Petroleum Economics and Management
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Module - 07
Petroleum Discoveries and Structural Changes
Lecture - 32
Labour Demand

Hi, everyone. Welcome to our NPTEL course Petroleum Economics and Management and I am your instructor Dr. Anwesha Aditya. So, we are in Module 7 of our course where we are discussing Petroleum Discoveries and Structural Changes and this is Lecture number 32 of our course which is devoted for discussing Labour Demand.

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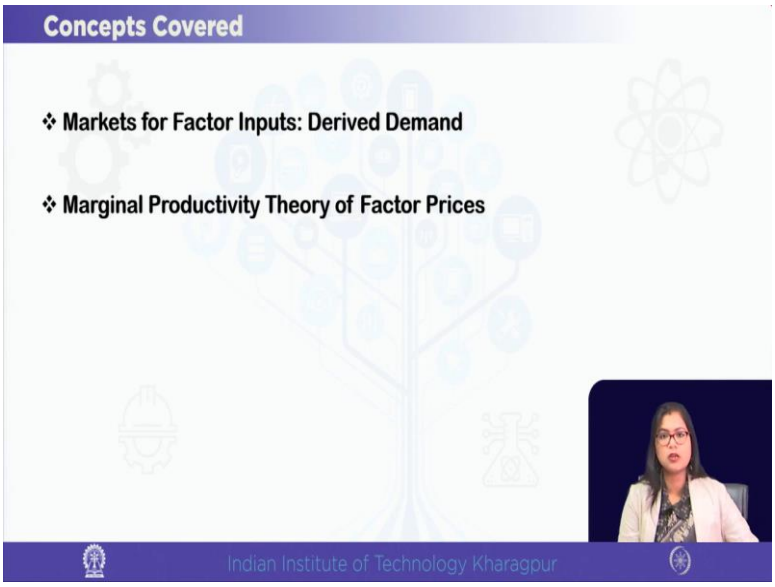

Now, if you remember in Module 7, we are going to study a theoretical model on what happens once a resource is suddenly discovered; how the structure of the economic changes; how the resources are reallocated; how the economies interaction with the rest of the world changes and how that affects the domestic country, the labour market, the factors market, the exchange rate prices.

So, we will study the theoretical model and also, we will empirically validate the model means we will match whether the find the theoretical model, they go by the empirical experiences of the countries. But, for studying the theoretical model we need to

understand some basic concepts of economics. So, we already have studied about the theories of production, the laws of production, we have studied the concept of PPF and how the shape of the PPF depends on the laws of production.

Now, we need to also know about very briefly about the factor market especially the labour demand. So, in today's class we will study the labour demand, how the wage rates are decided and how the demand for labour comes from the firm side. So, today's class we will start with market for factor input and why the demand for factors of production is called a derived demand and then we will study the very famous marginal productivity theory of factor prices.

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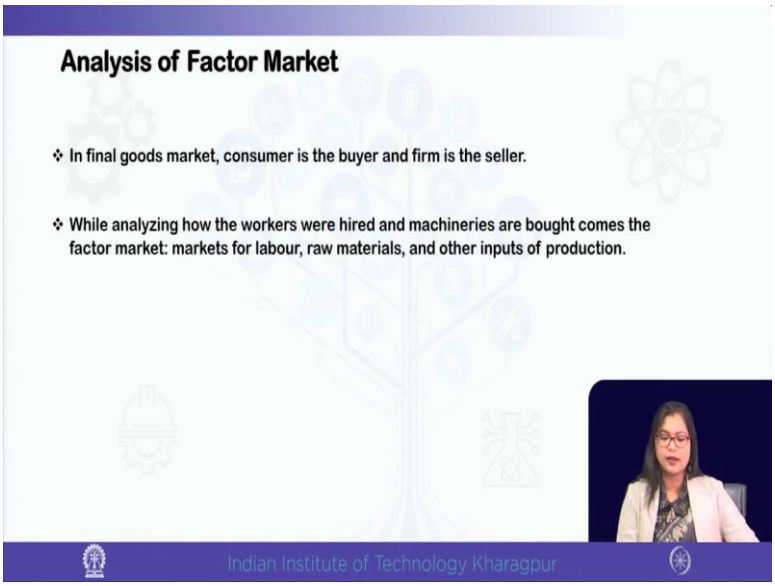

I have written factors of production, but mainly we will be studying the labour because in the neoclassical theories the factors of production are treated homogenously. So, there is no distinction made between skilled and unskilled labour. So, the same way we can also study the capital market. So, we are not going into that detail, we are just studying the labour market up to the extent which is required for successful understanding of our theoretical model of Module 7.

