Engineering Economic Analysis
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Lecture 30
Problem Solving based on Breakeven Analysis and EOQ

Welcome to the lecture on problem solving on breakeven analysis and economic order quantity. In this lecture we will solve the problem based on breakeven analysis, what we have studied in our earlier lecture and also on economic order quantity. Let us first discuss the problem on breakeven analysis.

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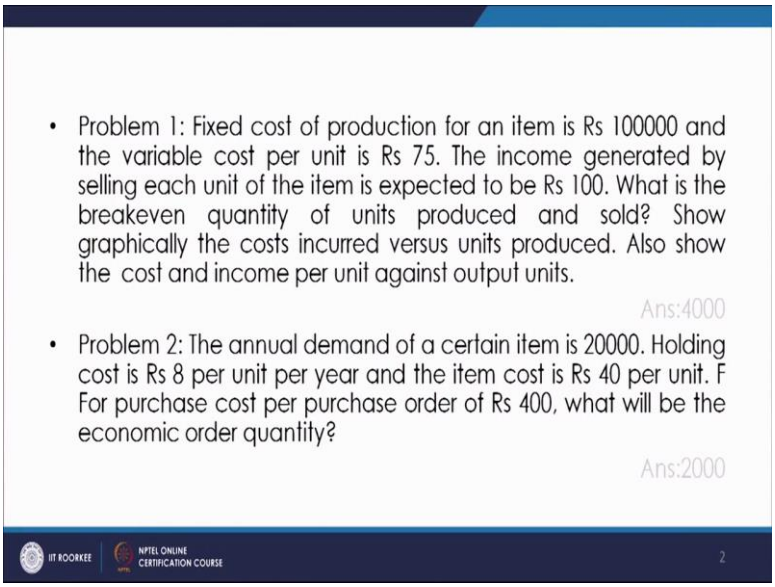

The problem is like this, the fixed cost of production of an item is Rs. 100,000 and the variable cost per unit is given as Rs. 75. The income generated by selling each unit of the item is expected to be Rs. 100, so you have fixed cost, you have the variable cost per unit as well as the selling cost. What is the breakeven quantity of units produced and sold? So we have to find the breakeven quantity at which there is no profit no loss.

The quantity which is produced and sold. Also we have to show graphically, the cost incurred versus the units produced and further the cost and income per unit against output. So let us all this question. The given quantities are fixed cost as Rs. 100,000, the variable cost per unit that is V is given as Rs. 75, the income generated by selling each unit that is selling cost that is given as Rs. 100. So we have to find the breakeven quantity.

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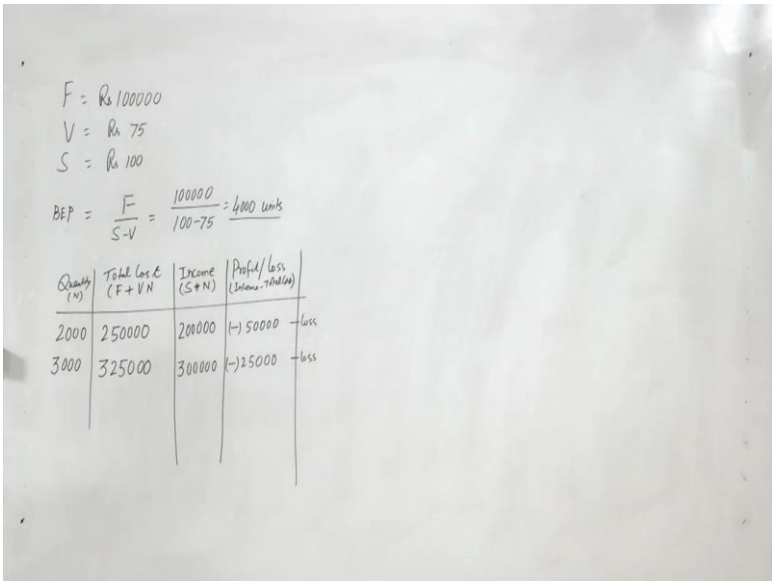

Now the breakeven quantity we know that breakeven point we find it by F upon S - V. So what we see is, F is 1,00,000 upon S - V that is 100 - 75, so it will be 4000 units. So when we produce 4000 units and selling, we are at the breakeven point means there is no profit no loss. Let us see by in the tabular form how can we see that. So let us see the here the quantity produced and sold.

