Managerial Economics
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Lecture - 55
Monopoly (Contd…)

So, we will continue our discussion on monopoly like what we discussed in the previous class, like short run, long run, output and price and output decision in the monopoly. How the firms gets profit, normal profit, super normal profit or incur loss and then also we check the demanded revenue what are the different entry barrier? What are the sources for barrier to entry? What are the different types of monopoly what we checked in the last class?

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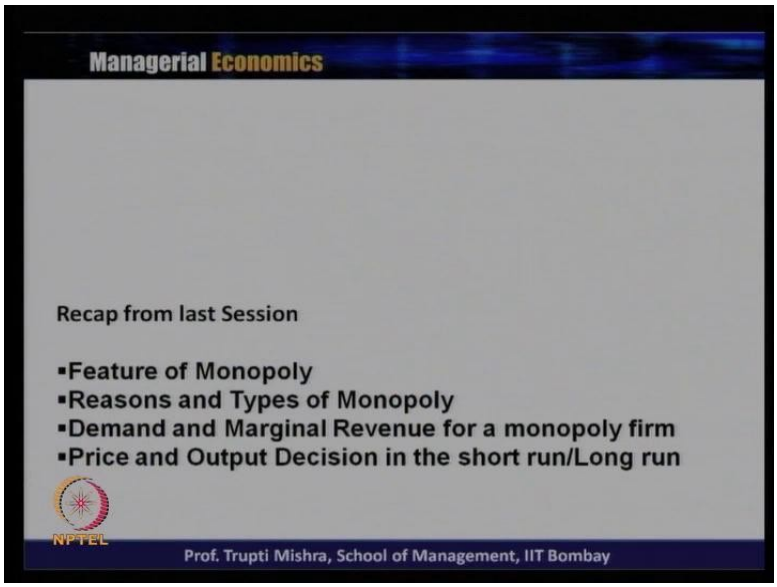

So, if you remember we talked about the feature of monopoly. First what are the different characteristic of monopoly? Then we discussed about the reasons and types of monopoly. Then we discussed about the demand marginal revenue for a monopoly firm and then we talked about the price and output decision in the short run and in the long run. So, if you remember in the short run may be the firm gets normal profit, super normal profit, incur loss. But generally in case of long run the firm never incur loss, rather they try to get it is the normal profit even if not the super normal profit.

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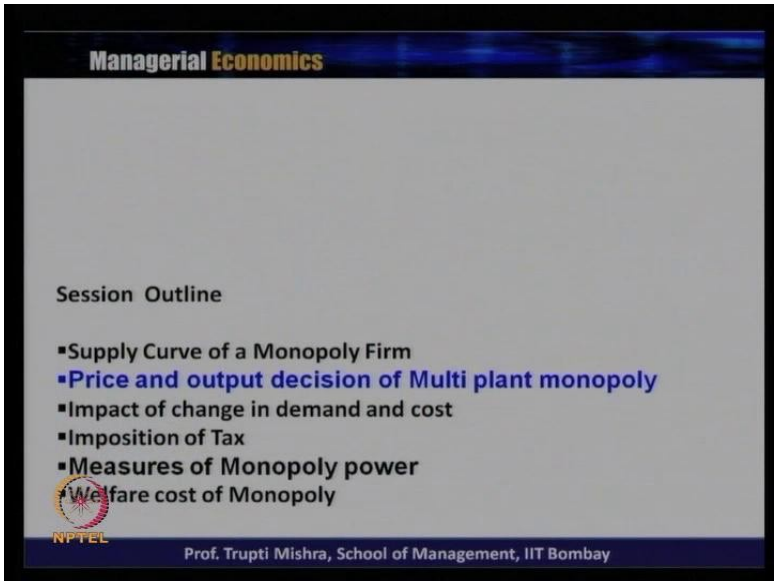

So, in this particular session we will talk about the supply curve of a monopoly firm. Then we will take a case of a multi plant monopoly and we will see how the price at output decisions are made in case of a multi plant monopoly. Then we will talk about the impact of change in the demand and cost. Then we will talk about the imposition of tax who gets the burden of tax whenever there is aim position of tax whether its buyers and sellers.

Then, we will talk talk about the different methods or measures of monopoly power and then we will talk about the welfare cost of monopoly. So, to start with we will start our discussion the supply curve of monopoly. So, if you remember in case of a perfect competitive firm; the supply curve is that segment of marginal cost which lies above the minimum point of average variable cost considered as the supply curve for the competitive firm.

Now, why that is considered as the supply curve of competitive firm because the the firm shut down the operation. If price goes below the minimum point of a VC and that is the reason the minimum point a VC is considered as the starting point for the firms supply function and that is the reason the supply the supply curve starts from that point of the marginal cost.

So, if the above segment of the marginal cost which lies above the average variable cost is generally known as a supply curve for the competitive firm. The situation is different in case of monopoly firm. Now let us see what we considered as the supply curve. In case of a monopoly firm whether there is a existence of supply curve or there is no existence of supply curve in case of a monopoly firm.

