UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING
FINAL EXAMINATION, DECEMBER 2001
DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MIE 358F - ENGINEERING ECONOMICS AND ACCOUNTING
Exam Type: A
Examiner: B. Bertrand

Aid Permitted:	Type 2 Electronic Calculator
Notes:	1. This examination has 8 questions on 6 pages.
	2. Answer all questions in the booklets provided.
	3. Show all your calculations and reasoning.
Duration:	Two and one-half (2 1/2) hours

Question 1 (7 Marks)
Bernard Company uses 6,000 grams of silver each year to produce jewelry. The cost of placing an order for silver is $2,000. The annual cost of holding one gram of silver in inventory is $50. Bernard currently places four orders of 1,500 grams each per year.

Required
(a) Compute the annual cost of ordering and carrying silver using the current inventory policy. (2 marks)
(b) Compute the costs Bernard would incur if it used the economic order quantity. (5 marks)

Question 2 (10 Marks)
Tocchet Company manufactures CB1, a citizens' band radio that is sold mainly to truck drivers. The company's plant in Windsor has an annual capacity of 50,000 units. Tocchet currently sells 40,000 radios per year at a selling price of $105 each. It has the following cost structure:

Variable manufacturing costs per unit	$45
Total fixed manufacturing costs per year	$800,000
Variable selling and distribution costs per unit	$10
Fixed selling and distribution costs per year	$600,000

Required:
(Consider each question independently, and ignore qualitative factors)
a) Calculate the breakeven volume in units and dollars (2 marks)
b) The marketing department indicates that decreasing the selling price to $99 would increase annual sales to 50,000 units. This strategy will require Tocchet to increase its fixed costs, although variable costs per unit will remain the same. What is the maximum increase in annual fixed costs for which Tocchet will find it worthwhile to reduce the selling price to $99, thereby selling 50,000 units? (4 marks)

c) The product design department proposes changes to the CB1 to add new features to the product, which will enable Tocchet to increase the selling price. The changes will increase annual fixed costs by $100,000, and variable manufacturing costs by $2 per unit. At the current sales quantity of 40,000 units per year, what is the minimum selling price above which Tocchet will find it worthwhile to add the new features? (4 marks)

Question 3 (13 Marks)

The Wolverine Corporation is working at full production capacity producing 10,000 units of a unique product, Rosebo. Manufacturing costs per unit of Rosebo are as follows:

Direct materials	$ 2
Direct manufacturing labour	3
Manufacturing overhead	5
	$10

The unit manufacturing overhead cost is based on a variable cost per unit of $2 and fixed costs of $30,000 (at full capacity of 10,000 units). The selling costs, all variable, are $4 per unit, and the selling price is $20 per unit.

A customer, the Windsor Company, has asked Wolverine to produce 2,000 units of Orangebo, a modification of Rosebo. Orangebo would require the very same manufacturing processes, selling costs, and materials as Rosebo. The Windsor Company has offered to pay Wolverine $15 per unit of Orangebo, and the selling costs per unit of Orangebo would be 50% less than for Rosebo.

Required

(a) Based only on a quantitative analysis, should Wolverine agree to produce and sell the 2,000 units of Orangebo for the Windsor Company? (4 marks)

(b) The Buckeye Corporation has offered to produce 2,000 units of Rosebo for Wolverine if Wolverine accepts the offer from the Windsor Company. That is, Wolverine would manufacture 8,000 units of Rosebo and 2,000 units of Orangebo, and would purchase 2,000 units of Rosebo from Buckeye. Buckeye would charge Wolverine $14 per unit for Rosebo. Should Wolverine accept this proposal? (6 marks)

(c) Identify three qualitative issues that should be considered for part (b). (3 marks)

Question 4 (18 Marks)

FlatScreen Corp. manufactures flat-panel LCD displays for sale to major PC manufacturers. Following is some manufacturing overhead data for the company for the year ended December 31, 2000.

	Actual Amount	Budget Amount for the Actual Output Achieved	Applied Amount
Variable Overhead	$1,532,160	$1,536,000	$1,536,000
Fixed Overhead	$7,004,160	$6,961,920	$7,526,400

FlatScreen expected to have normal volume of 17,760 units during the year 2000. Overhead is applied based on direct labor hours, and the standard labor usage is two hours per unit of output. At the normal volume of output, the budgeted variable overhead is $1,420,800. The actual number of labor hours used during 2000 was 36,480.

