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BSc.Eng/6th Sem. (ME) 7 March 2024 (10:00-11:30 AM)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination — Summer Semester, A.Y. 2022-2023
Course No. IPE 4639 — Time : 1½ hours
Course Title: Engineering Economy and Finance — Full Marks : 75

There are **3** (Three) Questions. Answer all of them.
Use the graph paper wherever necessary. Marks in the margin indicate the full marks.

1a) You are going to be an engineer. Discuss the engineering profession from the point of its meaning/s, role/s, and process. How are you going to be ready for this profession? Use the keywords or key points but write adequately. — 8 PO1

b) Give reason on the *relevance* of registering this course (Engineering Economy and Finance) for Mechanical Engineering students. — 5 PO1

c) Explain the scope of engineering costs and cost estimation. — 6 PO1

d) Explain the purpose of engineering education and profession from the points of ethical and moral orientation to all concerned. Give due focus on the key aspects. — 6 PO8 All CO1

2a) Suppose you are thinking of producing an electronic timing switch, the direct material, direct labor, and direct overhead costs per unit have been estimated to be Tk50, Tk8 and Tk4 respectively. The selling price is decided to be 138 percent of the variable cost per unit. The maximum capacity of the firm is 160,000 units per year. Its fixed cost is Tk2,024,000 per year. For this firm: — 10 CO1 PO11

i. Find the breakeven quantity in units and in percentage of total capacity.
ii. Calculate the percentage reduction in breakeven point if fixed costs are reduced 10 percent.
iii.... if variable cost per unit is reduced 10 percent.
iv.... if both costs are reduced 10 percent; and if the selling price is increased by 10 percent.

b) When the revenue and the total cost functions are respectively $R = 1000Q - 0.001Q^2$, and $TC = 0.005Q^2 + 4Q + 20000$. — 10 CO1 PO11

i. Formulate the profit function. State the fixed cost.
ii. Calculate the quantity you must produce to maximize profit.
iii. Determine the break-even volume, BEP(Q) and break-even cost.
iv. Find the quantity to be produced to maintain the average cost. Make comment/s on acceptable result.

c) Explaining the meaning and purpose of present value of money, highlight its significance in engineering economic analysis. Give the answer sufficiently. — 5 CO2 PO2

3a) A manufacturer plans to borrow BDT20,000 from a bank for one year at 9% interest to buy new shovel equipment. Apply simple and compound interest calculations separately and — 8 CO2 PO11

i. Compute the interest and the total amount due to after 1, 3 and 5 years. Show the results in tabular form.
ii. Construct a cash flow diagram (column graph) that shows the original amount and total amount due to after these years when applied the given interest rate (side-by-side both simple and compound amounts). Comment on the differences.

b) An investment of $10,000 can be made that will produce uniform annual revenue of $5,310 for five years and then have a positive salvage value of $2,000 at the end of year 5. Annual operating and maintenance expenses for the project will be $3,000 at the end of each year. Draw a cash flow diagram for the 5-year life of the project. In a table, show the net cash flows and cumulative cash flow from beginning to the end of the project. Determine the present worth when the discounted rate is 9%. 8 CO2 PO11

c) A man plans to invest the money by depositing $500/year from now. He has ensured that this deposit will increase by $100 yearly for ten years. All possible cash flow diagrams and compute 9 CO2 PO11

i. The present value of this investment when the rate of interest 5% per year, and
ii. The value of the annual amounts equivalent to this annually invested money.

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608 APPENDIX C: COMPOUND INTEREST TABLES

5% Compound Interest Factors 5%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor Find F Given P	Present Worth Factor Find P Given F	Sinking Fund Factor Find A Given F	Capital Recovery Factor Find A Given P	Compound Amount Factor Find F Given A	Present Worth Factor Find P Given A	Gradient Uniform Series Find A Given G	Gradient Present Worth Find P Given G	
n	F/P	P/F	A/F	A/P	F/A	P/A	A/G	P/G	n
1	1.050	.9524	1.0000	1.0500	1.000	0.952	0	0	1
2	1.102	.9070	.4878	.5378	2.050	1.859	0.488	0.907	2
3	1.158	.8638	.3172	.3672	3.152	2.723	0.967	2.635	3
4	1.216	.8227	.2320	.2820	4.310	3.546	1.439	5.103	4
5	1.276	.7835	.1810	.2310	5.526	4.329	1.902	8.237	5
6	1.340	.7462	.1470	.1970	6.802	5.076	2.358	11.968	6
7	1.407	.7107	.1228	.1728	8.142	5.786	2.805	16.232	7
8	1.477	.6768	.1047	.1547	9.549	6.463	3.244	20.970	8
9	1.551	.6446	.0907	.1407	11.027	7.108	3.676	26.127	9
10	1.629	.6139	.0795	.1295	12.578	7.722	4.099	31.652	10

9% Compound Interest Factors 9%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor Find F Given P	Present Worth Factor Find P Given F	Sinking Fund Factor Find A Given F	Capital Recovery Factor Find A Given P	Compound Amount Factor Find F Given A	Present Worth Factor Find P Given A	Gradient Uniform Series Find A Given G	Gradient Present Worth Find P Given G	
n	F/P	P/F	A/F	A/P	F/A	P/A	A/G	P/G	n
1	1.090	.9174	1.0000	1.0900	1.000	0.917	0	0	1
2	1.188	.8417	.4785	.5685	2.090	1.759	0.478	0.842	2
3	1.295	.7722	.3051	.3951	3.278	2.531	0.943	2.386	3
4	1.412	.7084	.2187	.3087	4.573	3.240	1.393	4.511	4
5	1.539	.6499	.1671	.2571	5.985	3.890	1.828	7.111	5
6	1.677	.5963	.1329	.2229	7.523	4.486	2.250	10.092	6
7	1.828	.5470	.1087	.1987	9.200	5.033	2.657	13.375	7
8	1.993	.5019	.0907	.1807	11.028	5.535	3.051	16.888	8

Factor by which to multiply the "Given"	Factor functional symbol	Factor by which to multiply the "Given"	Factor functional symbol
$[(1+i)^n-1]/i$	$(F/A, i\%, n)$	$\frac{i}{(1+i)^n-1}$	$(A/F, i\%, n)$
$[(1+i)^n-1]/i(1+i)^n$	$(P/A, i\%, n)$	$\frac{i(1+i)^n}{(1+i)^n-1}$	$(A/P, i\%, n)$

$$F = \frac{G}{i}\left[\frac{(1+i)^n-1}{i}\right] - \frac{nG}{i} = \frac{G}{i}\left(\frac{F}{G}, i\%, n\right) - \frac{nG}{i} \qquad A = G\left[\frac{1}{i} - \frac{n}{(1+i)^n-1}\right] = G\left(\frac{A}{G}, i\%, n\right) \qquad P = A\left(\frac{P}{A}, i\%, n\right)$$

$$= G\left[\frac{1}{i} - \frac{n}{(1+i)^n-1}\right]\left[\frac{(1+i)^n-1}{i(1+i)^n}\right]$$