OBJECTIVES

ENGINEERING ETHICS

- Explaining main concept in Engineering Ethics,
- Identify issues and challenges as an engineer after graduation.

Engineering Ethics Syllabus

1. Introduction
2. Engineering Ethics Code
3. Profession Ethics
4. Professional Engineers Responsibilities
5. Engineers in globalization
Course Synopsis

- Expose to engineering students basic knowledge in engineering ethics.
- Main and important concepts in engineering ethics in Malaysia.
- Engineers govern bodies: Institute of Engineers Malaysia (IEM) and Board of Engineers Malaysia (BEM)
- Future engineers.

Course Outcome (CO)

<table>
<thead>
<tr>
<th>Course Outcome (CO)</th>
<th>Domain and taxonomy levels</th>
<th>Possible assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1: Ability to understand, identify and evaluate the issues and challenges of engineering ethics.</td>
<td>C6 A5</td>
<td>√ √</td>
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<tr>
<td>CO2: Ability to explain and identify hazards; evaluate and review the function of risk management and occupational safety and health policies.</td>
<td>C6 A5</td>
<td>√ √</td>
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<tr>
<td>CO3: Ability to discuss and evaluate the aspects and procedures of legal on engineering issues.</td>
<td>C6 A5</td>
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Teaching Resources

- Download Notes from Subject Website
  - Lecture Notes for Engineering Ethics
  - REGISTRATION OF ENGINEERS ACT 1967 (Revised 2007)
  - REGISTRATION OF ENGINEERS REGULATIONS 1990 (Revised 2003)

What is Engineering?

Engineering programs at UniMAP:

The programmes are offered through 8 schools, namely:
- School of Microelectronic Engineering
- School of Computer and Communication Engineering
- School of Mechatronic Engineering
- School of Electrical Systems Engineering
- School of Manufacturing Engineering
- School of Materials Engineering
- School of Bioprocess Engineering
- School of Environmental Engineering

At present, there are 21 undergraduate programmes that lead to the degree of B.Eng (Hon.), namely:
- Microelectronic Engineering
- Electronic Engineering
- Photonics Engineering
- Computer Engineering
- Communication Engineering
- Computer Network Engineering
- Mechatronic Engineering
- Mechanical Engineering
- Biomedical Engineering
- Electrical Systems Engineering
- Industrial Electronic Engineering
- Electrical Energy Engineering
- Manufacturing Engineering
- Product Design Engineering
- Materials Engineering
- Metallurgical Engineering
- Polymer Engineering
- Bioprocess Engineering
- Biosystem Engineering
- Environmental Engineering
- Building Engineering
UniMAP Engineers

1. Ability to acquire to apply knowledge of mathematics, science and engineering and in-depth technical competence in engineering discipline.
2. Ability to identify, formulate and solve engineering problems.
3. Ability to design a system, component or process to meet desired needs.
4. Ability to design and conduct experiments as well as to analyze and interpret data.
5. Ability to use techniques, skills and modern engineering tools necessary for engineering practices.
6. Ability to understand the social, cultural, global and environment responsibilities of a professional engineer.
7. Ability to understand entrepreneurship, the process of innovation and the need for sustainable development.
8. Ability to understand professional and ethical responsibilities and commitment to the community.
9. Ability to function on multi-disciplinary teams.
10. Ability to communicate effectively.
11. Ability to understand the need for and an ability to engage in life-long learning.
12. Ability to demonstrate understanding of project management and finance principles.

BEM GUIDELINES FOR CODE OF PROFESSIONAL CONDUCT

Five (5) Main SECTIONS for CODE of ETHICS (27 Sub-Sections)

1. A Registered Engineer shall at all times hold paramount the safety, health and welfare of the public.
2. A Registered Engineer shall undertake assignments only if he is qualified by education & experience in the specific technical fields in which he is involved.
3. A Registered Engineer shall issue public statements only in an objective and truthful manner.
4. A Registered Engineer shall act for each employer or clients as faithful agent or trustee.
5. A Registered Engineer shall conduct himself honourably, responsibly, ethically and lawfully so as to enhance the honour, reputation and usefulness of the profession.

