BSc.Eng/5th Sem.(IPE)   11 October 2023 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING
Mid-Semester Examination   Winter Semester, A.Y. 2022-2023
Course No. IPE 4539   Time   : 1½ hours
Course Title: Engineering Economy and Finance   Full Marks   : 75

There are **4** (Four) Questions. Answers to questions numbered 1 and 4 are compulsory. Answer either question 2 or 3. Answer **3** (Three) questions altogether.
Use the graph paper wherever necessary. Marks in the margin indicate the full marks. CO/PO shown.

1	a)	*Describe* an engineer's profession (meaning/s, role/s, engineering process). Use the keywords or key points but write adequately.	6 CO1
	b)	Engineering education teaches students the concept "systems" in every field for the benefit of mankind. "Islam is the all-embracing knowledge-based System of life given by the Creator and Sustainer". *Explain* the statement relating to the scope of knowledge of engineering for the overall benefit of all creatures and natural ecosystems.	7 PO1 PO8
	c)	*State* the function of engineering economics. Point out the *relevance* of your registering for this course (Engineering Economy and Finance).	6 CO1 PO1
	d)	*State* the meaning, scope/types, and importance of engineering economic decisions.	6 CO1 PO1

2	a)	A company producing some engineering products is following the budgetary timeline of the respective country, which is July to June of the consecutive calendar years. Its production data is given in Table below:	15 CO1 CO2 PO2

Period (month)	Volume of production/activity ('000' units)	Total costs of production in Tk. (million)	Total fixed cost	Total variable cost	Remark
July 2020	29	39.6			
August	32	40.95			
September	38	47.7			
October	15	22.5			
November	45	61			
December	35	44.1			
January '21	30	41.4			
February	22	27			
March	33	43.2			
April	39	49.5			
May	41	51.3			
June	24	27.9			

i.   *Draw* the data in a graph paper (total cost vs volume, not total cost vs period) and locate the high and low activity levels in terms of production volume and cost involved (months).

ii. Then, *determine* the variable cost per unit (v) and the total fixed cost (F).

iii. *Show* the results in an equation in the form $y = c + vx$, where y stands for the total cost or revenue, c stands for fixed costs, v stands for variable costs per unit and x stands for volume of activity (units).

iv. *Verify* the results (fixed costs and variable costs per unit) found from graphical solution and analytical solution. *Complete* the table in your answer sheet.

b) When the revenue and the total cost functions are respectively $R = 1000Q - 0.001Q^3$, and $TC = 0.005Q^2 + 4Q + 20000$. **10 CO1 PO2**

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

Q3 is the alternative of Q2 (answer either one)

3 a) 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 PO2**

   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) *State* the top five features of the present value of money. Cite example/s. **5 CO2 PO2**

c) Explaining the meaning and purposes with examples *state* at least three main differences between Future value and annuity. **5 CO2 PO2**

d) *State* the main similarities and differences between an annual interest rate and effective annual interest rate. **5 CO2 PO2**

4 a) Money to be invested in engineering projects over the time bears or possesses the following issues: Riba, cost of money, opportunity cost, equivalence, and optimal investment for human benefits. *Describe* each of them. **7 CO2 PO11**

b) All undergraduate IPE students are required to complete one 3-credit-hour course on engineering economics and finance that is tends to focus on comparison of alternatives. Present worth (PW) analysis is a popular method used for comparing two or more alternatives for economic comparisons. *Explain* how this method is applied in selecting an IPE project out of two or more alternatives. [Hint: mention what must be required/considered, what theories should be applied, and how to reach a conclusion.] **7 CO2 PO11**

c) A coal-based power plant wants to buy coal from a new coal mine. The price of coal is changing. However, a team estimated profits over the next 5 years as below: Tk 200,000, 450,000, 20,000, 400,000 and 100,000 respectively. After that profits will be a constant amount of Tk 250,000 per year for the following 10 years, at which time the mine must be closed. The going discounted rate is 10%, found appropriate for the all these years; *find* the present value of the mine and suggest if it is economically feasible. *Draw* the necessary cash flow diagram/s. Suppose, plant manager asked you to find overall annual profit in terms of annuity at 10%, *determine* that annuity along with a cash flow diagram. **13 CO2 PO11**

00000