KATHMANDU UNIVERSITY
End Semester Examination [C]
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Level : B. E./ B. Sc./B. Pharm./B. Tech.
Year : III
Time : 2 hrs. 30 mins.

Course : MGTS 301
Semester : I
F. M. : 55

SECTION "B"

Attempt **ALL** the questions.

Missing parameters can be assumed suitably.

1 **a.** What is economics? Illustrate its importance to technical managers? **[2]**

b. A refinisher of antiques named Constance has been so successful with her small business that she is planning to expand her shop with all new equipment. She is going to start enlarging her shop by purchasing the following equipment. **[5]**

Equipment	Size		Cost of Original Equipment	Power Sizing Exponent	Cost Index	
	Original	New Equipment			When originally purchased	Today
Vanish bath	50 gal	75 gal	$3500	0.80	154	171
Power scraper	¾ hp	1.5 hp	$250	0.22	780	900
Paint booth	3 ft^3	12 ft^3	$3000	0.6	49	76

What would be the overall net cost (total cost) to Constance to obtain the new equipment in each of the following situations.
(i) Assume that she can sale the old equipment in 15% of its original cost. Also assume that the relative price to purchase the new equipment has not changed over time.
(ii) Assume the prices for the equipment that Constance wants to replace have not been constant. Use the cost index data for each piece of equipment to update the costs to the price that would be paid today. Again assume that she can sale the old equipment for in 15% of its original cost.

c. A company produces and sells a product and fixed costs of the company are Rs. 6,000 and variable cost is Rs. 25 per unit, and sells the product at Rs. 50 per unit. [*Please note that, function means equation*] **[3]**
(i) Find the total cost function.
(ii) Find the total revenue function.
(iii) Find the profit function, and determine the profit when 1000 units are sold.
(iv) How many units have to be produced and sold to yield a profit of Rs. 10,000?

2 **a.** What single amount on April 1, 1998, is equivalent to a series of equal, semiannual cash flows of $1000 that starts with a cash flow on January 1, 1996, and ends with a cash flow on January 1, 2005? The interest rate is 14% and compounding is quarterly. **[3]**

b. We want to donate a marble birdbath to the city park as a memorial to our cat, Fred, while he can still enjoy it. We also want to set up a perpetual care fund to cover future expenses "forever." The initial cost of the bath is $5000. Routine annual operating costs are $200 per year, but every fifth year the cost .will be $500 to cover major cleaning and maintenance as well as operation. **[4]**
(i) What is the present worth (capitalized cost) of this project if the interest rate is 8%?
(ii) How much is the present worth of this project if it is to be demolished after 75 years? The final $500 payment in the 75th year will cover the year's operating cost and the site reclamation.

c. A small company heats its building and spends $8000 per year on natural gas for this purpose. Cost increases of natural gas expected to be 10% per year starting one year from now (i.e. the first cash flow is $8000 at EOY one). Their maintenance on the gas furnace is $400 per year, and this expense is expected to increase by 10% per year starting one year from now. If the planning horizon is 10 years, what is the total annual equivalent expense for operating and maintaining the furnace? The interest rate is 18% per year. [3]

3 a. A steam generation system at a biomass-fueled power plant uses an electrostatic precipitator (ESP) to clean its gaseous effluents. The power plant has consistently made use of the same type of ESP over the past several years. The installed cost of a new ESP has been relatively constant at $80,000. Records of operation and maintenance expenses indicate the following average expenses per year as a function of the age of the ESP. The MVs of the ESP are also reasonably well known as a function of age. Determine the best time to replace the ESP if the MARR is 15% per year. [5]

Year	1	2	3	4	5
O&M expense	$30,000	$30,000	$35,000	$40,000	$45,000
Market value	$60,000	$50,000	$40,000	$25,000	$12,500

b. Using payback period method, select the best project among the following projects. [2.5]

	Project A		Project B	
	Revenues	Outlays	Revenues	Outlays
Year 0		500,000		500,000
Year 1	50,000		75,000	
Year 2	150,000		100,000	
Year 3	350,000		150,000	
Year 4	600,000		150,000	
Year 5	500,000		900,000	

c. A manufacturing firm has a minimum attractive rate of return (MARR) of 12% on new investments. What uniform annual benefit would Investment B have to generate to make it preferable to Investment A? [2.5]

Year	Investment A	Investment B
0	-$60,000	-$45,000
1-6	+15,000	?

4 a. Swagelok Co. of Solon, Ohio, makes variable area flow meters (VAFs) that measure liquid and gas flow rates by means of a tapered tube and float. If tooling and setup costs were $400,000 in year 0 and an additional $190,000 in year 3, determine the external rate of return using the modified rate of return approach. The revenue was $160,000 per year in years 1 through 10. Assume the company's MARR (investing rate) is 20% per year and its cost of capital (borrowing rate) is 9% per year. [4]

b. Illustrate with suitable example the importance of B/C analysis in public projects. Explain that the added benefit is similar to the reduced cost in B/C analysis. [2]

c. A firm is trying to decide which of two devices to install to reduce costs in a particular situation. Both devices cost $1000 and have useful lives of 5 years and no salvage value. Device A can be expected to result in $300 savings annually. Device B will provide cost savings of $400 the first year, but savings will decline by $50 annually, making the second year savings $350, the third-year savings $300, and so forth. With interest at 7%, which device should the firm purchase? Use Benefit-Cost Ratio method. [4]

5 **a.** Explain the basic requirements for a property to be characterized as depreciable property. **[1+3]**
Consider a $6500 piece of machinery, with a 5-year depreciable life and an estimated $1200 salvage value. The projected utilization of the machinery when it was purchased, and its actual production to date, are shown below.

Year	Projected Production (tons)	Actual Production (tons)
1	3500	3000
2	4000	5000
3	4500	
4	5000	
5	5500	

Compute the machinery depreciation schedule by each of the following methods:
(i) Double declining balance.
(ii) Unit of production (for first 2 years only).

b. A new online patient diagnostics system for surgeons will cost $200,000 to install, cost $5000 annually to maintain and will have an expected life of 5 years. The added revenue is estimated to be $60,000 per year, and the MARR is 10% per year. Examine the sensitivity of present worth to variation in selected parameter estimates, while others remain constant. **[6]**

Sensitivity to first cost variation: $150,000 to $250,000 (−25% to +25%).
Sensitivity to revenue variation: $45,000 to $75,000 (−25% to +25%).
Sensitivity to life variation: 4 years to 7 years (−20% to 40%).

Plot the results on a single graph and comment on the relative sensitivity of each parameter.

6 **Write short notes on (any two)** **[5]**
a. Integrated approach to develop net cash flow
b. Various types of costs associated with manufacturing industry
c. Reasons for replacement analysis

Use following formulas if needed:
Uniform series
$(F/A, i, N) = \{(1+i)^N - 1\}/ i$
$(P/A, i, N) = \{(1+i)^N - 1\}/\{i (1+i)^N\}$
$(A/F, i, N) = i/\{(1+i)^N - 1\}$
$(A/P, i, N) = i(1+i)^N /\{(1+i)^N -1\}$

Gradient series
$(A/G, i, N) = [\{(1+i)^N - iN-1\}/i\{(1+i)^N - 1\}]$
$(P/G, i, N) = [\{(1+i)^N - iN-1\}/i^2 (1+i)^N]$
$(P/A_1, g, i, N) = [\{1-(1+g)^N (1+i)^{-N}\}/(i - g)]$ if $i \neq g$
$(P/A_1, g, i, N) = \{N/ (1+i)\}$ if $i=g$