CHAPTER 2
ESTIMATING ENGINEERING COSTS AND BENEFITS

Reference: Table 1
Tech Engineering in TN is making a product for the overseas market.
The following cost data for the product has been compiled.

Item	Cost
Selling price	$167
Materials and purchased parts	$25/unit
Direct Labor	2 hrs at $20 per hour
Fixed Cost	$1,400,000

2.1. If the overhead expenses are charged at 80 % of labor cost, determine the manufacturing cost per unit.
A) $72

B) $97

C) $65

D) None of these

Answer: B **Refer to: Table 1**
Feedback: Total manufacturing cost = Materials cost + Direct labor cost + overhead cost
= $25 + 2×20 + 0.80×2×20 = $97

2.2. The breakeven volume for this product is _____.
A) 14,433

B) 8,383

C) 20,000

D) None of these

Answer: C **Refer to: Table 1**
Feedback:
Total revenue = Total cost = Fixed cost + variable cost
167X = 1,400,000 + 97X
X = 1,400,000 /(167-97) = 20,000 Units.

2.3. What is the profit per unit if 30,000 units are sold?
A) $23.33

B) $20.81

C) $24.35

D) None of these

Answer: A **Refer to: Table 1**
Feedback:
Total profit = Total revenue - Total cost
= 30,000 × 167 – (1,400,000+ 97×30,000) = $700,000
Profit per unit = 700,000/30,000 = $23.33

2.4. To reduce the breakeven volume to 15,000 units, what should be the selling price?
A) $210.33
B) $190.33
C) $241.35
D) None of these

Answer: B **Refer to: Table 1**
Feedback: Total revenue = Total cost = Fixed cost + variable cost
Y × 15,000 = 1,400,000 + 97 × 15,000
Y = (1,400,000 + 97×15,000) /15,000 = $190.33

2.5. A 2000-gallon metal tank to store hazardous materials was bought 15 years ago at cost of $100,000. What will a 5,000-gallon tank cost today if the power–sizing exponent is 0.57 and the construction cost index for such facilities has increased from 180 to 600 over the last 15 years? Choose the closest value.
A) $337,175
B) $666,667
C) $561,960
D) None of these.

Answer: C
Feedback:
Cost of a 5000-gallon tank without cost index = $100{,}000\ (5{,}000/2{,}000)^{0.57} = \$168{,}588$
Cost of a 5000-gallon tank today with the cost index = (600/180)168,588 = $561,960

Reference: Case Study 2

A product that is very labor intensive assembled at Boyds Aero Structure in Memphis has an average labor cost of $20/hr. Overhead expenses are charged at 100% of labor at this company.
Time for the very first unit = 10 hours
Time for the fourth unit = 8.1 hours.

2.6. The learning curve percentage for this operation is _____.

A) 90%
B) 85%
C) 95%
D) 75%

Answer: A **Refer to: Case Study 2**
Solution:

y_4= 10(4)^n
8.1= 10(4)^n
4^n= 8.1/10=.81
n = -.0.1521

learning curve % = 90%

2.7. What is the cumulative time for 100 units to be made?
A) 869.12 hrs
B) 581.33 hrs
C) 761.84 hrs
D) 621.68 hrs

Answer: B **Refer to: Case Study 2**
Solution: Time for the first unit = 10 hrs
Cumulative time for 100 units = $\{10 \times [(100+0.5)^{(1-0.1521}$ - $(0.5)^{(1-0.1521}]/ (1-0.1521)\}$
= 581.33 hrs.

2.8 What is the labor cost and overhead cost for the 500–th unit?
A) $162.30
B) $155.44
C) $139.88
D) $175.23

Answer: B **Refer to: Case Study 2**
Feedback:
Time for the 500 units = 10 $(500)^{-0.1521}$ = 3.8858 hrs
Labor cost for the 500-th unit = 3.8858 (20) = $77.72
Labor and overhead costs = $77.72+77.72 = $155.44.88

True/False

2.9. The learning curve percentage is 80% if the learning curve exponent is given as -0.3214.

Answer: True
Feedback: -0.3214 = log (learning curve expressed as a decimal) / log 2.0
Learning curve expressed as a decimal = 10^((log 2.0) * (-0.3214)) =0.80 or 80%

2.10. The breakeven volume is the quantity for which the unit cost is minimized.

Answer: False

Feedback: The breakeven volume is the quantity for which the total revenue is exactly equal to the total cost, both fixed cost plus variable cost.

2.11. Sunk costs must be ignored in engineering economic decision making as sunk costs are money
already spent and do not have any consequence on decision making.

Answer: True
Solution: Costs incurred in the past do not make a difference.

2.12. An opportunity cost is associated with using a resource in one activity instead of another.

Answer: True
Feedback: The amount of resources used in one activity cannot be used in another activity.

2.13. Life cycle costs (LCC) are costs incurred on a product from cradle to grave, (i.e) concept generation to retirement.

Answer: True
Feedback: The cost increased from concept generation to retirement of a product is life cycle cost.