Name _____
Student Number _____
Tutorial Section _____

ENGINEER 1P03 – Introduction to Professional Engineering Dr RV Fleisig
Version #1

DAY CLASS
DURATION OF EXAMINATION: 3 Hours
MCMASTER UNIVERSITY FINAL EXAMINATION April, 2008

THIS EXAMINATION PAPER INCLUDES 15 PAGES AND 50 QUESTIONS. YOU ARE RESPONSIBLE FOR ENSURING THAT YOUR COPY OF THE PAPER IS COMPLETE. BRING ANY DISCREPANCY TO THE ATTENTION OF YOUR INVIGILATOR.

Special Instructions:

1. No aids of any kind are allowed.
2. Use of any calculator is not allowed.
3. This is a "closed book" examination. You may not use any reference material other than that which is part of the examination paper.
4. Answer all the questions. Select the best answer for each multiple choice question. There is only one correct answer per question. Each correct answer is worth one mark. There is no deduction for incorrect answers.
5. This examination is out of 50 marks.
6. All pages in this paper must be returned with your answers.
7. Answer the questions on an Optical Scan Examination Answer Sheet. It is your responsibility to ensure that the answer sheet is properly completed: your examination result depends upon proper attention to these instructions. The scanner, which reads the answer sheets, senses the bubble-shaped areas by their non-reflection of light. A heavy mark must b made, completely filling the circular bubble, with a HB pencil. Marks made with a pen or felt-tip markers will not be sensed. Erasures must be thorough or the scanner may still sense a mark. Do not use correction fluid on the answer sheets. Do not put any unnecessary marks or writing on the answer sheet.
    a. On side 1 of the answer sheet, in the top box, in pen, print your student number, name, course name, section number, instructor name and the date in the spaces provided. Then you must write your signature in the space marked SIGNATURE.
    b. In the second box, with a pencil, mark your student number, exam version number and course section number in the space provided and fill in the corresponding bubble numbers underneath.
    c. For each answer, mark only one choice from the alternatives (1, 2, 3, 4, 5 or A, B, C, D, E) provided for each question. The question number is to the left of the bubbles. Make sure that the number of the question on the answer sheet is the same as the question number on the test paper.
    d. Pay particular attention to the marking directions on the answer sheet.
    e. Begin answering questions using the first set of bubbles, marked "1".

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The Code of Ethics of Professional Engineers Ontario

1. It is the duty of a practitioner to the public, to the practitioner's employer, to the practitioner's clients, to other members of the practitioner's profession, and to the practitioner to act at all times with,
    i. fairness and loyalty to the practitioner's associates, employers, clients, subordinates and employees,
    ii. fidelity to public needs,
    iii. devotion to high ideals of personal honour and professional integrity,
    iv. knowledge of developments in the area of professional engineering relevant to any services that are undertaken, and
    v. competence in the performance of any professional engineering services that is undertaken.
2. A practitioner shall,
    i. regard the practitioner's duty to public welfare as paramount,
    ii. endeavour at all times to enhance the public regard for the practitioner's profession by extending the public knowledge thereof and discouraging untrue, unfair or exaggerated statements with respect to professional engineering,
    iii. not express publicly, or while the practitioner is serving as a witness before a court, commission or other tribunal, opinions on professional engineering matters that are not founded on adequate knowledge and honest conviction,
    iv. endeavour to keep the practitioner's licence, temporary licence, limited licence or certificate of authorization, as the case may be, permanently displayed in the practitioner's place of business.
3. A practitioner shall act in professional engineering matters for each employer as a faithful agent or trustee and shall regard as confidential information obtained by the practitioner as to the business affairs, technical methods or processes of an employer and avoid or disclose a conflict of interest that might influence the practitioner's actions or judgment.
4. A practitioner must disclose immediately to the practitioner's client any interest, direct or indirect, that might be construed as prejudicial in any way to the professional judgment of the practitioner in rendering service to the client.
5. A practitioner who is an employee-engineer and is contracting in the practitioner's own name to perform professional engineering work for other than the practitioner's employer, must provide the practitioner's client with a written statement of the nature of the practitioner's status as an employee and the attendant limitations on the practitioner's services to the client, must satisfy the practitioner that the work will not conflict with the practitioner's duty to the practitioner's employer, and must inform the practitioner's employer of the work.
6. A practitioner must co-operate in working with other professionals engaged on a project.

