Question Paper

Exam Date & Time: 13-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH. (COMPUTER SCIENCE AND ENGINEERING/ INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - JUNE 2024

SUBJECT: HUM 3051/HUM_3051 - ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

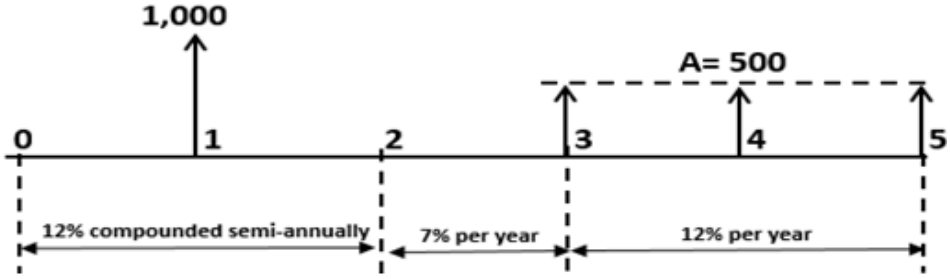
Marks: 50 **Duration: 180 mins.**

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.

1A) A loan of ₹40,00,000 requires monthly payments of ₹50,800 over a 30-year period of time. These payments include both principal and interest. (4)
i) What is the effective interest rate on the payment period (i.e. monthly) for this loan?
ii) What is the effective interest rate on yearly basis?
iii) Determine the unpaid loan amount after 20 years.

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



1C) If ₹5024 is a single deposited amount in a savings account at an interest rate of 10% per annum, then estimate the following: (3)
i) The amount that can be withdrawn from this account at the end of every 10 years which continues forever.
ii) If this withdrawal amount at the end of every 10 years is invested in an account growing at 10%, determine the total accumulated amount after 40 years.

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
31	19.194	.0521	.00550	.1055	181.944	9.479	8.296	78.640
32	21.114	.0474	.00497	.1050	201.138	9.526	8.409	80.108
33	23.225	.0431	.00450	.1045	222.252	9.569	8.515	81.486
34	25.548	.0391	.00407	.1041	245.477	9.609	8.615	82.777
35	28.102	.0356	.00369	.1037	271.025	9.644	8.709	83.987
40	45.259	.0221	.00226	.1023	442.593	9.779	9.096	88.953
45	72.891	.0137	.00139	.1014	718.905	9.863	9.374	92.454

2A) An equipment was purchased in 2009 for ₹8,50,000 and is depreciated by the declining balance (DBM) method. It has an expected life of 12 years with salvage value of ₹2,50,000. (4)

i) What is the book value of the equipment at the end of 2014?

ii) Determine the depreciation charge and book value at the end of 2018.

2B) A certain machine is past half its life and currently has four more years of useful life left with zero salvage value at the end of its useful life. Its purchase price was $9,200. Operating costs are estimated at $6,000 yearly. An equipment vendor has now agreed to offer an amount of $3,600 as trade-value for the old machine and $2,800 if it is traded-in in one year. The vendor offers a new machine to perform the same function as the old machine. Its purchase price is $14,000 and it will have an estimated operating cost of $4,500 per year and a salvage value of $3,000 at the end of four years. If the minimum return on the investment is 10%. If the company does not want to replace the existing machine now, but wants to consider replacement the next year, is it advisable to replace the machine one year from now? Use Outsider's point of view approach. (4)

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
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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) Helen can earn 10% interest in her savings account. Her daughter Roberta is 11 years old today. Suppose Helen deposits $4000 today, and then makes an annual deposit of $500 after one year and then increasing this amount by $500 each year until she makes her last deposit on Roberta's 18th birthday. How much is the accumulated deposit after the 18th birthday? (2)

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
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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
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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

3A) A small aerospace company is evaluating two alternatives: the purchase of an automatic feed machine and a manual feed machine for a finishing process. (4)

The auto feed machine has an initial cost of $23,000, an estimated salvage value of $4000, and a predicted life of 10 years. One person will operate the machine at a rate of $12 per hour. The expected output is 8 tons per hour. Annual maintenance and operating cost is expected to be $3500.