Required
Calculate the following (you should be able to do them in this order):

a) Budgeted number of labor hours planned (3 marks)
b) Standard fixed overhead per labor hour (3 marks)
c) Standard variable overhead per labor hour (3 marks)
d) Standard total labor hours allowed for the actual output achieved (3 marks)
e) Actual output in units (2 marks)
f) Actual labor hours used per unit produced (1 mark)
g) Variable overhead spending variance (3 marks)

Question 5 (8 Marks)
Identify and briefly comment on four reasons why Just-In-Time management may fail.

Question 6 (6 Marks)
Chemical Inc. has set up the following standards per finished output unit for direct materials and direct labor.

- Direct materials: 10 kilograms at $3 per kilogram
- Direct labor: 0.5 hours at $20 per hour

The number of finished output units expected to be produced in October was 10,000. Budgeted sales were 9,000 units. Actual results in October were:

- Actual production: 9,810 units
- Actual sales: 9,450 units
- Direct materials used: 98,073 kilograms
- Direct labor used: 4,900 hours, costing $102,900
- Materials purchased: 100,000 kilograms costing $310,000

There was no beginning inventory of raw materials or finished goods. Price variances are identified at the point of purchase; efficiency variances are identified at the point of usage.

Required

a) Calculate the four variances for materials and labor for the month of October. (4 marks)
b) Why would Chemical identify materials price and usage variances at different points in time? (2 marks)

Question 7 (15 Marks)
Zyton Corporation assembles its CardioX product at its Ottawa plant. Manufacturing overhead (both variable and fixed) is allocated to each CardioX unit using standard direct labor hours. Standard labor usage per CardioX unit is two hours. The budgeted variable

manufacturing overhead per labor hour is $40, and the expected number of CardioX units to be manufactured in October was 8,000 units. The budgeted fixed manufacturing overhead for October was $480,000.

Actual total manufacturing overhead costs for October were $1,113,920 (of which fixed manufacturing overhead was $503,420) for 7,400 units actually produced. Actual labor hours were 16,280.

Required:

a) Calculate the four overhead variances for October. (8 marks)
b) Provide one plausible reason for each variance you calculated. (4 marks)
c) How does the budgeting and control of variable manufacturing overhead differ from the budgeting and control of fixed manufacturing overhead? (3 marks)

Question 8 (23 Marks)

VacuTech manufactures testing instruments for microcircuits. These instruments sell for $3,500 each. VacuTech incurs incremental cash operating costs of $2,450 per unit to manufacture and sell these instruments. On January 1, 2001 VacuTech bought a vacuum pump for $400,000. Vacutech is considering the purchase of a new, more efficient pump today, which is January 1, 2005 (4 years later). The new pump costs $620,000. Both the old and the new pumps are in the same asset class where the CCA rate is 25%, declining balance. There are many other assets in this class, and it has a large UCC balance before this potential purchase. The new pump is expected to have a useful life of four years, after which it will be sold for $80,000. At current rates of production, the new pump's greater efficiency will result in annual cash savings of $125,000.

The old pump will be fully amortized for accounting purposes by December 31, 2004, but it can continue to be used for four more years, after which time its salvage value will be nil. If the new pump is bought now, the old one will be sold now for $50,000.

VacuTech is able to sell all of the testing instruments it can produce. Because of the increased speed of the new pump, output and sales are expected to increase by 30 units in 2005, 50 units in 2006 and 2007, and 70 units in 2008. These increases will not be possible without the new pump. Over and above the annual cash savings at current production levels, VacuTech's cash manufacturing costs will decrease by $150 per unit on all *additional* units produced.

VacuTech is subject to a 40% tax rate, and its after-tax required rate of return is 16%.

Required

(a) Present the appropriate quantitative analysis to determine whether VacuTech should purchase the new pump. (20 marks)
(b) Identify three non-financial factors that the company should consider before making the decision. (3 marks)

Formulae

PV of tax shelter = [(Cdt/(d+k)] x [(1+0.5k)/(1+k)] where:

C = capital cost of the asset
d = CCA rate
t = tax rate
k = discount rate

PV of tax shelter lost due to sale = [Sdt/(d+k)] x [1/(1+k)^n] where:

S = proceeds of disposition
n = year of disposition
d, t, k = as in above formula

Present Value of $1.00 received *n* years hence, at 16%:

n	*Present Value*
1	0.862
2	0.743
3	0.641
4	0.552
5	0.476

Present Value of $1.00 received every year for *n* years, at 16%:

n	*Present Value*
1	0.862
2	1.605
3	2.246
4	2.798
5	3.274