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7. A practitioner shall,
    i. act towards other practitioners with courtesy and good faith,
    ii. not accept an engagement to review the work of another practitioner for the same employer except with the knowledge of the other practitioner or except where the connection of the other practitioner with the work has been terminated,
    iii. not maliciously injure the reputation or business of another practitioner,
    iv. not attempt to gain an advantage over other practitioners by paying or accepting a commission in securing professional engineering work, and
    v. give proper credit for engineering work, uphold the principle of adequate compensation for engineering work, provide opportunity for professional development and advancement of the practitioner's associates and subordinates, and extend the effectiveness of the profession through the interchange of engineering information and experience.
8. A practitioner shall maintain the honour and integrity of the practitioner's profession and without fear or favour expose before the proper tribunals unprofessional, dishonest or unethical conduct by any other practitioner.

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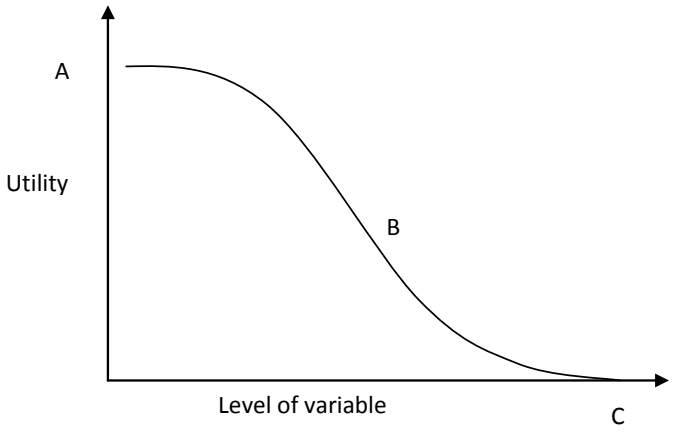
Questions

1. _____ occur because the engineer has responsibilities not just to the client and the user, but also to the public at large.
    A. Design conflicts
    B. Structural requirements
    C. Ethical problems
    D. Financial constraints
    E. Team dynamics
2. Design is motivated by a/an _____ who wants some sort of _____.
    A. engineer; profession
    B. client; artifact
    C. client; design
    D. user; product
    E. manager; problem solved
3. The three primary stakeholders in the engineering design process are the
    A. public, government regulatory agencies and for-profit corporations.
    B. project manager, lead engineer and manufacturer.
    C. designer, client and user.
    D. engineer, draftsperson and end user.
    E. business, government and manufacturing sectors.
4. _____ is/are the general term(s) for the initial stage(s) of the design process.
    A. Detailed design
    B. Scope and mission statement
    C. Conceptual design
    D. Performance specifications
    E. Interpretation of client needs
5. The interaction of multiple interests creates an interaction of _____ which may often conflict.
    A. designs
    B. cost parameters
    C. constraints
    D. obligations
    E. technical tradeoffs
6. Which of the following strategies for resolving conflict is most likely to result in positive outcome in the engineering design process?
    A. Compromise – attempting to meet the other party “halfway.”
    B. Avoidance – ignoring the conflict, hoping it will go away.
    C. Constructive engagement – determining the underlying desires of the parties.
    D. Smoothing – allowing the desires of the other party to win out in order to avoid conflict.
    E. Forcing – imposing a solution on the other party.

Continued on Page 5

7. In the following performance curve specification, designs situated at points A, B and C on the curve, are said to be _____, _____ and _____, respectively.



   A. of no utility; marginal; in the zone of interest
   B. saturated; in the zone of interest; of no utility
   C. of no utility; in the zone of interest; saturated
   D. in the zone of interest, marginal; of no utility

8. _____ are human-made objects; and a/an _____ is/are what _____ are supposed to do.
   A. Artifacts; function; artifacts
   B. Forms; function; forms
   C. Functions; artifact; functions
   D. Artifacts; parameter; artifacts
   E. Forms; specifications; forms

9. The textbook, *Engineering Design: A Project-Based Introduction*, is meant to
   A. clarify the full process of engineering design so that all steps are completed in order.
   B. fully explain the complex process of engineering design.
   C. model ways of thinking productively about some of the conceptual issues and choices that are made early in the design process.
   D. outline the key steps that must be followed in every engineering design to ensure the client needs are met and the manufacturing processes are fully utilized.
   E. explain how design variables are modelled in full before parameters and processes are finalized.