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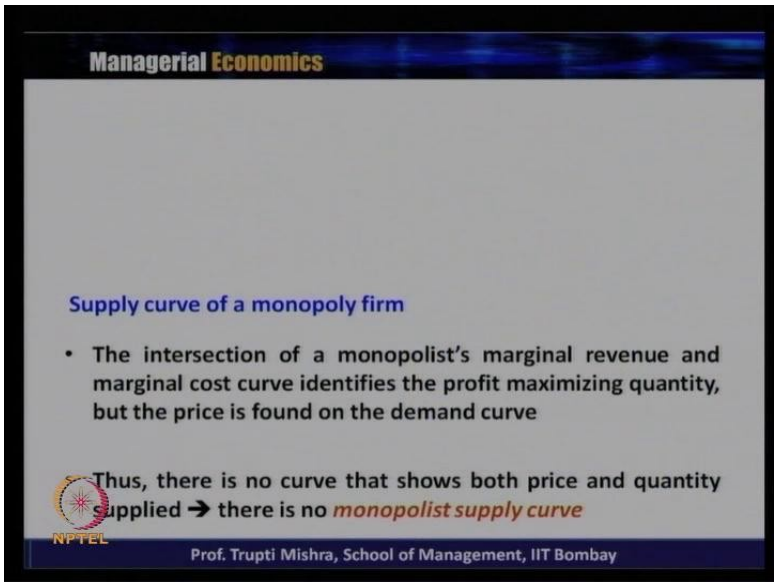

So, the intersection of a monopoly's marginal revenue and marginal cost curve identify the profit maximizing quantity if the price is found on the demand curve. So, if you remember our MC MR rule that gives us once we follow the MC MR rule. We get the we get the profit maximizing output and profit maximizing price and the price generally found on the demand curve. Thus there is no curve that shows both price quantity supply and there is no monopolist supply curve. But if you look at now how the supply of goods whatever decided by the monopolist where it gets represented.

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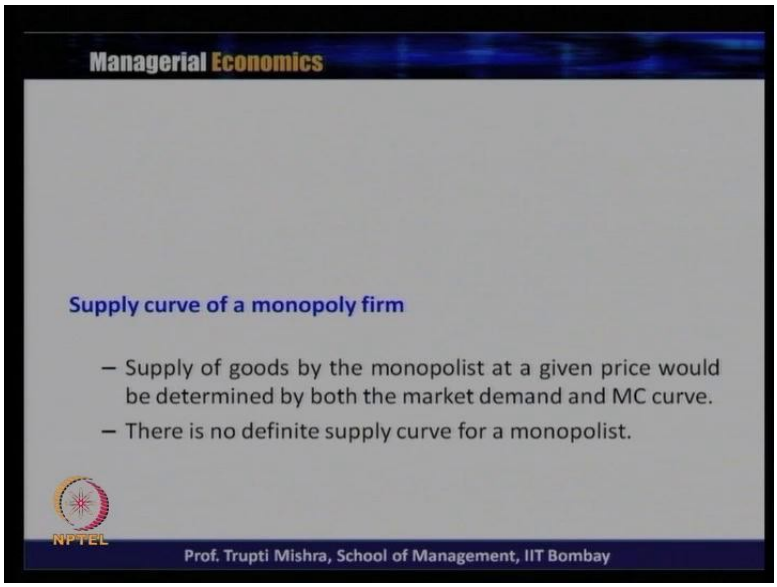

So, supply of goods by the monopolist at a given price would be determined by both market demand and the marginal cost curve. So, there is no definite supply curve for a monopolist because the whatever the supply of goods by the monopolist at a given price would always be dependent on the market demand. And the marginal cost function since it is a single seller single firm; they always look for the they always look for the profit where they will they always look for the price which goes above the marginal cost. So, that they can maximize the revenue and they can maximize the profit.

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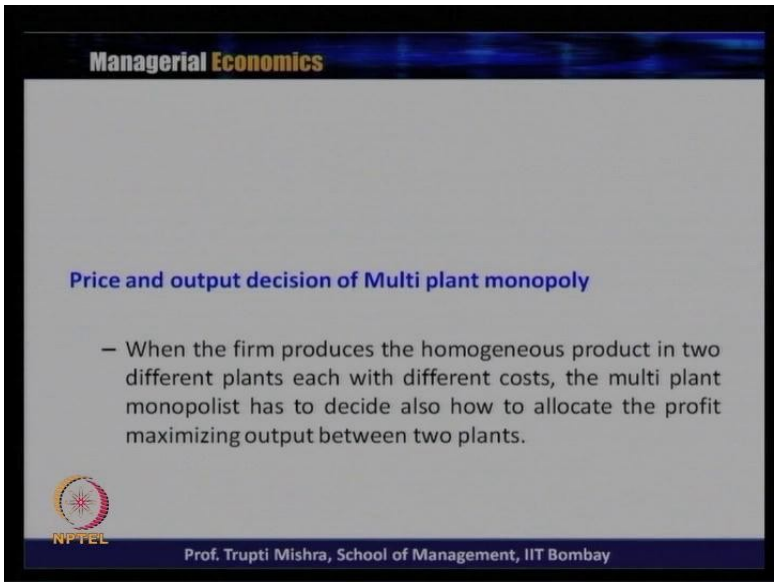

Because in case of monopoly if you find it is not that P is equal to MC rule the price is always greater than the marginal cost. Whereas, in case of perfect competitive firm its always P there is a equalization of P is equal to MC. That leaves the that leaves no scope for the profit of to maximize the profit for the individual firm since supply curve is absent. So, basically it is the demand and MC curve. They plays a greater role when it comes to the price and output decision of the monopolist firm

Now, we will take a different type of case that is the case of a multi plant monopoly and what is multi plant monopoly multi plant monopoly is. One where the firms produces the same product firms produces the homogenous product in different plants at different cost of production. So, if the firm has to produce hundred units of the particular quantity of product he can produce it in two three different plants where the cost of product the per unit cost of productions are different in some cases it is higher and in some case it is lower.

