IMPORTANT QUESTIONS AND ANSWERS

(1) a. *Who is a professional engineer? [2004(d), 2004 (d2)]*
b. *Give the definition of the "Practice of Professional Engineering". [2004(d), 2004 (d2), 2005]*

(2) a. *What are the five common elements of a profession (proper professional practice, essential requirements that qualify 'profession')? [2005, 2003, 2002, 1998, 2001]*
c. *Describe briefly how engineering satisfied these requirements [2001]*
d. *During what period in history was engineering first considered a profession? [2001]*
e. *Give actions that constitute 'proper or inappropriate professional practice'? [2003]*

Engineer

The professional art of applying science to the optimum conversion of resources to benefit humanity

Professional Engineer

- A person licensed to practice professional engineering by the provincial association of professional engineers (P.Eng)
- Must have completed Engineering degree (or equivalent), and have 48 months of work related experience in professional engineering.

P.Eng. designation identifies to the public that you are:

(a) legally and ethically responsible for your work and hold public safety paramount;
(b) maintain the highest levels of competence as judged by your peers;
(c) continually upgrade your knowledge; and
(d) adhere to a strict Code of Ethics.

Practice of Professional Engineering

- Any act of designing, composing, evaluating, advising, reporting, directing or supervising.
- Safeguarding of life, health, property, public welfare
- Requires application of engineering principles, but does not include practicing as a natural scientist.

Five Elements of a "Profession"

(1) Specialized knowledge
(2) Intensive preparation
(3) Maintaining high standards of achievement and conduct
(4) Continued study
(5) Prime goal of public service

<u>In engineering</u> →
a. apply their knowledge to benefit all
b. technical judgment/knowledge
c. ethical judgment

OTHER Common elements of a profession

- SPECIALIZED KNOWLEDGE
- OBLIGATION TO THE PUBLIC
- SELF-GOVERNING AND DISCIPLINE
- CODE OF ETHICS
- COMPENSATION

Leadership
Good Judgment

Engineering Considered a Profession

- In 1887 – Engineering Institute of Canada, Established Act
- In 1922 – APEO created, not regulated
- In 1936 – CCPE (Canadian Council of Professional Engineers)
- In 1937 – PEO, regulated
- In 1948 – PEO, Code of Ethics

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(2) a. What is it, and when is a certificate of authorization required under the PEO and who must apply for such a certificate? [2003, 2004(d), 2004 (d2), 2005]

d. What professional qualifications are required to be designated as the person responsible in a certification of authorizations? [2003, 2004(d), 2004 (d2)]

e. In the event that the holder of a certificate of authorization does not have professional liability insurance, what action must be taken? [2003, 2004 (d)]

Certificate of Authorization

- All individuals, partnerships or corporations that want to offer or provide services to the public within the practice of professional engineering require a certificate of authorization issued by the APEO.

Professional Requirements to Obtain a CoA

- Must designate a licensed or temporarily-licensed professional engineer with a degree or equivalent engineering education followed by 5 years of professional engineering experience to assume responsibility and supervise the services provided

- Must have appropriate professional liability insurance, subject to certain exceptions
  If no liability insurance: certificate holders should inform every client, in writing, about the fact that they don't have liability insurance; the client must agree to the conditions.

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(1) Name and briefly describe the purpose of three province of Ontario labour and employment Acts. [2003, 2004 (d), 2004 (d2), 2005, 2002]

Employment Standards Act (2000) – (ESA)

- Establishes the minimum terms and conditions of employment
- Administered by the Ministry of Labour (MOL)
- Complaint Driven
- E.g. work hours, lunch breaks, overtime,
  minimum pay, holidays, vacation pay
  notice of termination severance pay unpaid, job related pay

Exemptions exist for students and professional engineers

Labour Relations Act – (LRA)

- To facilitate collective bargaining between employers and trade unions
- Promotes resolution of workplace disputes (Stikes, lockouts)
- Gives right to employees to join trade union (in majority of workplace agrees)
- Administered by the Ontario Labour Relations Board (OLRB)
- Exemptions:
  - agriculture, federal jurisdiction, police, firefighters

Occupational Health and Safety Act (OH&S)

- Outlines particular duties for employers, workers, supervisors and owners
- Guides the employers to provide a safe environment for the workers
- Forces workers to comply and act with regulations
- Administered by the Ministry of Labour (MOL)
- Enforcement (inspections), Prosecution (defense: due diligence)
- Committees: Health and Safety committee, Joint Health and Safety Committee (20+)

