

NATIONAL EXAMINATIONS - MAY 2002

98-CS-1 Engineering Economics

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of any assumptions made.
2. The use of any non-communicating calculator is permitted. This is an open book examination.
3. Any four questions constitute a complete paper. Only the first four questions, as they appear in your answer book, will be marked.
4. The questions are of equal value.

Question 1

CRT Inc. intends to partially finance the purchase of a six-axes vertical milling machine by a loan secured from the local branch of the National Bank. The \$2,400,000 loan is repayable together with interest by twenty equal half-yearly payments (i.e., the loan balance owing after the 20th payment will be zero). The first payment will be made X months after receiving the loan.

MARR (the minimum attractive rate of return) for the company is 12 % The income tax rate is 40%.

Determine:

- a) the **equal half-yearly payments**. X=6 and the loan interest rate is 8 % annually compounding (5 marks)
- b) the **principal loan balance six years after receiving the loan**. X=12 and the loan interest rate is 8 % quarterly compounding (5 marks)
- c) the **after tax cost of the seventh loan payment**. X=6 and the loan interest rate is 8 % half-yearly compounding (5 marks)
- d) the **before tax present value of the loan cash flow** (from the point of view CRT Inc.). X=6 and the loan interest rate is 8 % half-yearly compounding (10 marks)

Question 2

C&R Electronics Ind. intends to set up a production facility in Oakville, Ontario to manufacture switchgear components for Nortel. MARR (the minimum attractive rate of return) for the company is 12 % and the income tax rate is 40%. The estimated ATCF (after-tax cash flow) for the four year project is given below:

End of year	0	1	2	3	4
ATCF, \$	-X	6,000,000	8,000,000	5,000,000	12,000,000

Determine:

- a) the **internal rate of return**. X = \$23,000,000 (5 marks)
- b) the **external rate of return**. X = \$20,000,000 and the reinvestment rate is 12 % (5 marks)
- c) the **break even value of X** (5 marks)
- d) the **sensitivity of the external rate of return with respect to the value of X**. The expected value of X is \$18,000,000 and the reinvestment rate is 12 %. Prepare a sensitivity diagram. (10 marks)

Question 3

Belmont Plastic Ind. operates a production division in Calgary in a leased building. The division produces extruded plastic containers for the local bottling plant of Cotex Ind. Some of the financial information relating to the operation of the Calgary division of Belmont Plastic Ind. for the fiscal year ending on April 30, 2002 is given below. Belmont Plastic Ind. sells some of its production equipment (extrusion and packaging machines) during the fiscal year and replace it by new equipment.

Revenue	\$21,500,000
Labour	\$ 5,800,000
Material and supplies	\$ 4,000,000
Maintenance	\$ 1,100,000
Other costs	\$ 1,300,000
Loan payment (total)	\$ 5,400,000
The interest portion of the (total) loan payment	\$ 890,000
Lease payment (building)	\$ 780,000
Equipment purchase during the year	\$ 3,500,000
Equipment sale during the year	\$ 900,000
The book value of the equipment at the beginning of the fiscal year	\$12,500,000
CCA (capital cost allowance) rate for the equipment	30 %
Income tax rate	40 %

Determine:

- a) the equipment CCA (capital cost allowance) for the fiscal year (according to the Canadian Tax law) and its book value at the end of the fiscal year. (5 marks)
- b) the before-tax cash flow (5 marks)
- c) the income tax payable (10 marks)
- d) the after-tax cash flow (5 marks)

Question 4

The after-tax cash flows of four engineering investment alternatives are given in the Table below:

End of Year	0	1 to 8
Alternative 1	-\$2,400,000	\$450,000
Alternative 2	-\$1,860,000	\$370,000
Alternative 3	-\$3,220,000	\$490,000
Alternative 4	-\$1,610,000	\$X

Determine - using the internal rate of return method:

- a) the **preferred** (economically superior) **alternative**. $X = \$360,000$ and MARR (the minimum attractive rate of return) is 12 %. (10 marks)
- b) the **preferred** (economically superior) **alternative**. $X = \$360,000$ and MARR is 16 % (5 marks)
- c) the **maximum value of X** that would make Alternative 4 preferred. MARR = 12 % (10 marks)

Question 5

The Finance Committee of the Mississauga City Council considers three road improvement proposals submitted by the Road Maintenance Sub-Committee for implementation in the next fiscal period. The financial data for the proposals, including construction costs, perceived monetary values of benefits and dis-benefits to the public, estimated yearly road maintenance costs, and reduced traffic policing costs, are given in the Table below. The planning period is 20 years. Salvage values are zero.

Proposals	A	B	C
Construction cost,\$	1,200,00	1,050,000	1,460,000
Benefit, \$/year	140,000	105,000	135,000
Dis-benefit, \$/year	25,000	0	0
Road maintenance cost, \$/year	32,000	0	14,000
Reduced traffic policing cost, \$/year	8,000	18,400	0

Determine

- a) the **benefit cost ratio** for Proposal A. The interest rate is 4 % (5 marks)
- b) the **preferred** (economically superior) **Proposal** - use the benefit cost ratio method. The interest rate is 5 % (10 marks)
- c) the **minimum value** of the interest rate which would make all three Proposals unacceptable - use the benefit cost ratio method. (10 marks)