10. _____ are constraints or variables that serve as indicators of the artifact's behaviour, while _____ are properties or characteristics of the artifact.
   A. Benchmarks; performance parameters
   B. Requirements; functions
   C. Specifications; traits
   D. Performance parameters; attributes
   E. Design controls; shape and geometry

Continued on Page 6

For questions 11, 12 and 13, choose the best answers to fill in the blanks in the following statement.
Engineering design is the organized thoughtful _____11_____ of characteristics of new objects that have a particular _____12_____ or perform some desired function(s) that meet the designers' aims without violating any special _____13_____.

11.
   A. selection
   B. testing
   C. generation and evaluation
   D. assessing
   E. constraining

12.
   A. set of constraints
   B. form and function
   C. attribute
   D. configuration
   E. organization

13.
   A. constraints
   B. sustainability principles
   C. ethical principles
   D. needs
   E. criteria

14. The endpoint of a successful design is the production of
   A. a working model of the artifact, the "prototype".
   B. a manufacturing process that creates multiple objects, the "production line".
   C. a set of details plans that can be turned into computer instructions, the "code".
   D. a finished working artifact or process, the "product".
   E. a set of plans for making the designed artifact, the "fabrication specifications".

15. The key issue in the engineering design process is
   A. problem solving.
   B. communication.
   C. evaluation.
   D. product testing.
   E. project management.

16. Which one of the following statements is NOT true with respect to objective trees?
   A. These are ordered lists of desired attributes of a design.
   B. They show that related sub goals or similar ideas can be clustered together.
   C. They are used to better clarify a client's project statement.
   D. The highest level of abstraction is the top-level design goal.
   E. The starting point for analysing the functionality of a proposed design is a "black box".

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The following four (4) questions refer to “attributes” of a safety ladder in an example in your text. In each questions, does the statement refer to an objective, a function, a constraint or an implementation?

17. “Ladder should be useful outdoors on level ground.”
    A. Function
    B. Constraint
    C. Implementation
    D. Objective
    E. None of the above
18. “Ladder must bear the weight of an average construction worker.”
    A. Constraint
    B. Implementation
    C. Objective
    D. Function
    E. None of the above
19. “Could be a stepladder or short extension ladder.”
    A. Objective
    B. Implementation
    C. Function
    D. Constraint
    E. None of the above
20. “Ladder should be relatively inexpensive.”
    A. Constraint
    B. Objective
    C. Function
    D. Implementation
    E. None of the above
21. _____ are used to measure how well objectives are met.
    A. Approximations
    B. Metrics
    C. Weighting objectives
    D. Specifications
    E. Ordinal rankings
22. The strategy of _____ allows us to choose among design alternatives which are different but all of which are at least minimally acceptable.
    A. ordination
    B. constrained agreement
    C. least objection
    D. satisficing
    E. clustering

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23. _____ are granted on the form or appearance of an idea; while _____ are granted for functions, that is, on how to do something to make something happen.
    A. Intellectual property patents; claims
    B. Design patents; utility patents
    C. Utility patents; copyrights
    D. Black box designs; glass box designs
    E. Trademarks; copyrights
24. Successful design calls for _____, which is done when we try to remove limits or barriers, hoping to increase our range of design ideas and choices, and for _____ when we try to narrow the design space to focus on the "best" alternative.
    A. reverse engineering; benchmarking
    B. convergent thinking; specification of parameters
    C. prior art; symbolic analogies
    D. the gallery method; symbolic analogies
    E. divergent thinking; convergent thinking
25. The "size" of a/an _____ reflects the number of possible design solutions and the number of design variables.
    A. design space
    B. objective tree
    C. function-means tree
    D. pair wise comparison chart
    E. interface parameter specification
26. In which order are the following steps taken in order to measure how well objectives are met? (P) Identify a means of assessing the value of a design in terms of relevant units. (H) Evaluate whether the particular measurement and its subsequent evaluation is feasible. (L) Identify both the units and the scale of something that it is approximate to measure about the objective.
    A. (P), (H), (L)
    B. (P), (L), (H)
    C. (H), (P), (L)
    D. (H), (L), (P)
    E. (L), (H), (P)
27. Important information about competitive products may be gained by _____ to evaluate how well existing products perform or by _____ to see how similar functions are performed.
    A. dissection; reverse engineering
    B. benchmarking; reverse engineering
    C. functional decomposition; benchmarking
    D. bounding design space; functional analysis
    E. reverse engineering; decomposition