Engineering ?

Engineering? 

Engineering is the branch of science and technology concerned with the design, building and use of engines, machines and structures (Oxford Compact English)

Engineering encompasses science and art, mathematics and creativity, models and approximations. (John Hopkins University)

Engineering - the Accreditation Board for Engineering and Technology’s (ABET) definition

• identifies engineering as, “the profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgement to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.”
What is Engineering
- the simplified definition

- is a discipline concerning…
  ❖ "the creative application of scientific knowledge to analyse, design, construct and operate the products and services of societal needs;
  ❖ with full cognizance of the environment, sustainable development and foremost the safety, health and welfare to human life."

- … concerning ethics.

Today’s Professional Engineers

- Today’s professional engineers demonstrate a personal and professional commitment to society, to their profession, and to the environment.
  - ENGINEERING COUNCIL UK

Teras Profesionalisme Jurutera UniMAP

Integriti
Satu kualiti dan ciri positif yang wujud secara keseluruhan pada individu dan organisasi. Ciri dan kualiti integriti mengandungi unsur kewujudan secara bersepadu serta keseluruhan pada diri individu ataupun organisasi.
**Integrity**

- A quality of excellence that is manifested in a holistic and integral manner in individuals and organizations. Integrity is based on ethics and noble values and their concrete manifestation in their daily lives.

  - (NIP page 22)

**Ethics vs. Etiquette**

- **Ethics** are the standards or codes of behaviour considered to be correct and expected by the group to which an individual belongs. There are national ethics, social ethics, company ethics, professional ethics. Sometimes a person's personal morals clash with the ethics he is expected to practice at work. For example a criminal defense lawyer may find murder immoral but the ethics of his job demand that he defend a murderer to the best of his ability.

- **Etiquette** is a code of behaviour that outlines expectations for social behaviour within a society, social class or group. Rules of etiquette include all aspects of social interaction including manners. But Etiquette is not just about saying ‘please’ and ‘thank you’. One important function of etiquette is that it shows respect and deference to others. For example in many countries not jumping the queue is considered normal etiquette. Etiquette can vary a lot from country to country especially in business and social interaction. For example the etiquette governing gift giving is different in different countries. So too can how much a person is permitted to touch another person. In America it may be okay to slap a man on the back but in China it is a serious breach of etiquette.

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**Pengertian Integriti**

- Integriti bermaksud keutuhan
- Integriti juga bermaksud berpegang teguh kepada prinsip kejujuran serta mempunyai prinsip moral yang tinggi
- Keseluruhan pembawaan kita dari segi peribadi, tuturkata dan sopan santun

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**Integriti**

- Provides access to the opportunity for superior performance and competitive advantage at both the individual, group and organizational level,
- Empowers (give strength and confidence to) the three virtue (high behaviour standard) phenomena of morality, ethics and legality.
Ethics

• A set of **moral values** and **principles** which form the **standards** guiding the **code of conduct** of individuals, organizations and professions.
  • (National Integrity Plan page 21)

Definition of Ethics

• **Ethics** deals with what we believe to be **good or bad** and with the **moral** obligations that these beliefs imply.

• **Ethics** involves the **rules** for deciding **right and wrong**, and the **code of conduct** that is based on our decisions.

  ("Developing Ethical Leaders Through Action", 1990)

What is ETHICS ?

• Ethics is the **moral** governing what is **right and wrong conduct**.

• Moral is the principles of **good and bad behaviour**.
  • Our understanding

• Behaviour is the way in which someone behaves.

• Conduct is the manner in which a person behaves.
  • Concise Oxford English Dictionary (10th Edition)

• Ethics is the principles of good and bad **behaviour** governing what is right and wrong **conduct**.