You have total cost total cost is nothing but F + V into N if N is the quantity. Based on that you will have income, income selling price per unit multiplied by number of units sold and then we have the column for profit or loss that will be income - total cost. So if we start from 2000 units, F + VN, so if is 1,00,000+ 2002 variable cost 75, so 1,00,000 + 1,50,000, it will be 2,50,000.

Then income will be S multiplied by N, 2000 multiplied by 100 that will be 2,00,000. So you will have profit or loss, income - total cost that is coming as - of 50,000, so this is basically a loss. If we take it to 3000, the total cost will be F + V into N 1,00,000 + 75 into 3000 so it will be 3,05,000. The income will be S into N 100 multiplied by 3000 that is 3,00,000. So it will be again negative of 25,000, so there is loss of 25,000.

If we go to 4000, total cost will be F + VN 1,00,000 + 75 multiplied by 4000, so 1,00,000 + 3,00,000 that is 4,00,000. The income is S into N, S is 100 and N is 4000 that is 4,00,000. What we see is, income is equal to total cost, so you have zero profit or zero loss. So if we can say this is no profit no loss. So further if you go to 5000, for 5000 total cost will be 1000 + 1,00,000 + 5000 multiplied by 75, so it is 4,75,000 4,75,000.

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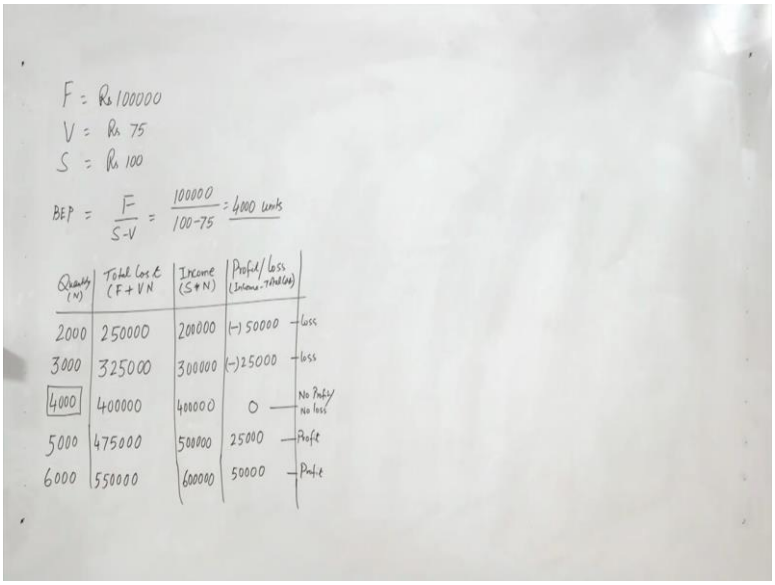

The income will be 5000 multiplied by 100 it is 5,00,000. So now the difference of 5,00,000 and 475,000, it will be coming as 45,000, so it is no profit. Further if you go to 6000 we expect that once we move from here onwards our profit will go on increasing just like see for example 6000, 1,00,000 + 6000 multiplied by 75 it will be 5,50,000 and income the 6,00,000 so profit is 50,000.

So till we go to the operational capacity, we are going to get the profit based on this data. And what we see is, you are justifying yourself by reaching to this value of zero profit zero loss for the quantity of 4000 which is produced and sold and that is why it is known as breakeven quantity. Now we have to find the costs and we have to find the graph of this cost against the units produced.

So in the graph you will have the fixed cost, you will have the variable cost or total and total cost and also the income. Now let us see, we have this data, we can have the variable cost based on the value per unit multiplied by the number of units produced. So if we try to plot, this is cost or income in rupees in lakhs of rupees, so and then on this side we have units produced.

