Question Paper

Exam Date & Time: 29-Apr-2024 (02:30 PM - 05:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING/ INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - APRIL / MAY 2024 SUBJECT: HUM 3051/HUM 3051 - ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

Marks: 50

1A)

Duration: 180 mins.

Answer all the questions.

Missing data may be suitably assumed. Interest factor table is provided for others use formula. Formula book and Interest factor table are included in reference material section.

Suppose you have borrowed ₹50,000 at an interest rate of 8% per year compounded semi-annually and (4) desire to repay the money with five equal end-of-year payments, with the first payment made two years after receiving the ₹50,000.

a) Estimate the size of the annual payment.

b) At the time of the fourth payment, suppose you decide to pay off the loan with one lump sum payment. How much should be paid? (*Use interest formula for calculations*)

1B) The cash flow diagram below shows the expected withdrawals during the five years' period along with (3) the expected interest rates during this period. Determine the present value using this information. (*use interest formula for calculations*)



- A donor wishes to endow a scholarship to a University in the name of his mother. The scholarship is to (3) provide ₹40,000 per year for the first five years and ₹1,00,000 per year thereafter forever. If University expects to be able to earn 10% per year on the endowment, then estimate the amount that the donor must give now if the first scholarship is to be given one year from now. (*use formula for calculations*)
- An asset was bought by a company at an initial cost \$1,750 with an expected salvage value of \$250 at (4) the end of its five-year depreciable life. Calculate and show the complete depreciation schedules for:
 a) If company adopts straight-line (SL) method of depreciation.

b) If company adopts double declining balance (DDB) method of depreciation.

2B) An electric utility company is looking at the following alternatives for tree- trimming equipment. Sub-contractor bid (3) calls for \$98,000 the first year with the additional increase of \$8000 every year, for the next 5 years. The utility company is also considering buying equipment with the first cost of \$220,000 and annual operating and maintenance expenses of \$65,000 per year. The equipment is expected to have a salvage value of \$25,000 at the end of its useful life of 5 years.

Evaluate the two alternatives on annual worth method using 10% interest rate and decide on whether to sub-

contract or buy the equipment.

100/

| n 10% | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G |
|-------|-------|-------|--------|--------|-------|-------|-------|--------|
| 1 | 1.100 | .9091 | 1.0000 | 1.1000 | 1.000 | 0.909 | 0 | 0 |
| 2 | 1.210 | .8264 | .4762 | .5762 | 2.100 | 1.736 | 0.476 | 0.826 |
| 3 | 1.331 | .7513 | .3021 | .4021 | 3.310 | 2.487 | 0.937 | 2.329 |
| 4 | 1.464 | .6830 | .2155 | .3155 | 4.641 | 3.170 | 1.381 | 4.378 |
| 5 | 1.611 | .6209 | .1638 | .2638 | 6.105 | 3.791 | 1.810 | 6.862 |
| 6 | 1.772 | .5645 | .1296 | .2296 | 7.716 | 4.355 | 2.224 | 9.684 |
| 7 | 1.949 | .5132 | .1054 | .2054 | 9.487 | 4.868 | 2.622 | 12.763 |

2C)

State the significance of solvency ratios. Define the two main solvency ratios.

(3)

(4)

3A) Providing restrooms at parks, zoos, and other city owned recreation facilities is a considerable expense for municipal governments. City councils usually opt for permanent restrooms in larger parks and portable restrooms in smaller ones. The cost of renting and servicing a portable restroom is \$7500 per year. In one northeastern municipality, the parks director informed the city council that the cost of constructing a permanent restroom is \$218,000 and the annual cost of maintaining it is \$12,000. He remarked that the rather high cost is due to the necessity to use expensive materials and construction techniques that are tailored to minimize damage from vandalism that often occurs in unattended public facilities. If the useful life of a permanent restroom is assumed to be 20 years, how many portable restrooms could the city afford to rent each year and break even with the cost of one permanent facility? Let the interest rate be 6% per year.