“Personal Ethics”

• is individual morality usually implies a set of internally held values;

• focus on what are held to be intrinsic or **universal values** - truth, honesty, or other measure of goodness;

• may guide our personal beliefs and actions.
“Professional Ethics”

• is usually connected to a *shared understanding of proper conduct* guidelines among a *group of people* associated by means of their *profession*;
• allows diverse, multidisciplinary, and multicultural teams to work in unison toward common goals.

Why do Engineers need to know about Ethics?

• With *knowledge & skills*, engineers have the capability to do services to the public.
• With this capability, engineers have a *tremendous responsibility* to clients, individuals and society.
• *Ethics* help engineers to guide their decisions to ensure they act *responsibly*.

Professional vs. Personal Ethics

Overlap between professional and personal ethics. Professional ethics more restrictive than Personal ethics.

Basic Ethical Concepts

• Ethical considerations are an *integral* part of making engineering decisions.
• The professional obligations of engineers go beyond fulfilling a contract with a client or customer.
• Codes of ethics can provide guidance in the decision-making process.
Basic Ethical Concepts ...

- Ethical obligations do not stop at any country’s border; they are **global**.
- Wherever engineers practice, they should hold paramount the health, safety, and welfare of the public.
- How an engineer fulfills those obligations may depend on the social and economic context of engineering practice.

“Engineering Ethics”

- means professional ethics for engineers.
- implies a shared understanding of proper conduct guidelines among members of the engineering profession.
- guided by code of ethics or code of professional conduct.

**Code of Ethics**

- Express the rights, duties, and obligations of the members of the profession.
- Provides framework for arriving at good ethical choices.
- May not be comprehensive, but all inclusive.
- Who has them?
  - Professional Societies, Corporations
  - Government & Academic Institutions
  - Others
Code of Ethics

- Codes of ethics are written by specific groups of people for specific groups of people, each group having its own purpose for existence and its own means of accomplishing its purpose.
- Codes of ethics are to be reflections of the morally permissible standards of conduct which members of a group make binding upon themselves.

PROFESSIONAL INTEGRITY

“Interaction Rules”

Indicate dedication to professional behavior
Recognition of professional responsibilities
Create ethical environment
Guide in specific circumstances

INTEGRITY

THE PHENOMENA OF MORALITY, ETHICS AND LEGALITY

- Integrity overlaps among the phenomena of morality, ethics and legality.
- Integrity is thus not about good or bad, or right or wrong, or what should or should not be.
- Integrity provides powerful access to increased performance for individuals, groups, or organizations.
- Morality, ethics and legality exist in a realm of virtues (high behaviour standard).
- Morality, ethics and legality are about good and bad, right and wrong, or what should or should not be.
THE STRUCTURE OF ENGINEERING ORGANIZATIONS IN MALAYSIA

• BEM
The Board of Engineers Malaysia
Lembaga Jurutera Malaysia (LJM)
http://www.bem.org.my/

• IEM
The Institution of Engineers Malaysia
Institusi Jurutera Malaysia (IJM)
http://www.iem.org.my/

The Institution of Engineers Malaysia, IEM

• IEM is a society established to promote and advance the Science and Profession of Engineering in any or all its disciplines and to facilitate the exchange of information and ideas related to Engineering.
• It is a professional learned society serving more than 20,000 members in Malaysia, overseas and the communities in which they work. It was formed in 1959. The Institution is a qualifying body for professional engineers in Malaysia.
• The Corporate member of the Institution can apply to the Board of Engineers, Malaysia (which is a registration body) for registration as a Professional Engineer, which will entitle him to set up practice.
• Membership Grades: Student, Associate, Affiliate, Incorporated, Graduate, Member, Fellow.

REGISTRATION OF ENGINEERS ACT 1967 (Revised – 2007)
An Act to provide for the registration of Engineers and for purposes connected therewith.