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Now in this case, if we take the units, suppose we start from 1000, 2000, 3000, 4000, 5000 and 6000. So for 1000 units now let us see if we have to see the fixed cost line, what we see is, so let us draw here also 1, 2, 3, 4, 5, 6, so this is in terms of lakhs of rupees. Now the fixed cost is 1,00,000, so the fixed cost line like this, this is the fixed cost. Now let us see total cost, for 1000 units total cost will be cost + 1000 times 75 75,000. So it will be 175,000, so it will be here.

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Then for 2000 units the total cost comes out to be 2,50,000, it is here. Then for 3000 units 3,25,000, it will be here. Then for 4000 units, it is 4,00,000, so this line goes like this. So this is your total cost line. Now we have the income line and if the income is shown for 100 units

1000 units it is 1,00,000, for 2000 units it is 2,00,000, for 3000 units if it is 3,00,000 and for 4,000 units, it is 4,00,000.

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So basically this line will move from here through this point and this line is known as the income line. So what we see is the total cost at this point is equal to the income produced. Once we moved to this side you get the profit and if you are this side you are in the loss. So this is how you can draw these costs against the number of units. Now let us see we have to find the graph for cost and income per unit against output units.

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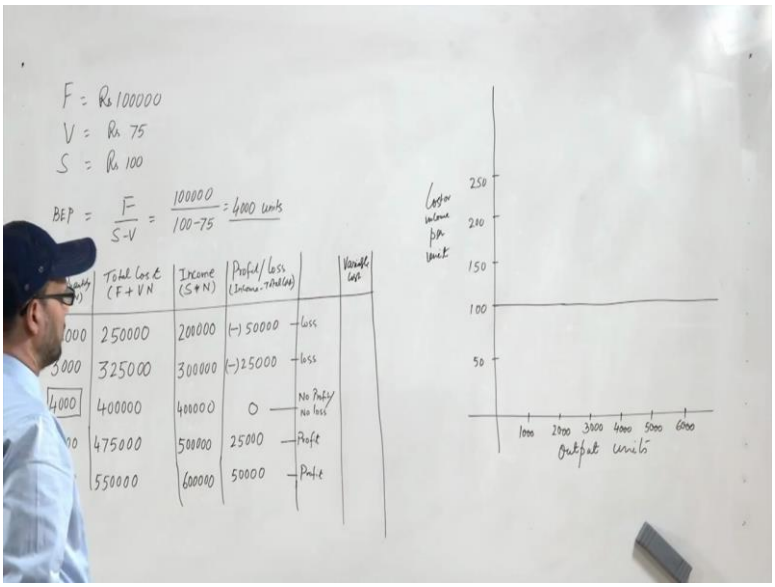

So we have to find the graph for this, now in that output units would be 1000, 2000, 3000, 4000, 5000 and 6000. Now in this side we will have cost or income per unit of the item. Now in that we can have 50, 100, 150, 200, 250. So what we see is the income per unit that is Rs. 100, so income per unit line will be this. Now what we can do is, we can have the variable cost here. Now in this case let us find something about the total cost.

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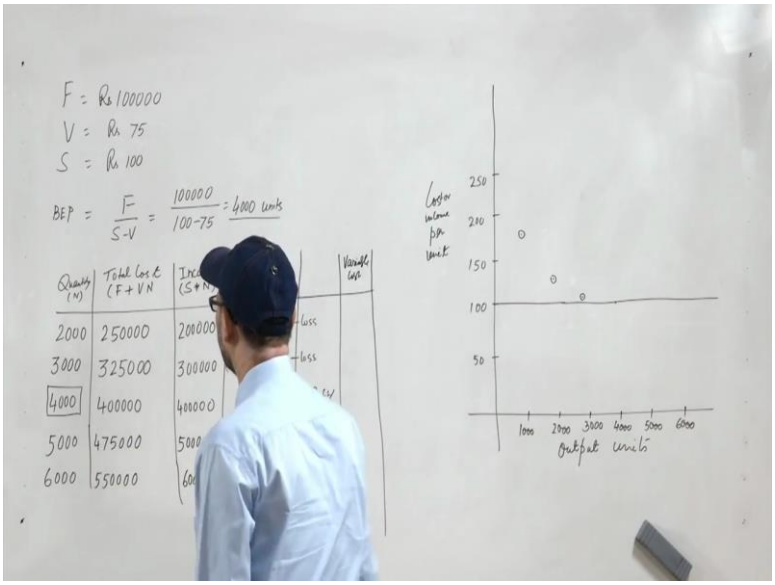

