UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, April 2001 - 4th Year and Graduate Programs

MIE540S PRODUCT DESIGN

Exam Type C

Examiner - Claude J. Gidman

Read Carefully CONTENTS

100 marks - Total for exam (35% of course mark)

Note: Use U of T exam booklets where more space is required, or for rough work.

A GENERAL QUESTIONS

A1 **There are several key product testing and certification organizations in North America. Tick the two (only) which are prime and applicable and referred to in class:**

1.0 marks

AMC	___	American Manufacturing Consultants
UL	___	Underwriters Laboratories
CCS	___	Canadian Consulting Services
CSA	___	Canadian Standard Associates
UL	___	Unlimited Liabilities
CAA	___	Canadian Appliance Association
CSA	___	Canadian Standards Association
UL	___	Unlimited Licencing
CAS	___	Certification Association Services

A2 The guidelines, nature and characteristics required in a new design project was described in class as a "Profile". Draw an example of such a Profile and print terms at the end of each wing of the diagram which could describe such a project as a household vacuum cleaner, to be manufactured for sale in major department stores.

3.0 marks

A3 "TECHNOLOGICALLY DRIVEN" DESIGN PROJECTS can be described as being driven by new technological advances which can and may need to be incorporated in a new product. Connect the following list to their appropriate definitions with lines:

1.0 marks

safety driven	response to trends in marketplace
cost driven	concern for meeting new government regulations
legally driven	concern for improvement of return on investment
profit driven	focussed on application of a protected idea
market driven	concern for measureable advantages and features
fashion driven	concern with use of dangerous materials and features
invention driven	concern for reducing purchase price
performance driven	concern for targeting toward certain consumer types

A 4 Describe the distinctive differences of each of the the following? :

2.5 marks

guidelines_____

parameters_____

ideas_____

criteria_____

specifications_____

B QUESTIONS REGARDING INITIAL PROJECT

B1 **When assigned to design a multipurpose product (the airport trolley with seating and other features), did you feel that this would mean that the product you would develop would be compromised in the sense that it would not suit any of the required purposes well?**

List 5 aspects of the multipurpose product you designed that were <u>not</u> as good for purpose as if separate products had been designed.

1.5 marks

1 _____

2 _____

3 _____

4 _____

5 _____

B2 **Did you feel that the trolley was really a poor design compromise when you considered that it might not be able to provide useful seating when loaded with baggage, or vice versa?**
Comment on your view of the trolley design you designed in respect to this aspect.

1.0 marks

_____

_____

_____

_____

B3 **List 5 aspects of the design your team developed which were <u>advantageous</u> and which made the product particularly useful and attractive.**

1.5 marks

1 _____

2 _____

3 _____

4 _____

5 _____

C CREATIVITY, EXPLORATION AND DEVELOPMENT OF CONCEPTS

C1 **Three types of approach to the design process were discussed and diagrams shown of each of these. What were these three different types of methodology?**
(Note: instead of wording you may draw a diagram for each if you wish)

1.5 marks

1 _____

2 _____

3 _____

C2 **The following were listed as a hierarchical value system and discussed in class. It defines various levels of significance in evaluating various issues, aspects or features being considered in developing a new product design:** *(fill in the two that are missing)*

1.0 marks

absolutely essential

critical

very important

_____

useful/helpful

enhancing

" _____ "

useless/irrelevant

C3 **Define and differentiate between the following:**

1.5 marks

invention _____

innovation _____

design _____

D TEAM INTERACTION - WORKING TOGETHER

D1 **Comment on the advantages of working in a design team incorporating different disciplines, skills and personalities, as opposed to working by yourself. Pros and cons:**

1.5 marks

working in a design project team

working alone on a design project

E PLANNING AND MARKETING INFLUENCES ON DESIGN APPROACH

E1 **Draw a graph which describes the life cycle of a new product with four phases indicated.**
(This graph was used in lecture on marketing)

4.0 marks

E2 **Four "Strategies" were presented as part of a "Marketing Mix". List them:**

2.0 marks

1

2

3

4

E3 List twelve normally sequential steps or phases which outline those which will likely be required to develop a new product from inception to being manufactured in full production (not including management reviews, nor every detailed step in the process.

