| Reg. No. | | | | | | | | | | |
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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

**VI SEMESTER B.TECH. (COMMON TO ALL)**

**END SEMESTER EXAMINATIONS- APRIL 2018**

SUBJECT: ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT [HUM 4002]

**REVISED CREDIT SYSTEM**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Interest factor table is provided in the last page (else use formulae).

**1A.** Compare the following alternatives on the basis of their capitalized cost at an interest rate of 11% per year. **(04)**

| | Petroleum based feedstock | Inorganic based feedstock |
|---|---|---|
| First cost, in Rs. | -2,50,000 | -1,10,000 |
| Annual operating cost, Rs./year | -1,30,000 | -65,000 |
| Annual revenues, Rs./year | 4,00,000 | 2,70,000 |
| Salvage values, in Rs. | 50,000 | 20,000 |
| Life in years (one cycle) | 6 | 4 |

**1B.** Explain with an example the steps in decision making process. **(02)**

**1C.** Three years ago a chemical processing plant installed a system at a cost of $20,000 to remove pollutants from waste water that is discharged into a nearby river. The present system has no present salvage value and will cost $14,500 to operate next year, with the operating cost expected to increase at the rate of $500 per year thereafter. A new system has been designed to replace the existing system at a cost of $10,000. The new system is expected to have first year operating of $9,000 with these costs increasing at the rate of $1,000 per year. The new system is estimated to have a useful life of 12years. The salvage values of both the system at any future time are expected to be zero. If the interest rate is 11% conduct replacement analysis based on the economic life of the asset. **(04)**



**4B.** A company is manufacturing 3 types of products A, B and C. It is considering of undertaking three research proposals one from each group of proposals and the research is expected to last for 5 years. The costs associated with each proposal are given in the table below. Taking an interest rate of 11%, find the best course of action if the budget available is Rs. 90,000. **(05)**

| Proposal | Initial cost(Rs.) | Annual 'O' & 'M' cost (Rs.) |
|---|---|---|
| A1 | 40,000 | 8100 |
| A2 | 50,000 | 2100 |
| B1 | 20,000 | 8200 |
| B2 | 25,000 | 6500 |
| C1 | 15,000 | 6200 |
| C2 | 20,000 | 5000 |

**5A.** Explain the different types of turnover ratios and financial leverage ratios with clearly stating the significance of each (2 on each type). **(06)**

**5B.** An company is planning to replace its old drilling machine now with an advanced drill machine whose initial cost of Rs.5,00,000. Its annual operating cost is expected to be Rs.7,500 and a salvage value of Rs.70,000 at the end of its life which is 10 years. The old machine was purchased two years ago at a price of Rs.3,50,000 which had a life of 6 years and salvage value of Rs.30,000. Its annual operating cost was Rs.6,000 at the first year which increases by a gradient of Rs.500 every year. Determine the best course of action making suitable assumptions (i=11%). **(04)**