Now total cost line for 1000 outputs per unit output so we have to get the value of total cost for 1000 units. For 1000 units the total cost will be 1,00,000 + 75 multiplied by 1000 that is 1,75,000. So 1,75,000 for 1000 units it is, so that will be 175, so it will go somewhere here. Now for 2000 units, 40,000 units the total cost is 2,50,000 so for unit output 2,50,000 divided by 2000 that is 125, so it will be here.

Then for 3000 units, it is 3,25,000, so for every unit it will be 108 point 3, so it will be here close to this. Now for 4000 units it is the 100 so 4000 unit it will reach at this point. For 5000 units 475 huh thousand, so if we divide it, it is coming less than 100, so it is 95. For 6000 units it is close to 90, so it goes like this and then it is going downwards as we move in this direction, it will go like that.

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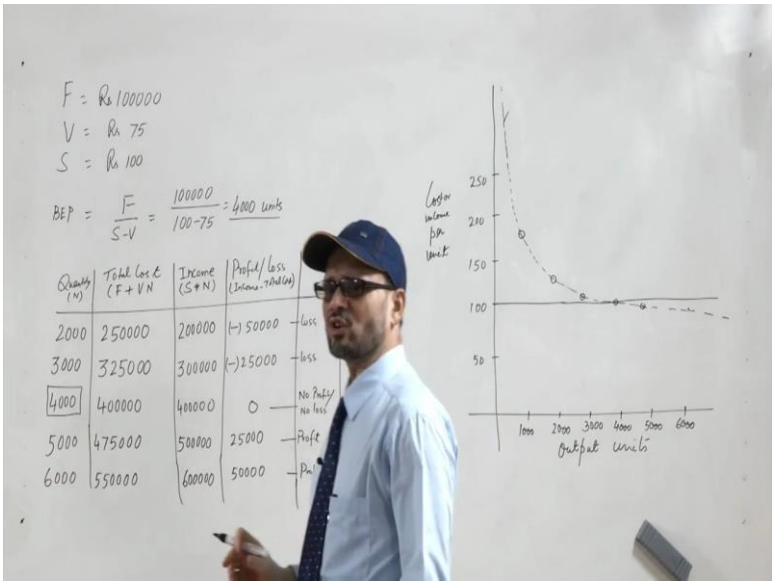

For 0 units, the fixed cost is 1,00,000, so anyone total cost is 1,00,000 but it will be approaching towards infinity. So that is why this line will come from infinity and then it will go like this. So basically, this is the average cost line. Now if we look at the fixed cost per unit line. So fixed cost is 1,00,000, so for 1000 units it will be 100 but certainly it would be zero for zero items it will be towards infinity.

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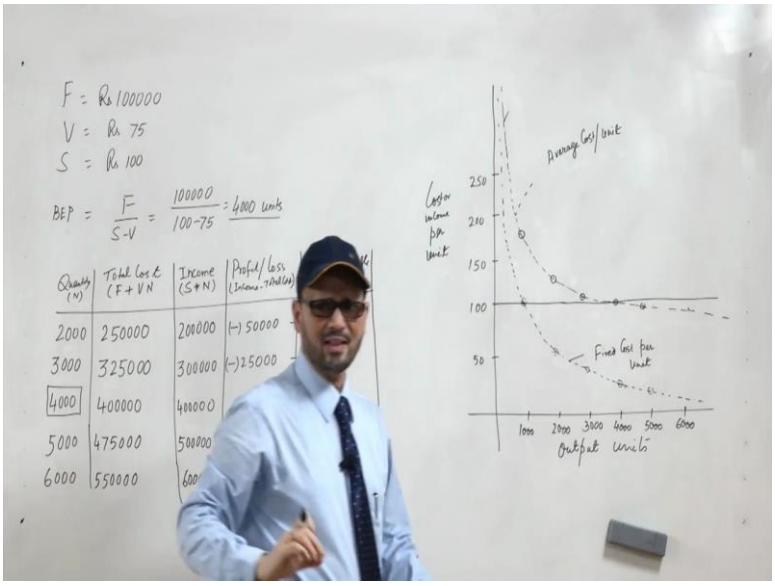