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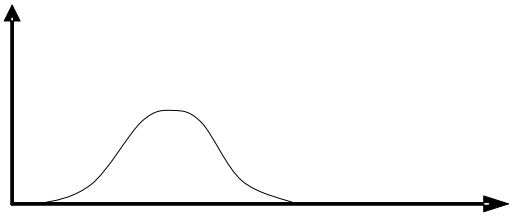
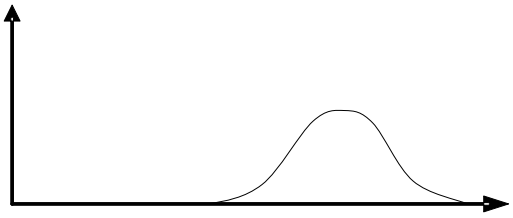
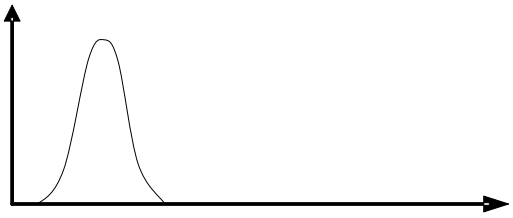
28. _____ is the first of its kind; while _____ represents a device or process.
    A. A prototype; a model
    B. A specification; prior art
    C. A scale model; proof-of-concept testing
    D. A benchmark; a controlled test
    E. Design space; a working model
29. Which of the following is not a step in the process a design team would follow to communicate its findings?
    A. Determine the purpose and audience of the communication.
    B. Review the outline with the team and with the team's mangers.
    C. Construct a topic sentence outline.
    D. Distribute individual writing assignments and assemble, write and edit an initial draft.
    E. Assign one individual the responsibilities of reviewing, editing and revising the final report.
30. Which of the following is good advice for a Power Point presentation of your design project?"
    A. Avoid using too many slides or graphics.
    B. Make points clearly, directly, and simply. Slides that are too flashy or clever tend to detract from a presentation.
    C. Use colour skilfully. Avoid weird or clashing colour in professional presentations.
    D. Avoid cluttering slides. Three to four lines of text per slide is sufficient.
    E. All of the above statements give good advice.
31. Which of the following is a way that drawings are NOT used in the engineering design process?
    A. Serve as a launching pad for a brand new design.
    B. Support the analysis of a design as it evolves.
    C. Simulate all aspects of the behaviour or performance of a design.
    D. Communicate the final design to the manufacturing specialists.
    E. All the above statements are ways in which drawings are used in the engineering design process.
32. Which of the following project management tools is used to graph the activities and events of the project and show the logical ordering in which they must be performed?
    A. Activity network
    B. Gantt chart
    C. Linear responsibility chart
    D. Work breakdown structure
    E. Percent-complete matrix
33. An activity for which we can adjust a start time is said to have _____ and activities that have none of the same are said to be _____.
    A. start-to-start precedence; complete
    B. slack; complete
    C. finish-to-finish precedence; a dummy activity
    D. slack; on the critical path
    E. start-to-start precedence; on the critical path

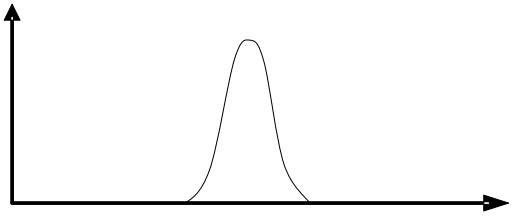
Continued on Page 10

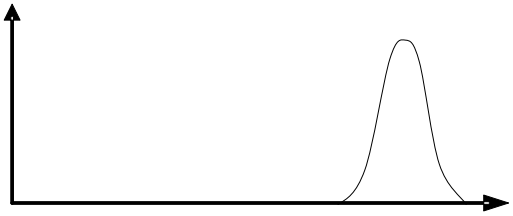
34. Which of the following probability density functions represents the best MTBF from a product quality perspective? The horizontal axis is time and vertical axis is the frequency of failure.