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**11.0%**

| | Single Payment | | Equal Payment Series | | | | Gradient Series | | |
|---|---|---|---|---|---|---|---|---|---|
| N | Compound Amount Factor (F/P,I,N) | Present Worth Factor (P/F,I,N) | Compound Amount Factor (F/A,I,N) | Sinking Fund Factor (A/F,I,N) | Present Worth Factor (P/A,I,N) | Capital Recovery Factor (A/P,I,N) | Gradient Uniform Series (A/G,I,N) | Gradient Present Worth (P/G,I,N) | N |
| 1 | 1.1100 | 0.9009 | 1.0000 | 1.0000 | 0.9009 | 1.1100 | 0.0000 | 0.0000 | 1 |
| 2 | 1.2321 | 0.8116 | 2.1100 | 0.4739 | 1.7125 | 0.5839 | 0.4739 | 0.8116 | 2 |
| 3 | 1.3676 | 0.7312 | 3.3421 | 0.2992 | 2.4437 | 0.4092 | 0.9306 | 2.2740 | 3 |
| 4 | 1.5181 | 0.6587 | 4.7097 | 0.2123 | 3.1024 | 0.3223 | 1.3700 | 4.2502 | 4 |
| 5 | 1.6851 | 0.5935 | 6.2278 | 0.1606 | 3.6959 | 0.2706 | 1.7923 | 6.6240 | 5 |
| 6 | 1.8704 | 0.5346 | 7.9129 | 0.1264 | 4.2305 | 0.2364 | 2.1976 | 9.2972 | 6 |
| 7 | 2.0762 | 0.4817 | 9.7833 | 0.1022 | 4.7122 | 0.2122 | 2.5863 | 12.1872 | 7 |
| 8 | 2.3045 | 0.4339 | 11.8594 | 0.0843 | 5.1461 | 0.1943 | 2.9585 | 15.2246 | 8 |
| 9 | 2.5580 | 0.3909 | 14.1640 | 0.0706 | 5.5370 | 0.1806 | 3.3144 | 18.3520 | 9 |
| 10 | 2.8394 | 0.3522 | 16.7220 | 0.0598 | 5.8892 | 0.1698 | 3.6544 | 21.5217 | 10 |
| 11 | 3.1518 | 0.3173 | 19.5614 | 0.0511 | 6.2065 | 0.1611 | 3.9788 | 24.6945 | 11 |
| 12 | 3.4985 | 0.2858 | 22.7132 | 0.0440 | 6.4924 | 0.1540 | 4.2879 | 27.8388 | 12 |
| 13 | 3.8833 | 0.2575 | 26.2116 | 0.0382 | 6.7499 | 0.1482 | 4.5822 | 30.9290 | 13 |
| 14 | 4.3104 | 0.2320 | 30.0949 | 0.0332 | 6.9819 | 0.1432 | 4.8619 | 33.9449 | 14 |
| 15 | 4.7846 | 0.2090 | 34.4054 | 0.0291 | 7.1909 | 0.1391 | 5.1275 | 36.8709 | 15 |
| 16 | 5.3109 | 0.1883 | 39.1899 | 0.0255 | 7.3792 | 0.1355 | 5.3794 | 39.6953 | 16 |
| 17 | 5.8951 | 0.1696 | 44.5008 | 0.0225 | 7.5488 | 0.1325 | 5.6180 | 42.4095 | 17 |
| 18 | 6.5436 | 0.1528 | 50.3959 | 0.0198 | 7.7016 | 0.1298 | 5.8439 | 45.0074 | 18 |
| 19 | 7.2633 | 0.1377 | 56.9395 | 0.0176 | 7.8393 | 0.1276 | 6.0574 | 47.4856 | 19 |
| 20 | 8.0623 | 0.1240 | 64.2028 | 0.0156 | 7.9633 | 0.1256 | 6.2590 | 49.8423 | 20 |
| 21 | 8.9492 | 0.1117 | 72.2651 | 0.0138 | 8.0751 | 0.1238 | 6.4491 | 52.0771 | 21 |
| 22 | 9.9336 | 0.1007 | 81.2143 | 0.0123 | 8.1757 | 0.1223 | 6.6283 | 54.1912 | 22 |
| 23 | 11.0263 | 0.0907 | 91.1479 | 0.0110 | 8.2664 | 0.1210 | 6.7969 | 56.1864 | 23 |
| 24 | 12.2392 | 0.0817 | 102.1742 | 0.0098 | 8.3481 | 0.1198 | 6.9555 | 58.0656 | 24 |
| 25 | 13.5855 | 0.0736 | 114.4133 | 0.0087 | 8.4217 | 0.1187 | 7.1045 | 59.8322 | 25 |

**2A.** Upjohn Company purchased new packaging equipment with an estimated useful life of five years. The cost of the equipment was $35,000, and the salvage value was estimated to be $5,000 at the end of year 5. Compute the annual depreciation expenses over the five-year life of the equipment under each of the following methods of book depreciation: **(03)**

(a) Straight-line method (b) Double-declining-balance method

**2B.** Three different plans were presented to the GAO by a high-technology facilities manager for operating a small weapons production facility. **(03)**

Plan A would involve renewable 1-year contracts with payments of $1 million at the beginning of each year.