• Enacted in 1967 as Act No. 66 of 1967
• Revised up to: 2007
• Conduct of Registered Engineer.
  – 23. Every registered Engineer shall at all times uphold the
dignity, high standing and reputation of his profession.
• Responsibility to employer, clients or profession.
  – 24. A registered Engineer in his responsibility to his employer,
client or the profession shall have full regard to the public
interest.
• Discharge of duties.
  – 25. (1) A registered Engineer shall discharge his duties to his
employer or client as the case may be with complete fidelity.
  – (2) Except with the permission of his employer, a registered
Engineer shall not accept any remuneration for services
rendered other than from his employer.

• Reputation etc. of a Registered Engineer not to be
injured.
  – 26. A registered Engineer shall not maliciously injure or attempt
to maliciously injure whether directly or indirectly, the
professional reputation, prospects or business of another
registered Engineer.
• Canvassing and advertising prohibited.
  – 27. A registered Engineer shall not —
  • (a) canvass or solicit professional employment;
  • (b) offer to make by way of commission or any other payment
  for the introduction of his professional employment;
• (c) except as permitted by the Board, advertise in any manner or form in connection with his profession; or
• (d) provide professional engineering services to any person, unless the scope of such services are clearly defined in a written agreement between both parties.

• A registered Engineer in an Engineering consultancy practice not to practise with any person whose registration has been cancelled.

— 28. A registered Engineer in an Engineering consultancy practice shall not practise engineering with any person whose registration has been cancelled.

• Restrictions on making payments or placing contracts.

— 29. A registered Engineer in an Engineering consultancy practice shall not be a medium of payment made on his client's behalf unless he is so requested by his client nor shall he, in connection with work on which he is employed, place contracts or orders except with the authority of and on behalf of his client.

• A registered Engineer not to intervene or to take over the work of another.

— 31. A registered Engineer shall not directly or indirectly—
• (a) supplant or attempt to supplant another registered Engineer;
• (b) intervene or attempt to intervene in or in connection with engineering work of any kind which to his knowledge has already been entrusted to another registered Engineer; or
• (c) take over any work of that other registered Engineer acting for the same client unless he has—
  • (i) obtained the consent of that other registered Engineer; or
  • (ii) been formally notified by the client that the services of that other registered Engineer have been terminated in accordance with the provisions of any contract for professional engineering services entered into between that other registered Engineer and the client, provided always that in the case of dispute over non-payment of fees or quantum of any outstanding fees under the contract, the client may request the Board to be the stakeholder.

• Restrictions on being a director, member or shareholder of contracting and manufacturing company, etc.

— 32. (1) Except with the prior approval of the Board, a registered Engineer in an Engineering Consultancy Practice shall not be a director or executive of or substantial shareholder in or agent for any contracting or manufacturing company or firm or business related to building or engineering.

— (2) If such approval is given, such registered Engineer shall not undertake any contract work wherein he is engaged to provide professional engineering services in such project unless it is in respect of a "design and build" project.
• Disclosure of interest.
  – 33. Every registered Engineer while acting in his professional capacity shall disclose in writing to his client of the fact if he is a director or member of or substantial shareholder in or agent for any contracting or manufacturing company or firm or business or has any financial interest in any such company or firm or business, with which he deals on behalf of his client.

• BEM & Route to Professional Engineer…LECTURE 3 ….cont

• Guidelines
  for Code of Professional Conduct

BOARD OF ENGINEERS (BEM)

• Establishment of Board of Engineers.
• 3(1) For the purposes of this Act there is hereby established a board to be called "Board of Engineers", which shall be a body corporate with perpetual succession and a common seal and which may sue and be sued.
• 4(1) The functions of the Board of Engineers Malaysia (BEM) – Registration & Regulation of Engineers.

