [Nov 2015]

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28. What is intellectual property right? (May 2016)

Intellectual Property right (IPR) refers to the creations of the human minds for which exclusive Rights are recognised. Innovators, artistes and business owners are granted certain exclusive rights to a variety of intangible assets for a specified duration.

PART B

1. How are conflicts of interest solved?

Employee conflicts of interest occur when employees have interests that if pursued could keep them from meeting their obligations to serve the interests of the employer or client for whom they work. Such conflicts of interest should be avoided because they threaten to prevent one from fully meeting those obligations.

In fact it is not always deemed unethical to pursue conflicts of interest. In practice some conflicts are thought to be unavoidable, or even acceptable. Of course many conflicts of interest are especially objectionable in business affairs precisely because they pose risks to free competition. In particular, bribes and large gifts are objectionable because they lead to awarding contracts for reasons other than the best work for the best price. For that reason, bribes and kickbacks have few defenders, even when they are fairly common as in awards of contracts let by government agencies.

In many a country or business sector, paying bribes to officials is considered a necessary business expense. Resorting to ethical relativism, such activity is excused as conforming to local custom, although almost all citizens oppose the practice as being unethical and indeed unlawful. The other excuse heard is the need to prevent job loss and plant closure. It usually meets with little sympathy from the competitors. Returning to conflicts of interest in general, where such are unavoidable or reasonable, employees are still obligated to inform their employers and obtain approval. This suggests a fuller answer to why conflicts of interest are generally prohibited: (1) The professional obligation to employers is very important in that it overrides in the vast majority of cases any appeal to self-interest on the job and (2) the professional obligation to employers is easily threatened by self-interest in a way that warrants especially strong safeguards to ensure that it is fulfilled by employees

Many conflicts of interest violate trust, in addition to undermining specific obligations. Employed professionals are in trust relationships with their employers and clients. Allowing side interests to distort one‘s judgment violates that trust. Even the appearance of conflicts of interest, especially appearances of seeking a personal profit at the expense of one‘s employer, is considered unethical since the appearance of wrongdoing can harm a corporation as much as any actual bias that might result from such practices. Again, some conflicts of interest might benefit a company if kept secret, but potentially bring great harm to the company if made public. For example, if a government subcontractor offered an insubstantial gift to a government official, the pleasantry might benefit everyone involved, and even be within the letter of the law. But if uncovered by a journalist the gift might raise questions that could greatly harm the company, and hence not be worth the risk.

2. Discuss in detail about the employee rights.

Employee rights are any rights, moral or legal, that involve the status of being an employee. They include some professional rights that apply to the employer-employee relationship. It also includes fundamental human rights relevant to the employee situation and some institutional rights created by organizational policies.
In Freedom Inside the Organization, David Ewing, editor of The Harvard Business review, refers to employee rights as the —black hole in American rights‖.
Ewing proposes that large corporations ought to recognize a basic set of employee rights. He gives the following concise statement of what those rights should involve:

- No public or private organization shall discriminate against an employee for criticizing the ethical, moral or legal policies and practices of the organization; nor shall any organization discriminate against an employee for engaging in outside activities of his or her choice, or for objecting to a directive that violates common norms of morality.
- No organization shall deprive an employee of the enjoyment of reasonable privacy in his or her place of work, and no personal information about employees shall be collected or kept other than that necessary to manage the organization efficiently and to meet legal requirements.
- No employee of a public or private organization who alleges in good faith that his or her rights have been violated shall be discharged or penalized without a fair hearing in the employer organization.

All employees have the right to pursue non-work activities of their own choice without coercion or retribution from employers. This is part of their basic human right to pursue legitimate interests without interference. But because this right has generally not been protected by state or federal laws, there have been some flagrant violations of it. Such abuses are becoming rarer, especially in states like California and Florida, which have passed laws prohibiting them.
There are some limits on the rights of employees to pursue outside activities. First, the rights of employees to pursue outside activities become limited at the point where those activities lead to violating duties of their jobs. An employee has a right to smoke, but how that right is exercised at the workplace is limited by the employer‘s right to create a pleasant and safe workplace for other employees.
Second, employees have the right to take action when outside activities constitute a conflict of interest. Here there may be no actual harm done. Third, employees have no right to consistently sabotage their employers‘ interests during off-hours. During labor disputes, a mutual recognition of each other‘s legitimate interests must be maintained.
Privacy
The right to pursue outside activities can be thought of as a right to personal privacy in the sense that it means the right to have a private life off the job. As with the right to outside activities, this right is limited in certain instances by employers‘ rights.
Consider a few examples of situations in which the functions of employers‘ conflict with the right employees have to privacy:

- Before being hired at a computer center that handles large banking transactions, applicants are required to answer questions about their criminal records while taking a polygraph test.
- A large manufacturer of expensive pocket computers has suffered substantial losses from employee theft. It is believed that more than one employee is involved. Without notifying employees, hidden surveillance cameras are installed.

Some of these examples involve abuse of employee prerogatives. Most of them involve a clash between the right to privacy of employees and the right of employers to effectively manage a corporation.
Employers should be viewed as having the same trust relationship with their employees concerning confidentiality that doctors have with their patients and lawyers have with their clients. In all of these cases personal information is given in trust on the basis of a special professional relationship. Moreover, with rare exceptions involving identification of other parties, employers owe employees the right to examine their dossiers so as to correct outdated or erroneous information.
The right to due process extends to fair procedures in firing, demotion, and disciplinary actions. Implementing the right to due process involves two general procedures: First,

written explanations are owed to employees who are discharged, demoed, transferred to less enriching work, or in other ways penalized.
Second, an appeals procedure should be established that is available to all employees who believe their rights have been violated. The procedure should be a stable part of the organization, effective, equitable, and efficient. For the sake of both management and employees, it must be easy to use and work quickly, generally yielding a decision within days after a grievance is filed.
Government employees and union members generally have some such procedures available to them, however flawed they may be in practice. Private companies have recently developed a variety of promising procedures, some of which are still largely experimental. Polaroid, for example, has set up a grievance committee composed of members elected by employees.
The power of these appeals groups and people is limited, but it can bring substantial relief. Binding verdicts, by definition, would remove substantial decision making authority from management. The ability to issue them would in effect create a new line of management authority. Yet the influence of appeals bodies can be significant: Where employees trust them, an overriding of their decisions by management without very compelling reasons can cause serious personnel problems.

3. What is the importance of loyalty and collegiality in teamwork?[May 2012]

Collegiality is an important virtue, even though it may seem to be out of place where there is competition among engineers from different companies. Likewise, the idea of loyalty to an employer or corporation may sound old-fashioned. When engineering codes of ethics mention collegiality they generally cite acts that constitute disloyalty.

Collegiality is a kind of connectedness grounded in respect for professional expertise and in a commitment to the goals and values of the profession, and … as such, collegiality includes a disposition to support and cooperate with one‘s colleagues. The central elements of collegiality are respect, commitment, connectedness, and cooperation.

Viewed from the perspective of society, collegiality is an instrumental value; it is good as a means to promoting professional aims. Viewed from the perspective of professionals, it is intrinsically valuable. It is part of what defines the professional community as composed of many individuals jointly pursuing the public good.

Loyalty to an employer can mean two things. Agency –Loyalty is acting to fulfill one‘s contractual duties to an employer. These duties are specified in terms of the particular tasks for which one is paid, as well as the more general activities of cooperating with colleagues and following legitimate authority within the corporation. As its name implies, it is entirely a matter of actions, whatever its motives.
Identification-Loyalty, by contrast, has a much to do with attitudes, emotions, and a sense of personal identity as it does with actions. It can be understood as agency-loyalty that is motivated by identification with the group to which one is loyal. In both these senses, loyalty can be a desirable character attribute.
Both agency- and identification-loyalty can be shown toward corporations as a whole or toward smaller divisions within corporations. For example, an engineer might identify closely with a group of committed professionals while working on a particular project, such as the Data General Project, but feel less identification with the more impersonal vast conglomerate compromising a large international firm. Conversely, an engineer might identify with the corporation but not with a particular team to which she is assigned. Sometimes inappropriate or misguided loyalty to a project team or supervisor can harm corporations, as well as the general public.
This case suggests three points about the relationship between professional responsibility between professional responsibility and loyalty to companies or employers. First, acting on professional commitments to the public can be more effective way to serve a company than a mere willingness to follow company orders. Second, loyalty to companies or their current owners should not be equated with merely obeying one‘s immediate supervisor. Third, it describes how an engineer might have professional obligations to both an employer and to the public that reinforce rather than contradict each other. Thus there need be no general contrast between the moral status of employees and professionals. In fact, obligations to the public and to one‘s employer often point in the same direction.

Nevertheless, obligations to employers and to the public do not always straightforwardly coincide. Sometimes an engineer seeking to protect the public is overruled by top management for financial reasons. At other times there are disagreements over technical matters, and engineers are told they must not push their own views further.
Agency- and identification-loyalty are virtues depending on the specific group, organization, or cause involved, and on the circumstances in which they are displayed. Hence, collegiality and loyalty are dependent virtues and they depend on the value of the projects and communities to which it contributes.

4. What are the procedures to be followed for Whistle Blowing? How can this be avoided?

Whistle-blowing occurs when an employee or former employees conveys information about a significant about a significant moral problem outside approved organizational channels to someone in a position to take action on the problem. There are four main features of whistle-blowing that characterize the cases such as:

a. Act of Disclosure
b. Topic
c. Agent
d. Recipient

There are several rules practical advice and common sense that should be heeded before whistle-blowing. They are:

1. Except for extremely rare emergencies, always try working first through normal organizational channels. Get to know both the formal and informal rules for making appeals within the organization.
2. Be prompt in expressing objections. Waiting too long may create the appearance of plotting for your advantage and seeking to embarrass a supervisor.
3. Proceed in a tactful, low-key manner. Be considerate of the feelings of others involved. Always keep focused on the issues themselves, avoiding any personal criticisms that might create antagonism and deflect attention from solving those issues.
4. As much as possible, keep supervisors informed of your actions, both through informal discussion and formal memorandums.
5. Be accurate in your observations and claims, and keep formal records documenting relevant events.
6. Consult colleagues for advice - avoid isolation.
7. Before going outside the organization, consult the ethics committee of your professional society.
8. Consult a lawyer concerning potential legal liabilities.

Sometimes whistle-blowing is a practical moral necessity. But generally it holds little promise as the best possible method for remedying problems and should be viewed as a last resort.
The obvious way to remove the need for internal whistle-blowing is to allow greater freedom and openness of communication within the organization. That is, the need to violate the often rigid channels of communication within organizations would be removed by making those channels more flexible and convenient. But these means more than merely announcing formal —open-doorǁ policies and appeals procedures that give direct access to higher levels of management. Those would be good first steps, and a further step would be the creation of an ombudsperson or an ethics review committee with genuine freedom to investigate complaints and make independent recommendations to top management. The crucial factor that must be involved in any structural change, however, is the creation of an atmosphere of tolerance. There must be a positive affirmation of engineers‘ efforts to assert and defend their professional judgments in matters involving ethical considerations.
Creating such an environment, then, requires the efforts of management and engineers alike. But it falls on the shoulders of top management to give this aspect of the organization equal priority with other organizational needs and goals. Management‘s tools include the formal ones of classes and workshops for employees.
The external whistle-blowing can also be avoided by the same sort of intra-organizational modifications. Yet there will always remain troublesome cases where top

management and engineers differ in their assessments of a situation even though both sides may be equally concerned to meet their professional obligations to safety. To date, the assumption has been that management has the final say in any such dispute. But our view is that engineers have a right to some further recourse in seeking to have their views heard.

It is impossible to generalize concerning what this recourse should be within all concerns. Minimally we think it essential that engineers be allowed to discuss, in confidence, their moral concerns with the ethics committees of their professional societies. And it is highly desirable that representatives from those committees, or perhaps professional arbitrators of some sort, be allowed to enter into deadlocked discussions between engineers and management, again in confidence, as far as the public is concerned.

Beyond this, ongoing piecemeal changes in the law, within regulatory bodies, and within corporations themselves, must be explored. Some will argue for strong legislation favorable to whistle-blowing. But this would allow greater public control over private corporate goals, and management could be expected to resist such outside threats to its autonomy.

5. Discuss the ways and means of reducing occupational crime in industries.

Occupational crimes are illegal acts made possible through one‘s lawful employment. It is the secretive violation of laws regulating work activities. Many occupational crimes are special instances of conflicts of interests, especially when the crime involves personal gain that constitutes or leads to the failure to meet professional obligations.

Moreover, occupational crime deserves further attention because of its frequency and magnitude, as well as because of the increasing public attention paid to it. The occupational crimes are of three types such as:

a. Industrial Espionage

b. Price Fixing

c. Endangering Lives.

Industrial Espionage

Santa Clara Valley in Northern California is a marvel of the high-tech and computer industries. For two decades it has been a major center for development and manufacture of integrated-circuit microprocessors, or computer chips. The Valley has attracted vast numbers of creative engineers and entrepreneurs. It has also attracted industrial espionage on an unprecedented scale.

Several factors contributed to make the Valley an ideal environment for industrial espionage. Let us consider the case of Peter Gopal, who for a decade ran a lucrative trade as a go-between until he was caught in 1978. Gopal was a semiconductor expert who worked for National Semiconductor Corporation. Gopal sold National Semiconductor‘s secrets to Intel Corporation. He also stole from Intel to sell to National Semiconductor. Intel has one of the tightest security systems in Silicon Valley. Its security includes magnetic switches and alarms over all doors, closed-circuit cameras in offices, passes worn by employees, strict control of access to documents, and armed guards. But Gopal learned that many Intel manufacturing materials were stored at NBK, an Intel subcontractor that lacked comparable security. NBK kept chip —reticles,‖ the palm-sized glass plates that display magnified chip circuitry. It also stored —masks‖ – prints of a reduced image of the reticle – and data tapes giving design information. Gopal purchased copies of reticles and masks from Lee Yamada, a supervisor at NBK, who had easy access to everything Gopal needed.

