DAYANANDA SAGAR COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

(Accredited by NBA)

Accredited by National Assessment & Accreditation Council (NAAC) with 'A' Grade

(AICTE Approved, an Autonomous Institute Affiliated to VTU, Belagavi)

Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-560078

SUBJECT	**Engineering Economics**
SEMESTER	6th
SUBJECT CODE	19HS6ICEEM
FACULTY	Dr. Vivek Bhandarkar V N

Engineering Economics	
Sub Code: 19HS6ICEEM	CIE: 50
Hrs/ Week: 3	SEE: 50
Total Hrs: 50	Credits: 3

Module 4

Depreciation: Causes of Depreciation, Basic methods of computing Depreciation charges: Straight line method of depreciation, Declining balance method, Sum of year's digits method and Sinking fund method.

Breakeven analysis: Introduction to breakeven analysis, calculation of BEQ, BEP, Numerical Exercises.

Module 5

Replacement Analysis: Deterioration, obsolescence, inadequacy, Economic life for cycle replacements, individual replacement, Numerical Exercises.

Costing: Elements of cost, Components of cost, preparation of cost sheet, Numerical Exercises..

Engineering Economics

Sub Code: 19HS6ICEEM	CIE: 50
Hrs/ Week: 3	SEE: 50
Total Hrs: 50	Credits: 3

SELF-STUDY COMPONENT/ASSIGNMENT:

Unit-1: Law of demand and supply, Law of returns.
Unit-2: Comparison of assets with infinite lives.
Unit-3: Rate of return calculations by using ERR method.
Unit-4: Depreciation computations by using double declining balance method
Unit-5: Group replacement analysis.

TEXT BOOKS:

1. RIGGS J.L., Engineering economy, McGraw Hill, 2002
2. R PANEERSELVAM, Engineering Economics, PHI, Eastern Economy Edition, 2013.
3. NAIDU, BABU & RAJENDRA, Engineering Economy, New Age international Publishers, 2006
4. M N Arora, Priyanka Katyal, Cost Accounting, Vikas Publishing house, 2nd Revised Edition, 2016

Engineering Economics

Sub Code: 19HS6ICEEM	CIE: 50
Hrs/ Week: 3	SEE: 50
Total Hrs: 50	Credits: 3

REFERENCE BOOKS:

1. TARACHAND, Engineering Economy, 2000
2. TUESEN.G. Engineering Economy, PHI, 9th edition, 2009.

Engineering Economics

Sub Code: 19HS6ICEEM	CIE: 50
Hrs/ Week: 3	SEE: 50
Total Hrs: 50	Credits: 3

Course outcome	
CO1	Identify the importance and role of engineering economy in investment decisions.
CO2	Understand the techniques of cash flows and interest calculations
CO3	Use present, annual & future worth comparisons for evaluation of investment decisions
CO4	Analyze and determine the various rates of reruns for different investments.
CO5	Plan a depreciation schedule for an asset and make break even decisions
CO6	Recommend decisions on replacement of equipment and assess the cost of product by considering the various elements of cost.

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Module 4: Breakeven analysis:

Module 4: Breakeven analysis:

- A breakeven analysis is used to determine how much sales volume your business needs to start making a profit.
- Breakeven analysis examines the short run relationship between changes in volume and changes in total sales revenue, expenses and net profit
- The breakeven analysis is especially useful when you're developing a pricing strategy, either as part of a marketing plan or a business plan.
- Also known as C-V-P analysis (Cost Volume Profit Analysis)

Module 4: Breakeven analysis:

Uses of Breakeven Analysis:

- Breakeven analysis is an important tool in terms of **short-term** planning and decision making
- It looks at the relationship between costs, revenue, output levels and profit
- Short run decisions where C-V-P is used include choice of sales mix, pricing policy etc.

Module 4: Breakeven analysis:

Decision making and Breakeven Analysis: Examples:

- How many units must be sold to breakeven?
- How many units must be sold to achieve a target profit?
- Should a special order be accepted?
- How will profits be affected if we introduce a new product or service?

Module 4: Breakeven analysis:

Key Terminology: Breakeven Analysis

Fixed Cost : (FC) The sum of all costs required to produce the first unit of a product. This amount does not vary as production increases or decreases, until new capital expenditures are needed.

Variable Unit Cost : (VC) Costs that vary directly with the production of one additional unit.

Material : VC Electricity – VC

Labour : VC

Transportation : VC

Plant Construction : FC , Equipment/Machine

Module 4: Breakeven analysis:

Key Terminology: Breakeven Analysis

Expected Unit Sales : Number of units of the product projected to be sold over a specific period of time.

Unit Price : The amount of money charged to the customer for each unit of a product or service.

Module 4: Breakeven analysis:

Key Terminology: Breakeven Analysis

- **Total Variable Cost (TVC):** The product of expected unit sales and variable unit cost.

TVC = Expected Unit Sales x Variable Unit Cost

= 100 x ₹10 = ₹1000

- **Total Cost (TC):** The sum of the fixed cost and total variable cost for any given level of production.

TC = Fixed Cost + Total Variable Cost

= 1000 + 100 x 10 = ₹2000

Module 4: Breakeven analysis:

Key Terminology: Breakeven Analysis

- **Total Revenue (TR):** The product of expected unit sales and unit price.

TR = Expected Unit Sales x Unit Price

= 100 x ₹25 = 2500

- **Profit (or Loss):** The monetary gain (or loss) resulting from revenues after subtracting all associated costs.

Profit / Loss = Total Revenue - Total Costs

= 2500 – 2000

= ₹ 500

Module 4: Breakeven analysis:

Key Terminology: Breakeven Analysis

BREAK EVEN POINT : Number of units that must be sold in order to produce a profit of zero (but will recover all associated costs).