| n | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G |
|----|-------|-------|--------|--------|--------|--------|-------|--------|
| 1 | 1.060 | .9434 | 1.0000 | 1.0600 | 1.000 | 0.943 | 0 | 0 |
| 2 | 1.124 | .8900 | .4854 | .5454 | 2.060 | 1.833 | 0.485 | 0.890 |
| 3 | 1.191 | .8396 | .3141 | .3741 | 3.184 | 2.673 | 0.961 | 2.569 |
| 4 | 1.262 | .7921 | .2286 | .2886 | 4.375 | 3.465 | 1.427 | 4.945 |
| 5 | 1.338 | .7473 | .1774 | .2374 | 5.637 | 4.212 | 1.884 | 7.934 |
| 6 | 1.419 | .7050 | .1434 | .2034 | 6.975 | 4.917 | 2.330 | 11.459 |
| 7 | 1.504 | .6651 | .1191 | .1791 | 8.394 | 5.582 | 2.768 | 15.450 |
| 8 | 1.594 | .6274 | .1010 | .1610 | 9.897 | 6.210 | 3.195 | 19.841 |
| 9 | 1.689 | .5919 | .0870 | .1470 | 11.491 | 6.802 | 3.613 | 24.577 |
| 10 | 1.791 | .5584 | .0759 | .1359 | 13.181 | 7.360 | 4.022 | 29.602 |
| 11 | 1.898 | .5268 | .0668 | .1268 | 14.972 | 7.887 | 4.421 | 34.870 |
| 12 | 2.012 | .4970 | .0593 | .1193 | 16.870 | 8.384 | 4.811 | 40.337 |
| 13 | 2.133 | .4688 | .0530 | .1130 | 18.882 | 8.853 | 5.192 | 45.963 |
| 14 | 2.261 | .4423 | .0476 | .1076 | 21.015 | 9.295 | 5.564 | 51.713 |
| 15 | 2.397 | .4173 | .0430 | .1030 | 23.276 | 9.712 | 5.926 | 57.554 |
| 16 | 2.540 | .3936 | .0390 | .0990 | 25.672 | 10.106 | 6.279 | 63.459 |
| 17 | 2.693 | .3714 | .0354 | .0954 | 28.213 | 10.477 | 6.624 | 69.401 |
| 18 | 2.854 | .3503 | .0324 | .0924 | 30.906 | 10.828 | 6.960 | 75.357 |
| 19 | 3.026 | .3305 | .0296 | .0896 | 33.760 | 11.158 | 7.287 | 81.306 |
| 20 | 3.207 | .3118 | .0272 | .0872 | 36.786 | 11.470 | 7.605 | 87.230 |

3B)

Two mutually exclusive alternatives are being studied the cash flows of the same are given below. If the (3) risk adjusted MARR is 12%, determine which alternative should be selected based on internal rate of return method.

| Year | А | В |
|------|-----------|-----------|
| 0 | -\$20,000 | -\$20,000 |
| 1 | 10,000 | 10,000 |
| 2 | 5,000 | 10,000 |
| 3 | 10,000 | 10,000 |
| 4 | 6,000 | 0 |

3C)

A company is currently paying its employees Rs. 30 per kilometer to drive their own cars on company business. The (3) company is considering providing employees with cars, which would involve in purchasing at Rs. 9,00,000 with the estimated three-year life and a net salvage value of Rs. 2,00,000. Insurance is payable in the beginning of each year at a cost of Rs. 35,000 per year and operating and maintenance expenses of Rs. 1.50 per kilometre. If the interest rate is 10% and the company anticipates that employees' annual travel to be 30,000 kilometres, what is the equivalent cost per mile? Should the company continue/ not continue with its current policy? Justify.