Finally, Silicon Valley corporations have high employee turnover rates because of opportunities for advancement with competitors. Gopal found it easy to buy dozens of major trade secrets from former employees.

It required a complicated undercover operation conducted jointly by National Semiconductor, Intel, and the police to capture Gopal. After arresting him, police searched his apartment to find twenty-seven reticles for a recent Intel chip and assorted items from other companies. Gopal was convicted of domestic crimes involving American corporations, but there was strong evidence that he had also sold to European companies that deal with eastern bloc countries.

Price Fixing

In 1980 Congress passed the Sherman Antitrust Act. It forbids companies from jointly setting prices in ways that restrain free competition and trade. The act has frequently been violated in the electrical equipment industry, where large contracts and few competitors are the norm.

The most famous violation of the Sherman Act in the electric power industry was prosecuted in 1961. Forty-five individuals from twenty-nine corporations pled guilty or entered pleas of no contest. Top officials of Westinghouse, General Electric, and other manufactures were indicted for conspiring to fix prices of large electrical apparatus, although their presidents were evidently kept ignorant of the conspiracy. Westinghouse and General Electric received fines of several dollars, insignificant sums for companies of their size. Several conspirators argued that the price fixing benefited the public by stabilizing prices.

The practice of price fixing had been so widespread in the industry for so long that it became accepted as proper. A General Electric vice president testified that in 1946 his superior causally introduced him to the practice and presupposed that he would cooperate. At the time, he was a recent graduate in electrical engineering and was rapidly moving up the ranks of management.

Endangering Lives

Employers who expose their employees to safety hazards usually escape criminal penalties. Victims will often have to sue companies for damages under tort law, which allows them to gain compensation without having to prove a crime has been committed. This is true even when people die as a result of horrendous corporate negligence. No example is more shocking than that of the companies in the asbestos industry, especially Manville Corporation, which is the large producer of asbestos.

Between 1940 and 1979, over 27 million U.S. workers were exposed to asbestos. Asbestos-related diseases can develop after only two to three months of exposure. About 350,000 persons will develop mesothelioma (an incurable cancer) and more than 1 million will develop nonmalignant asbestos diseases. More than 100,000 have already dead.

It seems doubtful that many, if any, of Manville‘s managers will be prosecuted. Tens of thousands of victims and their families have filed civil suits for damages, seeking monetary compensation rather than criminal justice. In order to postpone settling the flood of lawsuits, Manville filed for protection under bankruptcy in 1982. By 1994, at least sixteen other asbestos defendant companies had declared bankruptcy. A court agreement reached in 1985 allows Manville to continue operating while paying some $2.5 billion in lawsuits over the next 25 years. Twenty more companies have recently settled class-action suits. The total litigation cost to U.S. companies is an estimated $7 billion.

6. What is institutional authority? How do you correlate institutional authority, expert authority and power?

Institutional authority is acquired, exercised, and defined within institutions. Is may be defined as the institutional right given to a person to exercise power based on the resources of the institution. It is given to individuals in order for them to meet their institutional duties, that is, their assigned tasks within an organization. Managerial tasks, for example, may be to allocate money or other resources, to make a policy decisions or recommendations, or to oversee projects and issue directives to subordinates on particular topics. In order to enable managers to meet these duties, organizations assign them the requisite authority. Institutional rights and duties are for the most part two sides of the same coin, and they deal with precisely the same activities and functions.

Institutional versus Expert Authority It clearly benefits institutions to give authority to the individuals to the individuals best qualified to serve the institution‘s goals in a given capacity. But in practice there is not always a perfect match between the authority granted and the qualifications needed to exercise it. Incompetence is found in all large institutions, and there is some truth in the cynical remark that in bureaucracies people tend to rise to their own level of incompetence.

Thus institutional authority should not be equated with expert authority. Expert authority is the possession of special knowledge, skill, or competence to perform some task or to give sound advice. In this sense, doctors are authorities on health and civil engineers are authorities on structures or transportation. One of the key competencies for management

is leadership ability, which has its own kind of expert authority that has been called the —authority of leadership‖: the expertise to effectively direct others.
It is possible for engineers to have expert authority in matters in which they have little or no institutional authority to make decisions. Their institutional authority may extend no further than the right to provide management with analyses of possible ways to perform some technical task, after which they are restricted to following management‘s directives about which option to pursue. In large companies the staff engineers, advisers, and consultants carry expert authority, while institutional authority is vested in line managers.
Authority versus Power Institutional authority must also be distinguished from power. Institutional authority typically carries with it an allotment of the resources needed to complete tasks. Yet ineffectual persons may not be able to summon the power their position allows them to exercise. A manager, for example, who lacks the skills of leadership, may be unable to inspire and encourage employees to produce in ways the institution requires, much in the way a conductor may fail with an orchestra.
Conversely, people who are especially effective may acquire great power or influence – power that goes well beyond the authority attached to the positions they hold. Charismatic leaders often have influence outside their domains of authority. And highly respected engineers of proven integrity may have power within an organization exceeding their institutional rights.

7. Discuss faithful agent and public service arguments.

In the current NSPE code the ban on the use of —collective coercive action‖ appears as one of the principles of obligation concerning professional integrity. The faithful trustee of one‘s employer is incompatible with actively supporting collective action aimed against that employer.
In a number of NSPE publications this position has been explicitly endorsed. In 1976, for example, NSPE‘s Board of Ethical Review reiterated it in discussing a hypothetical example. The case concerned the unionized employees in a state highway department. The employees, most of who were not engineers, voted to strike when their demands for a pay increase of 60 percent and other benefits were denied. The Board of Ethical Review insisted that it was unethical for the engineers to participate actively, even though not to do so might mean facing union penalties. Passive participation, such as not crossing picket lines, was ruled permissible if it was necessary to avoid physical danger or abuse. The argument given was concise: —the engineers have a higher standard than self-interest; they have the necessary ethical duty to act for their employer as a faithful agent or trustee.‖ Obviously the Board saw active support of a strike or other collective action used against an employer as a violation of professional ethics, which it identified with the duty engineers have to serve as their employer‘s —faithful agents or trustees.‖ Many people involved in engineering would agree with such a view, and certainly a case can be made for it. The conduct under discussion involves several features, any one of which might seem inconsistent with loyalty to employers: (1) It goes against the desires or interests of the employer, (2) it uses coercion or force against the employer, and (3) it involves collective and organized opposition. Certainly we can all think of behavior along these lines that is unprofessional and disloyal. The difficulty, however, is that not every instance of such conduct is unethical, as the following example show.
Consider three supervisory engineers who have good reason to believe they are being underpaid. After individually reasoning with their bosses to no avail they threaten - in a polite way – to seek employment elsewhere. In doing so, they act against the desires and interests of their employer, and they use a type of collective coercion. But they have not acted unethically or violated their duty to their employers. The point, which should by now be familiar, is that the duty to an employer has limits. Loyalty and faithfulness do not always require sacrificing one‘s own self-interest to an employer‘s business interests.
The above example suggests two generalizations. First, employee duty to employers does not entail unlimited sacrifice of economic self-interest. —Faithful agency‖ primarily concerns carrying out one‘s assigned tasks; it does not mean that one should never negotiate salary and other economic benefits from a position of strength.
Second, as the NSPE code itself states, the duty to employers is limited by the more paramount duty to protect public health, safety, and welfare. Moreover, duty to employers is also limited by considerations such as worker safety and the right to refuse to obey illegal or unethical directives. Collective action of a coercive nature might

sometimes be the only effective way to pursue these concerns of over-riding importance. Professional societies have themselves engaged in a type of collective, coercive action when they print editorials in official journals exposing companies for abuses committed against engineers.
The NSPE recommends the use of a sounding board, composed of a mix of employees and managerial engineers, to settle disputes with employers through reasonable dialogue. Certainly where feasible this is preferable to the use of collective force. Yet only a confirmed optimist could think that this procedure will always provide adequate support for salaried engineers.
Public Service Argument:
A second general argument against unions begins by emphasizing that the paramount duty of engineers is to serve the public. It then notes that by definition unions seek to promote the special interests of their members, not the interests of the general public. It is inevitable, so the argument continues, that clashes will occur, posing a threat to meeting professional commitments to the public. Strikes, which are the ultimate source of power for unions, may wreak havoc with the public good. Witness what was happened in recent strikes by police officers, fire fighters, teachers, and nurses. Then imagine what would happen to the economy if all computer engineers and technicians were to go on strike.
There is force in this argument. Yet once again it points out only the dangers of unions, even using the worst possible scenario of what might happen, and assumes that engineering unions act irresponsibly. Of course many unions have acted in that way, but not all

8. Discuss the right of conscientious refusal.

The right of conscientious refusal is the right to refuse to engage in unethical behavior, and to refuse to do so solely because one views it as unethical. This is a kind of second-order right. It arises because other rights to pursue moral obligations within the authority-based relationships of employment sometimes come into conflict.

There are two situations to be considered: (1) where there is widely shared agreement in the profession as to whether an act is unethical and (2) where there is room for disagreement among reasonable people over whether an act is unethical. It seems clear enough that engineers and other professionals have a moral right to refuse to participate in activities that are straightforwardly and uncontroversial unethical. And coercing employees into acting by means of threats plainly constitutes a violation of this right.

The troublesome cases concern situations where there is no shared agreement about whether a project or procedure is unethical. The Jim Pope case, for example, involved opposing assessments of the overall effectiveness of ground- and air-based collision-avoidance systems.

There is no shared agreement over whether abortions are morally permissible. Yet, as is widely acknowledged, nurses who believe them to be immoral have a right to refuse to participate in abortion procedures. This is so even though nurses function under the institutional authority of doctors, clinics, and hospitals in ways analogous to how engineers work under the authority of management. Nevertheless, nurses‘ rights do not extend so for as to give them the right to work in an abortion clinic while refusing to play their assigned role in performing abortions.

Likewise, we believe engineers should be recognized as having a limited right to turn down assignments that violate their personal consciences in matters of moral disagreement among reasonable people about the situation in question. We emphasize the word ―limited‖ because the right is contingent on the organization‘s ability to reassign the engineer to alternative projects without serious economic hardship to itself. The right of professional conscience does not extend to the right to be paid for not working.

9. Discuss the right to recognition.

Engineers have a right to professional recognition for their work and accomplishments. Part of this involves fair monetary remuneration, and part nonmonetary forms of recognition.

The right to reasonable remuneration is clear enough to serve as a moral basis for arguments against corporations that make excessive profits while engineers are paid below pay scales of blue-collar workers. It can also serve as the basis for criticizing the unfairness of patent arrangements that fail to give more than nominal rewards to the creative engineers who make the discoveries leading to the patents. If a patent leads to millions of dollars of revenue for a company, it is unfair to give the discoverer a nominal bonus and a thank-you letter.

But the right to professional recognition is not sufficiently precise to pinpoint just what a reasonable salary is or what a fair remuneration for patent discoveries is. Such detailed matters must be worked out cooperatively between employers and employees, for they depend on both the resources of a company and the bargaining position of engineers.

It may seem, incidentally, that the right to fair remuneration is related merely to the engineer‘s self-interest, and as such does not properly fall under the basic right of professional conscience. of course it does centrally involve self-interest. But there are also reasons why it is related to the basic right of conscience. For one thing, without a fair remuneration engineers cannot concentrate their energies where they properly belong – on carrying out the immediate duties of their jobs and on maintaining up-to-date skills through formal and informal continuing education. Their time will be taken up by money worries, or even by moonlighting in order to maintain a decent standard of living. Or consider the seemingly ―purely‖ economic issue of portable pensions. If a company‘s retirement plan is tied to ongoing employment with that company, engineers will feel considerable pressure not to leave their jobs. This pressure can discourage them from vigorously pursuing their obligations in situations where employers‘ directives are not in line with the legitimate needs or safety of clients and the public.

10.Discuss Intellectual Property Rights.(April/May 2016)

Intellectual Property is a product of the human intellect that has commercial value.

- Many of the rights of the ownership common to real and personal property are also common to Intellectual Property.

- Intellectual Property can be bought, sold, and licensed.

- Similarly it can be protected against theft and infringement by others.

Patent

1. Derived from the Latin word _LITTERAE PATENTES‘ which means _Open Letters‘ or _Open Documents‘

2. A contract between an Inventor and the Government.
3. An exclusive privilege monopoly right granted by the Government to the Inventor.
4. Invention may be of an Industrial product or process of manufacture.
5. Invention should be new, non-obvious, useful and patentable as per Patents Act.

6. The right to the inventor is for limited period of time and valid only within the territorial limits of a country of grant.

Design

1. Meant for beautifying an industrial product to attract the consumer public.

2. Shaping, Configuration or Ornamentation of a vendible Industrial product

3. Exclusive _Design Rights' to the originator for a limited term
4. Patents & design embrace the production

Trade mark

1. Trade Mark is a name or symbol adopted for identifying goods.

2. Public can identify from the Trade Mark from whom the product is emanating.
3.Trade Marks protection is given for an industrial product by the Government.

Copy Right

1. The right to literary and artistic works.
2. Patent, Design & Trademark together with Copyright form _TOTAL INTELLECTUAL PROPERTY'.