For 2000 units it will be 50, for 3000 units it will be 33 point 33, for 4000 units it will be close to 24, then for 5000 units it is close to 20. Certainly it will go on decreasing as we move. So it will reach towards the infinity and this line in X direction will move like this and it will reach towards zero as we go on increasing the number of units per number of units. So

what we see is, you have this as fixed cost per unit line. Then this line is average cost per unit line.

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So what we see is, this is the average cost and this is the fixed cost per unit, it means in between the difference is nothing but the variable cost per unit line. So if you show that at any point if this is the fixed cost per unit line fixed cost per unit and this is the since this is the value of average cost, so in between this amount can be taken as variable cost per unit.

So that is how we see that how so this is a amount of fixed quantity and this fixed cost as you see, as you go on increasing the number of units, the fixed cost per unit is decreasing. Variable cost is remaining constant and average also cost you see that as you go on increasing the production, the average cost is decreasing for unit. So that is how we can see that such problems can be solved.

You can also see where you can locate the breakeven quantity, there is no profit no loss at that point and so. Now let us discuss about the next question.

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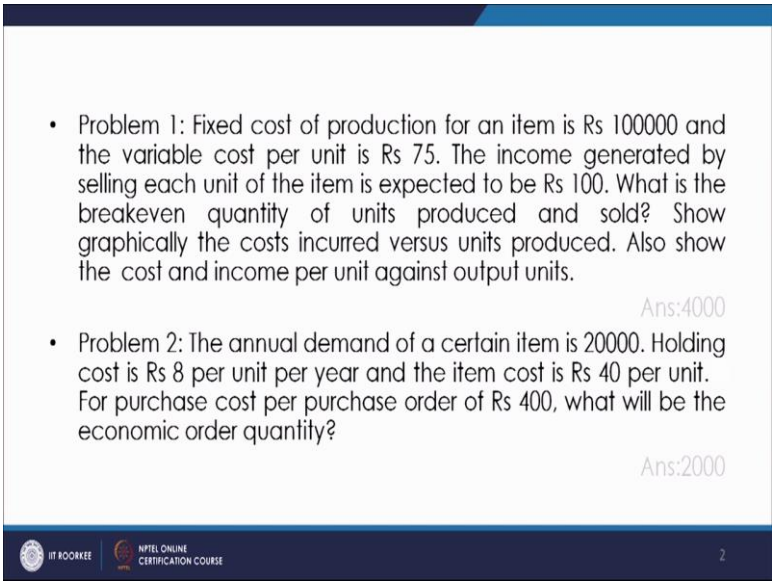

The next question is regarding the economic order quantity. So in that basically is given that the annual demand of a certain item 2,00,000, holding cost is Rs. 8 per unit per year and the item cost is Rs. 40 per unit. For purchase cost purchase order every purchase order is costing Rs. 400, what will be the economic order quantity?