| 10% | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G | |
|-----|-------|-------|--------|--------|-------|-------|-----|-----|--|
| 1 | 1.100 | .9091 | 1.0000 | 1.1000 | 1.000 | 0.909 | 0 | 0 | |
| | | | | | | | | | |

| 2 | 1.210 | .8264 | .4762 | .5762 | 2.100 | 1.736 | 0.476 | 0.826 |
|---|-------|-------|-------|-------|-------|-------|-------|--------|
| 3 | 1.331 | .7513 | .3021 | .4021 | 3.310 | 2.487 | 0.937 | 2.329 |
| 5 | 1.611 | .6209 | .1638 | .2638 | 6.105 | 3.791 | 1.810 | 6.862 |
| 6 | 1.772 | .5645 | .1296 | .2296 | 7.716 | 4.355 | 2.224 | 9.684 |
| 7 | 1.949 | .5132 | .1054 | .2054 | 9.487 | 4.868 | 2.622 | 12.763 |

4A)

A boring machine is to be purchased at a cost of Rs. 1,00,000.00. The following table shows the market (5) value and the expected annual operating and maintenance cost for each year of the machine's service:

| Year | Market Value at Year (₹) | Operation Cost at Year (₹) |
|------|--------------------------|----------------------------|
| 0 | 1,00,000 | - |
| 1 | 80,000 | 5,000 |
| 2 | 60,000 | 6,000 |
| 3 | 45,000 | 7,000 |
| 4 | 25,000 | 8,000 |
| 5 | 0 | 9,000 |

If the rate of return is 10%, what is the economic service life for this machine?

| n | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G |
|---|-------|-------|--------|--------|-------|-------|-------|--------|
| 1 | 1.100 | .9091 | 1.0000 | 1.1000 | 1.000 | 0.909 | 0 | 0 |
| 2 | 1.210 | .8264 | .4762 | .5762 | 2.100 | 1.736 | 0.476 | 0.826 |
| 3 | 1.331 | .7513 | .3021 | .4021 | 3.310 | 2.487 | 0.937 | 2.329 |
| 4 | 1.464 | .6830 | .2155 | .3155 | 4.641 | 3.170 | 1.381 | 4.378 |
| 5 | 1.611 | .6209 | .1638 | .2638 | 6.105 | 3.791 | 1.810 | 6.862 |
| 6 | 1.772 | .5645 | .1296 | .2296 | 7.716 | 4.355 | 2.224 | 9.684 |
| 7 | 1.949 | .5132 | .1054 | .2054 | 9.487 | 4.868 | 2.622 | 12.763 |

4B)

A large university that is currently facing severe parking problems on its campus is considering constructing parking decks off-campus. The shuttle service could pick up the students at the off-campus parking deck and transport them to various locations on campus. The university would charge a small fee for each shuttle ride, and the student could be quickly and economically transported to their classes. The funds raised by the shuttle service would be used to pay for the shuttle trolleys which would cost \$170,000 each. Each trolley has a 12-year service life within estimated salvage value of \$12,000. To operate each trolley, additional expenses will be incurred. First, drivers' annual expenses of at \$70,000, secondly, maintenance at \$15,000 and insurance costs \$5000 annually. If the student pays 10 cents (One \$ = 100 cents) for each ride, determine the annual ridership per trolley (number of shuttle rides per year) required to justify the shuttle project assuming that interest rate is 10%.