Need For a Patent System

1. Encourages an inventor to disclose his invention

2. Encourages R & D activities as the industries can make use of the technology, & avoids redundant research
3. Provides reasonable assurance for commercialisation.

4. Provides an inducement to invest capital in the new lines of production and thus, help for technical development and up gradation.

5. One may get a very good return of income through Patent Right on the investment made in R & D. What is not patentable?

1. An invention which is frivolous or claims anything obviously contrary to well established natural laws.

2. An invention intended use of which would be contrary to law or morality or injurious to public health
3. A mere discovery of a scientific principle or the formulation of an abstract theory.
4. Duplication of known devices.

5. Method of testing during process of manufacture or restoration or improvement of existing equipment

6. A method of agriculture or horticulture.

7. Any process for the medicinal, surgical, curative, prophylactic or other treatment of human beings or animals or plants to render them free of disease or to increase their economic value.

8. Inventions relating to atomic energy.

Effect of patent

1. A patentee gets the exclusive monopoly right against the public at large to use, sell or manufacture his patented device.

2. A patentee can enforce his monopoly right against any infringement in the court of law for suitable damages or profit of account.

3. The Government ensures full disclosure of the invention to the public for exchange of exclusive monopoly patent right to the inventor.
Patent Information

The information what one gets from the patent document

Advantages

1. Patent information source is enormous and wide.

2. 80% of the information is first published only in the patent documents and not elsewhere.

3. Classified according to the International Patent Classification System to enable easy approach and use.
4. Used for further research as a stepping-stone.

5. Available to the public for free use after the term of the patent expires or when the patent ceases to be in for Plays a vital role in Technology transfer

11. What are the factors that affect risk acceptability? What is the use of knowledge of risk acceptance to engineer? (April/May 2016)

The factors that affect risk acceptability are

1. Probability of risk (the statistical nature of occurrence of risk).
2. Consequence of the risk. This is a quantitative measure. It can be physical damage or death of people, economic loss or damage of property, loss of money or reputation, degradation of the environment, and sometimes mental agony.
3. Voluntaryness (i.e., for thrill and amusement or under compulsion (involuntaryness).
4. Magnitude i.e., number of people or extent of area involved.
5. Proximity, the closeness of relationship with those affected or the gap in time scale.
6. Method of information dissemination on risk.
7. Job-related, i.e., whether it is under compulsion or volition.

The knowledge of risk acceptance is useful to the engineers. The designer can redesign the product/project to include safety measures, so as to (*a*) allow the product fail safely, (*b*) abandon it safely, and (*c*) provide for safe escape/evacuation from the product or site, and thus eliminate or minimize the human loss.

The use of knowledge of risk acceptance to engineer is important to know about the risk benefit analysis.

There are many positive uncertainties in determining the risk of a product/service.

1. Restricted access to knowledge on risk: Some organizations do not disclose the data, citing legal restrictions.
2. Uncertain behavior of materials: Test data supplied by the suppliers are only statistical. The individual parts may behave considerably (! 3 σ) different from the statistical mean obtained from the tests on random samples.
3. Uncertain and varying behavior of user environments such as physical shock, thermal shock, fatigue, creep, impulse and self-excited vibrations in components or structures due to winds, snow fall, and rains cause sudden failure of the whole structure. An error or wrong procedure during assembly or joining the components may cause additional stress leading to early failure.
4. The use or misuse of materials/products, remaining untracked, e.g., exposure to rain or snow or damp weather is likely to change the properties.
5. Newer applications of obsolete technologies, remaining unpublished,
6. Substitution of newer materials whose behavior are not disclosed, and
7. The unexpected and unintended outcomes of the product/project.

All these aspects make the estimation of risk complex and unreliable. Hence, the data are to be monitored continuously and risk estimation updated periodically.

For example, a few friends live very near the cement plant, as they are unable to choose a better location for their house. The group work as motor mechanics in an automobile service station nearby.

The air is full of dust and some drainage canals cut across their house sites. They hold that they are exposed to involuntary risk, from dust and drain. But the same persons have previously-owned motor cycles, with which they travel during week ends to their villages through muddy roads.

Now they are willing to take risk voluntarily, i.e., they have no apprehensions on this travel. Statistical study indicates that individuals are more ready to accept voluntary risks (hunting, skiing, fighting in wars) than the involuntary risks (electric shock, natural calamity). Even though the voluntary risks are thousand times more fatal than involuntary ones, individuals meet them, for the thrill or adrenal quest or for achievement and for a page in the Guinness record.

Another stand or perception closely related to this example is that of 'Control'. There are people who choose to play stunts such as jumping through fire gates, skiing and flying, car racing through tortuous terrains. Most of these people exhibit extraordinary confidence in them and on their gadgets and also believe that the hazards are under their control.

UNIT V-GLOBAL ISSUES

Part A

1. What is meant by multi National Corporation? [May 2010]

Multinational Corporation does extensive business in more than one country. For example Hindustan lever ltd, Maruthi, Hyundai, etc are multinational corporations. For example, Union Carbide (Bhopal) of USA has more than 37 branches across the world, which includes INDIA also. The country in which the company is established is called the Home country and the company's country is called as Host country. In most of the multinational companies, the home company has a share of 51% and the host company has 49% of share.

2. What are the three senses of relative values?

Relative values mean relative principles. These relative values help in deciding how the multinational corporations and individuals have to act in host countries. There are many versions of relativisms depending on the way in which values are supposed to be relative. Here are three versions namely Ethical Relativism, Descriptive Relativism and Moral Relationalism or Contextualism

3. Explain : Ethical Relativism.[May 2011]

Ethical Relativism: Actions are morally right within a particular society when they are approved by law, custom, or other conventions of that society. It is a false one as it implies ridiculous and illogical ways. It justifies a deliberate extermination of a race of people such as in Germany. They are not morally correct as it is criticized with human rights, public good, and duties to respect people.

4. Explain : Descriptive Relativism.

Descriptive Relativism :As a matter of fact value beliefs and attitudes differ from culture to culture. It does not entail (involve) ethical relativism. As per this theory, there exists some difference between the moral beliefs and attitudes of different culture.

5. List some of the International Human Rights.

The following are some of the international human rights, namely

(i)The right to freedom of physical movement (ii) The right to ownership of property

(iii)The right to freedom from torture (iv) The right to fair trail The right to non-discrimination
(v)The right to physical security (vi) The right to freedom of speech and association

(vii)The right to minimal education (viii)The right to political participation (ix)The right to subsistence.

6. Explain : Moral Relationalism.

Moral Relationalism or Contextualism :Moral judgments should be made in relation to the factor that varies from case to case. In particular, customs and laws are usually morally relevant factors that should be taken into account. For example in our country, we remove the shoes before entering a house as a symbol of respect, but we cannot expect it in western culture.

7. List some steps for promoting morally Just measures. Some of the steps are listed below.

(i)Multinational corporations and individuals should respect the basic human rights of the people of the host countries.

(ii) The activities of the multinational corporations should give some benefits to the host countries.

(iii) The multinational should do more good to the host countries by the way of promoting the overall economy and improving the welfare of the workers.

(iv) The business activities of the multinationals must improve morally justified institutions in the host countries.

(v) Multinationals should respect the laws and the cultures of the host countries without violating the basic moral rights.

(vi) Multinationals should give a fair wage to their employee and workers of the home company same as that of the host company.

(vii) Sufficient safety of the workers and danger in the working conditions should be taken care of the multinationals.

8. What is technology transfer? [Nov 2015]

Technology Transfer: Technology transfer is a process of changing the technology to a new setting and implementing it. Technology includes hardware such as machines and installations as well as techniques such as technical, organizational, and managerial skills & procedures. The transfer of technology may be done by governments, universities private voluntary organizations, consulting firms and by multinational companies.

9. What is appropriate technology?

Appropriate Technology: Appropriate Technology means identification, transformation, and implementation of the most suitable technology for a new set of conditions. These conditions include

social factors, which are apart from economic and technical engineering constraints. Identification done, based on human values and needs.

10.What is meant by environmental ethics?[Nov 2011]

Environmental Ethics forbid the activities of people for deteriorating the surroundings of environment in so many ways. It is well known fact that we are misusing our major resources there by spoiling the environment. Moreover, it is well known agreed fact that industrial activities mainly affect the biosphere, polluting water and atmosphere.

11. What is computer ethics?

Computer Ethics is the analysis of the nature and social impact of computer technology and the corresponding formulation and justification policies for the ethical use of technology. It defines as a field concerned with "policy vacuums" and "conceptual muddles" regarding the social and ethical use of information technology.

12. What is meant by bio centric ethics?[May 2011]

A life-centered ethics regards all living organisms as having inherent worth. The most fundamental feature of us is our will to live, by which both a will to survive and a will to develop according to inmate tendencies. Most recent defenders of bio centric ethics however have developed complex sets of rules for guiding decisions.

13. Who are hackers?

The individuals who directly meddle with any computer security system by implanting unwanted codes with the objective of paralyzing the network and destroying the equipments said as hackers.

14. Who are consulting engineers?

Consulting engineers work in private practice. Fees for the services they render, not by salaries received from employers compensate them. Because of this, they tend to have greater freedom to make decisions about the projects they undertake. Yet, their freedom is not absolute. They share with salaried engineers the need to earn a living.

15. List out the problems of Defense Industry.

(i)Many nations feel with privilege on their defense industry but without thinking on some serious problems that they may come across along with huge military buildings.

(ii) The defense industry faces the problem of waste and huge cost in implementing and maintaining a weapon system.

(iii) The defense industry also facing the problem of technology creep, that is the development of new weapons. It makes changes in the arrangements relating to diplomacy. It upsets all negotiations. It affects the political ability of a country.

(iv) It also faces the problems in maintaining secrecy. The secrecy in weapons development paves the way for corruptions and leads to create mistakes in the weapon system itself.

(v) Every country allocates a large amount of its resources to defense sector. The amount spent in the defense industry creates only a few jobs when compared with the other industries.

16. List out the engineer involvement in Weapon Development.[May 2011]

(i)Engineer's involvement in manufacturing of weapons is unavoidable. For engineers who design weapons, manufacture them, and use them have some reasons to support their involvement. The following are some of the justifying arguments

(ii) Take a case of an engineer who involves in the manufacturing of antipersonnel bombs. Antipersonnel bombs are most dangerous. When they explode, they evolve a shower of sharp fragments of steel or plastic on the victims. They can fix the time to explode after some hours of delivery. When they explode on a person, the removal of the fragments is a time consuming task. The engineer who produces this kind of bomb clearly known about its danger. When he thinks morally he does not want to be involved in producing them.

(iii) However, for his involvement he may argue that if he does not do his job, someone else will be doing the job. Doing job produces a steady income for his family.

(iv) A chemical engineer who gets involved in the production of napalm (napalm is a jelly like petrol substance used in incendiary bombs) argues that only the government must take necessary actions to stop the production of napalms.

(v) Another engineer, who is a specialist in controlling and guiding missiles, says that he feels proud to be able to help his country through his involvement in the defense industry. He also adds that there should have not been any more world wars.

(vi) A nuclear engineer knows very well about the danger of increasing nuclear arsenal. Arsenal is a place where the weapons are being stored. He argued that he is working very hard to reduce the risk of nuclear accidents.

(vii) From the above examples it is clear that all over the world talented engineers are engaged in the weapons work. They should think morally, before getting involved in weapons production.

17. Explain competitive bidding for consulting engineers. [May2013]

Competitive bidding means offering a price in order to achieve something in return by that offer. The professional codes of ethics forbid the consulting engineers from involving competitive bidding. They are restricted from competing for jobs based on submitting priced proposals.

18. What is bias and explain three types of bias.

The most common abuses involve more subtle biases resulting from money, ego, and sympathy. The various types of bias are

(i)Financial Biases (ii) Ego Biases (iii) Sympathy Biases

19. Explain your views on engineers as managers. [MAY 2010]

Most of the engineers are experiencing the best methods of technical training like other professions. Many of the engineers move into managerial jobs. The reason being many companies' wants to

have the engineers as managers. Because they have thought that in order to manage technological corporation, the technical understanding of the engineers is very essential.

20. What is meant by conceptual framework in computer ethics? [Nov 2009]

Computer program: Is it an IP? Is copyright applicable to this? Or is it a process protected by a patent? Is it proprietary information? Here, guidelines are needed.

21. List the provision in NSPE codes on the advertisement by consultant. [May 2013] The following are prohibited:

Statement containing misrepresentation or omission of a necessary fact, Statement likely to create an unjustified expectation, statement containing prediction of future success, and Statement likely to attract clients, by the use of slogans

22. Mention the different types of intellectual property rights. [Nov 2013]

IP rights are categorized into different types, as per the nature of the intellectual property. The most common types are copyrights, trademarks, patents, industrial design rights, and trade secrets. So these rights safeguard the interests of the owners of IP. If you are an author, who has written a new book, you can apply for a copyright for your work. Likewise, patents can be obtained for inventions. Once you establish your IP right, you can protect your work legally.

23. What is meant by moral leadership? [Nov 2015,May 2016]

Moral Leadership is a very different kind of leadership. Rather than aspiring to being followed, Moral Leaders aim to serve. Instead of showcasing their own skills, Moral Leaders tend to develop the capacities of others. Moral Leadership is not about rank – any person holding any position can be a

Moral Leader, but such individuals are always characterized by a deep sense of ethics, are driven by core ideals (such as justice) and are motivated by the pursuit of a higher purpose.