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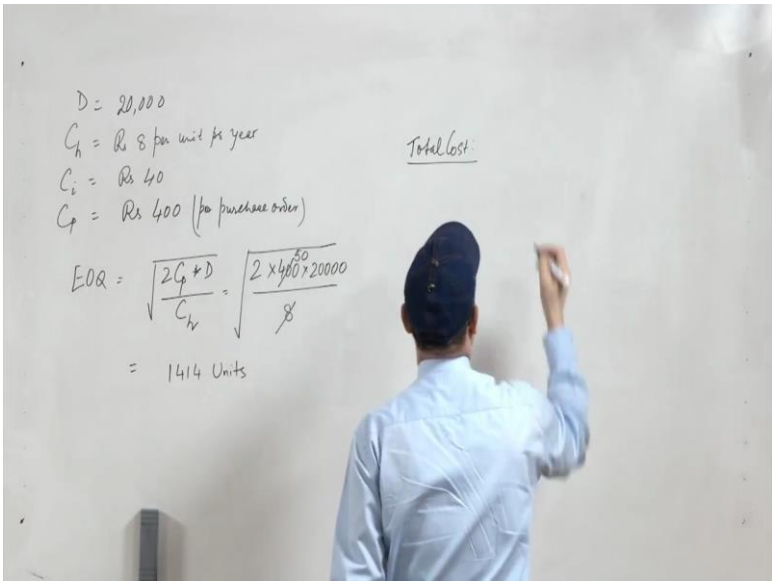

So for this we will have the formula and we have to place the values of the given quantities and we can have the economic order quantity. So it is given as D as annual demand, it is given as 20,000, then you have already cost is per unit per year that is Rs. 8 per unit per year. Many a times this holding cost may be given as in terms of percentage of the average inventory cost or sometimes may be the percentage of the unit cost of the time.

So you may not have the direct values, you may have calculate it once it is expressed in terms of percentage of certain values. So here it is given directly as Rs. 8 per unit per year. Then item cost Ci, it is given as Rs. 40 per unit and the purchase order cost that is CP, it is given as Rs. 400 per purchase orders. So such problems as we have discussed, we have the expression for the total cost and we have got anyway the expression for economic order quantity.

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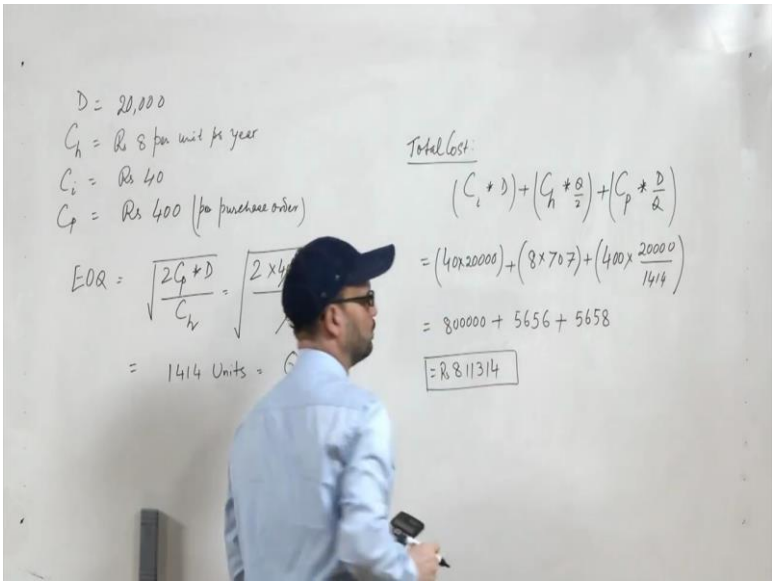

So economic order quantity as we know it is under root 2 Cp into D upon Ch. So we have to put this in the formula, we can have 2 times 400 multiplied by demand that is 20,000 divided by Ch that is 8, so it will be 50. So this will be equal to 1414 units. This is the economic order quantity, the quantity which when ordered once, basically it will lead to minimum total cost.

So corresponding to this if we have to find the total cost, we know that for total cost the expression is Ci times D + cost of holding times Q by 2. So this is your Q + cost of purchasing per purchase order times D by Q. Now we have to calculate this value, Ci times D, so 40 times 20,000 + Ch times Q by 2, Ch is 8 and Q by 2 is 707 + Cp, Cp is 400 times D by Q and D is 20,000 and Q is 1414 units.

Now we have to find its sum, it will be 8,00,000 + 5656 + 8,00,00,000 divided by 1414 that is 5657 point 7 that is 5658. So 5658 + 5656 + 8,00,000 equal to 8,11,314. So this is basically the total cost which is the minimum total cost of responding to this economic order quantity units. Thank you.