| n | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G |
|----|-------|-------|--------|--------|--------|-------|-------|--------|
| 1 | 1.100 | .9091 | 1.0000 | 1.1000 | 1.000 | 0.909 | 0 | 0 |
| 2 | 1.210 | .8264 | .4762 | .5762 | 2.100 | 1.736 | 0.476 | 0.826 |
| 3 | 1.331 | .7513 | .3021 | .4021 | 3.310 | 2.487 | 0.937 | 2.329 |
| 4 | 1.464 | .6830 | .2155 | .3155 | 4.641 | 3.170 | 1.381 | 4.378 |
| 5 | 1.611 | .6209 | .1638 | .2638 | 6.105 | 3.791 | 1.810 | 6.862 |
| 6 | 1.772 | .5645 | .1296 | .2296 | 7.716 | 4.355 | 2.224 | 9.684 |
| 7 | 1.949 | .5132 | .1054 | .2054 | 9.487 | 4.868 | 2.622 | 12.763 |
| 8 | 2.144 | .4665 | .0874 | .1874 | 11.436 | 5.335 | 3.004 | 16.029 |
| 9 | 2.358 | .4241 | .0736 | .1736 | 13.579 | 5.759 | 3.372 | 19.421 |
| 10 | 2.594 | .3855 | .0627 | .1627 | 15.937 | 6.145 | 3.725 | 22.891 |
| 11 | 2.853 | .3505 | .0540 | .1540 | 18.531 | 6.495 | 4.064 | 26.396 |
| 12 | 3.138 | .3186 | .0468 | .1468 | 21.384 | 6.814 | 4.388 | 29.901 |

4C)

200/

Mr. Kapur is planning to invest an amount of ₹10,00,000. He can invest in bank and earn a return of (2) 20% or he can invest in a land now and give this for rent. The annual rental income from land is ₹25,000 after paying tax. He is planning to sell this land after 6 years at an amount of ₹15,00,000? Is it worth investing on this land?

| 2070 | | | | | | | | |
|------|-------|-------|--------|--------|-------|-------|-------|-------|
| n | F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G |
| 1 | 1.200 | .8333 | 1.0000 | 1.2000 | 1.000 | 0.833 | 0 | 0 |
| 2 | 1.440 | .6944 | .4545 | .6545 | 2.200 | 1.528 | 0.455 | 0.694 |
| 3 | 1.728 | .5787 | .2747 | .4747 | 3.640 | 2.106 | 0.879 | 1.852 |

(3)

| 4 5 | 2.074 2.488 | .4823 .4019 | .1863 | .3863 .3344 | 5.368 7.442 | 2.589 2.991 | 1.274 | 3.299 4.906 |
|-----|----------------|----------------|-------|----------------|----------------|----------------|-------|----------------|
| 6 | 2.986 | .3349 | .1007 | .3007 | 9.930 | 3.326 | 1.979 | 6.581 |
| 7 | 3.583 | .2791 | .0774 | .2774 | 12.916 | 3.605 | 2.290 | 8.255 |
| 8 | 4.300 | .2326 | .0606 | .2606 | 16.499 | 3.837 | 2.576 | 9.883 |

5A) A company with a risk adjusted MARR of 15% must install one of two production machines that provide equivalent service (same benefits).

Machine X has an initial cost of \$40,000 with an annual operating and maintenance (O&M) cost of \$30,000 and a salvage value of \$5,000 after its 5-year life.

Machine Y has an initial cost of \$60,000 with an annual O&M cost of \$20,000 and a salvage value of \$12,000 after its 10-year life.

Which alternative must be selected using a present worth method with a study period of 13 years for the analysis?

Assume the market value of the machines is equal to the book value and the company adopts a straight line method of depreciation.