24. What are the normal issues that may arise in Multinational Corporation? [April 2014]

Multinational Corporation does extensive business in more than one country. For example Hindustan lever ltd, Maruthi, Hyundai, etc are multinational corporations. For example, Union Carbide (Bhopal) of USA has more than 37 branches across the world, which includes INDIA also. The country in which the company is established is called the Home country and the company's country is called as Host country. In most of the multinational companies, the home company has a share of 51% and the host company has 49% of share.

25. Differentiate eye witness and expert witness in the legal system. [April 2014]

To appropriately gather evidence and relevant opinions, both factual witnesses and expert witnesses will be called to testify. Although both entities offer relevant information to the case, there are fundamental differences between the two types of witnesses. The factual witness is an individual who is knowledgeable towards the facts of the case through a direct participation or observation of the intricacies involved. For example in a murder case, a factual witness would be an observer of the actual murder or an acquaintance of the individuals involved in the case. The factual witness simply delivers truthful statements regarding the character of those involved or an account of what they saw take place. In contrast, an expert witness is an individual who holds a specialized knowledge in a particular educational field concerning the case.

26. What is meant by Globalization? (May 2016)

The process by which businesses or other organizations or start develop international influence operating on an international scale.

PART B

1. Explain the role of engineers as managers.

ENGINEERS AS MANAGERS

Engineers undergo the most intensive technical training of any professionals, yet early in their careers many of them move into managerial roles for which they received little direct training as undergraduate students. On the one hand, many companies prefer engineers as managers because their technical understanding is essential to managing technological corporations, and because it is easier to teach engineers the business side of corporate work than to teach non-engineers engineering. In addition, corporations value engineers' general strengths in quantitative analysis, their strong work ethic, and their confidence in problem solving.

On the other hand, engineers find management inviting because of an array of corporate incentives. These incentives include higher salaries, greater authority, and widened areas of responsibility, and increased prestige and recognition. It is true that some corporations, especially large ones, have instituted a "dual-ladder system" that allows engineers to advance in their careers along either administrative or technological tracks. However, in practice the technical track tends to offer less recognition within the business culture than ―Becoming the Boss.‖

Managers as Professionals

Making the transition from primarily technical work to management involves many adjustments. It requires expanded knowledge about finances and scheduling, strengthened skills in coordinating and motivating other people, and the ability to make risk-taking decisions involving a wider range of factors than purely technical considerations. Engineers have ethical responsibilities outlined in their professional codes of ethics.

The primary ethical responsibility of managers is to produce a valuable product (or service) while maintaining respect for persons, including customers, employees, and the public. In deciding on ethical issues, persons and safe products come first, not profits. To be sure, there is an element of truth in Friedman's view. By contrast, with not-for-profit corporations (such as charitable groups, religious organizations, and universities), for-profit corporations function successfully only when they make a profit. Rather than being the only or the paramount goal of all business dealings, however, profits are an essential condition for remaining in business, to be able to produce useful products and services. The ultimate goal of managers and engineers alike should be to make valuable products that are also profitable.

Good business and sound ethics go together, for the most part, and in the long run. Hence, at a fundamental level, the moral roles of engineers and managers are complementary and symbiotic, rather than opposed. As managers, engineers remain professionals whose primary moral responsibility is to provide safe and useful products that are profitable. Admittedly, the transition to management does involve adjustments and shifts in emphasis. Moreover, higher management tends to be dominated by a culture that sometimes clashes with the culture of professional work

of engineers. As a result of their different experience, education, and roles, higher management tends to emphasize corporate efficiency and productivity, the bottom line. Engineers and other professionals tend to emphasize excellence of work and (we hope) ethical commitment to the public goods promoted by their work. But these differences should be a matter of emphasis rather than opposition.

Let us turn now to two responsibilities of engineer-managers: promoting an ethical climate and

resolving conflicts.

Promoting an Ethical Climate

An ethical climate is a working environment conducive to morally responsible conduct. Within corporations it is produced by a combination of formal organization and policies, informal traditions and practices, and personal attitudes and commitments. Engineers make a vital contribution to such a climate, but managers have even greater responsibility.

The defining features of an ethical corporate climate are suggested as four features.

First, ethical values in their full complexity are widely acknowledged, appreciated by managers and employees alike. Responsibilities to all constituencies of the corporation are affirmed not only to stockholders, but also to customers, employees, and all other stakeholders in the corporation. That does not mean that profits are neglected, nor does it neglect the special obligations that employees of corporations acquire to promote the interests of the corporation. For the most part, serving the interests of the corporation is the way in which the public good is promoted.

Second, the sincere use of ethical language is recognized as a legitimate part of corporate dialogue. One way to emphasize this is to make prominent a corporate code of ethics. Another way is to explicitly include a statement of ethical responsibilities in job descriptions of all layers of management.

Third, top management must set a moral tone, both in words, in policies, and by personal example. Official pronouncements asserting the importance of professional conduct in all areas of thecorporation must be backed by the willingness to respond to the effort by professionals to work according to the guidelines outlined in professional codes of ethics. Fourth, there need to be procedures for conflict resolution.

Equally important is educating managers on conflict resolution, a topic to which we discuss.
Managing Effectively dealing with conflicts, including value disagreements, is an essential managerial task in guiding and integrating employees' work. Managers have the authority and the responsibility to resolve or prevent damaging conflicts that threaten corporate efficiency. Their

ultimate weapon is force: "I'm in charge—see it my way or I'll fire you." But over reliance on force is generally regarded as self-defeating authoritarian abuse of authority. Certainly within technological cor-porations, successful management means evoking the fullest contribution of employees, and that sometimes means tolerating and even inviting some forms of conflict. The manager's task is to create climates in which conflicts are addressed constructively.

One study ranked the seven most common conflicts confronted by engineering project managers, in order of priority of overall intensity (as perceived by managers), as follows:

Conflicts over schedules, especially where managers must rely on support departments over which the manager has little control,

Conflicts over which projects and departments are most important to the organization at a given time, Conflicts over personnel resources made available for projects,

Conflicts over technical issues, in particular over alternative ways to solve a technical problem within cost, schedule, and performance objectives,

Conflicts over administrative procedures, such as the extent of the manager's authority, ac-countability procedures and reviews, and administrative support, Personality conflicts, and

Conflicts over costs.

All of these areas can involve explicit or tacit value disagreements. The study noted that while personality conflicts ranked relatively low in intensity, they tended to be the most difficult to resolve. In part, the difficulty was that they were sometimes difficult to pinpoint, since they were interwoven with other conflicts, such as disagreements over technical issues, and communication problems.

The Harvard Negotiation Project has explored all types of conflicts among persons, not just personality conflicts, in recent decades. The project has sought ways to avoid both the "win-lose" style of managing conflict in which one adversary wins and the other is humiliated, and the "being nice" style that is too eagerly yielding to others or that tries to avoid conflict altogether, even when conflict is creative. Among the central ideas generated by that project are the following four widely applicable principles for conflict resolution.

1 "People: Separate the people from the problem." This does not mean that only the problem is important. The personal aspect of conflicts is distinguished from the problem in order to be able to better deal with both.

2 "Interests: Focus on interests, not positions." This principle applies most clearly to personnel matters and ethical perspectives, rather than technical disputes.

3 "Options: Generate a variety of possibilities before deciding what to do." Especially in conflicts over technological solutions and ethical priorities it is crucial to evoke a wide range of options in order to overcome the effects of tunnel vision.

4 "Criteria: Insist that the result [of conflict resolution] be based on some objective standard." Within corporate settings it is usually clear what general standards are to be used in evaluating results. But beyond the goals of efficiency, quality, and customer satisfaction, it is important to develop a sense of fair process in how the goals are met. Otherwise disagreements easily degenerate into contests of will

2. Explain environmental ethics.
ENVIRONMENTAL ETHICS

Exxon's 987-foot tanker Valdez was passing through Prince William Sound on March 24th, 1989, carrying 50 million gallons of oil when it fetched up on Blioh Reef, tore its bottom, and spilled 11 million gallons of oil at the rate of a thousand gallons a second. This was one of the worst spills ever, not in quantity, but in its effect on a very fragile ecosystem.

As human beings, we share a common environment, a common ecosphere. Urgent concern for that environment must increasingly become a united commitment that cuts across national boundaries. It is thus appropriate that a discipline have begun to explore a new branch of applied ethics called environmental ethics. This field overlaps with engineering ethics at many points only a few of which are discussed here.

Case Studies

The disaster at Bhopal occurred with numbing terror during a few hours and days. Other disasters, such as the Chernobyl nuclear plant explosion, have involved longer-term environmental effects, but the patterns of damage are still relatively clear. Particularly difficult to assess are long-range changes in climate due to the greenhouse effect and depletion of the ozone layer.

Acid Rain Consider, for example, the damage currently being caused by acid rain and acid deposition. Normal rain has a pH of 5.6, but the typical rain in the northeastern areas of North America is now 3.9 to 4.3. This is 10 to 100 times more acidic than it should be, about as acidic as lemon juice. In addition, the snowmelt each spring releases huge amounts of acid that were in frozen storage during the winter months. "Acid shock" from snowmelt is thought to cause annual mass killings of fish. Longer-term effects of the acid harm fish eggs and food sources. Deadly quantities of aluminum, zinc, and many other metals leached from the soil by the acid rain also take a toll as they wash into streams and lakes. Forests have also been steadily killed, larger animals have suffered dramatic decreases in population and some farmlands and drinking-water sources are damaged. These results have occurred during only a few decades. The next decades will multiply them many times over.

The cause is now clear: the burning of fossil fuels that release large amounts of sulfur dioxide (SO2)—the primary culprit—and nitrogen oxides (N02). In both instances, major sources of the pollutants are located hundreds and even thousands of miles away, with winds supplying a deadly transportation system to the damaged ecosystems. As we know now, pollution does not stop at national borders, necessitating international control to control it.

Much remains to be learned about the mechanisms involved in the processes pictured in Fig. It is still impossible to link specific sources with specific damage. More research into shifting wind patterns and the air transport of acids is needed. Groundwater is undoubtedly being polluted, but it is unclear what that means for human health. Much underground water currently being used was deposited by rainfall over a hundred years ago, and current acid rain may have its main effects on underground water a century from now.

Worldwide use of fossil fuels by industrial nations is causing a buildup of carbon dioxide in the atmosphere, which could result in a greenhouse effect damaging the entire earth. Similarly, damage to the protective ozone layer of the earth's atmosphere resulting from the release of freon is related to technological products used by the populations of those same nations.

PCBs and Kanemi‘s Rice Oil A decade of rapid industrial growth in Japan had taken its toll on the environment. Then, in the summer of 1968, a disease of unknown origin appeared in southern Japan. Victims suffered from disfiguring skin acne and discoloration, fatigue, numbness, respiratory distress, vomiting, and loss of hair. Eventually 10,000 people were stricken and some died. What was the cause? An investigation of 121 cases was conducted, with 121 healthy individuals matched to the victims by age and sex being used as a control group. All 242 were questioned regarding their diets,

personal habits, and places of work. When it was discovered that the only significant difference between the two groups was in the amount of fried foods eaten, the disease was traced to rice oil produced by the Kanemi Company.

It took another seven months to find the specific agent in the oil. Autopsies performed on victims revealed the presence of PCBs, polychlorinated byphenyls. Oil made from rice bran at the Kanemi plant was heated at low pressure to remove objectionable odors. The heating pipes were filled with hot Kanechlor, a PCB containing fluid, but the pipes were corroding and tiny pinholes in them allowed PCBs to leak directly into the oil The Commons and a Livable Environment

Aristotle once remarked that what does the most people share get the least amount of care. Common experience confirms the frequent tendency of people to be thoughtless about things they do not own individually and which seem to be in unlimited supply. William Foster Lloyd was an astute observer of this phenomenon. In 1833 he described what the ecologist Garrett Hardin would later call "the tragedy of the commons." Lloyd observed that cattle in the common pasture of a village were punier and more stunted than those kept on private land. The common fields were themselves more worn than private pastures. His explanation began with the premise that each farmer is understandably motivated by self-interest to enlarge his or her herd by one or two cows, claiming that the overall effect is minuscule. Yet the combined effects of all the farmers behaving this way is overgrazing of the pasture, even though it is true that each act taken by itself does negligible damage.

In this century, increasing population and decreasing natural resources have prompted similar thinking about our relationship with nature. The same kind of competitive, unmalicious, but unthinking exploitation arises with all natural resources held in common: air, land, forests, lakes, and oceans. Indeed, increasingly we must regard the entire biosphere as our "commons." Guilty until Proven Innocent

The examples just given cover barely a fraction of the many environmental issues that might arise in engineering practice. But they suffice to raise some key questions of ethical import: Who is affecting whom—and where, when, and how? In the PCB pollution cases in Japan the question was:

Who is releasing toxic substances? In all instances the polluting companies refused to acknowledge their mistakes and rejected claims by the victims. The government did not intercede on behalf of those affected. It took long and costly court battles to win partial victories. The victims of pollution in Japan were easily identified, the offenders less so. These difficulties are multiplied many times in the case of acid rain.

Any search for answers as to how the responsibility for environmental degradation should be shared will invariably lead us to further questions about how polluters and pollutants should be controlled. The tempting recourse in these matters is the judicial system: Let the courts decide who is guilty and how they are to be stopped. But there are shortcomings in this approach: The courts move slowly, few individuals (whether plaintiff or defendant) can afford the process, and over-reliance on the law promotes minimal compliance. In environmental cases the difficulties are compounded. A judge cannot be expected to be a specialist on health, safety, and the environment, nor can he or she usurp the powers of the legislature and prescribe control mechanisms. The most a judge can do is to guarantee a fair legal process. Assuring a fair legal process is in itself a major undertaking.

