

	DAMEITTA UNIVERSITY Faculty of ENGINEERING				
	Program/ Year	First Year Mechanical & Electrical Depts. 2019-20	semester		First
	Course title:	Engineering Economy	Sheet No.		4

1. A company that manufactures magnetic membrane switches is investigating two production options that have the estimated cash flows shown (\$1 million units). Which one should be selected on the basis of a present worth analysis at 10% per year?

	In-house	Contract
First cost, \$	-30	0
Annual cost, \$ per year	-5	-2
Annual income, \$ per year	14	3.1
Salvage value, \$	2	—
Life, years	5	5

2. The manager of a canned food processing plant must decide between two different labeling machines. Machine A will have a first cost of \$42,000, an annual operating cost of \$28,000, and a service life of 4 years. Machine B will cost \$51,000 to buy and will have an annual operating cost of \$17,000 during its 4-year life. At an interest rate of 10% per year, which should be selected on the basis of a present worth analysis?
3. A metallurgical engineer is considering two materials for use in a space vehicle. All estimates are made.
 - (a) Which should be selected on the basis of a present worth comparison at an interest rate of %12per year?
 - (b) At what first cost for the material not selected above will it become the more economical alternative?

	Material X	Material Y
First cost, \$	-15,000	-35,000
Maintenance cost, \$ per year	-9,000	-7,000
Salvage value, \$	2,000	20,000
Life, years	5	5

4. To retain high-performing engineers, a large semiconductor company provides corporate stock as part of the compensation package. In one

particular year, the company offered 1000 shares of either class A or class B stock. The class A stock was selling for \$30 per share at the time, and stock market analysts predicted that it would increase at a rate of 6% per year for the next 5 years. Class B stock was selling for \$20 per share, but its price was expected to increase by 12% per year. At an interest rate of 8% per year, which stock should the engineers select on the basis of a present worth analysis and a 5-year planning horizon?

5. The Murphy County Fire Department is considering two options for upgrading its aging physical facilities. Plan A involves remodeling the fire stations on Alameda Avenue and Trowbridge Boulevard that are 57 and 61 years old, respectively. (The industry standard is about 50 years of use for a station.) The cost for remodeling the Alameda station is estimated at \$952,000 while the cost of redoing the Trowbridge station is \$1.3 million. Plan B calls for buying 5 acres of land somewhere between the two stations, building a new fire station, and selling the land and structures at the previous sites. The cost of land in that area is estimated to be \$366,000 per acre. The size of the new fire station would be 9000 square feet with a construction cost of \$151.18 per square foot. Contractor fees for overhead, profit, etc. are expected to be \$340,000, and architect fees will be \$81,500. (Assume all of the costs for plan B occur at time 0.) If plan A is adopted, the extra cost for personnel and equipment will be \$126,000 per year. Under plan B, the sale of the old sites is anticipated to net a positive \$500,000 five years in the future. Use an interest rate of 6% per year and a 50 year useful life for the remodeled and new stations to determine which plan is better on the basis of a present worth analysis.
6. Delcon Properties is a commercial developer of shopping centers and malls in various places around the country. The company needs to analyze the economic feasibility of rainwater drains in a 60-acre area that it plans to develop. Since the development won't be started for 3 years, this large open space will be subject to damage from heavy thunderstorms that cause soil erosion and heavy rutting. If no drains are installed, the cost of refilling and grading the washed out area is expected to be 1500\$per thunderstorm. Alternatively, a temporary corrugated steel drainage pipe could be installed

that will prevent the soil erosion. The cost of the pipe will be \$3 per foot for the total length of 7000feet required. Some of the pipe will be salvageable for \$4000 at the end of the 3-year period between now and when the construction begins. Assuming that thunderstorms occur regularly at -3month intervals, starting 3 months from now, which alternative should be elected on the basis of a present worth comparison using an interest rate of 4% per quarter?

7. A public water utility is trying to decide between two different sizes of pipe for a new water main. A -250mm line will have an initial cost of \$155,000, whereas a 300-mm line will cost \$210,000. Since there is more head loss through the 250-mm pipe, the pumping cost is expected to be \$3000 more per year than for the 250-mm line. If the lines are expected to last for 30 years, which size should be selected on the basis of a present worth analysis using an interest rate of 10% per year?
8. A pipeline engineer working in Kuwait for the oil giant BP wants to perform a present worth analysis on alternative pipeline routings—the first predominately by land and the second primarily undersea. The undersea route is more expensive initially due to extra corrosion protection and installation costs, but cheaper security and maintenance reduces annual costs. Perform the analysis for the engineer at 15% per year.

	Land	Undersea
Installation cost, \$ million	-215	-350
Pumping, operating, security, \$ million per year	-22	-2
Replacement of valves and appurtenances in year 25, \$ million	-30	-70
Expected life, years	50	50

9. An electric switch manufacturing company has to choose one of three different assembly methods. Method A will have a first cost of \$40,000, an annual operating cost of \$9000, and a service life of 2 years. Method B will cost \$80,000 to buy and will have an annual operating cost of \$6000 over its 4-year service life. Method C will cost \$130,000 initially with an annual operating cost of \$4000 over its 8-year life. Methods A and B will have no

salvage value, but method C will have some equipment worth an estimated \$12,000. Which method should be selected? Use present worth analysis at an interest rate of 10% per year.

10. Machines that have the following costs are under consideration for a robotized welding process. Using an interest rate of 10% per year, determine which alternative should be selected on the basis of a present worth analysis. Show the solutions.

	Machine X	Machine Y
First cost, \$	-250,000	-430,000
Annual operating cost, \$ per year	-60,000	-40,000
Salvage value, \$	70,000	95,000
Life, years	3	6

11. A sports mortgage is the brainchild of Stadium Capital Financing Group, a company headquartered in Chicago, Illinois. It is an innovative way to finance cash-strapped sports programs by allowing fans to sign up to pay a “mortgage” over a certain number of years for the right to buy good seats at football games for several decades with season ticket prices locked in at current prices. In California, the locked-in price period is 50 years. Assume UCLA fan X purchases a \$130,000 mortgage and pays for it now to get season tickets for \$290 each for 50 years, while fan Y buys season tickets at \$290 in year 1, with prices increasing by \$20 per year for 50 years. (a) Which fan made the better deal if the interest rate is 8% per year? (b) What should fan X be willing to pay up front for the mortgage to make the two plans exactly equivalent economically? (Assume he has no reason to give extra money to UCLA at this point.)