So, when the firm produces the homogenous product in two different plant each with different cost the multi plant monopolist has to decide also and how to allocate the profit maximizing output between two plants. So, the product is homogenous. But the plant is producing the homogenous product the same product or the identical product in all the firm on the different plants and obliviously the plant each plant is having a different cost function. They are not operating at the same cost function or they are not operating at the same level of cost. That implies that the per unit cost has to be different in the different plant.

So, now let us see how the price and output determination is generally done when it is a case of a multi plant monopolist. And the entire situation is called as the multi plant monopoly.
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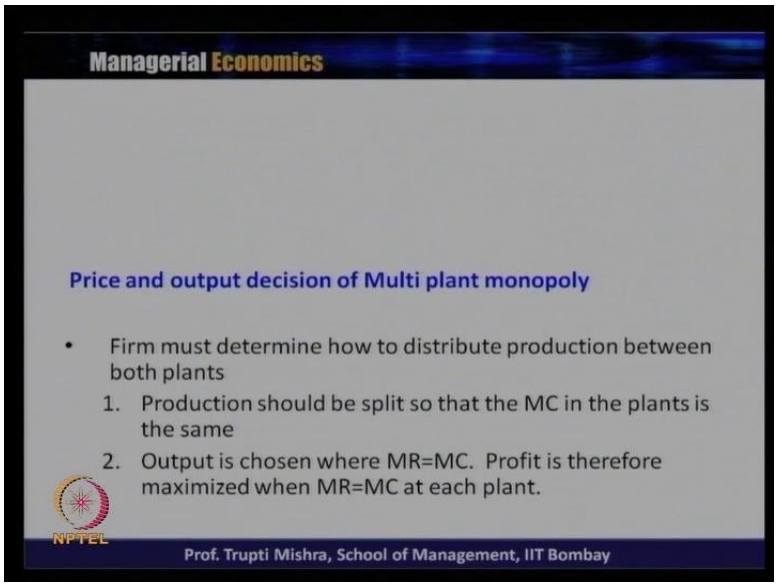

So, in this case the firm must determine how to distribute the production between both the plant which firm should produce how much, and because it always dependant on the cost of production. So, firm must determine how to distribute production between both plants production should be split. So, that marginal cost in the plant is the same and output is chosen where MR is equal to MC and profit is there for maximize when MR is equal to MC at each plant

So, productions will be split. So, that the marginal cost of the plant is the same. The per unit cost added to the total cost by producing one more unit should be same. And output is chosen on the basis of the same marginal is to that is marginal cost has to be equal to the marginal revenue and profit is maximized by following this equalization that is marginal revenue equal to the marginal cost at each plant. So, we will get two set of marginal revenue curve and we

will get we will get two set of marginal revenue curve and two set of marginal cost curve. And when it comes to the profit maximizing level in the both plant the MC MR has to be different because the cost is specific to the plant whereas, the revenue is specific to the firm has a whole.

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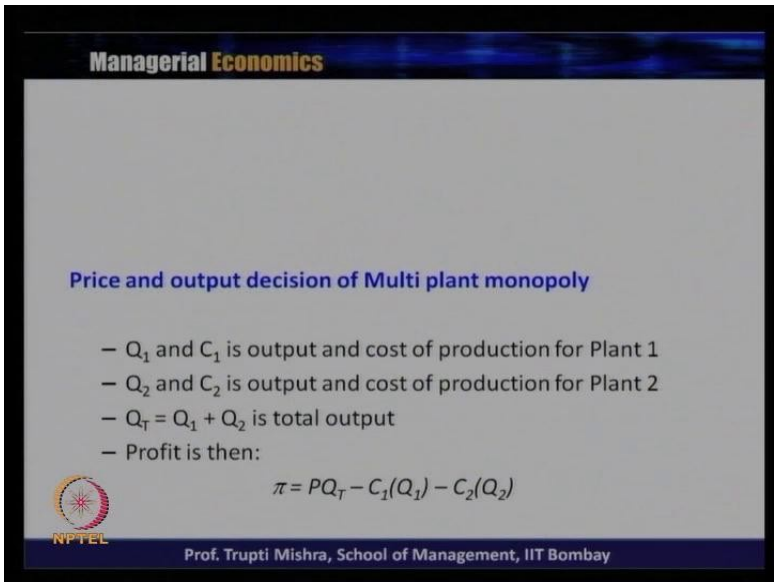

So, if you consider here Q 1 is the output, C 1 is the cost of production for plant 1. Q 2 and Q 2 is the output for plant 2 and C 2 is the cost of production for plant 2. Now, what is the total output? The total output has to be $Q_T = Q1 + Q2$. And in this case what will be the profit? The profit is the revenue what the firm gets that is $\pi = PQ_T - C1(Q1) - C2(Q2)$. $C1(Q1)$ is the cost function of the first plant. And $C2(Q2)$ that is the cost function of the second plant.