With so many uncertainties, one approach would be not to release a new product or process until it is shown to be risk-free. Industry and its engineers might claim that this is tantamount to declaring something to be guilty merely because innocence cannot be established.

In criminal law, as practiced in Britain and America, a man is "innocent until proven guilty." Scientists, however, see things otherwise. Science is an occupation in which most experiments fail. Engineers have more confidence in their projects and will therefore chafe at such an interpretation.

But they would have to be omniscient if they could foresee all the environmental effects of their work.

Internalizing Costs of Environmental Degradation

When we are told how efficient and cheap many of our products and processes are—from agriculture to the manufacture of plastics—the figures usually include only the direct costs of labor, raw materials, and use of facilities. If we are quoted a dollar figure, it is at best an approximation of the price. The true cost would have to include numerous indirect factors such as the effects of pollution, the depletion of energy and raw materials, and social costs. If these, or an approximation of them, were internalized (added to the price) then those for whose benefit the environmental degradation had occurred could be charged directly for corrective actions. The problem with the "technofix" approach—using technology to repair the damages of technology—is not so much with physical realization as it is with the financial burden. As taxpayers are

beginning to revolt against higher levies, the method of having the user of a service or product pay for all its costs is gaining more favor. The engineer must join with the economist, the natural and physical

scientists, the lawyer, and the politician in an effort to find acceptable mechanisms for pricing and releasing products so that the environment is protected through truly self-correcting procedures rather than adequate-appearing yet often circum-ventable laws. But we wish to point out that good design practices may in themselves provide the answers for environmental protection without added real cost.

For example, consider the case of a lathe that was redesigned to be vibration-free and manufactured to

close tolerances. It not only met occupational safety and health standards for noise, which its

predecessor had not, but it also was more reliable, more efficient, and had a longer useful life, thus

offsetting the additional costs of manufacturing it.

Technology Assessment

Until 1995, the U.S. congress had an Office of Technology Assessment. It prepared studies on the social and environmental effects of technology in areas such as cashless trading, nuclear war, health care, or pollution. At the federal and state levels, many large projects must be examined in terms of their environmental impact before they are approved. The purpose of all this activity is praiseworthy.

When scientists conduct experiments, they endeavor to distill some key concepts out of their myriad observations. As shown in Fig, a funnel can be used to portray this activity. At the narrow end of the funnel, we have the current wisdom, the state of the art. Engineers use it to design and build their projects. These develop in many possible directions, as shown by the shape of the lower, inverted runnel. The difficult task of technology assessment and environmental impact analyses is to explore the extent of this spread and to separate the more significant among the possibly adverse effects.

The danger in any assessment of technology is that some serious risks can easily be overlooked while the studies and subsequent reports, properly authenticated by the aura of scientific methodology, assure the decision maker that nothing is a miss. But there is a danger in believing that no further action is required once the reports have been approved and filed. Our contention remains that engineering must be understood as social experimentation and that the experiment continues, indeed enters a new phase, when the engineering project is implemented. Only by careful monitoring, which was well carried out by the Office of Technology Assessment, will it be possible to gather a more complete picture of the tangled web of effects encompassed in Fig. within the inverted, lower funnel.

3. What are the philosophical views of nature? Discuss ecocentric ethics.[Nov 2011]

Philosophical Views of Nature

Since the 1970s, and especially since 1979 when the new journal Environmental Ethics was founded, philosophers have explored a wide range of moral perspectives concerning the environment.

The most fundamental issue is whether ethical theories need to be rethought by widening the circle of things that have inherent worth, that is, value in themselves, independent of human desires and appraisals. Traditional theories were exclusively human-centered or "anthropocentric": They recognized only persons as having inherent worth and regarded nature as a mere resource for humanity.

Sentient-Centered Ethics Of the several versions of nature-centered ethics advanced by philosophers we examine first the one that recognizes all sentient animals as having inherent worth. Sentient animals are those that feel pain and pleasure and have desires. Thus, some utilitarians extend their theory (that right action maximizes goodness for all affected) to sentient animals as well as humans. Thus, in building a dam that will cause flooding to grasslands, engineers should take into account the impact on animals living there. Singer allows that sometimes animals' interests have to give way to human interests, but their interests should always be considered and weighed.

Philosophers, however, do ascribe rights to animals. Most notably, Tom Regan contends that conscious creatures have inherent worth because not only they can feel pleasure and pain, but because more generally they are subjects of experiences who form beliefs, memories, intentions, preferences, and can act purposefully. In his view, their status as subjects of experiments makes them sufficiently like humans to give them rights. Hence, they think of conscious animals as deserving equal consideration. That does not mean they must be treated in the identical way we treat humans, but only that interests should be weighed equally with human interests in making decisions.

Biocentric Ethics A life-centered ethics regards all living organisms as having inherent worth. Albert Schweitzer (1875-1965) set forth a pioneering version of this perspective under the name of "reverence for life." He argued that the most fundamental feature of us is our will to live, by which he meant both a will to survive and a will to develop according to our innate tendencies. All organisms share these instinctive tendencies to survive and develop, and hence consistency requires that we affirm the inherent worth of all life. Schweitzer refused to rank forms of life according to degrees of inherent worth, but he believed that a sincere effort to live by the ideal and virtue of reverence for life would enable us to make inevitable decisions about when life must be sacrificed. More recent defenders of biocentric ethics, however, have developed complex sets of rules for guiding decisions. Ecocentric Ethics A frequent criticism of sentient-centered and biocentered ethics is that they are too individualistic, since they locate inherent worth in individual organisms. By contrast, ecocentered ethics locates inherent value in ecological systems. This approach was voiced by the naturalist Aldo Leopold (1887-1948), who urged that we have an obligation to promote the health of ecosystems: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." This "land ethic," as he called it, implied a direct moral imperative to preserve, not just conserve, the environment.

More recent defenders of ecocentric ethics have included within this holistic perspective an appreciation of human relationships. Thus, J. Baird Callicott writes that an ecocentric ethic does not "replace or cancel previous socially generated human-oriented duties—to family and family members, to neighbors and neighborhood, to all human beings and humanity." That is, locating inherent worth in wider ecological systems does not cancel out or make less important what we owe to human beings Human-Centered Environmental Ethics Even this brief overview of non-human-centered ethics reveals substantial differences within each approach. The same is true of human-centered ethics. Increasingly, human-centered views of nature have shifted away from an exploitative to a conservationist attitude. Recognition of the limits of natural resources has inspired awareness of the need to conserve for the sake of both present and future generations of human beings.

Human- centered environmental ethics extends traditional ethical theories in light of the threats to human beings presented by the destruction of nature. Thus, virtue-ethics draws attention to the virtues of humility, appreciation of beauty, and gratitude toward the natural world that makes life possible. Rights-ethics urges that the basic right to life entails a right to a livable environment at a time when pollution and resource depletion has reached alarming proportions. Duty-ethics urges that respect for human life implies far greater concern for nature than has been traditionally recognized, and even Kant argues that callousness and cruelty toward conscious animals would carry over to indecent treatment of persons. Utilitarians emphasize that human pleasures and interests are linked to nature in ways beyond engineered products made from natural resources. We have aesthetic interests, as in the beauty of plants, waterfalls, and mountain ranges; recreational interests, as in hiking and backpacking

in wilderness areas; scientific interests, especially in the study of "natural labs" of ecological preserves; and survival interests, which we have learned are linked directly to preserving the natural environment.

It follows that not everything of importance within a human-centered ethics fits neatly into cost-benefit analyses with limited time horizons; much must be accounted for by means of constraints or limits that cannot necessarily be assigned dollar signs. Moreover, while there is a gulf between the human-centered and nature-centered perspectives, its extent should not be exaggerated. We can all agree that nature should not be denuded but instead left in a recoverable state as a safe exit and for the benefit of later generations to enjoy. Again, even if animal interests are not counted anywhere on a par with human interests, it remains abhorrent to inflict needless suffering on animals who share our capacity for pain.

4. Explain engineers as expert witnesses and advisors. (April/May 2016)

ENGINEERS AS EXPERT WITNESSES AND ADVISERS

Engineers sometimes serve as consultants who provide expert testimony in adversarial or potentially adversarial contexts. The focus may be on the past, as in explaining the causes of accidents, malfunctions, and other events involving technology. Or the focus may be on the future, as in public planning, policy-making that involves technology, and the potential value of patents.

Expert Witnesses in the Courts

Let us begin with the court system, either the plaintiff or the defense, usually in civil lawsuits but also in criminal proceedings, may hire engineers. Some engineers serve only occasionally as expert witnesses, while others do so routinely and become specialists in forensic engineering: the application of engineering skills within the justice system. Testimony may concern a wide variety of cases: defective products, personal injury, property damage, traffic accidents or airplane crashes. Typically, the main issue is who will be required to pay "compensatory damages" for injuries, loss of property, or violation of rights.

Their primary responsibility is to be objective in discovering the truth and communicating it honestly. In particular, the role must be understood in terms of the aims of a (morally justified) legal system, consistent with professional standards (as promulgated in codes of ethics).

The legal system distinguishes between eye witnesses and expert witnesses. Eye witnesses testify in matters of perceived facts. Whereas expert witnesses are permitted wider attitude in testifying on facts in their areas of expertise, on interpreting facts, in commenting on the views of the opposing side's

expert witnesses, and in reporting on the professional standards especially the standard of care

applicable at the time of making a product or providing a service. The role of expert witnesses is to

identify the truth about the causes of accidents. Codes of ethics have only recently begun to clarify the

roles of engineers in adversarial contexts, and as a result there has been little shared understanding

about the appropriate role.

Abuses

Hired Guns The most flagrant abuse is the unscrupulous engineer who makes a living by not even trying to be objective, but instead in helping attorneys portray the facts in a way favorable to their clients. A small minority of engineers do become hired guns, who violate the standards of honesty and due care in con-ducting investigations. Unfortunately, this minority has tainted the entire practice of serving as an expert witness.

Consider a simple case. A roofer falls while climbing down a wooden ladder and is seriously injured. The roofer sues the manufacturer of the ladder for medical costs and lost wages. Witnesses of the accident offer conflicting testimony about whether the accident was caused by a crack in the ladder, raising the question of a product defect, or by the carelessness of the roofer who was descending the ladder too quickly and perhaps caused the ladder to crack when falling on it. A structural engineer hired by the manufacturer writes a report favoring the manufacturer, selecting and emphasizing facts in the opposite way the engineer would have done if hired by the plaintiff's attorney.

The engineer acted improperly. A truthful report would express the best personal judgment of the engineer, and presumably, that judgment should yield the same report whether it was paid for by the plaintiff or defense attorney.

The most common abuses involve more subtle biases resulting from money, ego, and sympathy. Financial Biases Merely being paid by one side can exert some bias, however slight. This bias might influence one's investigations, testimony, and even the presentation of one's qualifications. Obviously, the bias would increase substantially if engineers were hired based on contingency fees paid only if case is won. Attorneys are permitted to accept contingency fees because the fees are believed to strengthen their determination to serve their clients. But contingency fees in adversarial contexts would tend to bias the judgment of expert witnesses. That is why they are unethical, even if law sometimes permits them.

Ego Biases Most of us know from experience that adversarial situations evoke competitive attitudes that can influence judgment. Identifying with their ―own‖ side of the dispute can easily influence engineers. The other side comes to be seen as the guilty party and one's own side as the innocent victim. There is also a combination of desires to serve the interests of one's client and to be well regarded by the client.

Sympathy Biases The courts are filled with human drama in which people's suffering is all too poignant. It is easy to identify with the plight of victims. Indeed, one may feel great sympathy for the opposing attorney's client. Such biases are capable of upsetting a purely disinterested investigation of the facts.

To overcome these biases, engineers must make a special effort to maintain their integrity when serving as expert witnesses.

Advisers in Planning and Policy-Making

We now see the role of expert advisers in public policy-making and planning, a role played by engineers as well as economists, sociologists, urban planners, and other professionals. Technology is always involved in decisions about public policy-making and public planning. In policy-making, public officials and the general public need objective studies about the costs and benefits of alternative systems of transportation, housing, energy use, land use, and national defense. In planning, they need expert advice about the feasibility, risks, and benefits of particular technological projects that affect local communities. For that reason, numerous laws and government policies have been adopted that require objective studies before public funds are committed to projects.

Large amounts of money, sometimes millions of dollars, are paid to engineering consultants to obtain their best judgment about options.

Technical Complexity and the Need for Assumptions The scale of public policy decisions can be immense, with considerable resources, potential benefits, and uncertainties involved. A variety of assumptions must be made, including highly controversial ones. In looking to the future there is usually a higher degree of uncertainty than in forensic investigations of past failures. This invites each adversary in political controversies to accent assumptions and estimates favorable to its case, all the while appearing to be in good faith.

For example, with regard to energy decisions, some assumptions concern the extent of demands for future energy, and hence assumptions about population increases and lifestyle. Other assumptions

involve economic estimates about the projected costs of developing alternative forms of energy. Still others involve political assumptions about the risks acceptable to the public. As a result, clients will always pressure engineers to limit studies to assumptions favorable to them.

Technical complexity contributes to moral complexity in an additional way. Forecasting studies may be so complex and expensive that consumer groups and public officials may lack the resources to check them for subtle biases.

Diffused Responsibility The usual sharing of responsibility within corporations is multiplied in public policy-making. Consulting corporations that work for government or other corporations and ultimately must make their case in the arena of public opinion usually makes policy forecasts. As a result it is easy to rationalize and to pass the buck in thinking about personal responsibility for complete impartiality. Corporate managers and engineers might tell themselves that it is the

responsibility of the public, through its officials and public referen-dums, to make adjustments for corporate partiality in studies. Then, if things go wrong, and overly optimistic estimates result in huge cost overruns that the public must pay, politicians easily blame the consultants for failing to be sufficiently impartial.