2.0 marks

PROJECT APPROVED

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

11 _____

12 _____

FULL PRODUCTION

F SELECTION OF MATERIALS AND PROCESSES

F1 All materials available to be selected and specified for a manufactured product come from three basic sources, according to the discussion in class. Tick the three (only) which apply:

1.5 marks

___forestry
___animals
___manufacturing byproducts
___waste material
___vegetable material
___precious stones
___ceramics
___rock
___minerals
___agriculture
___solar sources
___plastics

F2 Several material types are very often combined together to obtain preferred characteristics. Define the following:

1.5 marks

alloys _____

blends _____

composites _____

F3 Products can very rarely be designed to be manufactured in one material only? Give four reasons for this:

2.0 marks

1 _____

2 _____

3 _____

4 _____

G DESIGN FOR MANUFACTURING

G 1 All parts to be manufactured must have some amount of acceptable deviation allowed or specified.

What is the term for this which was emphasized in class? _____

1.0 marks

G2 List two considerations which guide a designer in dealing with this issue with respect to various parts which relate to each other in a product to be manufactured in quantity:

1.0 marks

1 _____

2 _____

G 3 Suggest four ways in which a new product can be evaluated prior to being manufactured and introduced to the actual end users:

2.0 marks

1 _____

2 _____

3 _____

4 _____

H DESIGN ECONOMICS

H1 What are the three general cost categories in designing, developing and manufacturing a new product?

1.5 marks

1 _____

2 _____

3 _____

H2 What is "amortization"?

Tick any of the following that define that term for product design/development purposes:

1.5 marks

___process of organizing manufacturing to obtain most efficient results
___rate of interest associated with financial investment required for tooling
___a type of manufacturing process for molding plastic parts
___the spreading of investment cost over a number of units produced
___the spreading of investment cost over a number of years
___the percentage of profit associated with manufacturing in quantity

H3 What is a B.O.M. and what six types of information does it normally list?

1.0 marks B.O.M. = _____

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

H4 List five levels of pricing markups usually involved in taking a product to market across a large country or continent, i.e. from manufacturer to customer

1.0 marks

1 _____

2 _____

3 _____

4 _____

5 _____

I PRESENTATION OF DESIGNS

What are four keys to effective presentation of a new product design concept?

1.5 marks

1 _____

2 _____

3 _____

4 _____

60 marks

J DESIGN PROJECT PARALLEL TO MAJOR TERM PROJECT

BASED ON MAJOR PROJECT DURING TERM

Refer to the product which your team has been designing.

Assume that you have joined a company which is competitive to the firm your MIE540 Product Design team has been working for during this term.

You have been assigned to heading up a project team which is set up to design and develop a new and better but lower cost version of the design your team has been working on during the term. We will call this new product "B".

This new product is to be sold through marketing channels and in much the same way as the more expensive model "A" you have just been involved with designing and developing, but it is aimed at a different level of customer/user who cannot afford to spend as much as for the product "A" that iks presently in production and showing success in the marketplace. The aim would be to provide most of the characteristics of the more expensive version, but at about 20% less retail cost.

Fill out the following sheets and add material if you wish.

11 Write a general product development plan for "B"

12 Compare the target features of the new "B" model with the "A" model:

A	B

13 Prepare a chart illustrating the stages and scheduling of developmental activities leading up to the production stage (i.e. 22 months from start)

Months

14 Prepare sketches (with notations) of at least three conceptual designs for the ~~TIP2000~~X development (general approaches to the design) from which you may select the direction and features to pursue. B.

