UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, ~~APRIL 2003~~ DECEMBER 2005

First Year

APS111 – Engineering Strategies and Practice I

Examiners – Prof. S. McCahan

Prof. P.E. Weiss

Prof. R.C. Andrews

Name: _____

Student Number: _____

This is a two and a half hour exam. For full credit, answer all questions completely. The percentage value for each part is given to help you allocate your time. This is a closed book exam. No aids are permitted. Return your booklet, multiple choice response sheet, and your exam when you are finished.

The final exam has two parts: multiple choice and essay question.

Make sure your name and student number are on both the multiple choice response form and the answer booklet.

Exam: 13 pages

2 parts: 60 multiple choice questions

1 long answer question

Part I: Multiple Choice (80% of the exam mark)

Answer all questions on the response sheet. Please be sure to fill out the answer form clearly with no overlaps. The answer sheet should be filled out using a number 2 (NO2) pencil. Erase any errors completely. All questions have **one or more** correct answers. You must respond with **all** of the correct answers to get full credit. Points will be deducted for incorrect answers.

1. In the design process, stakeholders should be identified in the:
   (a) Problem Definition stage
   (b) Concept Generation stage
   (c) Evaluation of Concepts stage
   (d) Product Architecture stage
   (e) Detail Design stage

2. The difference(s) between the design process and the process of developing a document are:
   (a) the design process is iterative
   (b) the design process involves understanding and implementing standards
   (c) the development of a document requires understanding the intended audience or user
   (d) the development of a document involves editing for grammar and word choice
   (e) the development of a document requires evaluating and organizing ideas

3. Engineering products of interest at the Mactaquac Generation Station include:
   (a) construction jobs
   (b) water
   (c) electricity
   (d) flood control
   (e) generating station

4. Which are **NOT** likely to be stakeholders in the Mactaquac Generation Station project?
   (a) Quebec dairy farmers
   (b) salmon fishing industry
   (c) upstream landowners
   (d) automotive industry in Ontario
   (e) New Brunswick residents

5. Once stakeholders have been identified, major areas of constraint associated with the stakeholders include:
   (a) legal impacts
   (b) social impacts
   (c) environmental impacts
   (d) life cycle cost
   (e) economic cost

6. When considering the design of a paper towel manufacturing facility, which categories of stakeholder concern would apply to the workers involved in construction and operation?
   (a) legal impacts
   (b) social impacts
   (c) environmental impacts
   (d) life cycle cost
   (e) economic cost

7. Why is the interstate highway H-3 considered to be a rare type of engineering product?
   (a) stakeholders were not easily identified
   (b) there was only one stakeholder
   (c) clients were not seeking a profit
   (d) clients were environmentally-motivated
   (e) all stakeholders agreed on the project plan from the beginning

8. The PEO legalistic definition of the role of an engineer in society does **NOT** address the ability to:
   (a) construct
   (b) operate
   (c) lead
   (d) learn
   (e) teach

9. As a leader, an engineer may address legal and ethical issues that include:
   (a) protecting intellectual property
   (b) offering legal council
   (c) preparing a contract to secure services
   (d) reviewing a design project to determine if a contractor should be paid
   (e) determining stock options

10. In which type of contract is agreement inferred by the parties' actions?
   (a) unilateral
   (b) bilateral
   (c) implied
   (d) express
   (e) ordinary

11. A tort is a civil wrong that can include:
   (a) ignorance
   (b) malice
   (c) negligence
   (d) unethical behavior
   (e) product liability

12. Which of the following may be viewed as causing many ethical dilemmas?
    (a) environmental impacts
    (b) client requests for illegal actions
    (c) conflicts between stakeholder constraints
    (d) bilateral contracts between the designer and the client
    (e) human error

13. When comparing design options in terms of objectives and constraints:
    (a) you must be able to weigh objectives and constraints appropriately
    (b) you must be able to weigh objectives appropriately
    (c) your objectives and constraints must use measurable metrics
    (d) your objectives must use measurable metrics
    (e) your objectives and constraints must be the same

14. Which of the following are **NOT** examples of metrics that could be used for a proposed design to address the example problem (used in class) of transporting Prof. Woodhouse from home to the university:
    (a) measuring how long it takes Prof. Woodhouse to go from home to school using a prototype of the proposed design.
    (b) observing Prof. Woodhouse's driving habits
    (c) evaluating the operating cost of the proposed design
    (d) counting the frequency of repairs required for the prototype of the design
    (e) measuring the size of the prototype transportation device

15. Which of the following would be included in a manageable life cycle for toilet paper?
    (a) disposal of the packaging
    (b) disposal of advertisements for the toilet paper
    (c) manufacture of the transport trucks
    (d) energy for transporting the paper to the store
    (e) processing of the pulp