| F/P | P/F | A/F | A/P | F/A | P/A | A/G | P/G |
|-------|--|--|---|--|--|---|---|
| 1.150 | .8696 | 1.0000 | 1.1500 | 1.000 | 0.870 | 0 | 0 |
| 1.322 | .7561 | .4651 | .6151 | 2.150 | 1.626 | 0.465 | 0.756 |
| 1.521 | .6575 | .2880 | .4380 | 3.472 | 2.283 | 0.907 | 2.071 |
| 1.749 | .5718 | .2003 | .3503 | 4.993 | 2.855 | 1.326 | 3.786 |
| 2.011 | .4972 | .1483 | .2983 | 6.742 | 3.352 | 1.723 | 5.775 |
| 2.313 | .4323 | .1142 | .2642 | 8.754 | 3.784 | 2.097 | 7.937 |
| 2.660 | .3759 | .0904 | .2404 | 11.067 | 4.160 | 2.450 | 10.192 |
| 3.059 | .3269 | .0729 | .2229 | 13.727 | 4.487 | 2.781 | 12.481 |
| 3.518 | .2843 | .0596 | .2096 | 16.786 | 4.772 | 3.092 | 14.755 |
| 4.046 | .2472 | .0493 | .1993 | 20.304 | 5.019 | 3.383 | 16.979 |
| 4.652 | .2149 | .0411 | .1911 | 24.349 | 5.234 | 3.655 | 19.129 |
| 5.350 | .1869 | .0345 | .1845 | 29.002 | 5.421 | 3.908 | 21.185 |
| 6.153 | .1625 | .0291 | .1791 | 34.352 | 5.583 | 4.144 | 23.135 |
| 7.076 | .1413 | .0247 | .1747 | 40.505 | 5.724 | 4.362 | 24.972 |
| 8.137 | .1229 | .0210 | .1710 | 47.580 | 5.847 | 4.565 | 26.693 |
| | F/P 1.150 1.322 1.521 1.749 2.011 2.313 2.660 3.059 3.518 4.046 4.652 5.350 6.153 7.076 8.137 | F/P P/F 1.150 .8696 1.322 .7561 1.521 .6575 1.749 .5718 2.011 .4972 2.313 .4323 2.660 .3759 3.059 .3269 3.518 .2843 4.046 .2472 4.652 .2149 5.350 .1869 6.153 .1625 7.076 .1413 8.137 .1229 | F/P P/F A/F 1.150 .8696 1.0000 1.322 .7561 .4651 1.521 .6575 .2880 1.749 .5718 .2003 2.011 .4972 .1483 2.313 .4323 .1142 2.660 .3759 .0904 3.059 .3269 .0729 3.518 .2843 .0596 4.046 .2472 .0493 4.652 .2149 .0411 5.350 .1869 .0345 6.153 .1625 .0291 7.076 .1413 .0247 8.137 .1229 .0210 | F/P P/F A/F A/P 1.150 .8696 1.0000 1.1500 1.322 .7561 .4651 .6151 1.521 .6575 .2880 .4380 1.749 .5718 .2003 .3503 2.011 .4972 .1483 .2983 2.313 .4323 .1142 .2642 2.660 .3759 .0904 .2404 3.059 .3269 .0729 .2229 3.518 .2843 .0596 .2096 4.046 .2472 .0493 .1993 4.652 .2149 .0411 .1911 5.350 .1869 .0345 .1845 6.153 .1625 .0291 .1791 7.076 .1413 .0247 .1747 8.137 .1229 .0210 .1710 | F/P P/F A/F A/P F/A 1.150 .8696 1.0000 1.1500 1.000 1.322 .7561 .4651 .6151 2.150 1.521 .6575 .2880 .4380 3.472 1.749 .5718 .2003 .3503 4.993 2.011 .4972 .1483 .2983 6.742 2.313 .4323 .1142 .2642 8.754 2.660 .3759 .0904 .2404 11.067 3.059 .3269 .0729 .2229 13.727 3.518 .2843 .0596 .2096 16.786 4.046 .2472 .0493 .1993 20.304 4.652 .2149 .0411 .1911 24.349 5.350 .1869 .0345 .1845 29.002 6.153 .1625 .0291 .1791 34.352 7.076 .1413 .0247 .1747 40.505 8.137 | F/PP/FA/FA/PF/AP/A1.150.86961.00001.15001.0000.8701.322.7561.4651.61512.1501.6261.521.6575.2880.43803.4722.2831.749.5718.2003.35034.9932.8552.011.4972.1483.29836.7423.3522.313.4323.1142.26428.7543.7842.660.3759.0904.240411.0674.1603.059.3269.0729.222913.7274.4873.518.2843.0596.209616.7864.7724.046.2472.0493.199320.3045.0194.652.2149.0411.191124.3495.2345.350.1869.0345.184529.0025.4216.153.1625.0291.179134.3525.5837.076.1413.0247.174740.5055.7248.137.1229.0210.171047.5805.847 | F/PP/FA/FA/PF/AP/AA/G1.150.86961.00001.15001.0000.87001.322.7561.4651.61512.1501.6260.4651.521.6575.2880.43803.4722.2830.9071.749.5718.2003.35034.9932.8551.3262.011.4972.1483.29836.7423.3521.7232.313.4323.1142.26428.7543.7842.0972.660.3759.0904.240411.0674.1602.4503.059.3269.0729.222913.7274.4872.7813.518.2843.0596.209616.7864.7723.0924.046.2472.0493.199320.3045.0193.3834.652.2149.0411.191124.3495.2343.6555.350.1869.0345.184529.0025.4213.9086.153.1625.0291.179134.3525.5834.1447.076.1413.0247.174740.5055.7244.3628.137.1229.0210.171047.5805.8474.565 |