Functions of the Board
  - on Ethics -

• For the purposes of this Act there is hereby established a board to be called "Board of Engineers", Malaysia (BEM). The functions of the Board shall be among others:
  – to hear and determine disputes relating to professional conduct or ethics of registered Engineers;
  – to determine and regulate the conduct and ethics of the engineering profession;
REGISTRATION OF ENGINEERS

• Section 5. (1) The Board shall keep and maintain a Register which shall be in five Parts, that is to say -
  (a) Part B - which shall contain the names, addresses and other particulars of Graduate Engineers;
  (b) Part A - which shall contain the names, addresses and other particulars of Professional Engineers;
  (c) Part C - which shall contain the names, addresses and other particulars of Temporary Engineers;
  (d) Part E - which shall contain the names, addresses and other particulars of Accredited Checkers;
  (e) Part D – which shall contain the names, addresses and other particulars of Engineering consultancy practices.

“Registered Engineer” means a Graduate Engineer, Professional Engineer, Temporary Engineer or Accredited Checker.

• registered with the Board under Subsections 10(1); 10(2); and Sections 10A; 10B; respectively.

“Graduate Engineer” means a person registered under subsection 10(1);

• 10(1) (a) Subject to this Act, a person who holds –
  (i) the qualifications required for Graduate Membership of the Institution of Engineers (Malaysia) and which are recognised by the Board; or
  (ii) any qualification in engineering which is recognised by the Board,
  shall be entitled on application to be registered as a Graduate Engineer.

(b) Subject to this Act, a person who is registered as a Graduate Engineer under paragraph (a) shall be required to obtain such practical experience as may be prescribed by the Board in order to be entitled to apply for registration as a Professional Engineer under subsection 10(2).

"Professional Engineer" means an Engineer registered under subsection 10(2);

• 10(2) Subject to this Act, the following persons shall be entitled on application to be registered as Professional Engineers:
  (i) any person who -
    (a) is registered as a Graduate Engineer and has obtained the practical experience as prescribed under paragraph 10(1)(b);
    (b) has passed a professional assessment examination conducted by the Board, or is a Corporate Member of the Institution of Engineers (Malaysia); and
    (c) has complied with all the requirements of the Board;
"Temporary Engineer" means a person registered under section 10A;

- 10A (2) A foreign engineer may be considered for registration as a Temporary Engineer if he satisfies the Board that:
  - (a) he possesses the necessary qualification which is recognised for the practice of engineering as a professional engineer in the country where he normally practises; and
  - (b) he possesses the necessary expertise and his physical presence is required in Malaysia for not less than one hundred and eighty days in one calendar year or he is a resident representative of the foreign component of a joint-venture.

"Accredited Checker" means a person registered under Section 10B;

- 10B (1) The Board may register a person as an Accredited Checker if —
  - (a) he is a Professional Engineer registered in the relevant branch of engineering approved by the Board,
  - (b) he has at least 10 years relevant practical experience in the design and construction of buildings as defined in the Street, Drainage and Building Act 1974 [Act 133]; and
  - (c) he satisfies the Board that by virtue of his ability, standing in the profession, special knowledge or practical experience, he is qualified to be registered under this Act.

"Engineering Consultancy Practice" means a sole proprietorship, partnership or body corporate, providing professional engineering services.

- registered with the Board under Sections 7A or 7B (including architectural consultancy and/or quantity surveying services);

"Professional Engineering Services" means engineering services and advice in connection with any feasibility study, planning, survey, design, construction, commissioning, operation, maintenance and management of engineering works or projects, and includes any other engineering services approved by the Board;
Restriction on employment of unregistered person to provide professional engineering services.

- Section 24A.
- (1) No person shall employ a person, sole proprietorship, partnership or body corporate, other than a registered Engineer or an Engineering consultancy practice, to perform professional engineering services.

Only Professional Engineer and Engineering consultancy practice may submit plans, drawings.

- 8. (1) Except as otherwise provided under any other written law, no person or body, other than a Professional Engineer who is residing and practising in Malaysia or an Engineering consultancy practice providing professional engineering services in Malaysia, shall be entitled to submit plans, engineering surveys, drawings, schemes, proposals, reports, designs or studies to any person or authority in Malaysia.