The alternative manual feed machine has a first cost of $8000, no expected salvage value, a 5-year life, and an output of 6 tons per hour. However, three workers will be required at $8 per hour each. The machine will have an annual maintenance and operation cost of $1500.

All projects are expected to generate a return of 10% per year. How many tons per year must be finished to justify the higher purchase cost of the auto feed machine?

10%

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1	1.100	.9091	1.0000	1.1000	1.000	0.909	0	0
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3B) Hewtonics Innovations, a manufacturer of advanced medical devices, is considering two different machines for a crucial sterilization process. Both machines can effectively perform the desired function ensuring the safety and effectiveness of the medical devices. Company's risk adjusted MARR is 12% per year. (3)

i) Tabulate the incremental cash flow.

ii) Recommend the best choice based on incremental rate of return analysis.

	SteriClean Pro	MediSteril Advance
First cost, $	-275,000	-250,000
Annual operating cost, $ per year	-138,000	-142,000
Salvage value, $	77,000	36,000
Life, years	7	7

3C) The following accounting information and financial ratios of Mry Limited relate to the year ended 31st March, 2023: (3)

- Inventory Turnover Ratio: 6 Times
- Debtors Turnover Ratio: 8 Times
- Gross Profit Ratio: 25%
- Total sales Rs. 30,00,000;
- Cash sales 25% of credit sales;
- Cash purchases Rs. 2,30,000;
- Closing inventory is Rs. 80,000 more than opening inventory.

You are required to calculate:

i) Average Inventory

ii) Average Debtors

iii) Average Collection Period

4A) A special-purpose machine is to be purchased at a cost of $15,000. The following table shows the expected annual operating and maintenance cost and the salvage values for each year of the machine's service: (5)

Years of Service	O&M Costs	Market Value
1	$2500	$9500
2	$3200	$8100
3	$5300	$5200
4	$6500	$3500
5	$7800	$0

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

10%

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4B) An automobile that runs on electricity can be purchased for $25,000. The automobile is estimated to have a life of 12 years with annual travel of 20,000 miles. Every three years, a new set of batteries will have to be purchased at a cost of $3000. Annual maintenance of the vehicle is estimated at $700. The cost of recharging the battery is estimated at 0.015 per mile. The salvage value of the batteries and the vehicle with the end of 12 years estimated to be $2000. Suppose the MARR is 10%, what is the cost per mile to own and operate this vehicle based on the preceding estimates? (3)

(Please note: The $3000 cost of the batteries is the net value with the old batteries traded in for the new ones).

10%

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4C) A credit card company charges interest at the rate of 3% per month on the unpaid balance. Calculate the effective interest rate for: (2)

i) Quarterly payments.

ii) Semi-annual payments.

5A) The data for the two alternatives are as follows (just including initial cost and salvage values): (4)

	Alternative X	Alternative Y
Initial cost	$15,000	$22,000
Life	4 years	6 years
Salvage Value at Life	$2,000	$1,000

Using a present worth method with a study period of 10 years, and an**interest rate of 10%**, determine which alternative should be selected.

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

10%

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5B) The following accounting information and financial ratios of Mry Limited relate to the year ended 31st March, 2023: (4)

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- Cash purchases Rs. 2,30,000;
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You are required to calculate:

i) Average Inventory.

ii) Average Debtors.

iii) Credit Sales Value.

iv) Average Collection Period.

5C) A design-to-cost approach to product pricing involves determining the selling price of the product and then figuring out if it can be made at a cost lower than that. Banner Engineering's QT50R radar-based sensor features frequency-modulated technology to accurately monitor or detect objects up to 15 miles away while resisting rain, wind, humidity, and extreme temperatures. It has a selling price of $589, and the variable cost of manufacturing the unit is $340. (2)

i) What could the company's fixed cost per year be in order for Banner to break even with sales of 9000 units per year?

ii) The company expects an uncertain risk scenario (pessimistic) with selling price dropping to $450 and variable cost increasing to $375, in this situation what would be the fixed cost per year to break-even if the sales remains unchanged at 9000 units per year.

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