Break Even Point (IN UNIT)=

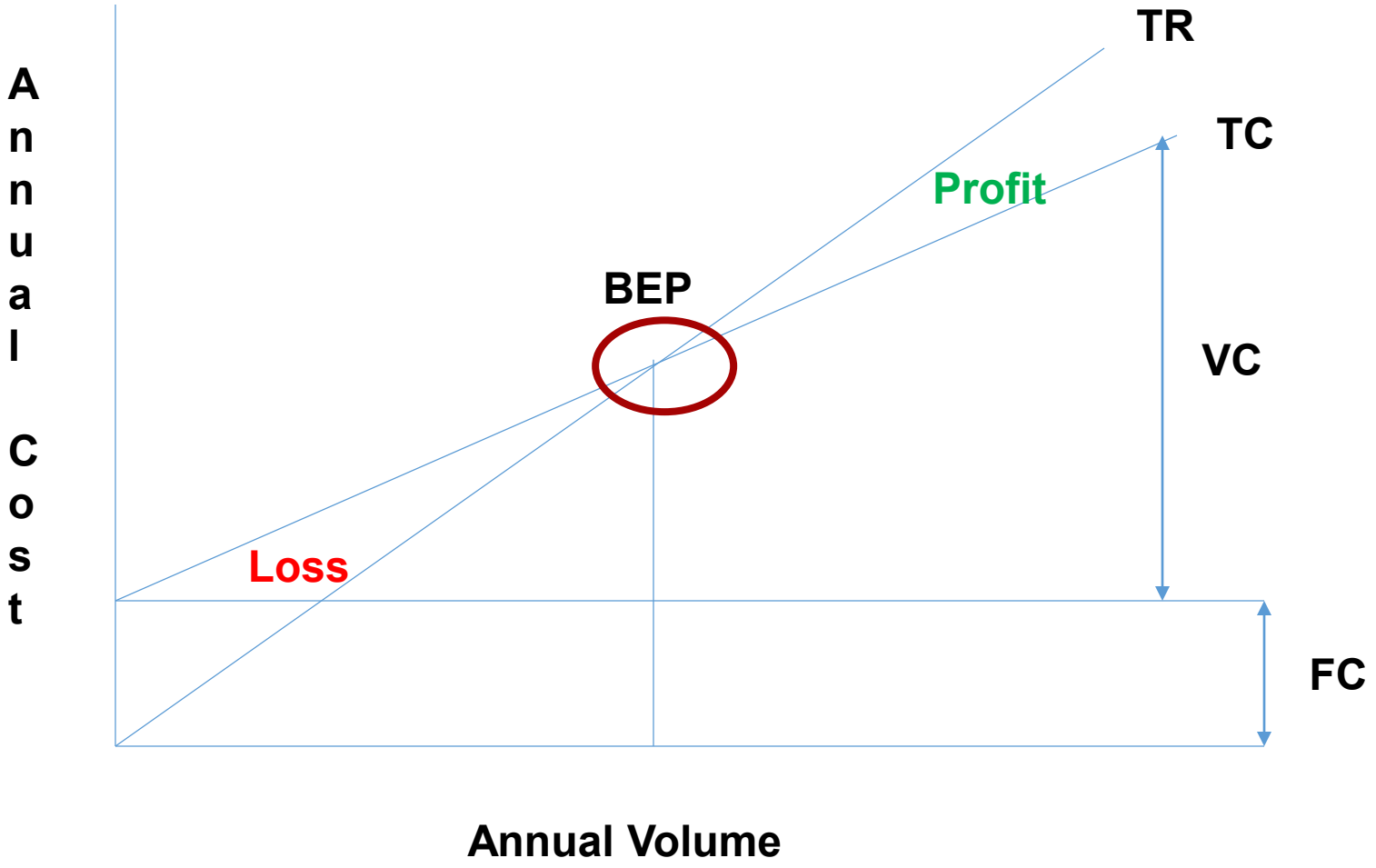
Fixed Cost /(Selling. Price- Variable Unit Cost)

Break Even Point (in Rs)=

Fixed Cost/ (Selling Price-(Variable unit Cost x Units)

Module 4: Breakeven analysis:

Key Terminology: Breakeven Analysis



Module 4: Breakeven analysis:

USES OF BREAK EVEVN POINT

- Helpful in deciding the minimum quantity of sales
- Helpful in the determination of tender price
- Helpful in examining effects upon organization's profitability
- Helpful in deciding about the substitution of new plants
- Helpful in sales price and quantity
- Helpful in determining marginal cost

Module 4: Breakeven analysis:

LIMITATIONS

- Break-even analysis is only a supply side (costs only) analysis, as it tells you nothing about what sales are actually likely to be for the product at these various prices.
- It assumes that fixed costs (FC) are constant
- It assumes average variable costs are constant per unit of output, at least in the range of likely quantities of sales.
- It assumes that the quantity of goods produced is equal to the quantity of goods sold (i.e., there is no change in the quantity of goods held in inventory at the beginning of the period and the quantity of goods held in inventory at the end of the period.
- In multi-product companies, it assumes that the relative proportions of each product sold and produced are constant.

Module 4: Breakeven analysis:

Example 1: . For a new product, the cost structures for producing at three location's Mysore, Bangalore and Mangalore are given below:

Location	Fixed cost / Year ₹	Variable cost/ unit ₹
Mysore	2,00,000	500
Bengaluru	4,00,000	300
Mangalore	8,00,000	100

The expected selling cost of the product is ₹ 1000 per unit. Find the most economical location for a proposed volume of 1800 units per year.