Now, you see what happens till now the economics part that we are discussing till now whether it is the even the petroleum economics part also the price of oil. So, whatever we have discussed till now we have considered the household as the buyer of the goods and services and the firm as the seller or the provider of the goods and services.

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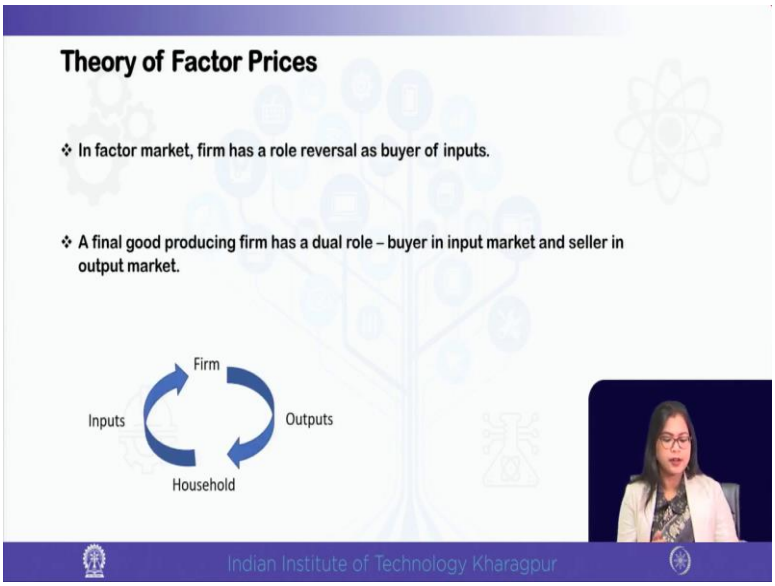

Now, in the factor market you see now there is a role reversal, right. Why because we have already studied the theories of production, we have studied the law of supply where we have seen that in theory of production, we have seen that the production function it is a mapping from input space to output space.

So, the firm combines the inputs of production like labour raw material capital using some technology and that gives us the output. So, firm is the supplier of output, but you see how the firm produces the output, the firm has to buy the factors of production, the firm has to hire labour, the firm needs investment fund – capital, the firm needs a land for setting up the factory.

Now, from where these factors of production will come? See these factors of production are owned by whom? Nothing, but the households, right. So, the factors of production are owned by the households. So, in the factor market what will happen the firm has to buy the factors of production from the household and the firm will produce will combine the factors of production using some technique to produce the final good. The household will buy the final good to consume to satisfy their consumption needs.

Now, how the household will buy the final goods and services? The household needs income or purchasing power. So, how will the household earn the income? The household will sell their factors of production like labour, the household can sell the or

lease the land or factory space to the firm, the household will also invest a fund in the firm right.

So, you see in the factor market there is a role reversal; in the output market that so far, we have considered their firm is the seller household is the buyer, in the factor market this is just the opposite. Now, the households are the seller of factors of production and the firm is the buyer of the factors of production. You see that is what we have we have represented here the role reversal, the just the complete opposite role of the firm at the household.

So, you see both the two parties firm and the household, by household we refer to a consolidated unit. So, both the two parties, firm and the household they have a dual role; firm is the buyer in the input market and seller in the output market and household is the buyer in the output market and seller in the input market. So, now in the factor market in today's class will be going to the other side where firm is the buyer of inputs of production and the household is the seller of the inputs of production.

