

National Exams May 2014
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

Smart Visa, Principal Card, and Acrobat Express are three credit card companies that charge different interest on overdue balances. Smart Visa charges 24% compounded daily, Principal Card charges 25% compounded weekly, and Acrobat Express charges 26% compounded monthly. (Hint: 1 year could be 365 or 52 weeks)

- What is the effective annual interest rate charged by each of the three companies? (8 Marks)
- What is the effective semi-annual interest rate charged by each of the three companies? (8 Marks)
- Which credit card company would you prefer? (3 Marks)
- How much should the interest rate be for Smart Visa in order to break-even with Principal Card? (6Marks)

QUESTION 2

An air compressor to be used by an assembly plant in Essex County costs \$5,000 to buy. The new compressor requires a running-in period that costs \$200 immediately. Operating and maintenance costs are estimated at \$500 for the first year, increasing by \$220 per year thereafter. The salvage value of the compressor can be estimated at any time by a declining-balance rate of 15% and the interest rate is 10%.

- Briefly explain the term “sunk costs” and how does it affect a replacement decision (4 Marks)
- Calculate the EAC (Equivalent Annual Cost) for the compressor over one year, two years, three years and four years of service life. (12 Marks)
- Assuming cash flows and interest rates are to be constant over the plant time horizon, how often should the compressor be replaced? (5 Marks)
- What depreciation rate will result in a \$500 book value for the compressor after four years? (4 Marks)

QUESTION 3

A & G Financial Inc. is investigating possible investment opportunities for the coming period. Two independent projects of an equal life of 10 years are available; Project A and Project B, and their information are given below. MARR (Minimum Acceptable Rate of Return) for A & G Financial Inc. is 10%.

	Project A	Project B
Capital Investment	\$300,000	\$620,000
Annual Revenue	\$75,000	\$155,000
Annual Expenses	\$21,000	\$61,000
Salvage Value	\$45,000	\$90,000

- Which project(s) should A & G invest in using Rate of Return analysis? (7 Marks)
- What is A & G's MARR that makes the two projects equivalent? (7 Marks)
- What project(s) should A & G invest in using Future Worth analysis? (6 Marks)
- Suppose the MARR is 4% and A & G must only choose one project, which one should it be? (Hint: you can answer this part without more calculations based on your answers to the first three parts) (5 Marks)

QUESTION 4

RTC Manufacturing is a sheet metal fabrication company in southern Ontario. The company is choosing between two sheet metal cutting machines; CNC plasma and CNC laser. MARR (Minimum Acceptable Rate of Return) for RTC Manufacturing is 9%. Answer the following questions using the information in the table below.

	CNC plasma	CNC laser
Down payment	\$90,000	\$140,000
Annual payment	\$1,400	\$1,900
Maintenance cost	\$1,200 for the first year, increasing by 5% per year thereafter	\$800 for the first year, increasing by 4% year thereafter
Operating cost per year	\$6,300	\$4,100
Salvage Value	20,000	50,000
Service Life	15 years	20 years

- What is the assumption made to compare mutually exclusive alternatives of different lives? (4 Marks)
- Using Annual Worth comparison, which cutting machines should be selected? (6 Marks)
- Using Present Worth comparison, which cutting machines should be selected? (6 Marks)
- Do both methods (Present Worth and Annual Worth) always yield to the same decision? (3 Marks)
- For a fifteen-year study period, what salvage value for the CNC laser would make it a better choice? (6 Marks)

QUESTION 5

Three investments are being studied by Blue Star Housing Limited. The table below summarizes estimated cash flows for each of the three investments over the next five years. Due to budget constraints, Blue Star can only select one investment out of the three investments. At a MARR (Minimum Acceptable Rate of Return) of 12%, answer the following.

Investment	Initial Cost	Expenses per Year	Return at end of year 5
1	\$500,000	\$150,000	\$2,000,000
2	\$700,000	\$200,000	\$2,900,000
3	\$900,000	\$300,000	\$3,800,000

- Use a rate of return method to determine the economically best investment for Blue Star (12Marks)
- Are you expecting different results if the comparison is based on Annual Worth? (Hint: no calculations are needed) (5 Marks)
- What are the case(s) in which a rate of return method is recommended? (3 Marks)
- Is it always necessary for the alternative with the highest rate of return to be the best alternative? (5 Marks)