16. Assuming that you were trying to determine the environmental impact of a proposed new petrochemical refinery, which of the following would you **NOT** likely include on your list?
    (a) workplace safety
    (b) toxicology of materials
    (c) transport phenomena (fate of materials)
    (d) environmental reactions
    (e) internal costs

17. An improvement analysis that helps reduce an overall environmental impact may include:
    (a) design of a product to better fulfill the objectives
    (b) design of a product such that it may be recycled
    (c) reduction in energy use
    (d) reduction of number of products produced
    (e) reduction of production time

18. When examining alternative means to address biosolids issues, which of the following would likely carry the highest weight when considering "Study Criteria"?
    (a) technical performance
    (b) financial considerations
    (c) construction considerations
    (d) public health and safety
    (e) technical feasibility

19. Which of the following are not stages of life cycle assessment?
    (a) scope and life cycle development
    (b) life cycle cost
    (c) inventory analysis
    (d) improvement analysis
    (e) external cost analysis

20. When considering biosolids management options, which of the following is common to both incineration and land application as a fertilizer?
    (a) atmospheric interference: air pollutants and greenhouse gases
    (b) high capital costs
    (c) concern with possible pathogens
    (d) low capital costs
    (e) ground water contamination

21. Which biosolids management option or options for the GTA would likely be associated with the most opposition from nearby (GTA) residents?
    (a) use as a raw material to industry
    (b) land application
    (c) landfill
    (d) pelletization
    (e) truck (transport) it to Michigan

22. Accounting profit equals:
    (a) total revenue - external costs
    (b) total revenue - internal costs
    (c) total revenue - (external + internal costs)
    (d) true profit – internal costs
    (e) true profit – external costs

23. Total revenue equals:
    (a) true profit – accounting profit
    (b) true profit – internal costs
    (c) price x number of items sold
    (d) price x number of items sold – internal costs
    (e) true profit – (price x number of items sold)

24. Examples of external costs of an automobile include:
    (a) cost for gasoline to run the automobile
    (b) manufacturing costs for automobile parts
    (c) cost to the owner to have a junkyard dispose of the automobile
    (d) healthcare costs from air pollutants due to the automobile
    (e) road maintanence costs

25. Capital costs may be defined as the following:
    (a) one-time costs required to produce a product
    (b) continuing costs required to produce a product
    (c) costs to society that result from the product
    (d) energy costs
    (e) costs to mitigate environmental impacts as a result of production

26. Operating costs for a manufacturing plant include:
    (a) plant construction costs
    (b) maintenance costs
    (c) labour costs
    (d) costs for plant decommissioning
    (e) cost of raw materials used in the manufacturing process

27. Sustainability and external costs include the following:
    (a) direct costs of environmental damage
    (b) societal costs due to poor working conditions
    (c) societal costs due to environmental damage
    (d) insurance costs
    (e) costs to purchase land to build a production facility

28. If one of your constraints is to minimize environmental damage when building a new computer chip manufacturing facility in the Muskoka area, how could you quantitatively evaluate the impact?
    (a) number of species of plants and animals lost
    (b) number of workers injured per month
    (c) number of hectares of forest lost
    (d) true profit earned from the plant
    (e) quantity of taxes paid by the new plant

29. Which of the following is not a part of Problem Definition?
    (a) establish functions
    (b) identify stakeholders
    (c) identify stakeholder concerns
    (d) evaluate concepts
    (e) describe the service environment

30. When considering an overall life cycle analysis for the production of paper towels, what is common to all of the processes in the life cycle?
    (a) safety is a stakeholder concern
    (b) packaging material is an output
    (c) printer ink is used
    (d) energy is used
    (e) pulp is an input

31. When proposing to sell waste milk from a diary such that it may be used as an input to another industry, which of the following questions should be investigated?
    (a) How much milk can a cow produce?
    (b) What type of milk do most people prefer?
    (c) What industries could use waste milk?
    (d) Are there any regulatory issues that need to be addressed?
    (e) Are the cows stakeholders in this?

32. The idea proposed in question 31 is an example of:
    (a) applying the rules of brainstorming
    (b) applying life cycle analysis
    (c) applying the principles of industrial ecology
    (d) applying the code of conduct for professional engineering
    (e) turning an external cost into an internal cost

33. Which of the following could be considered social impacts in the life cycle of toilet paper:
    (a) jobs in the town where the manufacturing plant is located
    (b) profit for the company owners
    (c) energy usage at the local water treatment plant
    (d) safe working conditions in the pulp mill
    (e) low cost, high quality toilet paper

34. Which are **NOT** specific objectives when considering the design of a new product to compete with existing paper towel products?
    (a) should be made out of paper
    (b) should be easy to use
    (c) should be absorbent
    (d) shall be as strong as competitive products
    (e) shall cost no more than $.50 per roll to manufacture