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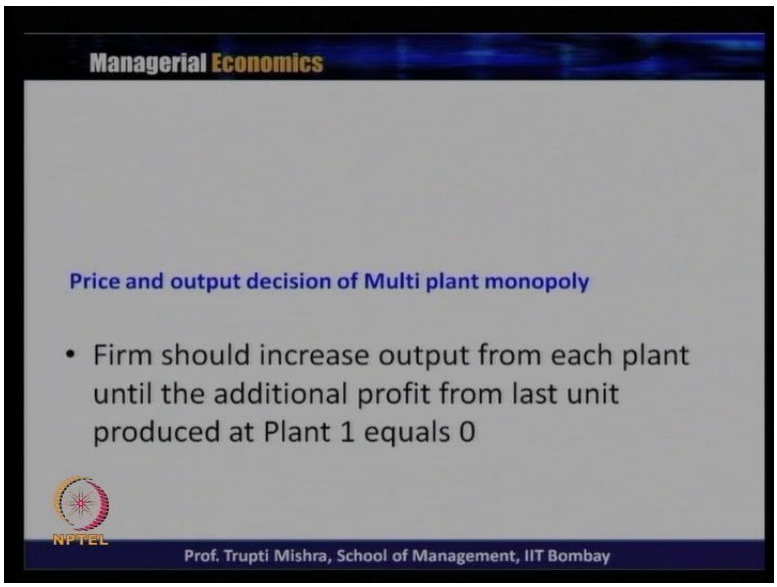

So, firm should increase the output from each plant until the additional profit from last unit produce at plant 1 equals to 0. So, the firm is going on increasing the output production of output in each plant till the time there is a positive profit comes to the firm. Once the profit goes to 0; then the firm generally stops increasing output in that plant because if after that it may happen that the profit goes in the negative side.

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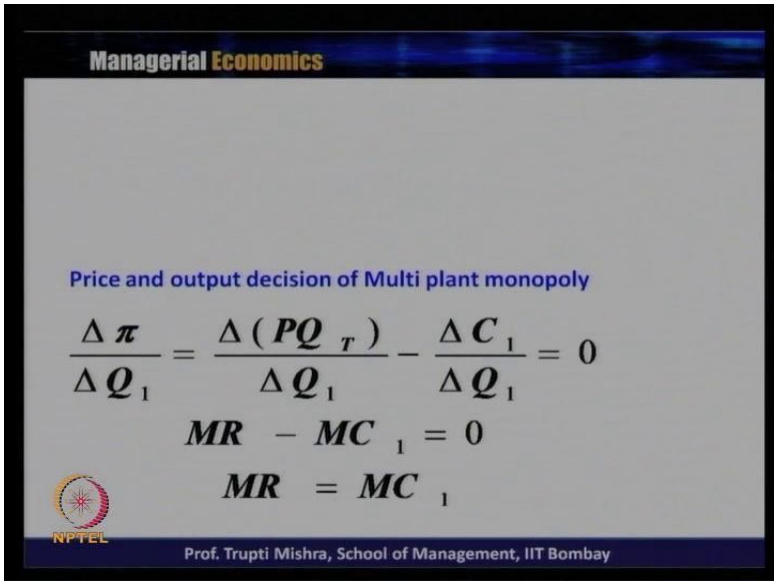

So, this the profit maximization we take the change in the profit with respect to change in the q 1. That is change in the revenue minus change in the cost function of the first plant. And change Q that is again MR. If you look at the first term is generally MR because that is changed in the revenue with respect to change in Q 1

And second part is generally MC 1; that is the specific cost function for the plant 1 and as per the marginal list rule it has to be equalized to 0. So, marginal revenue minus marginal cost 1 is equal to 0, marginal revenue equal to… And marginal revenue and that again if we simplify this then the marginal revenue is equal to the marginal cost for the plant that is MC 1.

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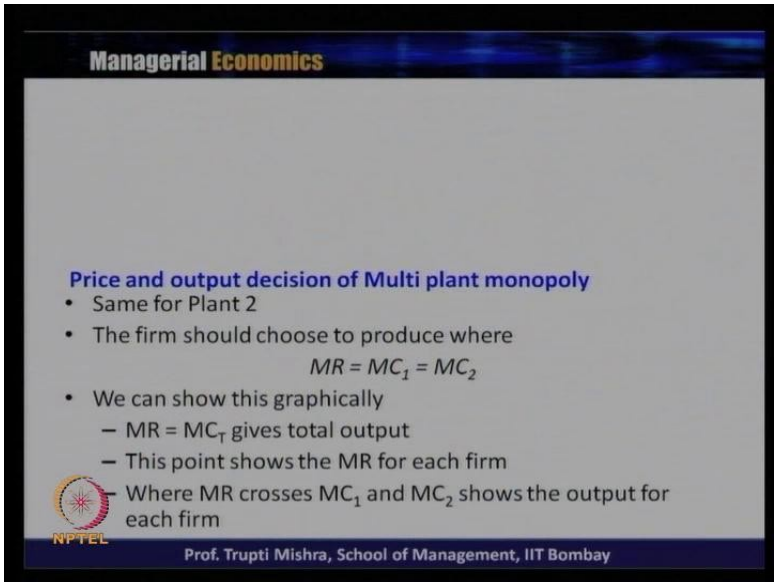

Now, the same thing we can do it for the plant 2 and what we will get for plant 2 that is the marginal revenue has to be equal to the MC 2. That is the cost function marginal cost function for the plant 2. Now, firms should choose to produce where marginal revenue is equal to marginal cost one and marginal cost two and we can show this graphically like marginal revenue. And marginal cost it gives the total output and this point shows marginal revenue for each firm and where marginal revenue crosses the MC 1 and MC 2 shows the output for each firm.

So, now we can see graphical representation of this multi plant and monopoly. Generally how it happen? How the price is decided on the basis of the? So, we look at here the equilibrium quantity. Equilibrium price is decided on the basis of the total revenue and total cost of both the plants, but when it comes to how much they have to produce and because they do not have the control on the price. Only they have control over the how much they have to produce in each plant. That is again comes from the fact that marginal revenue is equal to MC 1 following the marginal's rule and marginal revenue for equal to MC 2 for the plant 2 again following the marginal's rule.

