

ENGINEERING ECONOMICS ASSIGNMENTS - JAN 2015

ASSIGNMENT 1 (Time Value of Money)

1. The first cost of equipment and tooling modifications for an investment is expected to be Rs. 18,50,000. Increase in annual maintenance cost and operating costs due to this investment is expected to be a constant Rs. 80,000 per year. Potential inventory reductions are estimated to be Rs. 3,20,000 for the first year with further arithmetic gradient reductions of Rs. 40,000 per year for the following four years (life of the project). Also, production rates are expected to increase to Rs. 20,000 increase per year in each of the four years (i.e. Production cost). If an interest rate of 10% is used, should the investment be considered? Use-
 - a. Present worth method? (i.e. Finding P value at time zero)
 - b. Use annual worth method? (i.e. Finding annuity (A) for all the cash flows)
2. A person is planning to withdraw an amount of Rs. 5000 in the tenth year from now and then onwards he increases his removal with the previous withdrawal amount with a gradient of Rs. 250 till the end of 15th year. For these expenses he is planning to invest an equal amount for eight years starting from the first year end. Find this equal amount what he has to save using an interest rate of 12%?
3. PizzaRush, which is located in the general Los Angeles area, fares very well with its competition in offering fast delivery. Many students at the area universities and community colleges work part-time delivering orders made via the web at PizzaRush.com. The owner, a software engineering graduate of USC, plans to purchase and install five portable, in-car systems to increase delivery speed and accuracy. The systems provide a link between the web order-placement software and the On-Star system for satellite-generated directions to any address in the Los Angeles area. The expected result is faster, friendlier service to customers, and more income for PizzaRush. Each system costs Rs. 4600, has a 5-year useful life, and may be salvaged for an estimated Rs. 300. Total operating cost for all systems is Rs. 650 for the first year, increasing by Rs. 50 per year thereafter. The MARR is 10%. Perform an annual worth evaluation for the owner that answers the following questions.
 - a. How much new annual income is necessary to recover the investment at the MARR of 10% per year?
 - b. The owner conservatively estimates increased income of Rs. 1200 per year for all five systems. Is this project financially viable at the MARR?

4. To provide for a college education for his daughter, a man opened an escrow account in which equal deposits were made. The first deposit was made on January 1, 1990, and the last deposit was made on January 1, 2014. The yearly college expenses, including tuition were estimated to be Rs.400000 in the first year, and then onwards increases with a gradient of Rs.20000 every year for each of the remaining 4 years. Assuming the interest rate to be 6%, how much did the father have to deposit each year in the escrow account for the daughter to draw this required college expenses for the 5 years duration beginning from January 1, 2015?
5. Conventional agricultural equipment has a service life of 6 years. Newly designed equipment is 50% costlier than the conventional one but has more advantages. The operating costs of both these equipment are almost same and salvage value is negligible. What will be the service life of the new equipment that makes its costs comparable to that of the conventional one at $i=10\%$?

ASSIGNMENT-2 (Nominal and Effective Interest Rates)

1. On January 1, a woman deposits \$5000 in a credit union that pays 8% nominal annual interest compounded quarterly. She wishes to withdraw all the money in five equal yearly sums, beginning December 31 of the first year. How much should she withdraw each year?
2. An engineering student bought a car at a local used car lot. Including tax and insurance, the total price was 300000. He is to pay for the car in 12 equal monthly payments, beginning with the first payment immediately (in other words, the first payment was the down payment). Nominal interest on the loan is 12%, compounded monthly. After six payments (the down payment plus five additional payments), he decides to sell the car. A buyer agrees to pay a cash amount to pay off the loan in full at the time the next payment is due and also to pay the engineering student 100000. If there are no penalty charges for this early payment of the loan, how much will the car costs to the new buyer?
3. A sheltered workshop requires a lift truck to handle pallets for a new contract. A lift truck can be purchased for Rs.270000. Annual insurance costs are 3% of the purchase price, payable on the first of each year. An equivalent truck can be rented Rs. 15000 per month payable at the end of each month. Operating costs are same for both alternatives. For what minimum number of months must a purchased truck be used on the contract to make purchasing more attractive than leasing? Interest rate is 12% compounded monthly. Assume that the purchased truck has no salvage value.