STRUCTURE OF ENGINEERING PROFESSION IN MALAYSIA

ENGINEERING PRACTICE
- GOVERNED BY THE REGISTRATION OF ENGINEERS ACT 1967 (Revised 2007)
  ✓ no person is allowed to practice unless he is a professional engineer
  ✓ professional engineer may use “Ir” before his name or “PEng” after his name
  ✓ graduate engineer is required to register before taking up employment as an engineer

CATEGORIES OF ENGINEER
- GRADUATE ENGINEER
  ✓ those who has successfully completed an accredited engineering program
- PROFESSIONAL ENGINEER
  ✓ a graduate engineer who has obtained the prescribed practical experience, passed the Professional Assessment Examination, and satisfied all other requirements of BEM
**STRUCTURE OF ENGINEERING PROFESSION IN MALAYSIA**

**CATEGORIES OF ENGINEER - cont.**

- **TEMPORARY ENGINEER**
  - a foreign engineer who has satisfied all requirement of the BEM

- **ACCREDITED CHECKER**
  - a Professional Engineer who has min 10 years of relevant experience and has satisfied all requirements of the BEM

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**THE 12 GENERIC ATTRIBUTES OF A GRADUATE ENGINEER**

Graduates from accredited program should have the following attributes:

1. Ability to acquire to apply knowledge of mathematics, science and engineering and in depth technical competence in engineering discipline.
2. Ability to identify, formulate and solve engineering problems.
3. Ability to design a system, component or process to meet desired needs.
4. Ability to design and conduct experiments as well as to analyze and interpret data.

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**THE 12 GENERIC ATTRIBUTES OF A GRADUATE ENGINEER**

1. Ability to use techniques, skills and modern engineering tools necessary for engineering practices.
2. Ability to understand the social, cultural, global and environment responsibilities of a professional engineer.
7. Ability to understand entrepreneurship, the process of innovation and the need for sustainable development.
8. Ability to understand professional and ethical responsibilities and commitment to the community.
9. Ability to function on multi-disciplinary teams.
10. Ability to communicate effectively.
11. Ability to understand of the need for and an ability to engage in life-long learning.
12. Ability to demonstrate understanding of project management and finance principles.

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**How to be a PE?**

- Qualifications
- Experience
- Documentation
ROUTE TO PROFESSIONAL ENGINEER STATUS

• Listed below the steps which are necessary to enable Graduate Engineers to be registered by the Board of Engineers, Malaysia (BEM) as Professional Engineers (P.Eng).
  1) Register with the Board of Engineers upon graduation as it is compulsory under the Engineers Act 1967 for all practising engineers to register with the Board.
  2) All Graduate engineers are required to complete at least THREE (3) years of relevant work experience after graduation with an accredited engineering degree. These training stints should as far as possible be completed under the guidance of a P.Eng who is in the same discipline as the Graduate engineer.
  3) After registration with the Board, the engineers could approach towards their objectives of obtaining P.Eng either on their own or through the IEM.
  4) Once the candidates complete their training (either on their own or through the IEM), the next step for them is to sit for the Professional Interview conducted by IEM or BEM.
  5) Once they pass this Professional Interview (which consists of oral questions and essay writing), they are then eligible to apply to the BEM to be registered as P.Eng and could be admitted as Corporate Members of IEM.

The practical experience that a registered Graduate Engineer is required to obtain under Section 10 (1)(b) of the Act in order to be entitled to apply for registration as a Professional Engineer for a period of not less than THREE (3) years

a) General Training which should link the conceptual analytical abilities developed during the degree course with its wide application in industry and give sound base for professional development, for a period of not less than TWO (2) years of which up to twelve months of relevant, accredited recognised industrial training during the undergraduate course may be credited.

b) Professional Career Development Training, which will provide exposure to skills awareness, management, responsibility, teamwork, logical approach etc. for a period of not less than TWO years.

c) Satisfactory Attendance in the following course conducted by BEM or institution approved by BEM: (60 hrs)
   (i) Code of Ethics (12 hrs)
   (ii) Occupational Safety and Health at work, relevant by laws / regulation (12 hrs)
   (iii) Engineering Management Practice (12 hrs)

(d) Topics related to branch of engineering (24 hrs)

Professional Assessment Examination


1. PAE will consist of professional interview, followed by essay writing.

2. In the professional interview, the practical experience of the candidate will be assessed by the Examiners both on time and quality basis.