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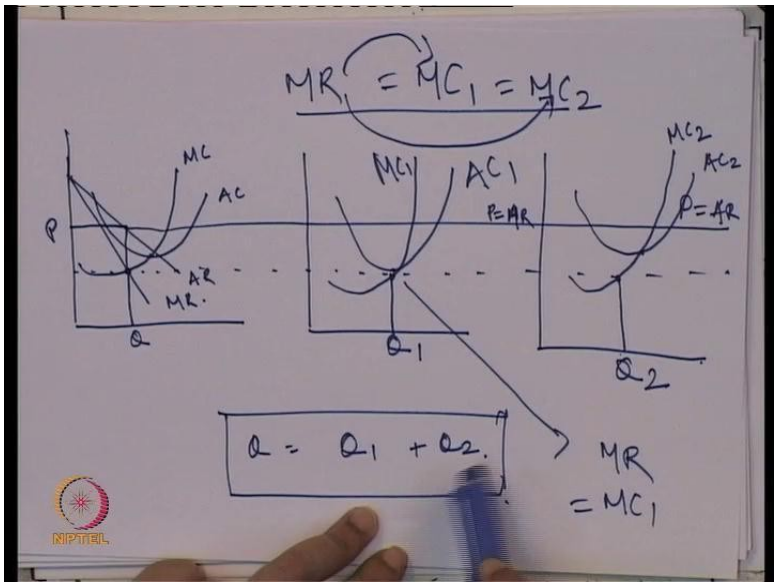

So, this is our average revenue curve. This is the marginal revenue curve, this is our average cost curve, this is the marginal cost curve. This is the point where marginal revenue and marginal cost intersect each other from here. We can find out the equilibrium quantity and equilibrium price. So, this price has to be followed in both the firms. So, this is again P is equal to M R and P is equal to A R and here it is again P is equal to A R.

Now, we will see how we get it from how. How the this Q is divided between plant Q_1 and Q_2? Now, suppose we have a average cost. At here we have a marginal cost at here. Now, this is the point where there is a equalization of the marginal cost and marginal revenue. Since we have only one marginal revenue, but we have two level of cost of production cost production.

So, we will equalize MR with MC_1 we will equalize MR with MC_2. So, corresponding to this we get a point here that is and this gives us the marginal revenue equal to the marginal cost one and corresponding to this this is the output level. That has to be produced by plant A, whereas if we look at again we have a different cost function for plant two and this is average cost two. This is marginal cost two. This is average cost one this is marginal cost one. Similarly, again we will take a point corresponding to the marginal cost and marginal revenue and this gives us the output for plant 2.

So, this $Q=Q1+Q2$ and generally how this how this output is decided. Initially the total output this profit maximizing output Q is decided on the fact that marginal cost which is the sum total of marginal cost one and marginal cost two is equal to marginal cost. On that basis

this following, the marginalized principle marginal cost, marginal revenue on that basis this is the equilibrium level of output. And this is the equilibrium price. The same price is same price has to be followed for plant one, plant two. How plant 1 and plant 2 they are different from each other? Plant one operate at a lower cost of production and plant 2 and is operates at a higher cost of production.

Because average cost two is higher than average cost one. And similarly corresponding to that we get two different level of cost function that is MC_1 and MC_2. And MC_1 when you equalize with MR, we get the level of output that is going to produced by plant one corresponding to MC 2. When $MC_2$when you equalize the MC_2 with MR we get the Q 2 which is the same level again the level of output that is going to be produced by plant B.

Now, the question comes what is the logic over here on what basis generally the firm produces more. Obliviously the firm produces more in that plant where the cost of production where the average cost of production is generally at a lower level because through that they can they get the economies of scale. When they operate the scale of when they they when they expand the scales of scale of operation, they expand at a lower cost of production and that is the reason they prefer to produce more in a low cost firm rather in a high cost firm because if they are producing in a high cost firm they are producing more in a high cost firm. The cost of production the the gap between the cost of production and the market price that generally narrow down, and market price is same for that whether the output gets produced from the plant one or output get produced from the plant two.

And this is how the multi plant monopolist generally decides it? The same thumb rule what we apply for the profit maximizing level of output the monopolist firm the multi plant monopolist firm generally takes a total of marginal revenue for across the firm for across the plants. And then they take the marginal cost which is the summation of marginal cost one for plant 1 and marginal cost 2 for plant 2. Since, it there are 2 plants; there may be many plants and always the marginal cost is the summation of marginal cost function of the all the plants where the output gets produced.

So, after getting this summation of all this now; it is get equalized with marginal revenue and corresponding to that we get a profit maximizing level of output. And this profit maximizing level of output generally gives us the total quantity that has to be produced by the firm. Now, firms decide now firm divides the total output among all the firms. On the basis of their cost of production if it is low cost of production generally the firm prefers to give them more

output to to get produce. And if it is a high cost firm they generally produce at a produce less because the per unit cost is on a higher side.