Module 4: Breakeven analysis:

Example 1: .

Location	Fixed cost / Year ₹	Variable cost/ unit ₹
Mysore	2,00,000	500
Bengaluru	4,00,000	300
Mangalore	8,00,000	100

Total Cost (TC) = FC + VC x Volume

TC(Mysore) = 2,00,000 + 500 x 2000 =₹ 12,00,000

TC(Bengaluru) = 10,00,000

TC(Mangalore) = 10,00,000

Total Cost (TC) = FC + VC x Volume

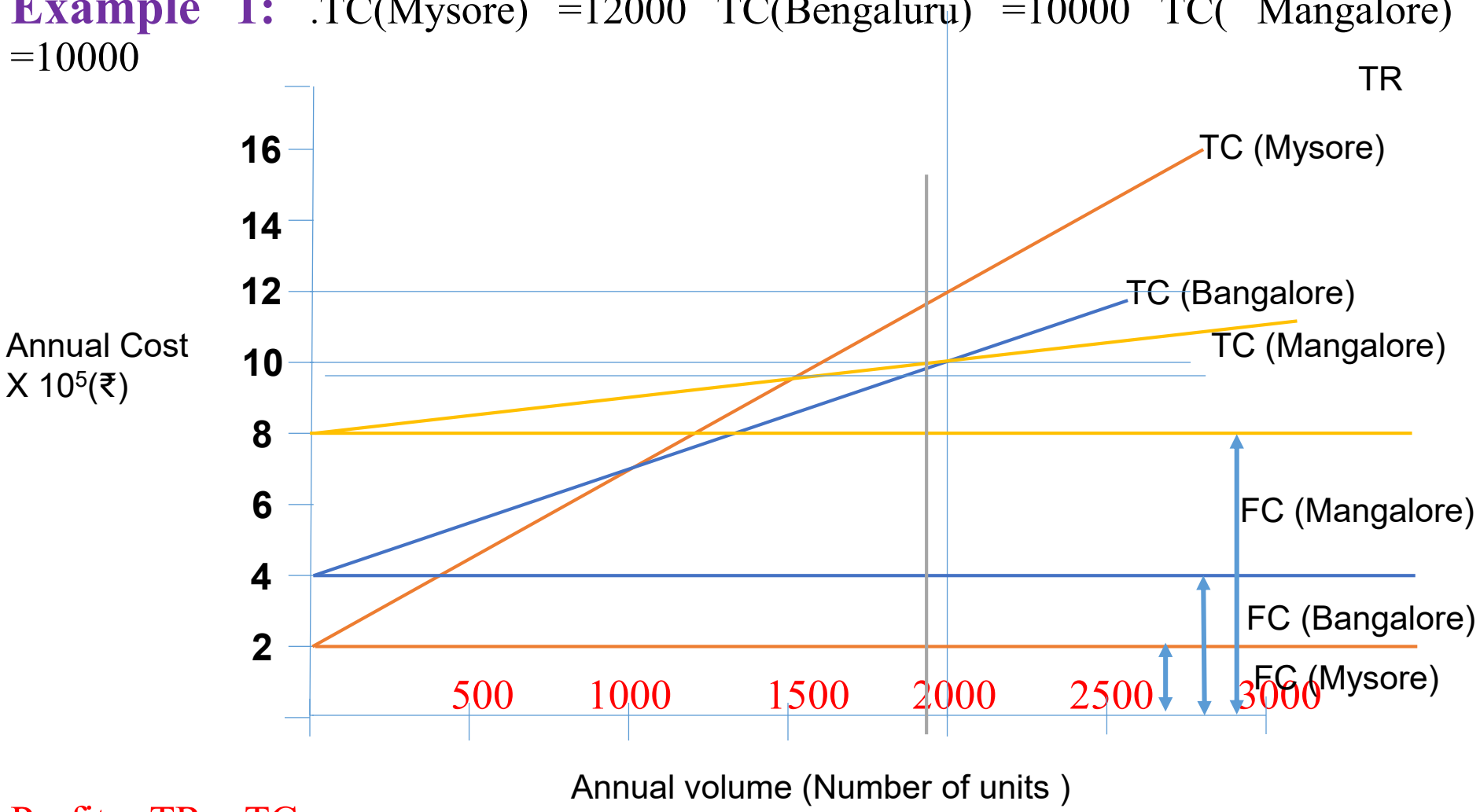
TC(Mysore) = 2,00,000 + 500 x 1800 =₹ 11,00,000

TC(Bengaluru) = ₹9,40,000

TC(Mangalore) = ₹ 9,80,000

Module 4: Breakeven analysis:

Example 1: .TC(Mysore) =12000 TC(Bengaluru) =10000 TC(Mangalore) =10000



Profit = TR – TC

= ₹1000 x 1800 – 10,00,000 = ₹ 8,00,000

Module 4: Breakeven analysis:

Example 2: . For an industry trying to locate a unit at location A would result in an annual fixed cost of ₹4,00,000 variable cost of ₹65 per unit and revenue of ₹75 per unit. For another location B under consideration, the annual fixed costs are ₹7,50,000 variable costs are ₹45 per unit and revenue are ₹75 per unit. The estimated sales volume is 27,000 units per year. Determine the most suitable location using break even analysis.

BEP (A) = FC / (Revenue – Variable cost)

= ₹ 4,00,000 / (75 – 65) = 40,000 units

BEP (B) = ₹ 7,50,000 / (75 – 45) = 25,000 units

Plant A: variable cost = 27000 x 65 = 17,55,000

Fixed cost = 4,00,000

Revenue : 27000 x 75 = 20,25,000

Plant B: variable cost = 27000 x 45 = 12,15,000

Fixed cost = 7,50,000

Revenue : 27000 x 75 = 20,25,000

Module 4: Breakeven analysis:

Example 2: .

