**HUM 3051 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT**

**QUESTIONS**

1. 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 portables, 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. Perform the solution by hand and by computer, as requested below.
   1. How much new annual income is necessary to recover the investment at the MARR of 10% per year?
   2. The owner conservatively estimates increased income of Rs. 1200 per year for all five systems. Is this project financially viable at the MARR?
2. A debt of $5000 can be repaid, with interest at 8% compounded annually, by the following payments.

|  |  |
| --- | --- |
| **Year** | **Payments ($)** |
| 1 | 500 |
| 2 | 1000 |
| 3 | 1500 |
| 4 | 2000 |
| 5 | X |

The payment at the end of the fifth year is shown as X. How much is X?

1. Mr. Jones, 35, is planning for a 20-year retirement. He intends to withdraw $6000 at the end of the first year (the 61st year), then increase withdrawals by $800 each year to cover inflation. He intends to make equal payments from the 45th to 60th years. However, he expects to receive a $1,000 lump sum payment in his 40th year as a result of the maturity of one of his investments, which will also be used for this purpose. If the bank pays 9% compounded annual interest on his savings, what equal payments he should make to meet his retirement plan?
2. A person is planning to withdraw an amount of Rs. 50,000 in the tenth year from now and then onwards he increases his removal with the previous withdrawal amount with a gradient of Rs. 25,000 till the end of 15th year. For these expenses he is planning to have an investment plan where he invests 15000 in the 2nd year and then onwards increases it by an equal amount G. This investment will continue till the 8th year. Determine the amount he needs to increase each year (i.e. G value) so that he can meet his withdrawal plan. Assume an interest rate of 12%.
3. 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). The interest rate is one percent per month. 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?
4. A new plant to produce tractor gears requires an initial investment of $10 million. It is expected that a supplemental investment of $4 million will be needed every 3 years to update the plant. The plant is expected to start producing gears 2 years after the initial investment is made (at the start of the third year). Revenues of $5 million per year are expected to begin to flow at the start of the fourth year. Annual operating and maintenance costs are expected to be $2 million per year. The plant has a 15-year life. Determine the present value of all the cash flows.
5. A company is considering buying a new bottle capping machine. The initial cost of the machine is $325,000 and it has a 10-year life. Monthly maintenance costs are expected to be $1200 per month for the first 7 years and $2000 per month for the remaining years. The machine requires a major overhaul costing $55,000 at the end of the fifth year' of service. Assume that all these costs occur at the end of the appropriate period. What is the future value of all the costs associated with owning and operating this machine if the interest rate is 1.5% per month?
6. 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.)
7. A local newspaper headline blared, "Bo Smith Signs for $30 Million." The article revealed that, on April 1, 2002, Bo Smith, the former record breaking running back from Football University, signed a $30 million package with the Nebraska Lions. The terms of the contract were $3 million immediately, $2.4 million per year for the first five years (with the first payment after one year), and $3 million per year for the next five years (with the first payment at the end of year six). If the interest rate is 8% compounded annually, what is Bo's contract worth at the time of contract signing?
8. Suppose that you have a savings plan covering the next ten years, according to which you put aside Rs.6,000 today, Rs.5,000 at the end of every other year for the next five years, and Rs.4,000 at the end of each year for the remaining five years. As part of this plan, you expect to withdraw Rs.3,000 at the end of every year for the first three years, and Rs.3,500 at the end of every other year thereafter. Draw your cash flow diagram. Determine the Future balance amount left in the account if the interest rate is 15%.
9. An industrial firm is considering purchasing several programmable controllers and automating the company’s manufacturing operations. It is estimated that the equipment will initially cost $100,000 and the labor to install it will cost $35,000. A service contract to maintain the equipment will cost $5,000 per year. Trained service personnel will have to be hired at an annual salary of $30,000. Also estimated is an approximate $10,000 annual income-tax savings (cash inflow). How much will this investment in equipment and services have to increase the annual revenues after taxes in order to break even? The equipment is estimated to have an operating life of 10 years, with no salvage value because of obsolescence. The firm’s MARR is 10%.
10. Champion Chemical Corporation is planning to expand one of its propylene manufacturing facilities. Land costing $3.5 million must be purchased to build a plant. The building, which needs to be expanded, costs $5 million. At the end of the first year, the company needs to spend about $4 million on equipment and other start-up costs. Once the building becomes operational, it will generate revenue in the amount of $3.5 million during the first operating year. This will increase by 0.2 million every year with respect to previous year revenue for the next 9 years. After 10 years, the sales revenue will stay constant for further years before the operation is phased out. (It will have a project life of 13 years after construction.) The expected salvage value of the land at the end of the project’s life would be about $2 million, the building about $1.4 million, and the equipment about $500,000. The annual operating and maintenance costs are estimated to be approximately 40% of the sales revenue each year. If the company’s MARR is 15%, determine the present value of this cash flows.
11. An engineer is thinking of starting a part-time consulting business next September 5, on his 40th birthday. He expects the business will require an initial cash outlay of $5000, to come from his savings, and will cost $500 per year to operate; the business ought to generate $2000 per year in cash receipts. During the 20 years that he expects to operate the business, he plans to deposit the annual net proceeds in a bank each year, at an interest rate of 12% per year, compounded annually. When he retires, on his 60th birthday, the engineer expects to invest whatever proceeds plus interest he then has from the business in a long-term savings plan that pays 15% per year, compounded annually. What is the maximum amount he could withdraw from the savings plan each year during his retirement and still have the funds last 15 years?
12. A new plant to produce steel tubing requires an initial investment of $10 million. It is expected that after three years of operation an additional investment of $5 million will be required; and after six years of operation, another investment of $3 million. Annual operating costs will be $3 million and annual revenues will be $8 million. The life of the plant is 10 years. If the interest rate is 15% per year, compounded annually, what is the NPV of this plant?
13. Sunbelt Corporation, an investment company, is considering building a 50-unit apartment complex in a growing area near Tucson, Arizona. Since the long-term growth potential of the town is excellent, it is believed that the company could average 85% full occupancy for the complex, each year. If the following financial data are reasonably accurate estimates, determine the minimum monthly rent that should be charged if a 12% rate of return is desired:

* Land investment cost Rs. 10 Lakh
* Building investment cost Rs. 25 Lakh
* Annual upkeep cost Rs. 1,50,000
* Property taxes and insurance = 6% of total initial investment
* Study period of 25 years
* Salvage value = Only land cost can be recovered in full.

1. A company one year ago borrowed Rs.4,00,000 to pay for a new machine tool, agreeing to repay the loan in 25 monthly equal payments at an annual nominal interest rate of 12% compounded monthly. The company now wants to pay off completely the remaining loan amount, which will be paid during the next instalment period (i.e. at 13th installment). How much would this payment be, assuming no penalty costs for early payout?
2. A piece of land may be purchased for $780,000 to be strip-mined for the underlying coal. Annual net income will be $200,000 per year for first two years after which it increases by a gradient of $20,000 with respect to previous year, till 10 years. At the end of the 10 years, the surface of the land will be restored as required by a federal law on strip mining. The reclamation will cost $1.5 million more than the resale value of the land after it is restored. Using a 12% interest rate and present worth method of comparison, determine whether the project is desirable.
3. A man arranges to repay Rs. 1,00,000 bank loan in 10 equal annual installments at 12% interest per year. Immediately after his 3rd payment, he borrows another loan of Rs. 50,000 also at the same interest rate. When he borrows Rs. 50,000, he made an agreement with the banker to repay the remaining debt of the first loan and the entire amount of the second loan in 12 equal annual payments. The first of 12 payments would be made one year after the receipt of the second loan. Compute the amount of each of 12 payments.
4. Upon the birth of his first child, Dean Jones decided to establish a savings account to partly pay for his son's education. He plans to deposit $20 per month in the account, beginning when the boy is 13 months old. The savings and loan association has a current interest policy of 12% per annum, compounded monthly (1% per month).
5. Assuming no change in the interest rate, how much will be in the savings account when Dean Jones son becomes 16 years old?
6. If the interest rate increases to 15% per annum (1.5% per month) from the 37th month onwards, what would be the accumulated amount in the account when Dean Jones son becomes 16 years old?
7. A new plant to produce tractor gears requires an initial investment of $10 million. It is expected that a supplemental investment of $4 million will be needed every 3 years to update the plant. The plant is expected to start producing gears 2 years after the initial investment is made (at the start of the third year). Revenues of $5 million per year are expected to begin to flow at the start of the fourth year. Annual operating costs are expected to be $2 million per year. The plant has a 15-year life. Determine the net annual worth of the cash flows.
8. A consulting engineering firm is considering two models of SUVs for the company principals. A GM model will have a first cost of $26,000, an operating cost of $2000, and a salvage value of $12,000 after 3 years. A Ford model will have a first cost of $29,000, an operating cost of $1200, and a $15,000 resale value after 4 years. At an interest rate of 15% per year, which model should the consulting firm buy?
9. A remotely located air sampling station can be powered by solar cells or by running an electric line to the site and using conventional power. Solar cells will cost $12,600 to install and will have a useful life of 4 years with no salvage value. Annual costs for inspection, cleaning, etc., are expected to be $1400. A new power line will cost $11,000 to install, with power costs expected to be $800 per year. Since the air sampling project will end in 4 years, the salvage value of the line is considered to be zero. At an interest rate of 10% per year, which alternative should be selected on the basis of a future worth analysis?
10. A person is depositing an amount of Rs.5,000 on a quarterly basis with an interest rate of 12% per year compounded quarterly from past three years in a saving account. He is planning to deposit the amount for another two years after which he planning to withdraw the amount from the account and will be depositing it in a FD account earning an interest rate of 10% with a maturity of five year period. What amount the person will be getting at the end of the five-year tenure of the FD account?
11. A company engaging in selling of laboratory equipment estimates that profit from sales should increase by Rs.2,00,000 per year if a mobile demonstration unit is built. A large unit with sleeping accommodation for the driver will cost Rs.9,70,000 while a smaller unit without sleeping cabin will be Rs. 6,30,000. Salvage values for the large and small units after five years will be, Rs.97,000 and Rs.35000 respectively. Lodging costs saved by the larger unit should amount Rs.1,10,000 annually, but its transportation costs will exceed those of the smaller unit by Rs.31,000. With the money at 12% should a mobile demonstration unit be built? And if so which size is preferable? Use annual worth analysis.