Normative Models of Advisers

Like engineers working in corporations, engineers who serve as planning advisers and policy analysts have responsibilities both to their clients and to the general public. These responsibilities, as always, can conflict. We can distinguish three normative (value-laden) models for how to balance these responsibilities.

Hired Guns This model makes the obligation to clients paramount, if not exclusive. Studies conform to clients' wishes, whatever they may be. Facts favorable to the client are dramatically highlighted, and unfavourable facts downplayed.

Value-Neutral Analysts This model insists that engineers should be completely impartial. Not only should they conscientiously avoid any taint of bias and favoritism, but they should avoid any form of advocacy. Their role is to identify all options and analyze the factual implication of each option. If they engage in weighing options, in particular by making cost-benefit analyses, they do so according to value criteria that are stipulated by someone else and made explicit and overt.

Value-Guided Advocates According to this model, engineering consultants may adopt partisan views in controversial issues, but they remain honest and independent in their professional judgment. Unlike value-neutral analysts, they understand that values are interwoven with facts, and they also affirm the help provided by value-oriented technological studies. Unlike hired guns, value-guided advocates make their responsibility to the public paramount and maintain honesty about both technical facts and the values that guide their studies

5. Discuss an engineer’s involvement in weapons work.(April/May 2016)

WEAPONS DEVELOPMENT
Introduction

The technological activities of the world centered on the military. The engineers supported to get involved in the development of the military weapons either directly or indirectly. The reason for the engineer to do his best on a military job is patriotism and interest in the future. However, the same the engineer may refuse to war work due to some unethical activities such as manufacture of devices or weapons, which kill the human beings and the innocent civilians.

While forming the forms of weaponry, the engineers have to examine their own interest and to consider the political circumstances. Engineers have the ethical obligations to design bridges, which do not collapse while using and nuclear power plants that do not emit radiations.

Business relating to weapon and military skill has been in long run in the world for a long period of time and still going on. Every country is spending a large amount only on its military development. Out of the amount spent, a specific and large percentage has spent on the purchase of weapons and military equipments.

Weapons such as bombs play a dangerous and crucial role in the world. For example, consider the case of atom bombs dropped on Hiroshima and Nagasaki. This incident was horrible not only because of large number of deaths, not because of the unpleasant medical results for the survivors, not because they were unnecessary, but only because they had been used in hasty manner and quick decision without considering the fact that they cannot be retrieved again. The bombs Hiroshima and Nagasaki were of heavy load. However, today‘s bombs are smaller size and it can accurately targeted.

The Weapons Seesaw

The trade in arms and military know-how has a long tradition. Military expenditures throughout the world total hundreds of billions of dollars annually. Of this amount, one-quarter is earmarked for purchases of weapons and related equipment, 17 percent of which are traded internationally.In the early months of World War II the chiefs of staff of the warring countries would still agonize over the question of whether to bomb targets in civilian population centers at night. Toward the end of the war, night raids had become common practice and civilians themselves had become the targets.

To us the atom bombs dropped on Hiroshima and Nagasaki are horrible not only because of the many

deaths they caused, nor because of the ghastly medical consequences for survivors, nor because they

were unnecessary, but mostly because they ushered in the age of rapid, irretrievable delivery of

destructive power in immense concentrations.

Engineer Involvement in Weapon Development

Engineer‘s involvement in manufacturing of weapons is unavoidable. For engineers who design weapons, manufacture them, and use them have some reasons to support their involvement. The following are some of the justifying arguments.

- Take a case of an engineer who involves in the manufacturing of antipersonnel bombs. Bob's employer manufactures antipersonnel bombs. Antipersonnel bombs are most dangerous. When they explode, they evolve a shower of sharp fragments of steel or plastic on the victims. They can fix the time to explode after some hours of delivery. When they explode on a person, the removal of the fragments is a time consuming task. The engineer who produces this kind of bomb clearly known about its danger. When he thinks morally he does not want to be involved in producing them. However, for his involvement he may argue that if he does not do his job, someone else will be doing the job. Doing job produces a steady income for his family.

- Mary is a chemical engineer. A promotion has gotten her into napalm manufacturing. As a chemical engineer she gets involved in the production of napalm (napalm is a jelly like petrol

substance used in incendiary bombs) argues that only the government must take necessary actions to stop the production of napalms.

- Joanne is an electronics engineer whose work assignment includes avionics for fighter planes that are mostly sold abroad. She has no qualms about such planes going to what she considers friendly countries, but she draws the line at their sale to potentially hostile nations. Joanne realizes that she has no advantage within the company, so she occasionally alerts journalist friends with news she feels all citizens should have. "Let the voters direct the country at election time"—that is her motto.

- Ron is a specialist engineer in missile control and guidance. As an engineer, he is a specialist in controlling and guiding missiles, says that he feels proud to be able to help his country through his involvement in the defense industry. He also adds that there should have not been any more world wars.

- A nuclear engineer knows very well about the danger of increasing nuclear arsenal. Arsenal is a place where the weapons are being stored. He argued that he is working very hard to reduce the risk of nuclear accidents.

- Marco's foremost love is physical electronics. He works in one of the finest laser laboratories. Some of his colleagues do exciting research in particle beams. That the laboratory is interested in developing something to the "death ray.‖ More bothersome is the secrecy that prevents him from freely exchanging ideas with experts across the world. However, why change jobs if he will never find facilities like those he has now?

- Ted‘s background and advanced degrees in engineering physics gave him a ready entry into nuclear bomb development. As a well-informed citizen, he is seriously concerned with the dangers of the ever-growing nuclear arsenal. He is also aware of the possibilities of an accidental nuclear exchange.

- From the above examples it is clear that all over the world talented engineers are engaged in the weapons work. They should think morally, before getting involved in weapons production.

- Problems of Defense Industry

- Many nations feel with privilege on their defense industry but without thinking on some serious problems that they may come across along with huge military buildings.

- The defense industry faces the problem of waste and huge cost in implementing and maintaining a weapon system.

- The defense industry also facing the problem of technology creep, that is the development of new weapons. It makes changes in the arrangements relating to diplomacy. It upsets all negotiations. It affects the political ability of a country.

- It also faces the problems in maintaining secrecy. The secrecy in weapons development paves the way for corruptions and leads to create mistakes in the weapon system itself.

- Every country allocates a large amount of its resources to defense sector. The amount spent in the defense industry creates only a few jobs when compared with the other industries.

- It is very important for any country to think to what extent and how long they can divert their men, material, money, and machinery into a sector that is economically contributing. To conclude the use and development of weapons be minimized, as they are the most hazardous to public. Therefore, before involving in the weapons development engineers must take some personal decisions based on the individuals conscious and the social and political issues of weapon technology.

Decommissioning Weapons and Lasting Effects

To this day, farmers in France plough up shells, duds or live, which landed in the ground more than 3/4 of a century ago during World War I. Over time the repetitive cycle of freeze and thaw has caused these shells to move close to the surface. Special bomb disposal units keep busy with hundreds of

calls a year, and injuries occur as well. To this must be added the many still-hidden, unexploded bombs that fell all over the world during World War II.

The U.S. State Department estimates that 85 to 100 million land mines still remain scattered in the countries like Afghanistan, Angola, Bosnia, Mozambique, Nicaragua, & Somalia and those that were involved in the two world wars. Used indiscriminately against soldiers and civilians, the use of land mines presents a serious ethical dilemma to military leaders who would prefer to adhere to the just war ethic. Clearly the design, manufacture, and deployment of weapons of all kinds is a huge experiment that includes not only their use but also eventual disposal of the arsenal by means other than export. In terms of pure experimentation, the real tragedy of widespread ignorance regarding radiation is only now being revealed. The use of agent orange defoliants in Vietnam is only now officially recognized as a health hazard as U.S. soldiers show symptoms of ill effects, long after scientists warned of its effects on farmers and their animals in the war zones of Vietnam. Gas warfare experiments had their share of involuntary subjects among soldiers of the United States and Australia. In the former Soviet Union, anthrax carriers spread accidentally from biological warfare plants and affected tens of thousands of people living downwind. But engineers and scientists deal-ing with materials dangerous enough to be considered useful as weapons must consider not only their direct use but also their accidental diversion and ultimate safe disposal. After all, structural engineers are not free to build huge structures without considering how to safely dismantle them eventually.

6. Write a brief account on 'consulting engineering'.

Consulting engineers work in private practice. Fees for the services they render, not by salaries received from employers compensate them. Because of this, they tend to have greater freedom to make decisions about the projects they undertake. Yet their freedom is not absolute: They share with salaried engineers the need to earn a living.

Here we will raise questions in four areas—advertising, competitive bidding, contingency fees, and provisions for resolution of disputes—which illustrate some of the special responsibilities of consulting engineers. We will also note how in safety matters consulting engineers may have greater responsibility than salaried engineers, corresponding to their greater freedom.

Advertising Some corporate engineers are involved in advertising because they work in product sales divisions. However, within corporations, advertising of services, job openings, and the corporate image are left primarily to advertising executives and the personnel department. By contrast, consulting engineers are directly responsible for advertising their services, even when they hire consultants to help them.

Before 1976 Supreme Court decision, competitive advertising in engineering was considered a moral issue and was banned by professional codes of ethics. As in law and medicine, anything beyond a tasteful notification of the availability of one's services was thought to be "unprofessional." It was deemed unfair to colleagues to win work through one's skill as an advertiser rather than through one's earned reputation as an engineer. It was also felt that competitive advertising caused friction among those in the field, lessened their mutual respect, and damaged the profession's public image by placing engineering on a par with purely money-centered businesses.

However, the Supreme Court disagreed with that view. According to it‘s ruling, as well as other rulings by the Federal Trade Commission, general bans on professional advertising are improper restraints of competition. They serve to keep prices for services higher than they might otherwise be, and they reduce public awareness of the range of professional services available, particularly from new firms.

These rulings have shifted attention away from whether professional advertising as such is acceptable toward whether an advertisement is honest. Deceptive advertising normally occurs when products or

services are made to look better than they actually are. This can be done in many ways, including: (1) by outright lies, (2) by half-truths, (3) through exaggeration, (4) by making false innuendos suggestions, or implications, (5) through obfuscation created by ambiguity vagueness, or incoherence,

(6) through subliminal manipulation of the unconscious. Another way is to impress with performance data that is meaningless because it has no reference standards.

There are notorious difficulties in determining whether specific ads are deceptive or not. Clearly, it is deceptive for a consulting firm to claim in a brochure that it played a major role in a well-known project when it actually played a minor role.

As another example, think of a photograph of an electronics device used in an ad to convey the impression that the item is routinely produced and available for purchase, perhaps even "off the shelf," when in actuality the picture shows only a preliminary prototype or mock-up and the item is just being developed.

Advertisers of consumer products are generally allowed to suppress negative aspects of the items they are promoting and even to engage in some degree of exaggeration or "puffery" of the positive aspects. By contrast, norms concerning the advertising of professional services are much stricter. For example, the code of the National Society of Professional Engineers (NSPE) forbids all of the following:

The use of statements containing a material misrepresentation of fact or omitting a material fact necessary to keep the statement from being misleading; statements intended or likely to create an unjustified expectation; statements containing prediction of future success; statements containing an opinion as to the quality of the Engineer's services; or statements intended or likely to attract clients by the use of showmanship, puffery, or self-laudation, including the use of slogans, jingles, or sensational language format. (NSPE Code of Ethics, Sec. 3b).

Competitive Bidding For many years codes prohibited consulting engineers from engaging in competitive bidding, that is, from competing for jobs on the basis of submitting priced proposals (as contrasted with a fee structure to be applied to the contract). The following statement, for example, formerly appeared in the code of the American Society of Civil Engineers:

It shall be considered unprofessional, inconsistent with honorable and dignified conduct, and contrary to the public interest for any member of the American Society of Civil Engineers to invite or submit priced proposals under conditions that constitute price competition for professional services.

It was considered permissible for industrial and construction firms to use competitive bidding because they could formulate cost estimates with some accuracy based on fixed design specifications. By contrast, the job of the consulting engineer is generally to develop creative designs for solving novel problems. Often there is no way to make precise bids. Allowing competitive bidding in such cases, it was felt, would open the door to irresponsible engineering in that inaccurate bids would encourage either cutting safety and quality (in the case of low bids) or padding and over designing (in the case of high bids).

However, in 1978 the Supreme Court ruled that professional societies were unfairly restraining free trade by banning competitive bidding. The ruling still left several loopholes, though. In particular, it allowed state registration boards to retain their bans on competitive bidding by registered engineers. It also allowed individual consulting firms to refuse to engage in competitive bidding. Thus, fee competition where creative design is involved has remained a lively ethical issue. Is it in the best interests of clients and the public to encourage the practice?

Contingency Fees

Consulting engineers essentially make their own arrangements about payment for their work. Naturally, this calls for exercising a sense of honesty and fairness. But what is involved specifically? As one illustration of the kinds of problems that may arise, consider the following entry in the code of the National Society of Professional Engineers:

An Engineer shall not request, propose, or accept a professional commission on a contingent basis under circumstances in which his professional judgment may be compromised, or when a contingency provision is used as a device for promoting or securing a professional commission. (NSPE Code of Ethics, Sec. llb).