BEP (A) = FC / (Revenue – Variable cost)

= ₹ 4,00,000 / (75 – 65) = 40,000 units

BEP (B) = ₹ 7,50,000 / (75 – 45) = 25,000 units

Plant A: variable cost = 27000 x 65 = 17,55,000

Fixed cost = 4,00,000

Revenue : 27000 x 75 = 20,25,000

Profit (Loss) = TR – TC = - 1,30,000

Plant B: variable cost = 27000 x 45 = 12,15,000

Fixed cost = 7,50,000

Revenue : 27000 x 75 = 20,25,000

Profit (Loss) = TR – TC = 1,10,000

Module 4: Breakeven analysis:

Example 3: . A company wants to manufacture a new product for expansion of its business. It has considered three location Bangalore, Tumkur and Mysore. The fixed cost per annum and the vaiable cost per unit at each locations are as follows:

	Tumkur (T)	Bangalore (B)	Mysore (M)
Fixed Cost / Year (₹ in lakhs)	25	35	50
Variable cost/Unit	₹ 375	₹ 320	₹ 200

The revenue per unit is ₹ 750. Determine the range of annual sales volume for which each location becomes suitable. Also find the most suitable location for a sales volume of 20,000 units.

Module 4: Breakeven analysis:

Example 3: .

	Tumkur (T)	Bangalore (B)	Mysore (M)
Fixed Cost / Year (₹ in lakhs)	25	35	50
Variable cost/Unit	₹ 375	₹ 320	₹ 200

TC = FC + VC x Volume

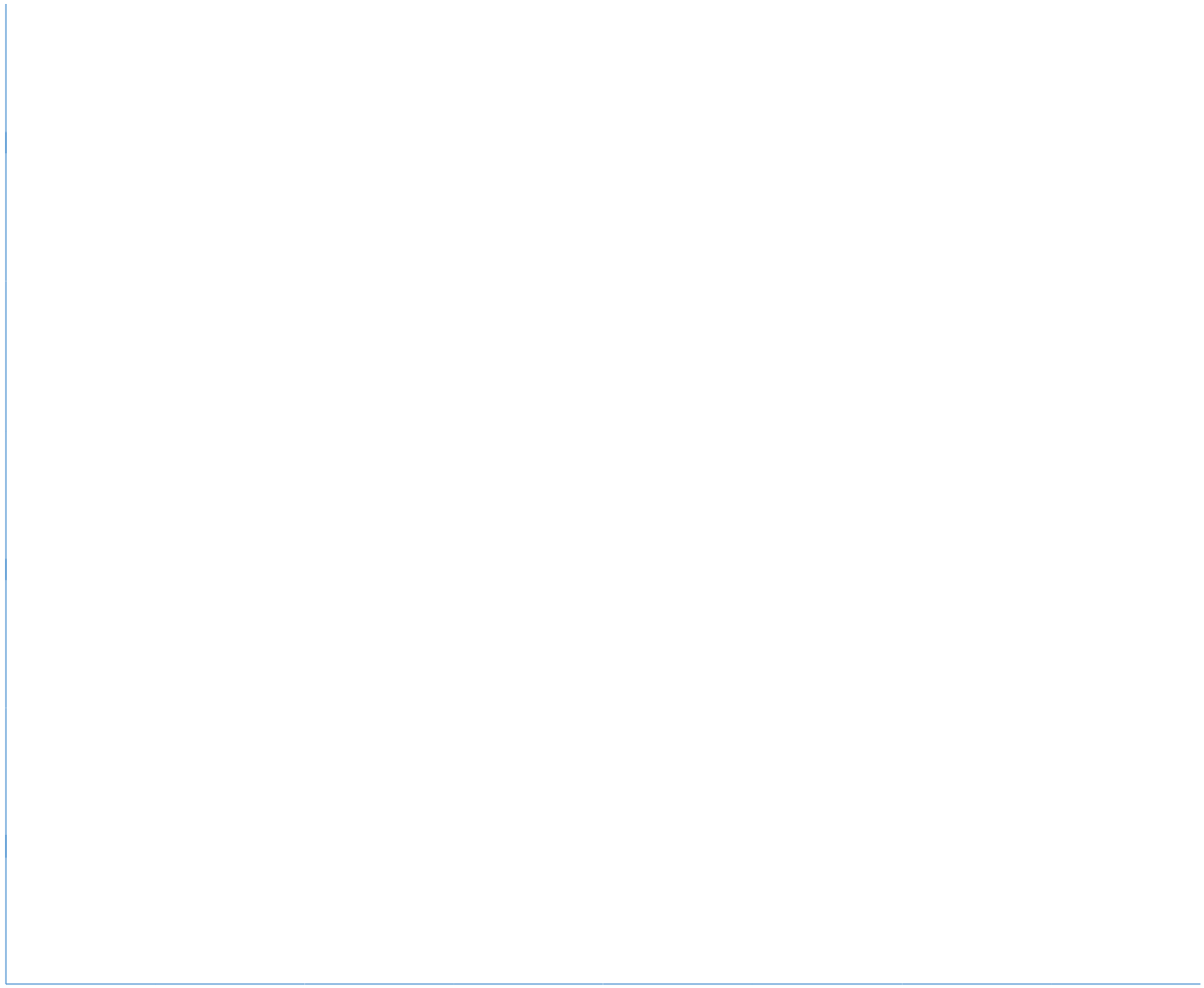
TC(T) = 25,00,000 + 375 x 20000 = ₹ 1,00,00,000

