

Name: _____

Student # _____

University of Toronto
Faculty of Applied Science and Engineering
MIE241S ENGINEERING DESIGN AND GRAPHICS

Final Examination April 24, 2001

Instructor: Duncan Newman

Closed book and notes. Calculators and drawing aids allowed.

Mark value /100 is shown before each question.

Please answer questions in the space provided, using the back of the previous page if necessary

Duration 2½ hours

4 Sketch and describe 4 distinct material/process combinations to manufacture a coat hanger.

3 Explain why the limbs of a large mature tree have different proportions from those of a sapling. Why is this of relevance to making scale models?

3 In the ISO9001 design control system, what is meant by the terms V&V and HRS? Describe

2 What property of leather is different from that of plastic film that makes it more tear resistant?

3 Discuss the choice of materials that slide on each other under load. Would you use a stainless steel shaft in a stainless bearing? If not, propose an alternative.

4 Name and describe in sketches 3 chip-making material removal processes. What principles do they share?

2 Show why a punched metal disc will not pass thru the hole it's punched from.

2 In an injection moulded plastic part, show where the first and last material to enter the mold exist in the part.

3 Explain In a sketch the difference between a simple & compound curve. How does this distinction affect sheet metal forming?

2 In metal cutting, what is a burr? Describe an automatic deburring method

2 Show in a graph the relationship between manufacturing cost and tolerance,

3 What is a progressive die? How many strokes of the press produce a finished part?

3 Give three outstanding properties of low carbon steel.

2 Describe two methods of rapid prototyping.

3 Describe the steps in making a steel tool that has a hard cutting edge, high accuracy, and good toughness.

5 Make an orthographic 3-view drawing of a simple chair using a third-angle projection. Make one additional view with a first-angle projection.

3 Describe three ways the flow of metallic ions in an electrolyte is of importance to the design engineer

3 In fabricating a large plastic housing suggest 1 advantage & 2 disadvantages of vacuum forming over injection moulding.

4 Cite 4 ways in which thermoplastics are generally superior to metals and 4 ways they are inferior.

5 Make concept sketches of a design for a vehicle drive which will move the vehicle forward when a cord is pulled from behind. Try to make your sketch as clear as possible.

2 In engineering drawings, what is the reason for the border?

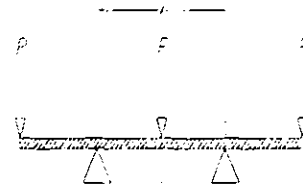
2 Explain the significance of a reference dimension.

4 Explain in detail the two main factors that drive the proper choice of tolerances.

3 If 3 parts, each having a height tolerance of $\pm 1\text{mm}$, are stacked, what is the tolerance of the stack?

2 The design process: In the form of short statements, give 3 essential lessons that you have learned to improve your chances of design success.

4 Optimization: consider a beam of total length L with 3 equal point loads as shown. We wish to find the optimal distance between the supports, A . a. state in detail two valid criteria for an optimal design. b set up the equations and solve one of them.



6. Decision-making. Use a weighted property-scoring scheme to compare acrylic, polycarbonate and glass for a workshop safety eye shield. -Some comparative properties are: density 1.1, 1.2, 2.5, strength 5, 9, 5ksi, stiffness 300, 350, 7000ksi, toughness 0.5, 5, 0.5 ftlb/in, cost 1, 5, 0.2 \$/lb.

2. What part of a patent carries the most legal significance? What must a new product do to infringe on an existing patent?

GUEST LECTURE QUESTIONS

3 A brass cymbal is suspended from a vertical string. The cymbal is perfectly balanced so that the plane of the cymbal is perpendicular to the string. The cymbal is then struck and emits, as expected, a sharp musical sound. Thereafter, a thin plastic film is adhesively bonded to the underside of the cymbal and struck again. What sound do you expect to hear and why?

2 Does a fuel cell convert 1) chemical energy into electrical energy? 2) mechanical to electrical energy? 3) chemical energy to mechanical energy? 4) it is a new source of energy.

2 Numerous types of fuel cells exist. The more popular varieties under development include the Solid Polymer {Proton Exchange Membrane}, Potassium Hydroxide [KOH], Molten Carbonate, Phosphoric Acid and Solid Oxide. What part of the generic fuel cell is described by the names of these various fuel cells?

2 Winds can excite large structures, such as bridges, and if such structures are not suitably damped the amplitudes can be sufficiently large leading to the catastrophic failure of the bridge. Explain how such catastrophic failure might occur with reference to the natural frequency of the bridge

2 A slender bridge was presented that had been designed to span the fjords in Norway. What was a prime concern in the design of this bridge with respect to its stability?

3 The world's tallest buildings are designed with sophisticated stabilizing systems to limit excessive deflection during high winds. Identify two such dynamically stabilizing systems.