(2) Explain the difference between the structure of an 'essay' and the structure of an 'engineering report'. [2004 (d), 2005, 2003]

(3) In her presentation, Professor Artemeva suggested that there are generally three major considerations when communicating technical information in writing. Identify these considerations and explain the significance of each. [2004(d), 2005, 2003]

Essays

- Read in detail from beginning to end
- Contain little to no visual formatting

Reports

- May be selectively read
- Designed to maximize the ease of extract of necessary information
- Heavily formatted

Memo

- Short document
- Request or delivers a quick response to a specific question
- May be compact version of report
- Components:
    a. Header (to, from, date, subject)
    b. Purpose – why writing
    c. Summary – mini version of memo
    d. Discussion – background, big picture, active verbs, simple, language
    e. Action – finish with clear call of action

Communicating Technical Information

(1) Purpose
Why are you writing or presenting orally?

(2) Audience
Who is your reader/listener?
What does the reader/listener know already?
What does the reader/listener need to know?

(3) Assessment Criteria
How is your writing/oral presentation evaluated?

(*) Note: Feedback on Drafts – How to revise a presentation/written draft based on the feedback.

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(3) a. What is due diligence as it relates to health and safety legislation? [2004(d), 2004 (d2), 2005, 2003]

b. What four actions can an employer take to demonstrate due diligence? [2003]

Due Diligence

- Taking every precaution reasonable in the circumstances to protect the health and safety of all workers.
- Due diligence is assessed case-by-case, not as a blanket for all activities.
- Balance of probabilities

It means:

- You fully understand your obligations under legislation
- You have identified all risks that are foreseeable.
- Taking the precautions reasonable in the circumstances as they apply to *every situation*.
- Using *foresight* to counteract the *hindsight* that will be used if you or your employer end up in court.

To Demonstrate Due Diligence:

(1) Know workplace hazards and legal obligation
(2) Develop a proper system, written policies, practices and procedures.
(3) Ongoing communications
(4) Training, Monitoring
(5) Enforcement and discipline
(6) Clarity responsibilities and duties for supervisors and managers
(7) Document, Document, Document!

(4) a. Define discrimination and list several (five) forms of discrimination that may exist in the workplace. [2004 (d2), 2005, 2003].

b. What steps can you take if you are aware of discrimination in your workplace? [2004(d2), 2005]

Discrimination

- When people deny others the opportunities because of perceived differences
- Prejudice often accompanies discrimination

Forms of Discrimination

(1) race — RACE physical characteristics: eyes, head size, lips, skin colour

(2) religion/culture/ ethnicity — CULTURE
learned, share and transmitted social activities of a group
Human-made part of environment
e.g. way we dress, greet people and eat
ETHNICITY
Group of people within a larger society, set apart by religion, language and traditions (not the same as race or culture, but contains both)

(3) age

(4) sex — SEXISM
Belief that one sex is inferior to the other
Socially organized set of attributes, deny one sex rewards/opportunities

(5) physical handicap

(6) national origin

Steps to Take

- Be responsible for your own behaviour
- If you witness it, try to contact the person who can mostly direct affect the situation (instructor, supervisor, housing authority, etc.)
- If you experience it, speak up – weigh the pros and cons of reporting
- Keep it documented and dated

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(7) *a.* *Define sustainable development and describe it's principles. [2002, 2003, 2001]*

b. *What is the relevance of sustainable development to engineering education and practice? [2003]*

c. *Describe problems that can be solved by sustainable development. [2003]*

d. *What is the Kyoto Protocol (1997) regarding the environment? [2002, 2001]*

e. *Suggest alternatives to fossil fuel energy sources that can contribute to Canada's commitment to the Kyoto agreement. [2001]*

Sustainable Development

- Development that meets the needs of the present without compromising the ability of future generations to meet their own needs
- A *continually evolving* concept based on integration of *social (intergenerational), economic(living on interest) and environmental concern*s (conservation and preservation)
- A key goal of public policy, in Canada and internationally

Principles of Sustainable Development

(1) Anticipation and prevention
(2) Full Cost Accounting
(3) Informed decision making
(4) Living off the interest – renewability of a resource
(5) Quality of development – "Smart Growth"
(6) Respect for nature and the rights of future generations