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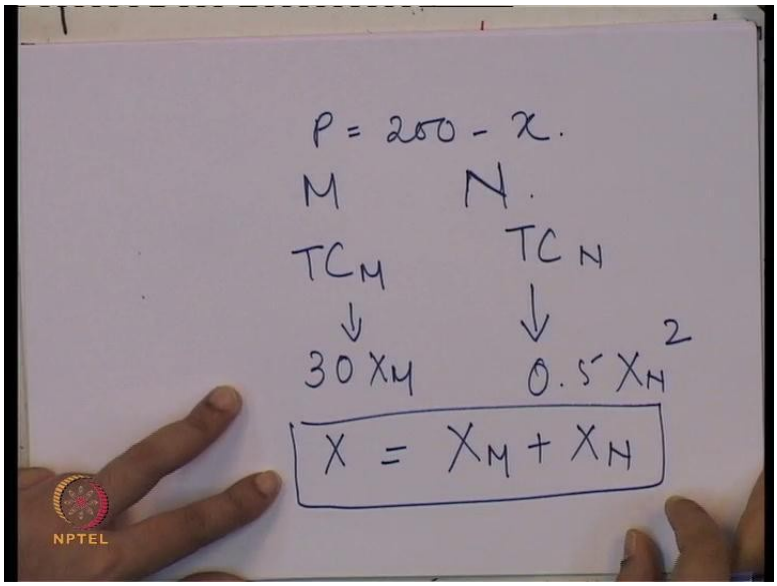

Then we will take a numerical to understand this that how this Q gets divided between 2 plants or how the profit gets firm we can find out with the help of a numericals. So, so demand function is $P=200-X$ we have 2 plants M and N. So, this is the total cost of function form, this is the total cost function for N. So, total cost function for M is $30\,X_M$ and total cost function for N is $0.5\,X_N^2$. Now, this X is output $X=X_M+X_N$ because this is the output gets from both the firms that is $X=X_M+X_N$.

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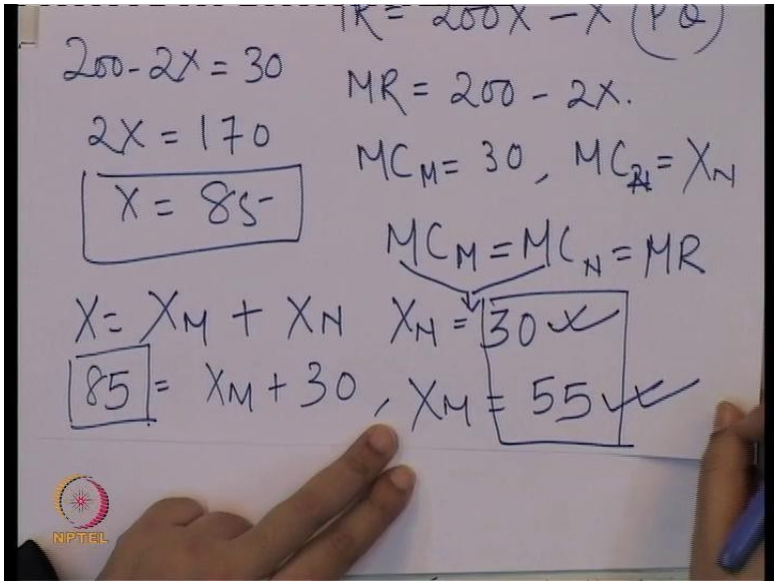

Now, we will find out the output output level what output to get produced. What is the amount of X and we will find out what is the revenue and what is the profit. So, if you look at then; now we have to find the total revenue and total revenue is $TR=200X-X^2$because this is basically the P Q marginal revenue is equal to $MR=200-2X$, MC_1 is equal to 30 and MC_2 is equal to X_N.

Now, to find out what is the value of X_M and X_N what we should do now we should equalize the MC_1. May be that is you can call it $MC_M$and this is MC_N also. So, marginal cost for M marginal cost of N has to be equal to marginal revenue that is MR. Now, when we equalize this MC_M and MC_N then we get X_M is equal to from this 2. We get X_N is equal to 30 and from MC_1 and MR what is our MR, $MR=200-2X$ it has to be equal to what is MC_M that is 30. So, 2 X is equal to 170, X is equal to 85

So, x is always a summation of $X=X_M+X_N$. So, that way if X is 85 and X_M is not known and X_N is 30. Then we can say that X_M is equal to 55. So, the total output to be produced is 85 and among this 85 X_N has to be produced by X_N has to produced plant N has to be produced thirty and plant M has to produced 55 units of output.

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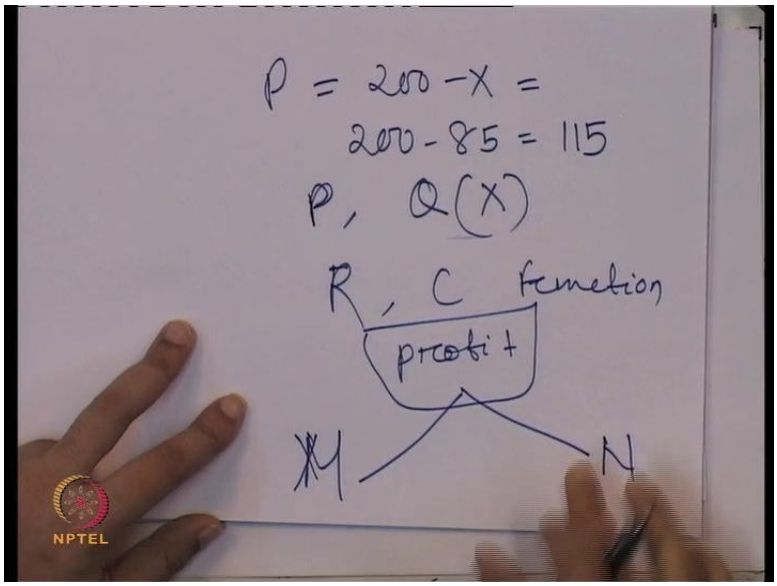

Now, what is the price? Once we get this; what is the price to? In order to find out the price; now you remember your demand equation that is $P=200-X$. So, that comes to $P=200-85=115$. So, we have the value of P, we have the value of Q in term of X. And

from there we can once we put the value of P and Q in our revenue function and cost function we can get the value of the profit what the firm gets. And please remember this profit is from both the plant. That is plant M and plant N because the both the output all the output gets aggregated between both the plants to produce the attain the. But when it comes to the firm it is an it is a when it comes to the firm the finish good always the price is same. And the revenue goes to the firm that is also same irrespective of it whether its produce in the plant M or whether it produce in plant N.