A contingency fee or commission is dependent on some special condition beyond the normal performance of satisfactory work. Typically, under a contingency-fee arrangement the consultant is paid only if she or he succeeds in saving the client money. Thus, a client may hire a consultant to uncover cost-saving methods that will save 10 percent on an already contracted project. If the consultant does not succeed in doing so, no fee is paid. The fee may be either an agreed-upon amount or a fixed percentage of the savings to be realized.

In many contingency-fee situations, the consultant's judgment may easily become biased. For example, the prospects of winning the fee may tempt the consultant to specify inferior materials or design concepts in order to cut construction costs.

Provision for Resolution of Large and complex engineering projects involve many participants at different levels of responsibility within the organizations representing the owner, the consulting engineer, and the construction firm. Overlapping responsibilities, fragmented control, indecision, delays, and an inability to resolve disputes quickly and amicably characterize many projects. To forestall potential liabilities in such situations, the parties involved usually devote much time to protect themselves when this time could be more profitably used to improve the quality of the project. Resolution of disagreements is made more difficult when construction lasts several years and personnel changes occur during that period, because mutual trust and understanding are not easily nurtured under such conditions. It has been observed by engineers engaged in construction projects that

Litigation has increased considerably in recent decades, and the character of litigation has changed as well. The construction industry is no exception, and its experience, as described by a panel of experts, serves as a good illustration of the kinds of legal problems consulting engineers now sometimes face:

Traditionally law suits were fairly clear cut and involved matters directly related to the construction process; suits by owners were relatively uncommon; the design professional had to contend with virtually no litigation; and disputes were almost entirely confined to participants in the construction process.

Today not only has the number of lawsuits dramatically increased but the nature of the lawsuits and the participants also have changed. Third forces, historically external to the process, today are the motivating factors behind a great many suits.

Since litigation is time-consuming and costly, the consulting engineer should arrange contractually for methods of resolving conflicts. Quite apart from defining how risks are to be apportioned and payment of fees to be made, there should be contractual provisions for dispute-solving vehicles (designed to avoid costly court battles) such as mediation-arbitration in which a mediator attempts to resolve a dispute first, and if that is not fruitful, to act as the final, binding arbitrator. It should also be specified contractually that the National Joint Board for Settlement of Jurisdictional Disputes will be called upon to provide a hearing board and appeals board.

7. Explain computer ethics. [May 2013]

COMPUTER ETHICS

Computers have become the technological backbone of our society. Their degree of sophistication, range of applications and sheer numbers continue to increase. Through networks, they span the globe. If anything, it is more difficult to envisage the eventual impact of computers since they are not limited to any one primary area of use comparable to a car's function in transportation. To evaluate and deal with these problems a new area of applied ethics called computer ethics has sprung up. Computer ethics has special importance for the new groups of professionals emerging with computer technology, for example, designers of computers, programmers, systems analysts, and operators. To the extent that engineers design, manufacture, and apply computers, computer ethics is a branch of engineering ethics.

Power Relationships Computers dramatically increase the ability of centralized bureaucracies to manage enormous quantities of data, involving multiple variables, and at astonishing speed. Computers are powerful tools, which do not by themselves generate power shifts. They contribute to greater centralization or decentralization in so far as human decision-makers so direct them. This is not to say that computers are entirely value-neutral. It is to say that moral issues about power relationships tend to be nuanced and contextual. Below we list a few examples.

Job Elimination Computers have led and will continue to lead to elimination of some jobs. The employment practices have often been embraced from prudential motives to prevent a public and employee backlash against introduction of computer technologies that eliminate jobs, but moral considerations of human costs should be weighed even more heavily.

Customer Relations There are also questions about public accountability of businesses using computer-based services. It can be very difficult or relatively simple for a consumer to notice and correct computer errors or computer-printed errors.

Biased Software In addition to computer hardware, there is software, and programs can quite easily be biased, just as can any form of communication or way of doing things.

Stock Trading Program trading is the automatic, hands-off, computer trading of stocks, futures, and options on the stock market. Attempts are under way to control this practice.

Unrealistic Expectations Computer sales people have the power to oversell "state-of-the-art" systems that are too large or sophisticated for the intended purpose. They also may not even be ready for delivery; worse yet, the needed software may still be under development.

Political Power Politicians have always selectively disclosed their views. In a speech to a conservative group, a candidate will tend to say very different things from what he or she tells a liberal group. Different topics may be discussed, different emphases given, and inconsistent remarks made. Computers make it pos-sible to turn this political maneuver into a science. Computer from public records obtains the information about these groups of people. The characterizations of the groups' attitudes and norms are computer-generated. Computer personalizes the letters sent to them. In addition, the mailing process is computerized. With electronic accuracy and efficiency, politicians are enabled to have many different faces when viewed by different groups. Several moral issues are raised by this possible application of technology:

(1) Does such selective disclosure constitute deception?

(2) Does filtering the truth about a politician's views undermine the autonomy of voters in making de-cisions?

(3) Since use of computers is expensive, is it fair that the rich have more extensive access to this technology, or should equal-time laws for television be extended to computers?

Military Weapons The U.S. Department of Defense is supporting the creation of autonomous weapons that can be aimed and fired by on-board computers that make all necessary decisions, including enemy identification. Computer scientists and engineers are divided over the advisability of such a major step toward automation of the battlefield.

There is a dangerous instability in computerized defense systems even if they are working perfectly. Let us assume then that all the nuclear warning software works without error, and that the hardware is fail-safe. Nevertheless, the combination of two such correctly functioning but opposing systems is unstable. This is because secrecy prevents either system from knowing exactly what the other is doing, which means that any input that could be interpreted as a danger signal must be responded to by an increase in readiness on the receiving side. The opposing side, which then steps up its readiness, and so on, in turn, monitors that readiness.

Property

The most troublesome issues about property and computers fall under two general headings. The first is the use of computers in embezzlement and other forms of stealing money or financial assets. It is the most widely publicized form of computer crime and also the most morally clear-cut. The second set of issues con-cerns the theft of software and information. Here the issues are more complex. Embezzlement: Two factors make computers especially troublesome:

(1) Their speed and geographic coverage, which allows large numbers of people to be victimized, (2) the difficulty of tracing the underlying transactions to apprehend the thieves.

This problem is compounded when the communication lines linking the computers involved cross national boundaries.

Some of the most commonly discussed cases of computer abuse are instances of outright theft and fraud, of which there are many forms:

1. Stealing or cheating by employees at work;

2. Stealing by non-employees or former employees;

3. Stealing from or cheating clients and consumers;

4. Violating contracts for computer sales or service;

5. Conspiring to use computer networks to engage in widespread fraud.

Public interest has often been drawn to the glamorous capers of computer criminals. Enormous sums of money have been involved. The amount for an average computer-related embezzlement is twenty times the amount stolen in conventional embezzlement; many millions are often involved. Crime by computer has proved to be unusually inviting to many.

The technology for preventing crime and catching criminals has lagged behind implementation of new computer applications. Computer crime raises obvious moral concerns of honesty, integrity, and trust. It also forces a rethinking of public attitudes about crime and its punishment. The potential for

computer crime should enter significantly into the thinking of engineers who design computers. In fact, protection against criminal abuse has become a major constraint for effective and successful design of many computer systems and programs.

For some time secret computer passwords have been used as a security feature. More recently introduced, and still of limited effectiveness, is data encryption. This technique is widely employed to prevent theft from funds transfer systems. In data encryption, messages are scrambled before transmission over communication lines and unscrambled after reception according to secret codes. Such devices, of course, require special precautions in maintaining confidentiality and security, and engineers have a major role to play in making recommendations in these areas.

Data and Software In the United States, computer hardware is protected by patent laws. Software can be protected by copyright and trade secret laws. The latter permit employers to require their employees not to divulge proprietary information. Obviously trade secrets are useless once software is made publicly available as a marketed product. Here copyright laws offer the best protection. Privacy

Storage, retrieval, and transmission of information using computers as data processors has revolutionized communication. Yet this very benefit poses moral threats to the right to privacy. By making more data available to more people with more ease, computers make privacy more difficult to protect. Here we will discuss privacy and confidentiality for individuals, but the issues are similar for corporations. There are reasons for privacy namely Inappropriate Access & Data Bank Errors.
Professional Issues

Many of the issues in engineering ethics arise within the context of computer work. New variations or new difficulties may be involved, often owing to the high degree of job complexity and required technical proficiency introduced by computers. We provide some representative examples below.

Computer Failures Failures can occur because of errors in hardware or software. Hardware errors do not occur frequently, and when they do, they usually do so quite obviously. An exception was Intel's highly touted Pentium chip introduced in 1993. It produced very slight and rare errors in floating point arithmetic. Perhaps more serious was the loss of confidence Intel suffered by not revealing the error before it was detected by a user. Software errors are a different matter.

Computer Implementation It should not be necessary to say so, but a changeover to a new computer system should never be attempted without having the old system still operational. Computer vendors who are too sure of their machines to recommend some redundancy during a changeover display enough hubris for it to qualify as one of the seven deadly sins.

Health Conditions Engineers who supervise computer personnel or design computer terminals should check that ergonomic considerations are in effect to reduce back problems, provide wrist support and good keyboard layouts to prevent carpal tunnel syndrome, and offer good lighting and flicker control.

8. Discuss the pros and cons of multinational companies from ethical point of view.[May 2010]
MULTINATIONAL 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, a toxic ingredient used in pesticides. 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: 2500 deaths within a few days, 10,000 permanently disabled, and 100,000 others injured. Ten years later the list of victims rose to 4,000 to 7,000 deaths, with claims of injuries amounting to 600,000. Compensation was progressing at snail's pace for puny amounts while much of the $470 million settlement reached in court is spent on lawyers and government bureaucracy associated with the case.

Multinational corporations do extensive business in more than one country. For example, Union Carbide in 1984 operated in 37 "host countries" in addition to its "home country," the United States, and it was only a medium-sized "giant" corporation, ranking thirty-fifth in size among U.S. corporations. Generally multinationals establish foreign subsidiaries, such as Union Carbide of India, retaining 51 percent of the stock and allowing investors of the host country to own the remainder, but some countries restrict the parent company in the United States to 49 percent ownership.

The benefits to U.S. companies of doing business in less economically developed countries are clear: inexpensive labor, availability of natural resources, favorable tax arrangements, and fresh markets for products. The benefits to the participants in developing countries are equally clear: new jobs, jobs with higher pay and greater challenge, transfer of advanced technology, and an array of social benefits from sharing wealth.

Three Senses of "Relative" Values

There are many versions of relativism, depending on the way in which values are supposed to be relative. Here are three versions.

Ethical Relativism: Actions are morally right within a particular society when law, custom, or other conventions of that society approve them.

Descriptive Relativism: In Fact, value beliefs, and attitudes differ from culture to culture.

Moral Relationalism (or Contextualism): Moral judgments should be made in relation to factors that vary from case to case, usually making it impossible to formulate rules that are both simple and absolute.

The first version, ethical relativism, is false since it implies absurdities. The second version, descriptive relativism, is obviously true. It merely says there are differences between the moral beliefs and attitudes cf various cultures. The third version, moral relationalism, is also obviously true. Essentially it is a reminder that moral judgments are contextual:

Relationalism allows and insists that the customs of cultures are often morally pertinent

considerations that require us to adjust moral judgments and conduct. Relationalism is important in

multinational engineering contexts involving different cultural conventions. Relationalism, we might

add, is also consistent with ethical pluralism, the view that there is more than one justifiable moral

perspective.

"When in Rome"

Which standards should guide engineers' conduct when working in foreign countries? Ethical relativism supports the maxim, "When in Rome do as the Romans do." That is, it would have us believe there is no real problem with following the conventions dominant in the local area.
International Rights

A human right, by definition, is a moral entitlement that places obligations on other people to treat one with dignity and respect. If it makes sense at all, it makes sense across cultures. The Declaration of Independence, with its assertion that all people have rights to life, liberty, and the pursuit of happiness, recognizes and embeds that moral concept in law. But this legal recognition of the idea of human rights does not create those rights. The rights exist by virtue of the moral status of all people, including people living in countries that do not yet recognize those rights.

Donaldson suggests there are ten such international rights 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 nondiscriminatory treatment

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

These are human rights; as such they place restrictions on how multinational corporations may act in other societies, even when those societies do not recognize the rights in their laws and customs.
Promoting Morally Just Measures

More fully, the business activities of multinational corporations must do more overall good than bad, which means helping the country's overall economy and its workers, rather than benefiting a few corrupt leaders in oppressive regimes. Not only must they pay their fair share of taxes, but also they must make sure the products they manufacture or distribute are not causing easily preventable harms.

In addition, the overall impact of the business dealings must tend to promote morally just institutions in the society, not increase unjust institutions. At the same time, corporations should respect the laws and culture of the host country providing they do not violate basic moral rights. Of course, there is a tension between promoting just institutions and respecting local customs.

An example, consider the issue of worker safety in companies that manufacture hazardous chemicals. When is it permissible for the United States to transfer dangerous technology like asbestos production to another country and then simply adopt that country's safety laws? Workers have the right to informed consent. Even if the host country does not recognize that right, corporations are required to inform workers, in language they can understand, of the dangers of asbestos. That is a necessary, but not sufficient condition.

Workers may be so desperate for income to feed their families that they will work under almost any

con-ditions. Corporations must eliminate great risks when they can while still making a reasonable

profit. They must also pay workers for the extra risks they undertake. Exactly what this means is a

matter of morally good judgment and negotiation.

Technology Transfer and Appropriate Technology

Technology transfer is the process of moving technology to a novel setting and implementing it there; Technology includes both hardware (machines and installations) and technique (technical,

organizational, and managerial skills and procedures). A novel setting is any situation containing at least one new variable relevant to the success or failure of a given technology.

