

Disclaimer: Your Test 2 will have different questions on it.

**ISE 2014 Engineering Economy
1996**

Test 2 - Spring

Name (Printed) _____

**Class Time -
(circle)**

9:00 a.m.

11:00 a.m.

A B C D E F G

Instructions

1. Read these instructions and wait until you are told to begin before starting work on this test.
2. When time is called, stop work immediately. Continuing to work after time has been called will be considered a violation of the Honor Code.
3. If you have questions during the test period, raise your hand and someone will come to answer your question as quickly as possible.
4. This test is open book, open notes. Be sure to show all work. All work must be shown to receive full or partial credit.
5. If you complete the test prior to the end of the test period, please bring your test to the front of the room and place it in the appropriate stack (recitation section), face down.
6. This test has 4 questions. Check to see if you have a complete test.

Honor Pledge

I pledge I have neither given nor received any unauthorized assistance on this test.

Signed: _____

Quote of the Day:

"It's never too early in your career to 'learn the business side of engineering. You've got to understand what is meant by overhead, net revenue, labor per hour profits, hourly utilization on direct payroll time, and indirect costs."

Bob Sylar, Senior Partner at Gresham Smith & Partners
as quoted by Ellen Klein, Engineering Times, March 1996,

p. 3

Do Not Write Below This Line (Office Use Only) _____

Question 1 _____ Question 3 _____

Question 2 _____ Question 4 _____

Total Score _____

Question 1 (25 points)

Here are three alternatives for the heating, ventilation, and air conditioning (HVAC) system for a hospital.

	<u>Reamed</u>	<u>Forty Below</u>	<u>Trained</u>
Purchase & Installation Cost	\$2,000,000	\$2,300,000	\$2,250,000
Annual Operating Expense	\$ 80,000	\$ 50,000	\$ 70,000
Annual Maintenance Expense	\$ 20,000	\$ 14,000	\$ 12,000
Market (Salvage) Value	see table		
Useful Life (years)	15	17	16

Which alternative do you recommend? With an incremental procedure (not necessarily IRR), evaluate these alternatives by using the coterminated life assumption. DO NOT assume repeatability. The MARR is 12% per year. State all other assumptions. The Market Value for each alternative at the end of years 14 through 18 is given in the table below.

Market Value of Alternative HVAC Systems for EOY 14 - 18

	Reamed	Forty Below	Trained	Acme
EOY 14	\$100,000	\$340,000	\$235,000	\$500,000
EOY 15	\$ 50,000	\$225,000	\$100,000	\$400,000
EOY 16		\$110,000	\$ 10,000	\$300,000
EOY 17		\$ 0		\$200,000
EOY 18				\$100,000

Question 2 (25 points)

You are faced with a decision on an investment proposal. Specifically, the estimated additional income from the investment is \$180,000 per year; the initial investment costs are \$640,000; and the estimated annual costs are \$44,000, which begin decreasing by \$4,000 per year starting at the end of the second year. Assume an 8-year analysis period, no salvage value, and MARR = 15%.

19 pts (a) What is the IRR of this proposal? Use linear interpolation to obtain the answer to the nearest 1/2%.

6 pts (b) What is the simple payback period?

Question 3 (25 points)

Three mutually exclusive equipment alternatives are being considered. The estimated cash flows for each alternative are given below. The firm's MARR is 15%.

	<u>Catepillar</u>	<u>Deere</u>	<u>Komatsu</u>
Investment cost	-\$22,000	-\$26,200	-\$17,000
Annual costs	-7,000	-7,500	-5,800
Annual revenues	14,000	15,000	12,000
Salvage value at the end of useful life	4,000	5,000	3,500
Useful life	4 years	10 years	5 years
IRR	15.6%	26.3%	27.2%

Which of the three alternatives, if any, should be adopted? Please state your assumptions.

Question 4 (25 points) (Parts a, b and c relate to the same problem.)

A large chemical plant is being planned with the capacity to produce 3 million pounds (lb.) of product annually. Raw-materials costs for the product are \$0.45/lb., labor costs are \$0.40/lb., and utility costs are \$0.25/lb. Overhead costs are 75% of the labor costs.

9 pts (a) If the company desires a profit equal to 20% of the total product cost, estimate the selling price per pound of product.

9 pts (b) A similar plant with a capacity of 1.8 million lb. of product was constructed eight years ago at a cost of \$6 million when the cost index was 124. The current cost index value is 261 and the cost-capacity factor for this type of plant is 0.84. Estimate the cost of constructing the 3 million pound per year chemical plant.

7 pts (c) Annual sales estimates for the new plant are 3.2 million lb. per year for the first 10 years and 2.5 million lbs. per year for the following 5 years. Based on the estimates obtained in parts (a) and (b), will the new plant be profitable? Assume investment cost must be recovered from the 20% profit calculated in part (a). Use a MARR = 6% and the PW method to justify your decision. [If you can't work part a, use: profit per pound = \$0.30.]