TC(B) = 35,00,000 + 320 x 20000 = ₹ 99,00,000

TC(M) = 50,00,000 + 200 x 20000 = ₹ 90,00,000

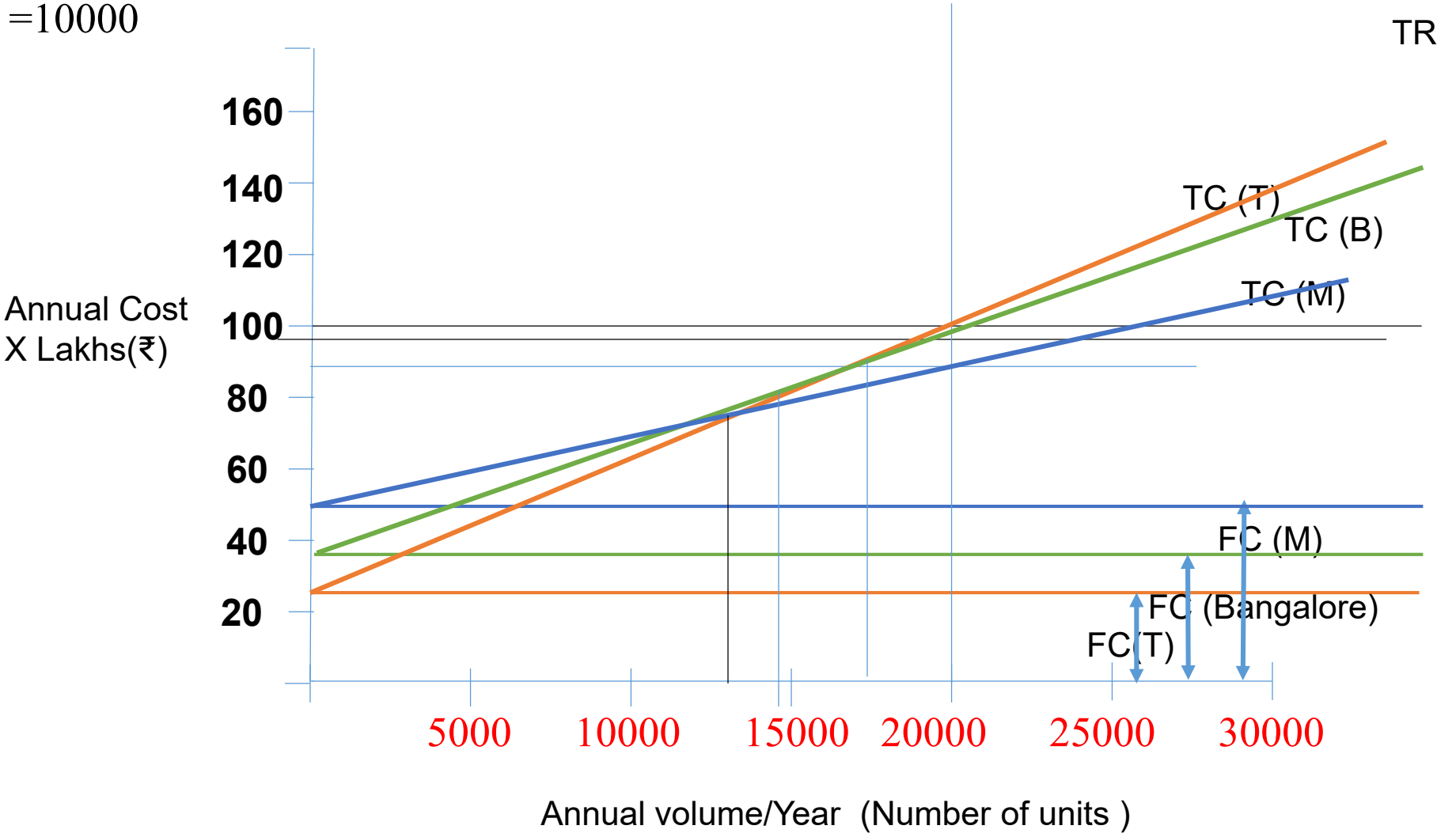
Module 4: Breakeven analysis:

Example 3: .



Module 4: Breakeven analysis:

Example 1: .TC(Mysore) =12000 TC(Bengaluru) =10000 TC(Mangalore) =10000



Module 4: Breakeven analysis:

Example 3: . A company manufacturing special screws is studying 4 alternative locations A, B and C for its new plant. The break up of various costs for different locations are given below:

Locations	A	B	C	D
Plant Constructions (₹ in lakhs)	46	39	40	48
Labour per unit (₹)	1.0	1.4	1.2	1.3
Material & Equipment (₹ per unit)	0.5	0.6	0.4	0.55
Electricity per year (₹)	35,000	30,000	33,000	28,000
Water (₹ Per year)	8000	7500	8000	7,000
Transportation (₹ per unit)	0.1	0.12	0.12	0.11
Taxes (₹ per year)	35,000	32,000	60,000	40,000

The company wants to raise the finance from public bonds at 15% p.a. interest. Determine the most economical location for output volume of 1,00,000 to 2,15,000 units per year.

Module 4: Breakeven analysis:

Example 3: .