Plan B would be a 2-year contract, and it would require four payments of $600,000 each, with the first one to be made now and the other three at 6-month intervals.

Plan C would be a 3-year contract, and it would entail a payment of $1.5 million now and another payment of $0.5 million 2 years from now. Assuming that the GAO could renew any of the plans under the same conditions if it wants to do so, which plan is better on the basis of a present worth analysis at an interest rate of 11% per year, compounded semiannually?

**2C.** Compare the alternatives below on the basis of equivalent uniform annual worth analysis, using the interest rate of 11% per year. (Where, K = Years, 1 through 12) **(04)**

| | Plan A | Plan B |
|---|---|---|
| First Cost (Rs) | 4,48,000 | 5,76,000 |
| Installation Cost (Rs) | 48,000 | 64,000 |
| Annual Maintenance Cost (Rs) | 16,000 | 32,000 |
| Annual Operating Cost (Rs) | (35,000 + 1200 K) | (12,800+800 K) |
| Life (Years) | 12 | 12 |

**3A.** From the following balance sheet of Skanda Industries Ltd. as on 31st March 2014 **(04)**

| Liabilities | Amt. (Rs.) | Assest | Amt. (Rs.) |
|---|---|---|---|
| Equity share capital | 10,000 | Fixed Assets (less depreciation Rs. 10,000) | 26,000 |
| 7% Preference share capital | 2,000 | Current Assets: | |
| Reserves and Surplus | 8,000 | Cash | 1,000 |
| 6% Mortgage Debentures | 14,000 | Investments (10%) | 3,000 |
| Current Liabilities: | | Sundry debtors | 4,000 |
| Creditors | 1,200 | Stock | 6,000 |
| Bills payable | 2,000 | | |
| Outstanding expenses | 200 | | |
| Tax provisions | 2,600 | | |



*Other Information:*

Net Sales Rs.60,000

Cost of goods sold Rs.51,600

Net Income before Tax Rs.4,000

Net Income after tax Rs.2,000

Calculate:

i) Current ratio
ii) Debt-Equity ratio
iii) Debtors Turnover ratio
iv) Gross Profit Ratio

**3B.** Determine the effective interest rate for the quarterly payment period if the nominal interest rate is **(02)**

i) 18% compounded monthly ii) 18% per year

**3C.** A metal plating company is considering four different methods for recovering byproduct heavy metals from a manufacturing site's liquid waste. The investment costs and incomes associated with each method have been estimated. All methods have an 8 years life. The MARR is 11 % per year. **(04)**

| Method | First Cost ($) | Salvage Value ($) | Annual Income ($/year) |
|---|---|---|---|
| A | -30,000 | 0 | +5,420 |
| B | -36,000 | 0 | +7,246 |
| C | -45,000 | +500 | +8,000 |
| D | -53,000 | -2,000 | +10,500 |

i) If the methods are independent, because they can be implemented at different plants, which ones are acceptable?

ii) If the methods are mutually exclusive, determine which one method should be selected, using a ROR evaluation.

**4A.** A contractor is offered his choice of either gasoline, diesel or butane engine to power a bulldozer he is to purchase. **(05)**

The gasoline engine will cost Rs. 3,00,000 and will have an estimated maintenance cost of Rs.30,000 per year and will consume Rs.540 worth of fuel per hour of operations.

The diesel engine will cost Rs.4,20,000 and will cost an estimated Rs.36,000 per year to maintain and will consume Rs.495 worth of fuel per hour.

The butane engine will cost Rs.4,95,000 and will cost Rs.47,250 per year to maintain and will consume 435 worth of fuel per hour of operation.

Since the salvage value of the engine is identical it can be neglected. All other costs associated with the three engines are equal and the interest rate is 11%. The service life of each engine is 6 years.

Plot the total annual cost of each engine as a function of no. of hours of operation/year.

Find the range of no. of hours of operation for which it would be most identical to specify the gasoline, diesel and butane engines.