In Engineering Education and Practice

- Research and Development (R&D)
- Policy, planning, design, implementation, operations and maintenance (O&M)
- strong endorsement by engineering societies and associations
- Needs to be part of the curriculum (Canadian Engineering Accreditation Board)

Problems that Can be Solved

(1) Limited non-renewable sources (oil and natural gas)
(2) High emissions (GHG)
(2) Health and Environmental Issues
(3) Waste disposal issues – industrial society
(4) Low levels of fertile land and freshwater
(5) Global Warming (climate change, glacial melts)
(6) Polluted aquifers – clean water is scarce
(7) Energy depletion

Kyoto Protocol (December, 1997)

- Canada must reduce GHG emissions to 6% below 1990 level by 2010-2012
- Transportation caused emission – decrease by 35%
- To reduce:

Energy efficiency (cleaner, large scale)	sustainable transportation
Renewable energy	sustainable develop of technology
Change direction (R&D)	

Alternative to Fossil Fuel Energy

(1) Fuel Cells (Electrochemical, Hydrogen/Oxygen)
(2) Bio-energy
(3) Wind
(4) Solar
(5) Geothermal
(6) Hydro

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(1) a. Name and explain 3 forms of Corporate Governance [2003, 2005, 2002]
b. What are the duties of a director? [2005]

Sole Proprietorship

- Owned by one person – basic and small
- All profits and all losses will apply to owner only
- Inexpensive
- Can be sued, or sue personally
- Must comply with Business Names Act
- Not regulated by PEA
- NOT A LEGAL ENTITY (tax return of owner)

Partnerships

- Two or more persons (individuals or corporations)
- Carry on a business, in common, with a view to a profit
- Inexpensive
- Few legal formalities
- NOT A LEGAL ENTITY (tax return of each partner)
- Regulated by PEA
- Types:
    a. *General Partnerships* – Unlimited liability for each
    b. *Limited Partnerships* - General partner: unlimited, limited partner: based on contribution
    c. *Limited Liability Partnerships* (LLP) – Hybrid, partners liable for own negligence (used by professionals)

Corporation

- 'Owned' by shareholders as a result of owning shares (do not own business undertaking or property)
- Run by a board of directors selected by the shareholders
- Most frequently used for commercial activity
- Can: own property, possess rights, sue, subject to taxes
- Corporate and Shareholder liabilities are different (SH: no liable for business)
- Regulated by PEA
- LEGAL ENTITY, separate from owners' assets (taxed as corporation, dividends)

Duties of a Director

- Manage and supervise affairs of the corporation (may be restricted by unanimous shareholders agreement (USA))
- Obligations:
  - (1) Fiduciary Duty to act:
    - Honestly and in good faith
    - In the best interest of the corporation
  - (2) Duty of Care
    - Exercise diligence and skill of a reasonably prudent person in comparable circumstances
- Can delegate duties to officers subject to articles, by laws and USA

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(2) In her presentation, Elza Seregeli outlined a five step plan for managing an engineering career. Identify the five steps in the plan and briefly discuss each step. [2002, 1998, 2000]

STEP 1 – Access Yourself

- What have been my best/worst experiences? Why?
- What are my strengths and weaknesses? Motivators?
- Find out how others perceive you.

STEP 2 – Set your Vision

- IS my personal/work life balanced?
- Where is my current path taking me? Am I in control of my own career?
- What do I want to be doing in 2, 5, 10 years?

STEP 3 – Gather Information

- Where do I look?
- What questions should I ask?
- Benchmark your progress using both internal and external data (salary surveys, job descriptions)
- Network – how to and who with?

STEP 4 – Develop a Plan

- Map out several alternatives and what you need to achieve them (training, experience)
- Go beyond just you next job or project – what's next?
- Consider lateral ("developmental") as well as vertical moves
- Get advice, seek a mentor

STEP 5 – Take Action

- Talk to your manager, career counselor or HR representative
- Get the training/experience you need
- Prepare your resume with focus on SKILLS
- Use your contacts, arrange visits, interview, etc.

