

NATIONAL EXAMINATIONS - May 2012
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

Your company offers \$Y to acquire HZK.Corp, a software developing company located in Regina. Some of the information related to HZK.Corp's 2011 financial year is given below:

Income	\$2,850,000
All cost (excluding loan and interest payments)	\$1,260,000
Loan payment	\$ 654,320
The interest portion of the loan payment	\$ 211,673
Capital cost allowance	\$ 465,000

The income tax rate for HZK.Corp is 30%, and the capital cost allowance rate for its equipment is 25%.

Determine:

- (a) the **before tax cash flow** in the 2011 financial year (3 marks)
- (b) the **income tax payable** in the 2011 financial year (5 marks)
- (c) the **un-depreciated capital cost** of HZK.Corp's equipment at the end of the 2011 financial year (5 marks)
- (d) the **after tax cash flow** in the 2011 financial year (5 marks)
- (e) the **maximum value of Y**, if your company is willing to purchase HZK.Corp for at most 1.4 times the present value of its after tax cash flow for the next five years (2012 to 2016). Assume that the after tax cash flow will increase by 8% each year. (7 marks)

Question 2

The initial cost of an air cleaning, and ventilating equipment for a nickel mine located in Sudbury, Ont. is \$X. The estimated yearly operating and maintenance (O&M) costs of this equipment for its five years life are given below:

End of year	1	2	3	4	5
O&M costs,\$	300,000	800,000	1,300,000	1,800,000	2,850,000

MARR (the minimum attractive rate of return) for your company is 10%. The salvage value of the equipment (at any time) is zero.

Determine

- (a) the **present value** of all costs of this equipment for its five year life, if $X=8,000,000$ (4 marks)
- (b) the **equivalent uniform annual cost** of this equipment if it is needed and used for 3 years only, and $X=6,500,000$ (4 marks)
- (c) the **economic life** of the equipment if $X=4,000,000$ (12 marks)
- (d) the **value of X** that would make the economic life of the equipment 5 years (5 marks)

Question 3

The Public Works Department of Calgary considers four alternative (mutually exclusive) road widening proposals for implementation. The financial data of the proposals (costs, perceived values of benefits and dis-benefits) are given below:

Alternative	1	2	3	4
Initial cost, \$	2,850,000	4,920,000	4,110,000	1,470,000
Operating cost, \$/year	67,000	83,000	75,000	48,000
Benefits, \$/year	236,000	378,000	390,000	212,000
Dis-benefits, \$/year	72,000	87,000	48,000	63,000

The planning period is 25 years, salvage values are zero, and the interest rate is i %.

Determine:

- (a) the **benefit–cost (B-C)** for Alternative 2 if $i = 3$ (3 marks)
- (b) the **benefit cost ratio (B/C)** for Alternative 4 if $i = 5$ (3 marks)
- (c) the **maximum value of i** that would make Alternative 2 economically acceptable (4 marks)
- (d) the **preferred (economically superior) Alternative** if $i = 4$ (10 marks)
- (e) the **maximum value of i** that would make Alternative 3 the preferred Alternative (5 marks)

Question 4

Your company's regional offices are located in Vancouver in a building rented for \$850,000 per year (payable at the end of each year). The building is for sale for \$Y. The local branch of the Royal Bank is willing to provide a mortgage of \$2,800,000 toward the purchase of the building. The duration of the mortgage is 20 years, at a yearly interest rate of 4%. The mortgage will have to be repaid by 20 equal yearly (end of year) payments of \$x each. (These payments would cover both interest and principal, so that after the last payment the mortgage is fully discharged).

Your company requires the building for ten years. The estimated value of the building at the end of 10 years is \$3,400,000, and the mortgage principal outstanding at that time is \$P. The yearly cost of owning the building (municipal tax, maintenance, etc.) is \$300,000. MARR (the minimum attractive rate of return) for your company is 12%.

Determine:

- (a) the **mortgage payments, x** (3 marks)
- (b) the **mortgage principal owing at the end of 10 years, P** (3 marks)
- (c) the **total amount of mortgage interest in the first ten years** (4 marks)
- (d) the **internal rate of return** of this purchase (for your company) if $Y = 3,550,000$ (10 marks)
- (e) the **maximum value of Y** which would be (economically) acceptable for your company (5 marks)

Question 5

Your company operates a seven years old (obsolete) injection moulding machine to manufacture plastic bottles in its plant located in Halifax. Purchasing of a new injection moulding machine is considered to replace the old one and reduce production costs. A new machine, with the same production capacity as the old one, costs \$X. The injection moulding machine is required for five years (project life). Salvage values are zero. MARR (the minimum attractive rate of return) for your company is 10%. The yearly (end of year) production costs (P/C) of the old and new machines are given below:

End of year	1	2	3	4	5
Old machine P/C, \$	260,000	320,000	680,000	440,000	500,000
New machine P/C,\$	120,000	140,000	160,000	180,000	200,000

Determine

- (a) the **present value cost** of the new machine if $X = 850,000$ (3 marks)
- (b) the **equivalent uniform annual cost** of the old machine (4 marks)
- (c) the **external rate of return** of this project (purchasing the new injection moulding machine) if $X = 1,200,000$ (10 marks)
- (d) the **maximum value of X** that would justify the purchase (economically) for your company (8 marks)