Space for rough work

12 marks for 3 concepts

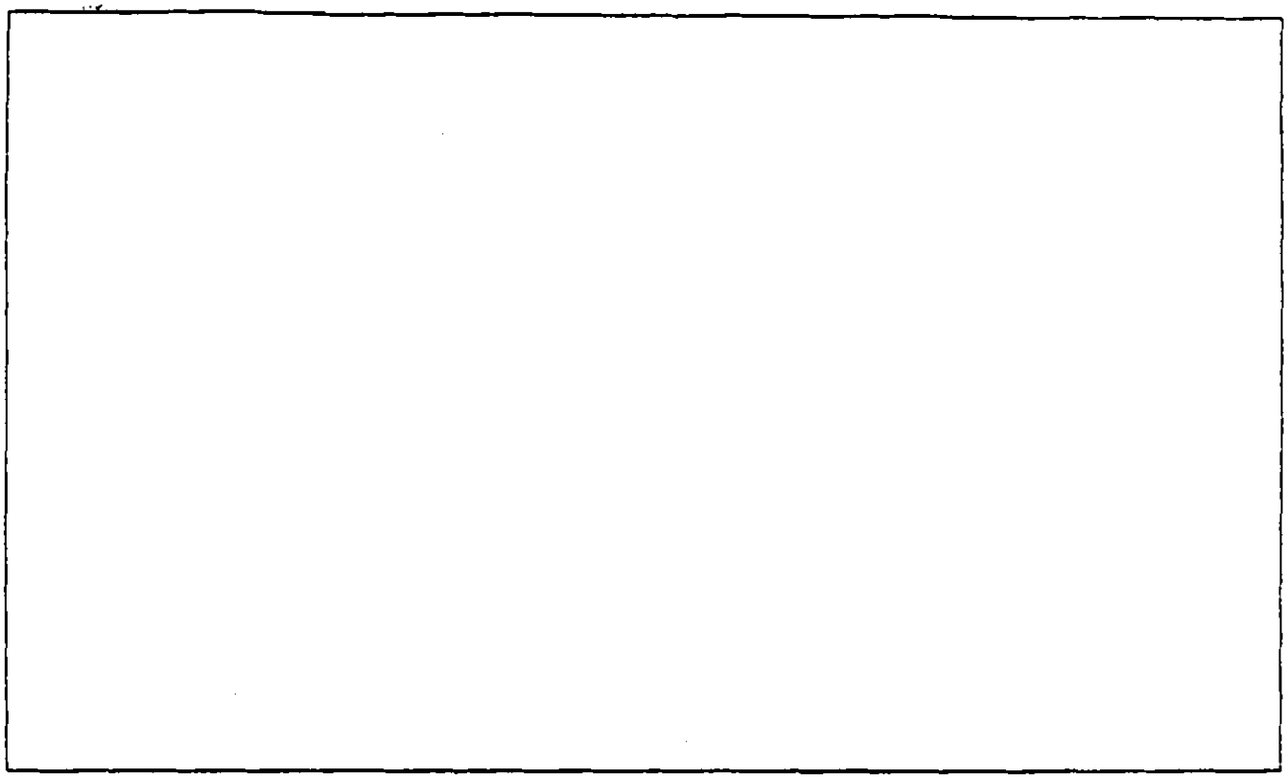
1

2

3

Space for rough work

15 **Make a composite sketch (or sketches) of the selected design with technical notations:**



16 **Do an economic analysis comparing the "A" model to the new concept "B"**

A	B
Development (list phases and cost estimates)	Development (list phases and cost estimates)

Parts/ sub-assemblies (list typical breakdown)	**Parts/ sub-assemblies (list typical breakdown**
Labor (what involved)	**Labor (what involved)**
Cost per unit (based on ____ units sold in 3 yrs) **Price to consumer**	**Cost per unit (based on ____ units sold in 3 yrs)** **Price to consumer**
Summary of economics of project	Summary of economics of project

17 Do a summary comparison product in terms of design, human factors, performance issues, manufacturing approach and features:

5 marks

A	B