35. Which of the following are **NOT** rungs on the human-tech ladder as identified in "The Human Factor":
    (a) organizational
    (b) physical
    (c) functional
    (d) political
    (e) team

36. If a new nuclear power plant was to be located in the GTA, which stakeholder would be the most motivated by profit?
    (a) design team
    (b) Ontario Power Generating Corporation
    (c) residents of the GTA
    (d) NGO's
    (e) people buying electricity

37. Human factor issues associated with the Panama Canal project include:
    (a) the political fallout from the Panamanian revolution
    (b) the introduction of foreign species from one ocean into the other
    (c) the economic gain in the canal zone due to ship traffic
    (d) the development of a communication protocol to guide ships through the Canal
    (e) the lift lock system that was developed for the Canal.

38. A full life cycle shows:
    (a) all points of environmental impact
    (b) all processes
    (c) all stakeholders' interests
    (d) all maintenance costs
    (e) all hierarchies

39. In your Engineering Notebook you should:
    (a) write in pencil so that you can correct errors easily
    (b) give complete references to sources of information
    (c) make entries at the time you do your work
    (d) crowd as much information onto each page as possible
    (e) organize information with headings and subheadings

40. The drafting process is like brainstorming in that both
    (a) generate ideas
    (b) enable creativity
    (c) narrow the design space
    (d) require persistence
    (e) require judgment

41. A credible statement:
    (a) is always in passive voice
    (b) may be supported with general knowledge
    (c) has some form of explanation
    (d) always has an in-text citation
    (e) may be supported with data

42. Purposes for reading an Executive Summary include:
    (a) deciding whether or not to read a whole report
    (b) deciding which section of a report to read
    (c) deciding whether the details are well documented
    (d) deciding whether to vote for or against a project
    (e) deciding which external costs should be revised

43. In writing, the revision step is like the decision making process in design in that it is the time when you
    (a) judge alternatives
    (b) focus on a solution
    (c) fix small mistakes
    (d) concentrate on ideas
    (e) make decisions

44. Which of the following is **NOT** true of engineering writing?
    (a) In engineering writing, one avoids impressionistic detail, or language that is suggestive.
    (b) In engineering writing, the writer struggles to increase the reader's emotional involvement.
    (c) In engineering writing, measures are given so that comparisons may be more easily made.
    (d) In engineering writing, the technical level of the reader must be taken into account.
    (e) In engineering writing, numbers must be spelled out in full at the beginning of sentences.

45. A correct complex or compound sentence can be
    (a) made up of two sentences joined with the word "therefore."
    (b) made up of two sentences joined with the word "because."
    (c) made up of two sentences joined with the word "however."
    (d) made up of two sentences joined with the word "and."
    (e) made up of two sentences joined with the word "nevertheless."

46. In which of the following sentences can you find grammatical errors?
    (a) Technology assessment, different than other forms of engineering analysis, which is still an evolving method.
    (b) The economic domain will be dominated by the capacity to innovate, manage information, and nourish knowledge as a resource.
    (c) A high premium will be placed on the talent to design not simply hardware, but entire technological delivery systems.
    (d) Cultural preferences and shifts will have more to do with technological choice than with the elegance, novelty, or virtuosity of the hardware.
    (e) Because of technology, borders will increasingly be crossed by people, capital, commodities, information, culture, and pollution.

47. Which of the following is **NOT** true of tense use in engineering reports?
    (a) Use future tense for describing a promised action
    (b) Use present tense to describe sections of the report
    (c) Use shall for objectives
    (d) Use future tense when expressing general principles
    (e) Use past tense when describing completed actions

48. Which of the following is illogical?
    (a) Based on personal opinion, the team chose the iguana video.
    (b) The engineering staff assessed the damage.
    (c) The spectra were examined by Professor Sigma.
    (d) The damage was assessed by the engineering staff.
    (e) Based on personal opinion, the iguana video was chosen.

49. Culturally based assumptions undermine scientific objectivity. Therefore, engineering writers should:
    (a) Avoid personal pronouns by always using the passive voice.
    (b) Use a thesaurus to find as much variety in words as possible.
    (c) Use "he or she" or "hers or his" when referring to a non-specific person.
    (d) Try to understand the culture of the reader who will receive the document.
    (e) Use "they" to avoid the issue of having to use "she or he" or "his or hers."

50. Which of the following are correctly written.
    (a) There pet toy design is on the table.
    (b) Its use is defined by certain critical factors.
    (c) "Data" is the plural form of the word "datum."
    (d) Alternative A was considered better then the others.
    (e) Choosing a solution, a weighted decision matrix was used.