4. A loan of Rs.10, 000/- is made today under an agreement that Rs.14, 000 will be received in payment some time in future. When should the payment be received, if the loan is to earn interest at a rate of 8% compounded quarterly (interpolate if necessary)
5. The New Mexico State Police and Public Safety Department owns a helicopter that it uses to provide transportation and logistical support for high-level state officials. The \$495 hourly rate covers operating expenses and the pilot's salary. If the governor uses the helicopter an average of 2 days per month for 6 hours each day, what is the equivalent future worth of the costs for 1 year at an interest rate of 6% per year, compounded quarterly.

ASSIGNMENT-3 (Present Worth, Annual Worth and Future Worth)

1. The present price (year 0) of kerosene is \$1.80 per gallon, and its cost is expected to increase by \$.15 per year. (At the end of year 1, kerosene will cost \$1.95 per gallon.) Mr. Garcia uses about 800 gallons of kerosene for space heating during a winter season. He has an opportunity to buy a storage tank for \$600, and at the end of four years he can sell the storage tank for \$100. The tank has a capacity to supply four years of Mr. Garcia's heating needs, so he can buy four years' worth of kerosene at its present price (\$1.80), or he can invest his money elsewhere at 6%. Should he purchase the storage tank? Assume that kerosene purchased on a pay-as-you-go basis is paid for at the end of the year. (However, kerosene purchased for the storage tank is purchased now.)
2. Compare the alternatives below on the basis of equivalent uniform annual worth analysis, using the interest rate of 10% per year. (Where, K = Years, 1 through 10)

	Plan A	Plan B
<i>First Cost (Rs)</i>	28,000	36,000
<i>Installation Cost (Rs)</i>	3,000	4,000
<i>Annual Maintenance Cost (Rs)</i>	1,000	2,000
<i>Annual Operating Cost (Rs)</i>	(2,200 + 75 K)	(800+50 K)
<i>Life (Years)</i>	10	10

3. A 50 HP motor is required to drive a pump to remove water from a tunnel. Two alternatives are under consideration. Alternative A calls for the construction of an electric motor along with power lines at a total cost of \$4,900. The salvage value of this equipment after 4 years is \$700. Alternative B calls for purchase of a diesel pump set at a cost of \$1925 with no salvage value at the end of 4 years of its life. The cost of diesel per hour is \$0.5 and maintenance cost of \$0.55 per hour. Cost of wages chargeable when the diesel pump set

runs is \$2 per hour. How many hours of operation per year, the two machines have to run so that the two alternatives incur equal annual cost. If the number of hours of operation is 100 per year which alternative is more economical if the interest rate is 12% per year?

4. Two sites are currently under consideration for a bridge to cross a river in New York. The north site, which connects a major state highway with an interstate loop around the city, would alleviate much of the local through traffic. The disadvantages of this site are that the bridge would do little to ease local traffic congestion during rush hours, and the bridge would have to stretch from one hill to another to span the widest part of the river, railroad tracks, and local highways below. This bridge would therefore be a suspension bridge. The south site would require a much shorter span, allowing for construction of a truss bridge, but it would require new road construction. The suspension bridge will cost \$50 million with annual inspection and maintenance costs of \$35,000. In addition, the concrete deck would have to be resurfaced every 10 years at a cost of \$100,000. The truss bridge and approach roads are expected to cost \$25 million and have annual maintenance costs of \$20,000. The bridge would have to be painted every 3 years at a cost of \$40,000. In addition, the bridge would have to be sandblasted every 10 years at a cost of \$190,000. The cost of purchasing right-of-way is expected to be \$2 million for the suspension bridge and \$15 million for the truss bridge. Compare the alternatives on the basis of their capitalized cost if the interest rate is 10% per year.
5. Using an interest rate of 10%, what is the capitalized cost of a tunnel to transport water through the Girnar Mountain range if the first cost is \$1,000,000 and the maintenance costs are expected to occur in a 6-year cycles as shown below?

