

National Exams Dec 2013
11-CS-1, Engineering Economics
3 hours Duration

NOTES:

1. Assumptions could be made about questions that are not clear to the candidate, but that should be stated clearly
2. Candidates are urged to draw cash flow diagrams whenever applicable
3. Any non-communicating calculator is permitted. This is an open book exam.
4. Any four out of the five questions constitute a complete exam paper. Only the first four questions, as they appear in the answer book, will be marked.
5. Each question is of equal value.

QUESTION 1

CFC Financial Inc., in the east of Canada, is studying the following two investments: the first investment pays 6% interest per six months, compounded semi-annually, while the second pays 3% interest per three months, compounded quarterly.

- What is the effective semi-annual interest rate for each of the two investments? (8 Marks)
- What is the effective annual interest rate for each of the two investments? (8 Marks)
- Which investment should CFC Financial Inc. choose? (3 Marks)
- How much should the interest rate be (per 3 months, compounded quarterly) for the second investment so that neither of the two investments is preferred over the other after a year of investment? (6Marks)

QUESTION 2

A major city in the west of Canada is planning to build a new power station to accommodate the increasing demand of the city currently being served by two electric power stations. Construction will start in 2020 and is going to take five years at a cost of \$75 million per year. After construction is completed, the cost of operation, maintenance and repairs is expected to be \$5 million for the first year, and to increase by 1% per year thereafter. The salvage/scrap value of the power station at the end of year 2054 is estimated to be \$10 million. Consider the present to be the end of 2015/beginning of 2016 and the interest rate to be 6%.

- Draw a cash flow diagram for this project (from present till end of year 2054). (8 Marks)
- What is the Present Worth of this project? (10 Marks)
- What is the Future Worth of this project? (7 Marks)

QUESTION 3

RTCC Mechanical is planning to buy an air sealing testing device that would cost \$20,000. As a result of this investment, quality improvement savings of \$3,700 are expected each year. The salvage value of the testing device is estimated to be \$3,000 after 9 years of service life. RTCC Mechanical has an after-tax MARR (Minimum Acceptable Rate of Return) of 11% and it is taxed at 40%. Tax rules in RTCC Mechanical country state that capital allowance for industrial equipment is to be calculated using straight-line depreciation scheme, with a life of 7 years and a 0 salvage value.

- Based on after-tax present worth analysis, should this investment be made? (Hint: use generic after-tax calculations) (12 Marks)
- How much is the approximate after-tax IRR (Internal Rate of Return) on this investment? (8 Marks)
- Based on approximate after-tax IRR analysis, should this investment be made? (5 Marks)

QUESTION 4

Three construction offers are being studied by ABC Construction Limited (see the following table). Each offer involves an initial payment that the client pays to ABC at the time the project begins, yearly construction costs incurred by ABC, and a final payment by the client to ABC at the end of five years. ABC can only select one of these offers. At a MARR (Minimum Acceptable Rate of Return) of 12%, answer the following.

Offer	Initial Payment	Cost Per Year	Final Payment
1	85,000	50,000	230,000
2	110,000	65,000	260,000
3	160,000	80,000	280,000

- a) Using a rate of return method, which offer should be selected by ABC Construction? (12Marks)
- b) In what case(s) would a rate of return method be a preferred choice? (3 Marks)
- c) Are you expecting different results if the comparison is based on Annual Worth? (Hint: no calculations are needed) (5 Marks)
- d) Is it always necessary for the alternative with the highest rate of return to be the best alternative? (5 Marks)

QUESTION 5

A small business owner is choosing between two US-made cargo vans of comparable rating. The business owner has a MARR (Minimum Acceptable Rate of Return) of 8%. Expected salvage value for both cargo vans at the end of their service lives is \$7500. Answer the following questions using the information in the table below.

	Cargo van A	Cargo van B
Down payment	\$11,000	\$12,000
Annual Instalment	\$1000	\$900
Maintenance cost	\$150 for the first year, increasing by \$110/year thereafter	\$160 for the first year, increasing by \$100/year thereafter
Running cost per year	\$3,000	\$2,800
Service Life	10 years	12 years

- a) State the necessary assumption for comparing mutually exclusive alternatives of different lives (4 Marks)
- b) Based on Annual Worth comparison, which alternative should be selected? (6 Marks)
- c) Based on Present Worth comparison, which alternative should be selected? (6 Marks)
- d) Do both methods (Present Worth and Annual Worth) always yield to the same decision? (3 Marks)
- e) For a ten-year study period, what salvage value for cargo van B would make it a better choice? (6 Marks)