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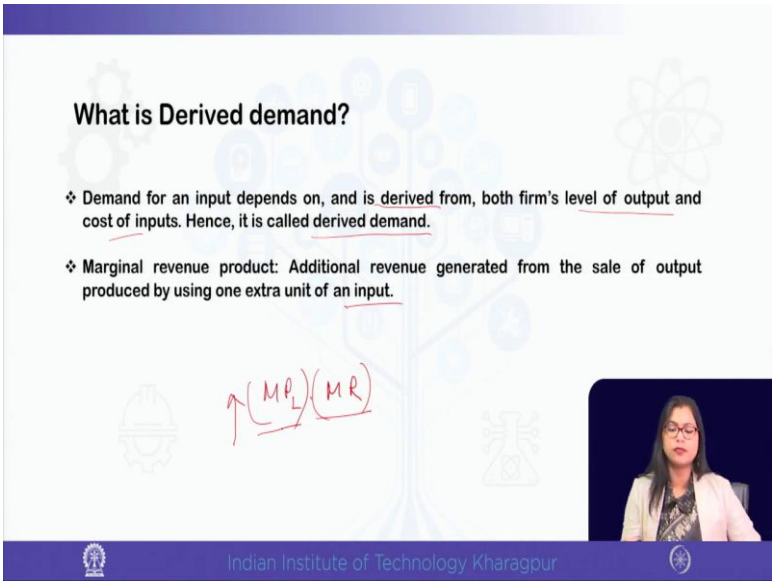

Now, you see demand for factor of production is generally is referred to as derived demand. Why? Because demand for an input it depends on and it is derived from both firm's level of output and the input prices. Why? If you remember theory of production there, I told that a firm output how much the firm will produce that depends on what? That depends on technology and the cost of production or the input price, right.

So, that means, the how much the firm will hire any particular input of production that depends on how much the firm will produce, if the firm wants to produce more the firm has to hire more input because with a given technology a particular amount of input can yield a maximum possible level of output. So, to produce more, the firm will need more input with a given technology, right.

So, demand for an input will depend on firm's level of output and also it depends on the cost or input price because if input price increases like if suppose labour becomes very costly say the skilled labour is very costly, then the firm may go for a more capital intensive or automated techniques of production.

So, you see demand for an input depends on and is derived from firm's level of output and cost of input. So, that is why demand for factors of production is called derived demand. Now, the demand curve for any factor of production how it is derived? So, very important concept in this regard is marginal revenue product. Let us say we just consider labour because here we are just concentrating on the labour demand derivation of the labour demand.

So, suppose we consider labour as the input we are just under consideration in this chapter. So, if the firm hires labour now, you see you have already studied the theory of production, we know that if the firm hires more labour; that means, which is the variable factor we have the law of diminishing return, but; that means, if the firm is hiring more labour what will happen? Output will change.

So, change in output by hiring one more unit of labour that is called marginal productivity of labour, right. So, if the firm hires one more unit of labour output will change. Now, what the firm will do with this extra output? The firm will sell the output in the market of final goods and services. By selling the output what happens? We already know by selling a output the firm earns revenue.

So, that means, when the firm hires labour, the labour contributes to output that is given by marginal productivity of labour, right and the firm will sell this extra output in the final goods and services market, and the firm will earn marginal revenue. So, what will be the contribution of the additional unit of labour? That will be MPL into MR. So, by hiring one more unit of labour output increases by the amount MPL. The firm will sell this MP L amount of output to get this revenue the change in revenue will be MR.

So, MRPL, this is the additional revenue generated from the sale of output which is produced by using one extra unit of labour. So, basically this is nothing, but the contribution of the extra worker. So, the firm was initially firm had ten workers for example. Suppose you have a start-up suppose after completion of your degree you have a start-up or if you have a consultancy firm where you have hired say ten of your juniors as intern.

So, if you hire one more intern eleventh one what will be the contribution of that intern in your revenue. So, that is given by marginal revenue productivity of labour because that one extra intern will add to your output you may get you may now complete one more project and that will change your revenue. So, marginal revenue productivity of labour that is the contribution of the additional unit of labour, ok.

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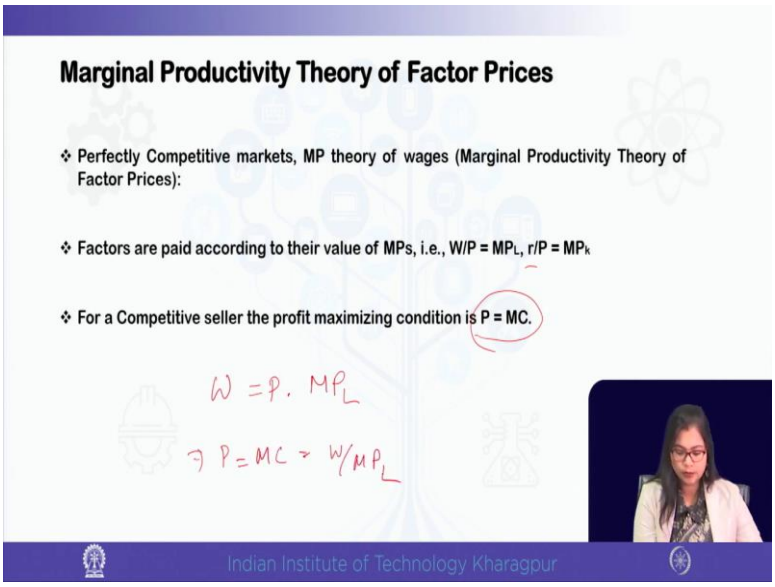