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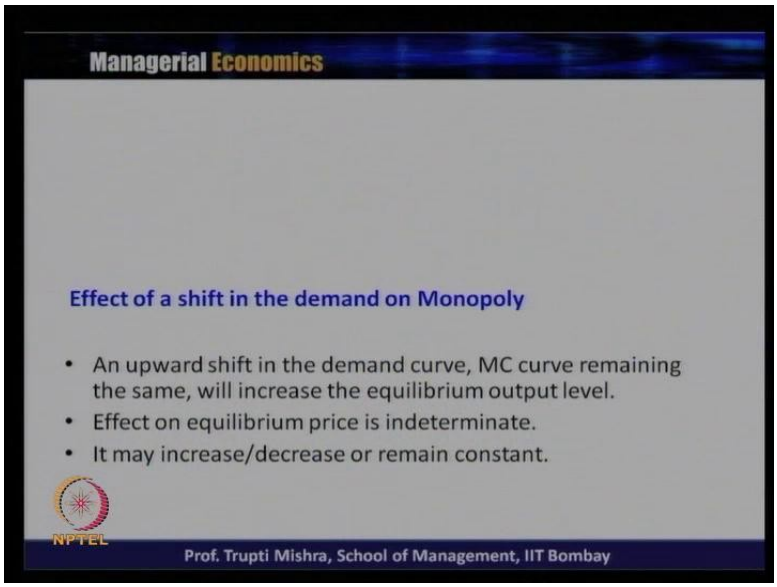

Next, we will see what is the effect of shift in the demand on the monopoly whenever there is a change in the demand. How it generally effects the monopoly equilibrium or how generally it effects the monopoly profit or how it effects the equilibrium price and equilibrium quantity of monopolist firm.

So, an upward shift in the demand curve that is increase in the demand curve marginal cost curve remaining the same will increase the equilibrium output level. So, MC remains same upward shift in the demand curve. So, generally average revenue shifts off. So, equilibrium output will increase and effect on the equilibrium price remain indeterminate. So, it is difficult to predict whether the price has to increase equilibrium price has to increase. Whenever there is a upward shift in the demand curve whether it has to be decreased or whether it has to be remain constant. So, will check in which case it may increase in which case it may decrease and it which case it may remain constant.

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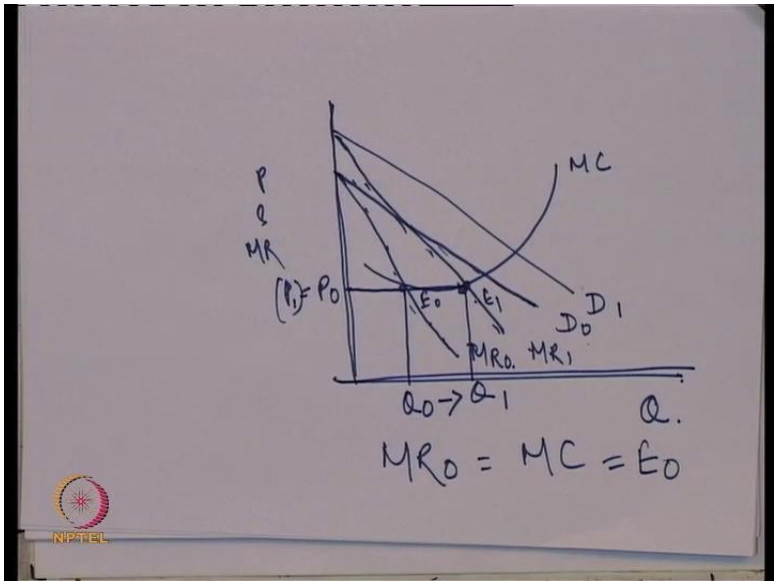

So, we are just taking one case here where we are saying that demand is upward. So, demand is increasing. So, suppose this is your D_1 this is D_0 or this is you can call it as MR_1, this is D_0 and this is MR_0 this is the marginal cost. So, we have 1 point here one point here. So, join this point to understand more clearly. So, this is demand. So, initially we can consider the quantity over here we can consider the price and MR over here.

So, initially the demand curve is D_0, marginal revenue curve is MR_0. What is the corresponding equilibrium point? The equilibrium point is the equalization of marginal 0 and marginal cost and we get the point E_0, E_0 has the equilibrium point increase in the demand takes places from D_0 to D_1. Correspondingly we get a new level of marginal revenue curve and that the new point of marginal revenue curve again it is the equilibrium point we get as E_1.

So, with the increase in the demand also if you look at still the price is constant even if the output is increasing from Q_0 to Q_1. But the price remain same at P_0 which is also equal to P_1. So, in this case what we can say? We can conclude that if if the if the demand is increasing if there is upward increase in the demand. Correspondingly there is a shift in the marginal revenue curve. But the position of the marginal cost curve is such that even if due to change in the demand. The new equilibrium is taking place and the corresponding to new equilibrium

we are getting a new level of output. But we are not getting a new level of price the price remain constant only the output changes.