A. 

B. 

C. 

D. 

E. 

35. Which of the following is a metric for maintainability?
    A. MTBF
    B. MTTR
    C. QFD
    D. MRP
    E. FV
36. Which of the following is not an essential step in lifecycle analysis (LCA)?
    A. Inventory analysis
    B. Impact analysis
    C. Incidence analysis
    D. Improvement analysis
    E. None of the above

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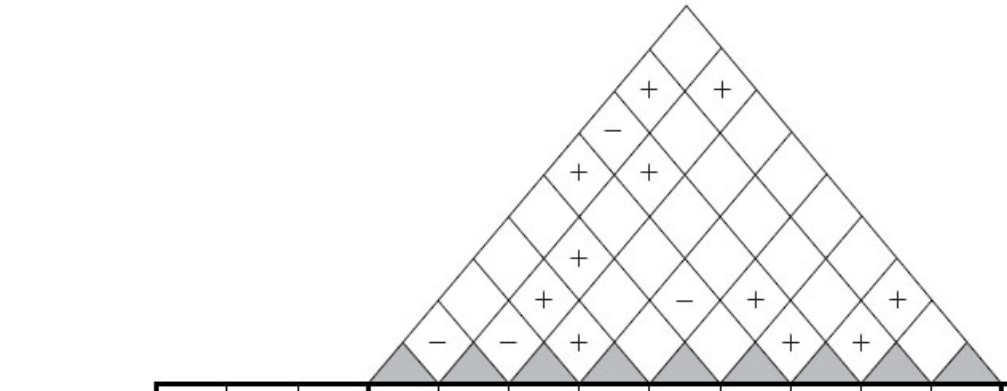
37. Consider the house of quality for a laptop housing shown below. Which of the following conclusions is incorrect?



	Traveling Users	Office Users	Manufacturing	Weight (oz)	Cost of Materials ($)	Cost of Assembly ($)	Number of Parts (#)	Conforms to IEEE Std (Y/N)	Yield Strength (MPa)	Rank in Focus Group (#)	Number of Ports or Cards (#)	Postconsumer Reusable Percent (%)	Current Laptop Casing	Current Desktop Casing
Lightweight	H	L	L	●									1	2
Inexpensive	M	H	H		●	●	○						2	1
Attractive	H	M	L							●	○	□	1	2
Durable	H	M	L	○			□		●				2	1
Adaptable	L	M	H								●		2	1
Safe	H	H	L					●					2	1
Recyclable	M	M	M									●	2	1
			Target	16	20	10	2	Y	50	1	4	50		

Priorities:
H: High
M: Medium
L: Low

Relationship:
● Strongly Related
○ Moderately Related
□ May Be Related/Weakly Related

A. Weight is likely to trade-off negatively with ranking of the design by focus groups.
B. Adaptability is of high importance to manufacturing.
C. The current laptop casing is more attractive than the current desktop casing.
D. The target number of parts for the design is two.
E. Yield strength is strongly related to safety.

38. Which one of the following characteristics is NOT required for the definition of a “profession?”

A. Extensive tertiary training.
B. Practices an art that requires significant intellectual development.
C. Provides an important service to the public.
D. Is certified or licensed by the state.
E. Is paid for the work.