In most instances, the transfer of technology from a familiar to a new environment is a complex process. The technology being transferred may be one that originally evolved over a period of time and is now being introduced as a ready-made, completely new entity into a different setting. Discerning how the new set-dug differs from familiar contexts requires the imaginative and cautious vision of "cross-cultural social experimenters."

The expression appropriate technology is widely used, but with a variety of meanings. We use it in a generic sense to refer to identification, transfer, and implementation of the most suitable technology for a new set of conditions. Typically the conditions include social factors that go beyond routine economic and technical engineering constraints. Identifying them requires attention to an array of human values and needs that may influence how a technology affects the novel situation.

As examples, we may cite the introduction of agricultural machines and longdistance telephones. A country with many poor farmers can make better immediate use of small, single- or two-wheel tractors that can serve as motorized ploughs, to pull wagons or to drive pumps, than it can of huge diesel tractors that require collectivized or agribusiness-style farming. On the other hand, the same country may benefit more from the latest in microwave technology to spread its telephone service over long distances than it can from old-fashioned transmission by wire.

Appropriate technology also implies that the technology should contribute to and not distract from sustainable development of the host country by not degrading the environment beyond its carrying capacity and by providing for careful stewardship of its natural resources.

Appropriate technology overlaps with, but is not reducible to, intermediate technology, which lies between the most advanced forms available in industrialized countries and comparatively primitive forms in less-developed countries. The British economist E. F. Schumacher argued that intermediate technologies are preferable because the most advanced technologies usually have harmful side effects, such as causing mass migrations from rural areas to cities where corporations tend to locate. These migrations cause overcrowding, and with it poverty, crime, and disease. Far more appropriate, he argued, are smaller-scale technologies replicated throughout a less-developed country, using low capital investment, labor intensiveness to provide needed jobs, local resources where possible, and simpler techniques manageable by the local population given its education facilities.

9. Discuss 'morally creative leaders' and participation in professional societies.

MORAL LEADERSHIP

As managers, business entrepreneurs, corporate consultants, academics, and government officials, engineers provide many forms of leadership. In this section, we focus on engineers as moral leaders within their professions and communities. We will sample a few current activities that illustrate leadership within the profession, as well as take note of ongoing challenges that will require continuing moral leadership.

Morally Creative Leaders "Leadership" is an achievement word: It indicates success in moving a group toward goals. When a leader's goals are not only permissible but also morally valuable, we will speak of moral leadership. Moral leaders, then, are individuals who direct, motivate, organize, creatively manage, or in other ways move groups toward morally valuable goals. Leaders may be in positions of authority within a corporation, or they may not be. Individuals participating at all levels of organizations can show leadership.

In speaking of the moral leadership provided by engineers and engineering societies we set aside any notion of engineers as a group leading society. Most emerging professions have at times dreams of governing, if not dominating, society. A comparable dream for technologists was presented early in

the twentieth century as a technocracy in which engineers and scientists are best qualified to govern technology-driven societies. Frederick Taylor, the inventor of "scientific management," argued that technologists were best qualified to govern because of their technical expertise, as well as their logical, practical, and unprejudiced minds.

Today most of us believe that no single profession holds the key to moral governance of society. Indeed, leadership typically requires moving above any narrow professional interest in grappling with increasing social diversity and cross-disciplinary complexity. Certainly moral leadership within democracies is not a matter of imposition of values by a governing elite. Nevertheless, engineers have their share of moral leadership to contribute to their professional societies, to their profession as a whole, and to their communities.

The moral leadership means employing morally permissible means to stimulate groups to move toward morally desirable ends. Precisely what means are most effective depends on the situation? Sometimes political shrewdness is most important; other times a largely nonpolitical commitment to moral ideals. Again, sometimes conflict resolution is most important in order to forge unity amidst diversity; other times the key ability is to stir things up to provide the stimulus for change.

Moral leaders are morally creative. That does not mean they discover or improvise new moral values from scratch. Moral values are the product of centuries and millennium of gradual development, not instantaneous invention. Moral creativity consists in identifying the most important values that apply in a particular situation, bringing them into focus through effective communication within groups, and forming workable commitments to implementing them. As with other forms of creativity, moral creativity means achieving valuable newness, in this case morally valuable newness. However, the newness consists in identifying new possibilities for applying, extending, and putting values into practice, rather than inventing values. That may require fresh moral insight, but even more, it requires deep commitments grounded in integrity.

Participation in Professional Societies

Not surprisingly, moral leadership within engineering is often manifested in leadership within professional societies. Professional societies do more than promote continuing education for their members. They also serve to unify a profession, and to speak and act on behalf of it (or a large segment of it). Professional societies provide a forum for communicating, organizing, and mobilizing change within and by large groups. That change has a moral dimension.

Many of the current tensions in professional societies exist because of uncertainties about their involvement in moral issues. This was illustrated in the Bay Area Rapid Transit (BART) case. One chapter of the California Society of Professional Engineers felt it should play a role in supporting the efforts of the three engineers who sought to act outside normal organizational channels in serving the public. Another chapter felt it was inappropriate for the society to do so. In this and other controversial cases, professional societies have often been reluctant to become involved.

It is unlikely that existing professional societies will, and it is perhaps undesirable that they should, take any univocal pro-employee or pro-management stand. Their memberships, after all, are typically a mixture of engineers in management, supervision, and non-management. Yet professional societies can, should, and are playing a role in conflicts involving moral issues, although rank and file engineers remain skeptical because they still consider the societies management-dominated. Through membership participation on committees, these societies provide a sympathetic and informed forum for hearing opposing viewpoints and making recommendations. Through their guidelines for

employment practice and conflict resolution they can help forestall debilitating disputes within corporations. On a national level, they can lobby for earlier vesting and portability of pensions. Details of the extent and form of such activities deserve ongoing discussion within engineering ethics. Clearly there is an ongoing need for individual engineers to provide moral leadership.

Just as moral responsibilities are shared, moral creativity in the professions is a shared phenomenon. Nevertheless individuals make a difference. To cite just one example, Stephen H. Unger is largely responsible for persuading the Institute of Electrical and Electronics Engineers (IEEE) to move beyond the traditional focus of most societies on punishing wrongdoers toward supporting responsible en-gineers. After investigating the activities of the BART engineers, he succeeded in getting IEEE to present the three with awards for outstanding professional service. He also helped organize and lead the Committee on Social Implications of Technology, which later became the IEEE Society on Social Implications of Technology (SSIT). For several decades this group has institutionalized an ongoing concern for moral issues. Steve Unger in turn credits the late Victor Paschkis of Columbia University for awakening in him an awareness of the engineer's social responsibility. And it was also Victor Paschkis with his pioneering Society of Social Responsibility in Science that greatly influenced the career path of the engineer.

Many other individuals have spurred professional societies to foster the study of engineering ethics. They have helped to sponsor ethics workshops, conduct surveys on matters of ethical concern, inform their members of developments related to ethics, and encourage schools of engineering to support regular and continuing education courses in engineering ethics. A 1980 study of the activities of professional societies concluded that "little attention and only minimal resources have been directed toward professional ethics matters."

Making general appraisals of the role of professional societies ultimately entails examining a profession's "macroeconomics": that is, examining how they do and should function as a group within contemporary society. For example, to what extent is it desirable for the engineering profession as a whole to set standards in such areas as disposal of toxic wastes?

Or, to take another kind of topic, is the trend toward increasing rule making on behalf of professionalism within engineering in the public interest? Here many issues are involved, at least given the model of professionalism derived from developments in medicine and law:

1. Should the engineering profession be allowed to have the authority to decide which students and how many students will be admitted to schools of engineering? Should laypersons representing the public have a say?

2. Should licensing of all engineers in industrial practice be mandatory, as it is for doctors and lawyers? There would be potential benefits: for example, greater assurance that all engineers would meet minimal standards of training and skill. Nevertheless, there would also be drawbacks, if only that bureaucratic red tape would increase.

3. Should continuing education be mandatory for all engineers?

There is also the question of the direction and course of existing and possible new professional organizations. Perhaps it is desirable to have greater unity among engineering societies and thus to encourage newer and higher-level umbrella organizations to arise (such as the relatively young American Association of Engineering Societies). Yet there are risks in seeking more unified power and action. Everything depends on the goals and structures of such organizations, combined with the creative opportunities envisioned by their moral leaders.

Ultimately these "macro" issues return us to the "micro" issues of individual responsibility. For it is individuals involved in their professional societies who are the ultimate loci of action and hence of leadership.

This leads us to engineers' obligations to their profession. The code of ethics of the Accreditation Board for Engineering and Technology suggests that engineers should obey the code in order to

"uphold and advance the integrity, honor and dignity of the engineering profession." Similarly, the preamble to the code of the National Society of Professional Engineers suggests that the code should be followed in part "to uphold and advance the honor and dignity of the engineering profession."

Surely, something can be said in defense of a duty to respect and defend the honor of the profession. Effective professional activity, whether in engineering or any other profession, requires a substantial degree of trust from clients and the public. Total absence of such trust would undermine the possibility of making contracts, engaging in cooperative work, exercising professional autonomy free of excessive regulation, and working under humane conditions. Engineers as individuals and as a group owe it to the public to sustain a professional climate conducive to meeting their other obligations to the public.

10. Discuss the ethical issues related to computer ethics? [Dec 2015]

7.13.1. What Is Computer Ethics?

- ✓ *Computer ethics is the study of ethical issues that are associated primarily with computing machines and the computing profession.*
- ✓ It is the field of applied professional ethics dealing with ethical problems aggravated, transformed, or created by computer technology.
- ✓ Cyber ethics is the field of applied ethics that examines moral, legal, and social issues in the development and use of cybertechnology.
- ✓ Cybertechnology refers to a broad range of technologies from stand-alone computers to the cluster of networked computing, information and communication technologies.
- ✓ Thus computer ethics is the analysis of the nature and social impact of computer technology and the corresponding formulation and justification policies for the ethical use of such technology.

7.14. CATEGORIES OF COMPUTER ETHICS PROBLEMS

The three board categories of computer ethical problems are:

1. Those ethical problems for which the computer is the instrument of the unethical act. For example, the use of a computer to defraud the bank.
2. Those problems for which the computer is the object of the unethical act. For example, stealing computer software and installing it on one's own computer to access others' information.
3. Those problems associated with the autonomous nature of computers.

7.14.1. Computers As The Instrument Of Unethical Behavior

Computers are sometimes used as an instrument for carrying out some unethical activities. The two important unethical acts under this category are:

1. Bank robbery; and
2. Privacy

1. **Bank Robbery**
   - ✓ Computers can be used to steal from an employer; outsiders can got into a system and steal from an institution such as a bank. In the same way, a company can use the computer to steal from its clients and customers.
   - ✓ Computers are used more efficiently to steal money in a bank. The robber simply sits at a computer terminal, invades the bank's computer system and directs some of the banks assets be placed in a location accessible to him. The use of computer makes the crime impersonal. The criminal never comes face to face with the victims.

2. **Privacy**
   - ✓ *Privacy means the basic right of an individual to control access to and use of information about himself.*
   - ✓ Computers make privacy more difficult to protect, since large amounts of data on individuals and corporations are centrally stored on computers where an increasing number of individuals can access it.
   - ✓ Invasions of privacy can be harmful to an individual in two ways, as given below:
     1. The leaking of private information can lead an individual being harassed or blackmailed.
     2. Personal information can also be considered personal properly. Any unauthorized use of this information is theft.

7.14.2. Computers As The Object Of Unethical Acts

- ✓ When the computers are used as the objects of the unethical acts, ethical issues may arise. This act is prevalently known as '*hacking*'.
- ✓ ***What does hacking mean?***
  Hacking is nothing but gaining unauthorized access to a database, implanting false information in a database or altering existing information, and disseminating viruses over the Internet.
- ✓ In other words, hacking is a crime in which a person cracks a system and gains unauthorized access to the data stored in them.
- ✓ Accessing private information violates the private rights of individuals and corporations.
- ✓ *Hacking* has thrown a challenging threat to the internal security of a nation when hackers develop illegal access to the secret military information.
- ✓ ***Computer viruses:*** *Viruses are programs introduced deliberately for destroying or altering the operating systems and database of computer.*
- ✓ Transmission of computer viruses leads to the complete destruction of files and data stored in the computers. This type of destruction frequently occurs in the records of financial institutions, corporations, government offices, and taxpayers.

7.14.3. Autonomous Computers

Autonomous nature of computers creates other ethical problems.

- ✓ ***Computer autonomy*** *refers to the ability of computer to make decisions without the intervention of humans.* This autonomous function of computers creates a lot of negative implication.
- ✓ ***Example illustrating negative implication of computer autonomy:*** An autonomous computer, responsible for running a spaceship, wrongly directed the spaceship against the human designed it, instead of heading towards Jupiter.
- ✓ ***Example illustrating positive implication of computer autonomy:*** Autonomous computers are valuable for automatic monitoring of certain manufacturing processes.
- ✓ However, the autonomous computer application creates unethical activities in most cases. For example, autonomous computers are used in trading of some major stock market exchanges. Some brokers and institutional investors utilize computers to sell stocks automatically for their favor.
- ✓ Autonomous computer systems also create problems when they have been used in military weapons. Many of the weapons used by military sources depend greatly on computer sensors and computer controls. Sometimes the instability of computer sensors and controls may create an unstable situation, which may lead to the serious conflicts.
- ✓ Thus although autonomous computers are productive and more efficient in more areas, eventually there should be some human control over them in order to prevent disasters.