Costs	A	B	C	D
Fixed cost (per year)				
Electricity per year (₹)	35,000	30,000	33,000	28,000
Water (₹ Per year)	8000	7500	8000	7,000
Taxes (₹ per year)	35,000	32,000	60,000	40,000
Bond interest @15% on plant	6,90,000	5,85,000	6,00,000	7,20,000
Total	**7,68,000**	**6,54,500**	**7,01,000**	**7,95,000**
Variable cost (per unit)				
Labour per unit (₹)	1.0	1.4	1.2	1.3
Material & Equipment (₹ per unit)	0.5	0.6	0.4	0.55
Transportation (₹ per unit)	0.1	0.12	0.12	0.11
Total	**1.6**	**2.12**	**1.72**	**1.96**

Module 4: Breakeven analysis:

Example 3: .

Total cost : TC = FC + VC x V

Let us calculate the TC at a production volume of 1,00,000 units for all locations.

TC(A) = 7,68,000 + 1.6 x 1,00,000 = ₹ 9,28,000

TC(B) = 6,54,500 + 2.12 x 1,00,000= ₹ 8,66,500

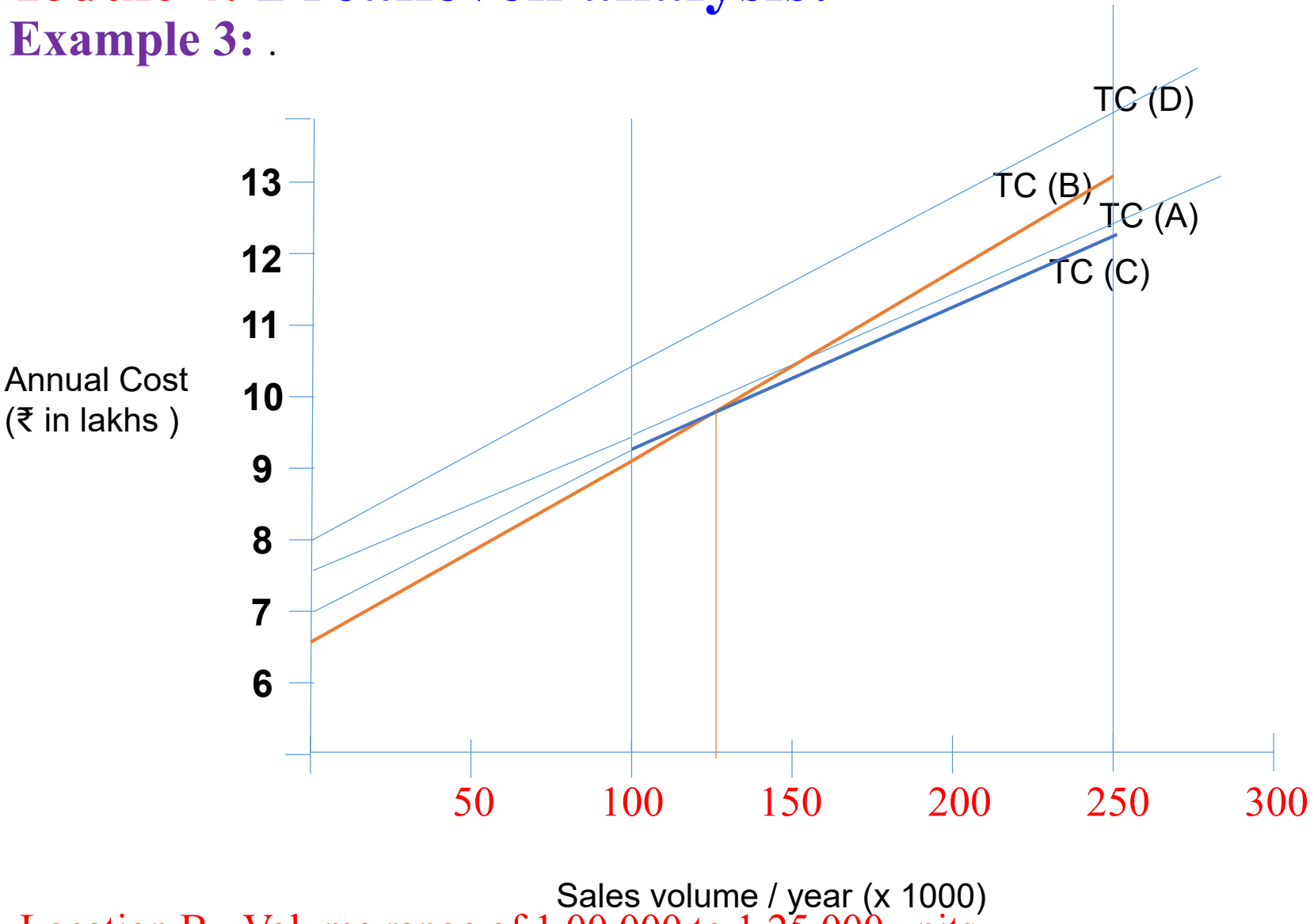
TC(C) = 7,01,000 + 1.72 x 1,00,000 = ₹ 8,73,000

TC (D) = 7,95,000+ 1.96 x 1,00,000 = ₹ 9,91,000

TR

Module 4: Breakeven analysis:

Example 3: .



Location B - Volume range of 1,00,000 to 1,25,000 units

Location C - Volume range of 1,25,000 to 2,15,000 units

Module 4: Breakeven analysis:

Example 4: . A consumer product manufacturing firm have these three potential locations in Mysore, Mangalore and Bengaluru have the cost structures shown below for a product expected to sell for Rs 260

Potential Locations	Fixed cost (₹)	Variable cost/ Year (₹)
Mysore	2,50,000	150
Mangalore	3,00,000	100
Bengaluru	5,00,000	50

i. Find the best economic location for an expected volume of 5000 units/year

ii. What is the expected profit if the selected option is used?

iii. For what output range, which location is best? Compare the result graphically

Module 4: Breakeven analysis:

Example 4: .

i. Find the best economic location for an expected volume of 5000 units/year

TC(Mysore) = FC + VC x V = 250000 + 150 x 5000 = ₹ 10,00,000

TC(Mangalore) = 3,00,000 +100 x 5000 = ₹ 8,00,000

TC (Bengaluru) = 5,00,000 + 50 x 5000 = ₹ 7,50,000

Bengaluru is the best location

ii. What is the expected profit if the selected option is used?

revenue = Selling price x Volume = ₹ 260 x 5,000 = ₹ 13,00,000/yr.