5B)

15%

You have been hired as an analyst for Mellon Bank and your team is working on an independent assessment of Daffy Duck Food Inc. (DDF Inc.) DDF Inc. is a firm that specializes in the production of freshly imported farm products from France. Your assistant has provided you with the following data for Flipper Inc. and their industry.

| Ratio | 1999 | 1998 | 1997 | 1999- Industry Average |
|----------------|------|------|------|------------------------------|
| Long-term debt | 0.45 | 0.40 | 0.35 | 0.35 |

(4)

(3)

| Inventory Turnover | 62.65 | 42.42 | 32.25 | 53.25 |
|-----------------------|-------|-------|-------|--------|
| Depreciation/Total | 0.25 | 0.014 | 0.018 | 0.015 |
| Assets | | | | |
| Days' sales in | 113 | 98 | 94 | 130.25 |
| receivables | | | | |
| Debt to Equity | 0.75 | 0.85 | 0.90 | 0.88 |
| Profit Margin | 0.082 | 0.07 | 0.06 | 0.075 |
| Total Asset Turnover | 0.54 | 0.65 | 0.70 | 0.40 |
| Quick Ratio | 1.028 | 1.03 | 1.029 | 1.031 |
| Current Ratio | 1.33 | 1.21 | 1.15 | 1.25 |
| Times Interest Earned | 0.9 | 4.375 | 4.45 | 4.65 |
| Equity Multiplier | 1.75 | 1.85 | 1.90 | 1.88 |

In the annual report to the shareholders, the CEO of Flipper Inc. wrote, "1997 was a good year for the firm with respect to our ability to meet our short-term obligations. We had higher liquidity largely due to an increase in highly liquid current assets (cash, account receivables and short-term marketable securities)." Is the CEO correct? Explain and use only relevant information in your analysis.

The financial statements of a company contain the following information for the year ending 31st March, (3) 2014:

| Particulars | ₹ | | | |
|---|-----------|--|--|--|
| Cash | 1,60,000 | | | |
| Sundry Debtors | 4,00,000 | | | |
| Short-term Investment | 3,20,000 | | | |
| Stock | 21,60,000 | | | |
| Prepaid Expenses | 10,000 | | | |
| Total Current Assets | 30,50,000 | | | |
| Current Liabilities | 10,00,000 | | | |
| 10% Debentures | 16,00,000 | | | |
| Equity Share Capital | 20,00,000 | | | |
| Retained Earnings | 8,00,000 | | | |
| Statement of Profit for the year ended 31st March, 2014 | | | | |
| Sales (20% cash sales) | 40,00,000 | | | |
| Less: Cost of goods sold | 28,00,000 | | | |
| Profit before Interest & Tax | 12,00,000 | | | |
| Less: Interest | 1,60,000 | | | |
| Profit before tax | 10,40,000 | | | |
| Less: Tax @ 30% | 3,12,000 | | | |
| Profit After Tax | 7,28,000 | | | |

You are required to calculate:

i) Quick Ratio

ii) Debt-equity Ratio

iii) Average collection period (Assuming 360 days in a year).

-----End-----