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(4) a. List and briefly describe 5 types of protection of IP. [2003, 2000, 1999, 2001]

d. What is a patent and what are the key elements of a patent and securing a patent? [2004(d), 1998]

Patents

- Exclusive right to make, use, sell and offer sale on a product, process or apparatus
- 20 year protection
- E.g. pat on the back apparatus

Patents

Key Elements, must be:

a. New – not anticipated
b. Useful - Utility
c. Not obvious – inventive step

Securing a Patents

a. Non-Disclosure, confidentiality agreement
b. Keep dated records – use bound notebook
c. Hire a Patent Agent (possibly)
d. Apply when invention is complete, first-to-file

Trademarks

- Distinguish your goods and services from other
- Exclusive right to use mark, device, etc.
- Special Types: certification mark, distinguishing guide
- Must prove that it is recognizable
- No time limit
- E.g. Coca-Cola, SKI-DOO

Industrial Design

- Protection of the appearance, not function (shape, configuration, pattern, ornament)
- 10 year protection
- Supplements patents
- E.g. furniture, toys, cars

Copyright

- Written or electronic form of protection, automatically protected world-wide
- Protects expression of idea
- Protection from copying

Trade Secrets

- Protection of anything confidential (research, inventions not patented, know how)
- For items with very long, or very short useful life
- Dangers – reverse engineering, upset employees
- Caution – spread the bits around, need to know basis

(5) a. List 4 ethical theories and how they may help make decisions on ethical dilemmas.[2003, 2000, 1999]

~~b. Describe the ethical decision-making process. [2003, 2000]~~

~~c. Describe how an ethical workplace can be achieved . [1998]~~

Virtue Ethics (Aristotle)

- Aspire to be an idea person – excellent character
- Development of requisite dispositions – emotions, moral habits, character
- E.g. Virtues: honesty, benevolence, fairness, kindness, courage, optimism, patience
- Good course of act is the mean between extremes of excess and deficiency

Utilitarianism (Mill)

- Best act is the one with the highest net benefits
- Maximize value to the greatest number of people
- Minimize suffering
- Difficulty in calculating the maximum benefit

Rights Ethics (Locke)

- Every individual has rights (life, liberty, dignity, etc.)
- Canadian Charter of Rights and Freedoms – 1982
- People deserve respect
- Some rights are set aside for the great good

Duty Based Ethics (Kant)

- Every individual has a fundamental duty to act in an ethical manner
- One has a duty to follow the rules – be honest, fair, do not hurt other
- An act itself is right or wrong, the end does not justify the means
- Moral duty must be done for it's own sake
- This approach emphasizes the importance of following universal rules

(2) As required under the Ontario Health and Safety Act, name: [2004 (d), 2004 (d2), 2005, 2000, 1999]

a. Three duties of the employer.
b. Three (five) duties of the supervisor.[1999]
c. The Quebec Bridge… learned from this target [2003]

Duties of the Employer

(1) Provide equipment, materials and protective devices that are prescribed by regulation
(2) Ensure that equipment, materials and protective devices are maintained in good condition
(3) Provide information, instruction and supervision to a worker
(4) Appoint a 'competent supervisor'
(5) Establish a health and safety system
(6) Take every precaution reasonable in the circumstances to protect workers

Duties of the Supervisor

(1) Ensure workers comply with the Act
(2) Ensure workers use equipment, devices and clothing provided
(3) Advise workers of hazards and danger
(4) Provide written instructions
(5) Take every precaution reasonable in the circumstances to protect workers

Duty of Worker

(1) Comply with the Act
(2) Use equipment, protective devices and clothing provided
(3) Use equipment in a safe manner
(4) Not to make protective devices ineffective

Liability of Engineer (OHSA)

In violation if:

a. negligently gives advice that leads to endangered worker
b. negligently provides certification, leads to endangered worker

Duty of Engineer (P-Eng, Code of Ethics)

- Act at all times with devotion to high ideals of personal honour and professional integrity
- Act at all times with knowledge of developments in the area of professional engineering relevant to any services that are provided
- Act at all times with competence in the performance of any professional engineering services that are undertaken

Quebec Bridge

[First tragedy was a result of fault design and inadequate engineering supervision]
[Second tragedy was a result of material failure]

- Provide adequate capitalization for large-scale projects
- Hire capable and competent professionals
- Defining clear the duties, authority, and responsibilities of professional personnel
- Discus design decisions and related technical problem openly, and listen respectively
- Review details, monitor work on the site adequately
- Ensure that communication is rapid and accurate
- Provide adequate support staff and remuneration for highly skilled professional people