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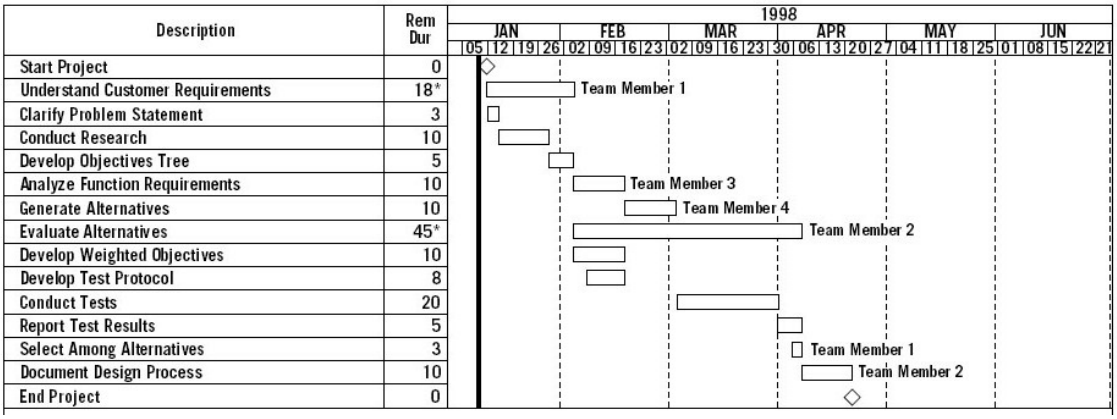
39. A civil engineer designs a building with the knowledge that it must withstand winds of up to 200 km/h. To compensate for uncertainty in the properties of materials and consistency of construction, this engineer uses a safety factor of two. During construction, the building is constructed to an effective safety factor of 1.5 due to an error in reading the engineering drawings. What is the minimum wind speed that the building should withstand without damage?
    A. You cannot compute the wind speed without more information.
    B. 400 km/h.
    C. More than 400 km/h.
    D. Less than 200 km/h
    E. 300 km/h.
40. In the following Gantt chart, which of the following tasks is not on the critical path?



    A. Develop Objectives Tree
    B. Analyze Function Requirements
    C. Conduct Research
    D. Generate Alternatives
    E. Evaluate Alternatives

41. Which section of the PEO Code of Ethics is most relevant to the following scenario?
A regional hospital owns a hospital facility and contracts with a private health care provider to manage, administer, and generally operate a hospital facility. Engineer A, a principal in a local engineering firm, serves on the board of directors of the private health care provider. Certain engineering and surveying work will need to be performed at the hospital facility. Engineer A seeks and receives a contract from the private health care provider to perform the engineering and surveying work at the hospital. The decision to select Engineer A's firm was made by the private health care provider's board of directors and Engineer A participated in the decision.
    A. 7iv
    B. 1i
    C. 3
    D. 5
    E. 7i

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42. Which of the following items is NOT present in the PEO's definition of the practice of engineering?
    A. Safeguarding of life, health, property or the public welfare.
    B. Application of engineering principles.
    C. Demonstration of good character and successful completion of the Professional Practice Exam.
    D. Any act of designing, composing, evaluating, advising, reporting, directing or supervising.
    E. None of the above.
43. Which of the following represents a way in which the PEO regulates the profession?
    A. Ensuring practice at the requisite level by only authorized professionals.
    B. Enforcing the regulations and standards.
    C. Setting standards for admission and the practice of professional engineering.
    D. Developing and communicating standards of practice.
    E. All of the above are ways to regulate the profession.
44. Designers may use _____ to collection information for use in the formal design process, while _____ is a method of analyzing and testing outcomes. In _____, we both collect and analyze information.
    A. simulation; computer analysis; discipline-specific CAD systems
    B. analogies; structured interviews; focus groups
    C. user surveys and questionnaires; prototype development; laboratory experiments
    D. literature reviews; informal reviews; computer analysis
    E. proof-of-concept testing; simulation; reverse engineering
45. The SMP and EIT programs are NOT intended to
    A. increase the level of professional awareness and behaviour.
    B. reduce the professional practice requirements for qualified individuals.
    C. promote better communication between students and the practicing professionals.
    D. standardize the delivery of PEO programs and activities to students.
    E. provide a seamless transition from student through to licensure.
46. Which of the following items correctly completes the following statement? OSPE and PEO serve to _____ and to _____, respectively.
    A. benefit the engineer; serve and protect the public
    B. advocate on behalf of the profession within government and industry; license qualified individuals
    C. provide services including salary surveys; regulate the practise of engineering through enforcement and discipline
    D. All of the above
    E. Neither A nor B nor C are correct