Profit = revenue – TC = ₹ 13,00,000 – 7,50,000 = ₹ 5,50,000

Module 4: Breakeven analysis:

Example 4: .

i. Find the best economic location for an expected volume of 5000 units/year

TC(Mysore) = ₹ 10,00,000 TC(Mangalore) = ₹ 8,00,000

TC (Bengaluru) = ₹ 7,50,000 Bengaluru is the best location

ii. What is the expected profit if the selected option is used?

revenue = Selling price x Volume = ₹ 260 x 5,000 = ₹ 13,00,000/yr.

Profit = revenue – TC = ₹ 13,00,000 – 7,50,000 = ₹ 5,50,000

iii. For what output range, which location is best? Compare the result graphically

Location Mysore: Break even point

= FC / (P – VC) = 250000 / (260-150) = 2272.7 **= 2273 units**

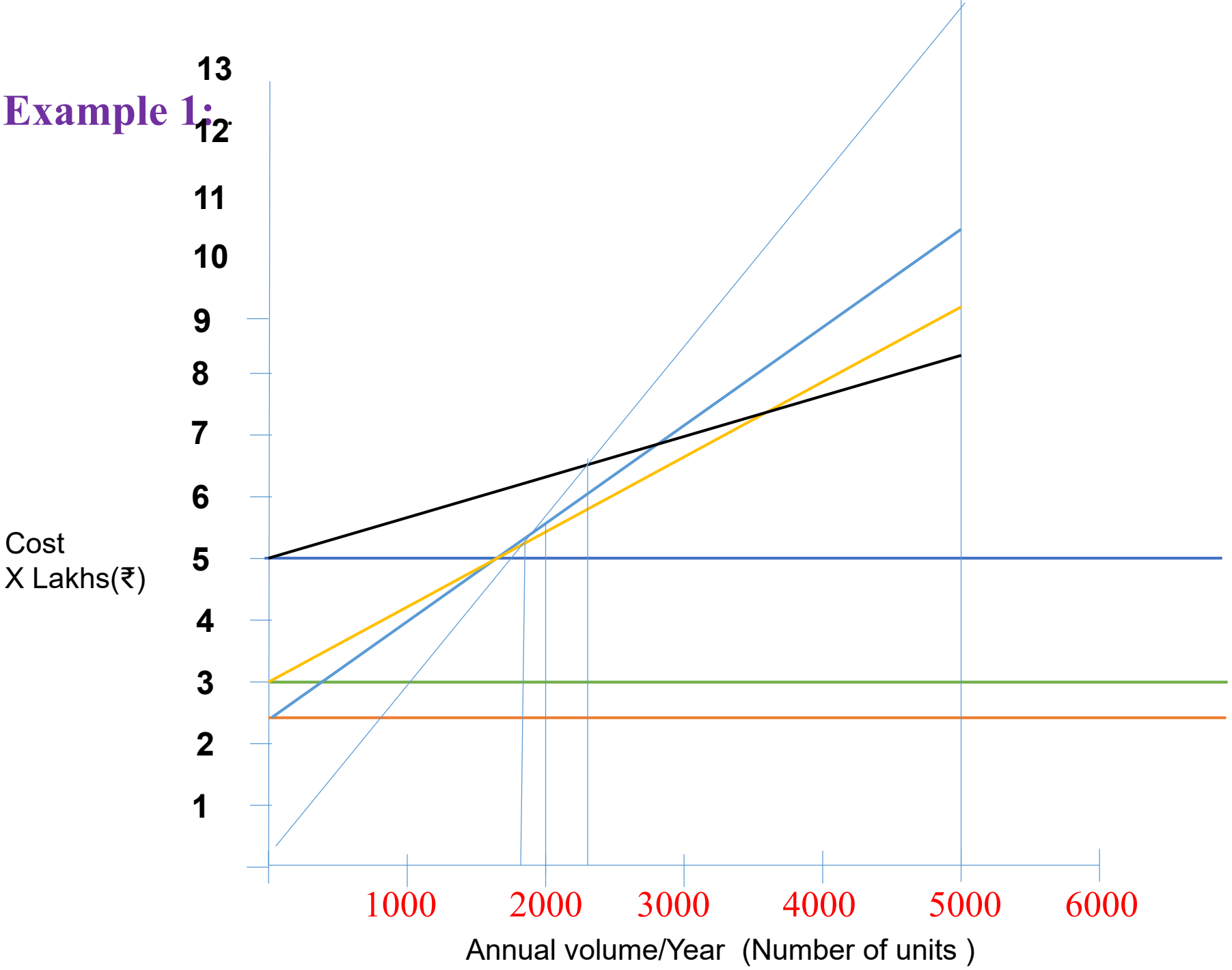
Location Mangalore: Break even point

= FC / (P – VC) = 300000 / (260-100) =**1875 units**

Location Bengaluru : Break even point

= FC / (P – VC) = 500000 / (260-50) = **2381 units**

Example 1:


13
12
11
10
9
8
7
6
5
4
3
2
1
Cost
X Lakhs(₹)
1000
2000
3000
4000
5000
6000
Annual volume/Year (Number of units)

Module 4: Breakeven analysis:

Example 5: . A computer company evaluating three cities for a new plant to manufacture hardware components which will sell at **Rs. 170/-** each. The economic portion of a plant location study shows the following cost and market data

Cost Data

Cities	A	B	C
Fixed costs/year in 1000Rs.	300	200	150
Variable cost/ unit	30	45	65

Market Data

Volume	Probability
4500	0.1
5500	0.3
6500	0.6

i) On the basis of maximizing an economic expected value, graph the plant location curve (Cost) using appropriate scale.

ii) Which city should be selected on the basis of given volume estimate(From Graph)

iii) What is the break-even volume for the city selected?