So, if you look at it all it more to more to on the shape of the marginal cost curve that will decide whether with the increase in the demand the equilibrium price will increase decrease or constant. So, it this is the first case where the price is constant whenever there is a increase in the demand from D_0 to D_1. Then we will take a case where the marginal when there is a increase in the demand function that generally increases the price also along with the change in the equilibrium output.

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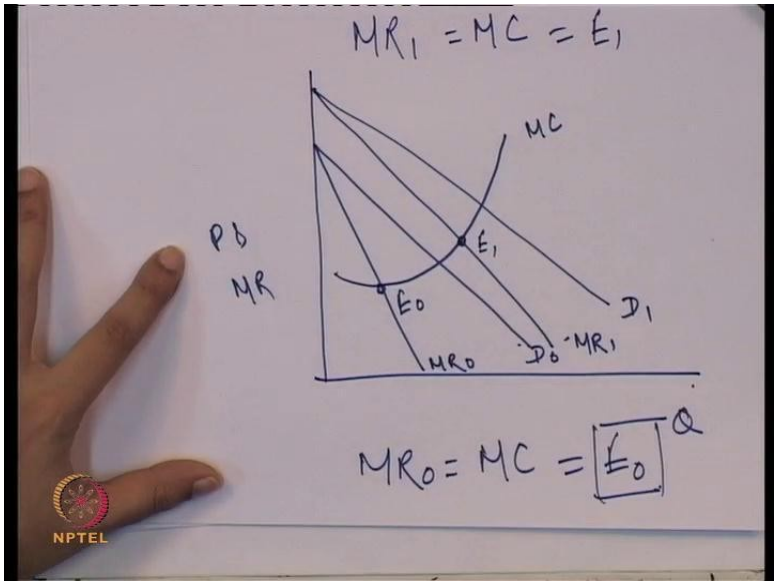
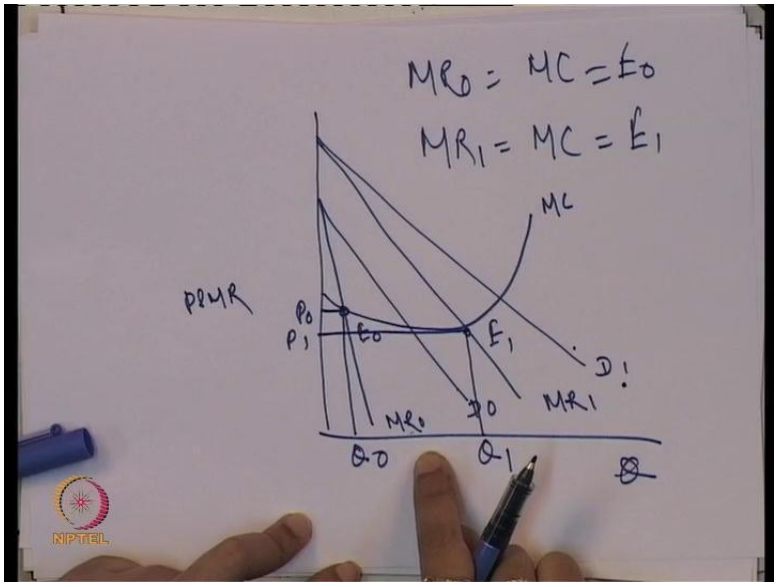


So, this is D_0 this is marginal revenue 0 demand increases from D_0 to D_1 and marginal revenue is also we get a new marginal revenue curve corresponding to new demand curve this is the marginal cost curve. So, we get point E_0 which is the equalization of the marginal revenue and corresponding to we get the equilibrium point E_0. And we get another point E_1 which is equalization of MR_1 and MC. So, we get another point of the we get another point of equilibrium

So, in this case in the first case. This is the quantity profit maximizing quantity. This is the profit maximizing price after increase in the demand corresponding to new level of equilibrium. This is the output and this is the price. So, in this case what is the outcome? The outcome is when the demand is increasing and correspondingly that MR is also increasing the. In this case the price is increasing equilibrium price is increasing and also equilibrium output is increasing.

So, if equilibrium price is increasing that is all to do with the shape of the marginal cost curve because marginal cost is increasing. And if you look at the per unit cost cutting added to produce more output because of in response of demand is increasing and that is the reason the price is increasing due to change in the demand. Then we will take a case where there is a decrease in the equilibrium price whenever there is a increase in the demand for the product this is. (Refer Slide Time: 28:39)



So, D_0 is the initial demand curve marginal revenue 0 is the P initial marginal revenue with respect to the demand curve D_1 is the change in the demand curve. Because of there is a upward shift in the demand curve marginal revenue is the change in the marginal revenue is the change in the marginal with respect to D_1.

Now, we will see how this leads to a decrease in the demand? We have one point again where we get the equalization of marginal revenue 0 equal to marginal cost and we get E_0. Corresponding to that we get the price is P_0 and quantity is Q_0. Then we get a new equilibrium. That is marginal revenue one which is equal to marginal cost and we get the equilibrium point as E_1. Corresponding to that we get as Q_1 and we get as P_1. So, equilibrium price is P_1 and equilibrium quantity is Q_1.

So, in this case what is happening? In this case the outcome is when there is a increase in the demand from D_0 to $D_1$the equilibrium output is increasing and, but the price is decreasing. So, here if you can see the difference also in the previous two cases the change in the output is not very high as compared to this, because relatively here the change in the output is also

more. Because is this is the increase in the demand and that leads to decrease in the price which again leads to the increase in the output and if you look at this again follows the basic demand supply condition; generally it happens in case of a open market or in case of a in case of a market which is competitive.