End of Year	1	2	3	4	5	6
Maintenance cost	\$35,000	\$35,000	\$35,000	\$45,000	\$45,000	\$60,000

ASSIGNMENT-4 (Internal Rate of Return and Incremental IRR)

1. A man would like to invest an amount of Rs. 5,00,000 for which he is expecting a revenue of 2,00,000 in the 2nd year, 3,50,000 in the 4th year and 7,00,000 in the fifth year. He also has an expense of 1,50,000 in 3rd year. What rate of return he would get for this investment.
2. A tool and die company in Pittsburgh is considering the purchase of a drill press with fuzzy-logic software to improve accuracy and reduce tool wear. The company has the opportunity to buy a slightly used machine for \$15,000 or a new one for \$21, 000. Because the new machine is a more sophisticated model, its operating cost is expected to be \$7000 per year, while the used machine is expected to require \$8200 per year. Each machine is expected to

have a 25-year life with a 5% salvage value. Tabulate the incremental cash flow and determine the incremental rate of return.

3. Sandersen Meat Processors has asked its lead process engineer to evaluate two different types of conveyors for the bacon curing line. Type A has an initial cost of \$70,000 and a life of 8 years. Type B has an initial cost of \$95,000 and a life expectancy of 12 years. The annual al operating cost for type A is expected to be \$9000, while the AOC for type B is expected to be \$7000. If the salvage values are \$5000 and \$10,000 for type A and type S, respectively, tabulate the incremental cash flow using their LCM and determine the Incremental IRR.
4. Caterpillar Corporation wants to build a spare parts storage facility in the Phoenix, Arizona, vicinity. A plant engineer has identified four different location options. Initial cost of earthwork and prefab building, and annual net cash flow estimates are detailed in Table below. The annual net cash flow series vary due to differences in maintenance, labor costs, transportation charges, etc. If the MARR is 10%, use incremental ROR analysis to select the one economically best location.

	A	B	C	D
Initial Costs	-200,000	-275000	-190000	-350000
Annual Cashflow, \$	+22000	+35000	+19500	+42000
Life, Years	30	30	30	30

ASSIGNMENT-5 (Replacement Analysis and Depreciation)

1. An 8 year old asset may be replaced with either of the two new assets. Current data for each alternative are given below, using the cash flow approach and interest rate of 18% per year. Determine the best course of action.

Course of action	Current asset (Rs)	Challenger 1 (Rs)	Challenger 2 (Rs)
First cost	-	30000	54000
Defender trade	-	10500	7500
Annual cost	9000	4500	3600
Salvage value	1500	3000	1500
Life, years	5 yr	5 yr	5 yr

2. The country tailors use many sewing machines in their clothes line. The general manager wants to know the minimum cost life for these machines. Find this value at an interest rate of 20% per year, if the first cost is \$5000 per machine.

Life in years	Market value (\$)	Estimated AOC (\$/year)
0	5000	----
1	3000	1000
2	1500	1500
3	1000	2000
4	500	2500
5	0	3000
6	0	5000

3. An economic analysis is to be made to determine whether existing (defender) equipment in an industrial plant should be replaced. A \$4000 overhaul must be done now if the equipment is to be retained in service. Maintenances estimated at \$1800 in each of the next 2 years, after which it is expected to increase by \$1000 each year. The defender has no present or future salvage value. Determine the economic service life of the defender considering $i = 10\%$.
4. An 11-year-old piece of equipment having a life of 15 years with an initial cost of \$12100 is being considered for replacement. It can be sold for \$2000 now, and it is believed that the same salvage value can also be obtained in future years. The current maintenance cost is \$500 per year and is expected to increase \$100 per year in future years. If the equipment is retained in service, compute the minimum EUAC, based on 10% interest. Also, if the equipment is sold now what will be the sunk cost if the asset is being depreciated according to double declining balance method?
5. An asset has a first cost of Rs.2,50,000 and an expected life of ten years. The estimated salvage value at the end of ten years is Rs.50,000. If straight line method and reducing balance method of depreciation is used, find,
- Undepreciated amount of capital remaining in the asset at the end of sixth year.
 - The depreciation charges for fourth year and eighth year.