3. The Examiners shall test the candidate during the interview on the following aspects:

   1. Understanding of the application of engineering principles to the solution of problems arising from the investigation, planning, design, construction, operation or maintenance of engineering works; or on the subject of his research; and
   2. The ability to communicate.

4. The candidate is required to write two essays, one each from section A and section B. Section A is for an essay related to the candidate’s training and experience as stated in his report. Essay for section B will be on the code of ethics.

5. The candidate will be required to choose one out of two questions from section A. The candidate is also required to answer a question from two alternative questions selected by the examiners on code of professional conduct (Section B).

6. 1 1/2 hours will be allowed for each written paper.

7. The essays are intended primarily to test the candidate’s ability to marshal his knowledge and thoughts and to express them in words in a clear and concise manner.
Globalization and Sustainability…
LECTURE 4

Core Issues and Challenges in Engineering Ethics

• The importance of honesty in engineering, the various forms of dishonesty, and how a conflict of interest can compromise an engineer’s judgment.
• Issues of risk in engineering such as how risk should be defined and how much risk is acceptable.
• Engineer-manager conflicts within the context of a company or organization, the tensions that can result from the engineer-manager relationship and how these conflicts might be resolved.
• Some impediments to responsible action to be considered. To explore and apply these challenges in the context of contemporary issues.
• Their impact on society and the country - government agencies, law enforcement, public behaviour, social maturity, political parties, etc.

Globalization

• Globalization is a term that is used to describe the increasing trend towards internationally integrated markets and global interconnectedness, making national boundaries less important in terms of political, cultural, technological, financial, environmental, and national security issues.

– http://www.marquette.edu/servicelearning/conference/example_pap.pdf

Effects of Globalization

• “The results of globalization are changing the way we live our lives on a personal basis and they are changing the institutions which we collectively use to give form and predictability to our economic, social and political relationships”

Challenges of Globalization

- defining global engineering ethics,
- developing procedures for the international licensing of engineers, and
- developing international codes and standards of practice.
- international accreditation and recognition of engineering programs.

Sustainable Development

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

» Conserving natural resources and protecting environmental quality.

Sustainable Development Definition & Principles

- “Sustainable Development ……
  is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.”

- National Society of Professional Engineers

- Need vs. Desire?
Environmental Problems?

We run more and more earth’s natural resources for economy caused:

- Shrinking forest, expanding deserts, eroding soils, deteriorating the agricultural lands, lower atmosphere is warming, melting glaciers, increasing sea levels, more destructive storms, failing water tables, disappearing of sea corals, drying rivers, fisheries are collapsing, extinction of many species.
Environmental Problems: Cause?

Major causes are:

✓ Population growth
✓ Wasteful and unsustainable resource use
✓ Poverty
✓ Exclusion of environmental cost of resource use
✓ Attempts to manage nature with insufficient knowledge
Sustainability:

Our lives and economies depend on energy from the sun (sun capita) and on natural resources (natural capita) provided by the earth.

Living sustainably means living off the earth’s natural income without depleting or degrading the natural capital that supplies it.
Oil - The lifeblood of today's economics may be unaffordable sometime during this century.

Geologist project that known and projected global reserves of conventional oil will be 80% depleted between sometime 2050 and 2100, depending on consumption rate. Natural gas: 60 yrs, Coal: 200yrs (World Energy Council, 2004)

The challenge for this century is to sharply reduce the waste of oil and other resources and to find array of substitutes for oil and other fossil fuels.