Module 4: Breakeven analysis:

Example 5: .

Volume = 4500 x 0.1 + 5500 x 0.3 + 6500 x 0.6 = **6000 units** **1 Marks**

TC(A) = FC + VC x V = 300 x 1000 + 30 x 6000 = **4,80,000**

TC(B) = 200 x 1000 + 45 x 6000 = **4,70,000**

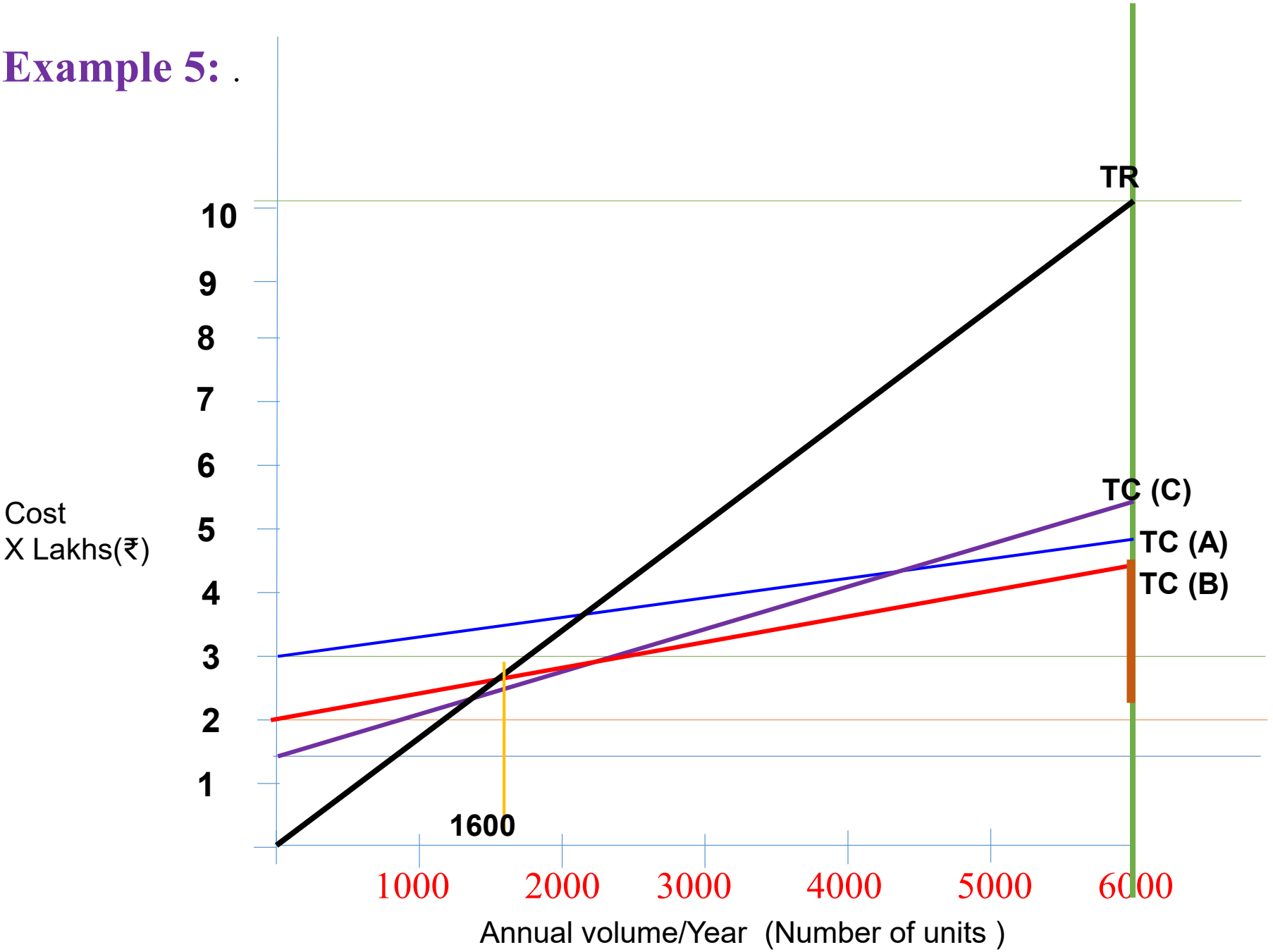
TC(C)= 150 x 1000 + 65 x 6000 = **5,40,000** **3 Marks**

iii. Breakeven volume for the city B

BEP = FC / (P-VC) = (200 x 1000) / (170 -45) = 1600 units **1 Mark**

Graphical **3 Marks**

Example 5: .


TR
TC (C)
TC (A)
TC (B)
10
9
8
7
6
5
4
3
2
1
Cost
X Lakhs(₹)
1600
1000
2000
3000
4000
5000
6000
Annual volume/Year (Number of units)

THANK YOU

Attendance Link