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47. A Canadian engineering firm learns that a South American country is seeking proposals for a multimillion-dollar public works project. The firm has never bid on a project in that country, so the firm's president – a professional engineer in Ontario – hires a local agent to assist in the process. The agent explains that while the firm could itself submit its proposal to the decision-making body, the standard practice in his country is to retain a private consultant for the job, someone who can ensure that the bid comes to the attention of the appropriate parties. The agent offers the name of one such consultant, an individual who has had great success on such matters in the past. While the firm's president does not fully understand the type of service the consultant will provide, there is no doubt about the consultant's connections; indeed, he is the eldest son of a senior member of the decision-making body. Still, the president is concerned about the ethical implications of hiring someone with such close ties to an official involved in the award process. The agent explains that, in contrast to norms in Canada, the appearance of nepotism (favouritism) in his country is not necessarily a drawback or something that creates suspicion, and he assures the president that nothing about the proposed deal violates the country's laws or ethical norms. The services of the consultant do not come cheap, but the agent cautions that if the Canadian firm does not move swiftly to engage the person's services; one of the two U.S. firms competing for the project will do so. Recognizing that the consulting fee – however steep – is still a drop in the bucket compared with the expected profit on the contract as a whole, the president authorizes the agent to hire the consultant. Which section of the PEO Code of Ethics is most relevant to this case?
    A. 7iv
    B. 4
    C. 7i
    D. 1iii
    E. 8
48. What kind of specification is the following statement? *To ensure backward compatibility, the Solid Edge software must use the OpenGL standard for implementing 3D graphics.*
    A. Interface
    B. Prescriptive
    C. Procedural
    D. Performance
    E. None of the above
49. In which one of the following design stages should ethical decisions be made that pertain to the impact of the product on the public?
    A. Concept selection
    B. Functional analysis
    C. Project planning
    D. Metric selection
    E. Concept generation

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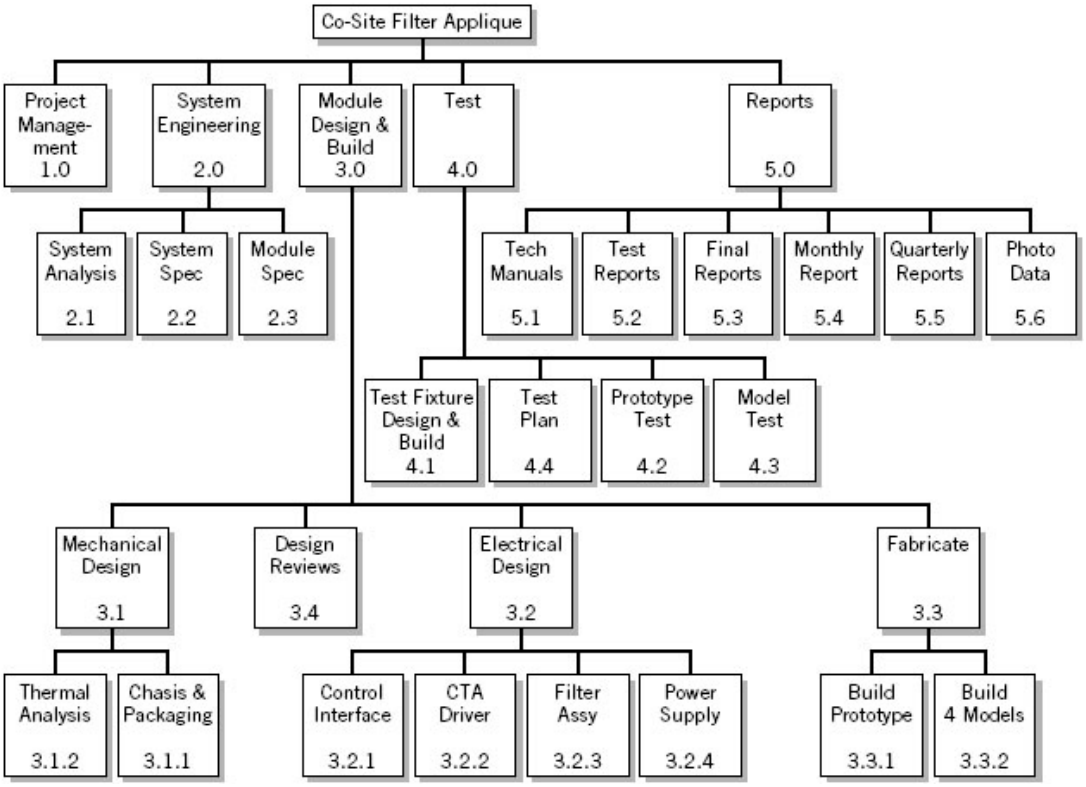
50. What type of design tool does the following figure represent?



A. Objective tree
B. Work breakdown structure
C. Linear responsibility chart
D. Function-means tree
E. Activity network

The End