51. Which of the following are **NOT** true? A paragraph
    (a) is introduced with a sentence that gives the reader the paragraph's focus
    (b) is considered better writing than a bullet list.
    (c) is used to emphasize the relationship between ideas.
    (d) has a single idea developed with explanation and evidence
    (e) uses relationship terms such as "because" and "subsequently."

52. A bullet list should
    (a) never be organized from least to most important point
    (b) not be organized chronologically
    (c) often be organized from most to least important point
    (d) always be organized alphabetically
    (e) never be organized in a random fashion

53. Identify the problem in the following sentence:
The microscope and associated apparatus consists of an electrodynamic levitator trap equipped with lateral-centering electrodes, a homemade microscope, and a cooled integrating CCD camera.
(a) The word "with" introduces a misplaced modifying clause.
(b) There is a compound subject with a singular verb.
(c) There is an error in parallel construction in the list.
(d) The pronouns do not agree with their antecedents.
(e) The word consists should have an apostrophe – "consist's"

54. Which of the following uses of collective nouns are **NOT** correct?
(a) The couple is married.
(b) The series demonstrates important features.
(c) The series of spectra were transferred onto transparencies.
(d) Fourteen dollars are the unit price for the pet toy.
(e) The couple are divorced.

55. Which of the following statements are true?
(a) The academic offence known as "plagiarism" is "representing someone else's ideas or expression of ideas" as your own.
(b) If you use the web for research, you really do not have to use books, journals or manuals.
(c) You may make up your own system of referencing as long as it has both in-text citations and a reference list.
(d) IEEE referencing is the professional reference standard used by Electrical and Electronic Engineers.
(e) In the IEEE in-text citations, sources are cited with the names of the author and publication date in round brackets.

56. The beginning of a document, section, paragraph or sentence:
(a) is always the word "the."
(b) helps the reader orient her/himself to the text
(c) gives the reader her or his first impression
(d) never requires an in-text citation
(e) should have the most important ideas first.

57. Which of the following are **NOT** true?
(a) The end of a document, section, paragraph or sentence is what the reader remembers.
(b) The last sentence of a well-written paragraph must always link to the next paragraph.
(c) The subject and verb should be as close to the start of a sentence as possible.
(d) A Conclusion should summarize a document and leave the reader understanding what to expect in the future.
(e) Engineering reports in university should always have five paragraphs.

58. Which of the following is **NOT** a reason to define a term in a report to client?
    (a) When you are using a general term in a narrow or specific way.
    (b) When the term is easily confused with another term.
    (c) When the term was unfamiliar to you before writing the report.
    (d) When the term is crucial to the discussion of the project.
    (e) When you are writing for engineers with different technical backgrounds.

59. Which of the following statements is true?
    (a) When first using an acronym, (for example, IC) spell out the term fully.
    (b) Numbers must be spelled out in full unless they are given as part of a formula.
    (c) For the abbreviation *no.* (meaning number), you must put a period after the abbreviation.
    (d) In writing engineering reports, you must never use the first person (I, we).
    (e) In technical writing, word variety and elaborate language are important.

60. Which of the following sentences are credible:
    (a) Students we surveyed indicated they were discontent with backpacks that did not have separate compartments.
    (b) The suspension systems for our backpack design will guarantee future back problems will not occur.
    (c) Thin unpadded shoulder straps dig in to students' shoulders and lower neck region causing horrendous pain.
    (d) We think that our improved backpack design will increase profits for your company over the next five years.
    (e) Statistics show students today suffer the risk of adult back and shoulder ailments due to the use of poorly designed backpacks.

Part II: Essay Question (20% of the exam mark)

Answer only **ONE** of the following questions. We are looking for 2 to 3 well structured paragraphs with a main point, and credible statements. You do not have to cover every issue that was discussed in your seminar. Choose a main point on which to focus.

We are looking for 2 pages maximum. Please write VERY legibly. You may want to begin by constructing a draft or outline. You can do this in the booklet, please label your preliminary work "draft" so we will not mark it as your final submission.

Make sure to clearly indicated which question number you have chosen to answer.

You do not need to include references in this essay. However, if you refer to a specific idea that you would have liked to reference if you had the source information available to you, you can put a citation (a number in square brackets) indicating that you would have been citing a reference at that point under normal circumstances.

Using evidence from your seminar materials and discussions, answer **ONE** of the following:

1. Specific to your seminar topic, explain social impacts that can arise in the interface between humans and technology (or engineering design).
2. Specific to your seminar topic, explain environmental impacts that can arise in the interface between humans and technology (or engineering design).
3. Specific to your seminar topic, explain ethical issues that can arises in the interface between humans and technology (or engineering design).
4. Specific to your seminar topic, explain issues at the different levels of the human-tech ladder that can arise in the interface between humans and technology (or engineering design).