We Depend Heavily on Oil

Advantages
- Ample supply for 42-93 years
- Low cost
- High net energy yield
- Easily transport within and between countries
- Low land use
- Technology is well developed
- Efficient distribution system

Disadvantages
- Need to find substitute within 50 years
- Large government subsidies
- Environmental cost not included in market price
- Artificially low price encourage wastages
- Can cause pollution

Conventional Oil

We Depend Heavily on Oil-Petroleum Products

Petroleum products are useful materials derived from crude oil (petroleum) as it is processed in oil refineries


**Energy Resources**

**Non Renewable**
- Fossil fuel
- Nuclear
- Coal
- Natural gas

**Renewable**
- Direct Sun
- Wind
- Biomass
- Flowing water

**We Can Save Money and Energy in Industry**

- By introducing co-generation system or combined heat and power (CHP) system. Especially for manufacturing that involve heating process where the heat generated is feed back to re-generate electrical for independent use.

- Equipments that being used in the system can be replaced by low loss energy efficient equipment such as motors, lightings and air conditioner.

- Recycling waste materials from manufacturing also can be a intelligent steps for money saving activities.

**We Can Save Money and Energy in Transportation**

- Use high efficient engine that perform well with minimal petrol used.
- Use hybrid car
- Use electric car (Plug in hybrid electric vehicle)
- Energy efficient diesel car, biodiesel can be an alternative fuel.
- Next Generation: Fuel Cell (Hydrogen to produce electricity) 2012.

**We Can Design Buildings That Save Energy and Money**

- Designing energy efficient building
- Green architecture, based on energy efficient approach
- Building certification, Green Building Index, LEEDS, BREEAM, etc.
- Natural lights, natural ventilation, orientation, materials selection.

- Research:
  - 60% of electrical energy goes to Air Conditioning
  - 15% of electrical energy goes to Lighting (During Daytime)

(Energy Commission, 2002 office building of 1000sm)
LEED, or Leadership in Energy and Environmental Design, is an internationally-recognized green building certification system. Developed by the U.S. Green Building Council (USGBC) in March 2000, LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

- LEED promotes sustainable building and development practices through a suite of rating systems that recognize projects that implement strategies for better environmental and health performance.
- LEED is flexible enough to apply to all building types – commercial as well as residential. It works throughout the building lifecycle – design and construction, operations and maintenance, tenant fitout, and significant retrofit. And LEED for Neighborhood Development extends the benefits of LEED beyond the building footprint into the neighborhood it serves.
- LEED also makes business sense, benefiting commercial building owners as well as tenants.
ZERO CARBON HOUSE KEY FEATURES

- Sustainable construction
- Solar panels
- Wind turbines
- Insulation
- Domestic hot water
- Heat store
- Coil heat exchanger
- Under floor heating

SOURCE: ESD (Energy for Sustainable Development)
We Can Save Energy and Money in Existing Buildings

- Retrofit to save energy
- Insulate and plug leaks
- Use energy efficient window
- Stop other heating or cooling loses
- Heat house more efficiently
- Heat water more efficiently
- Use energy efficient appliances for lighting, etc.

We Can Use Renewable Energy and Plant Nonrenewable Energy

- Sun, moving water, wind, biomass
ENVIROMENTAL PROBLEMS - MALAYSIA
What Can We Do?

We Can Cool Buildings Naturally
We can Use Sunlight to Produce Heat
We Can Heat Water With Solar Energy
We Can Use Solar Cells to Produce Electricity
We Can Convert Plant and Plant Waste to Liquid Biofuels.

Professional Obligations

• Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations.
Notes on the Code of Professional Conduct, Board of Engineers, Malaysia

• The Engineering Professional plays a paramount role in a developing country such as ours. The work of engineers shapes the physical environment of society, and has a profound effect on the economic growth and development of the nation.

• It is therefore essential that the members of the engineering profession should always perform their duties to the highest standards of professional integrity. They should maintain the dignity of the profession, and not be led astray by commercial motives into performing actions which are not for the good of the profession as a whole, or for the good of society in general.

• The Code of Professional Conduct describes the professional behaviour of Engineers.
  • The Institution of Engineers, Malaysia.