Now, in perfectly competitive market we have a very famous theory which is called the marginal productivity theory of factor prices. Here we are just concentrating on labour. According to this theory, factors of production or labour they are paid according to their value of marginal productivity, ok. So, what is this value of marginal productivity just so, just now that I explained.

So, that means, factors of production are paid according to their value of marginal productivity. So, say W is the per unit wage rate ok. So, if the firm hires one more unit of workers like the example I was giving. So, if you hire one more junior as intern. So, you

will be able to do one more project. So, that will be the contribution of that intern. So, that is given by output will change by the amount MPL and the firm will sell that additional output this is the firm will earn revenue.

Now, under perfect competition price is equal to marginal revenue. So, by selling this MPL amount of output for per unit of output suppose the price is P. So, what will be the contribution of the worker? That will be price into the marginal productivity of labour. So, in perfectly competitive market the factors of production are paid exactly equal to their marginal product value of marginal productivity; W is equal to P into MPL.

Similarly, rate of return to capital will be R is equal to P into MPK, ok. Because in perfect competition we have P equals to MR.

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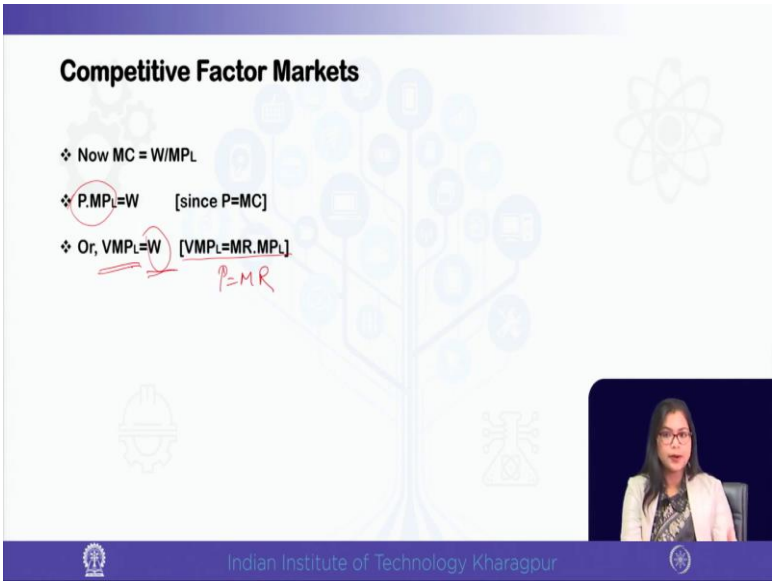

And, also, we have already had discussed that price is equal to marginal cost in perfect competition. So, if marginal cost is equal to, we can write over here. So, if your price is equal to marginal cost. So, what happens here? We can write that P is equal to MC is equal to what W by MPL. So, basically MC is equal to W by MPL or P into MPL is equal to W and this P into MPL is called the value of marginal productivity.

So, this is the marginal productivity theory of factor prices. Factors of production are paid according to their contribution. So, just now you see I interpreted when I discussed about MRPL, so, this MRPL is nothing but the contribution of the extra unit of labour.

So, if the firm hires one more unit of labour how output changes and if the firm sells the additional unit of output how revenue will change.

And, under perfect competition price is equal to marginal revenue that is why this MRP L is nothing, but now P into MPL which is the value of marginal productivity. So, W is the wage rate is the price of labour or that can also be interpreted as the cost of labour because if the firm wants to hire labour the firm has to offer the wage W, W is the per unit price of labour. So, W is basically the cost of labour and VMPL is the contribution of the labour.

So, the labour is getting whatever he or she is contributing, there is no exploitation. But if the firms have market power, we can show that basically W the firm will pay less wage to the workers and the workers are exploited. They contribute more, but they get less wage, ok. But, in perfect competition there is no exploitation.

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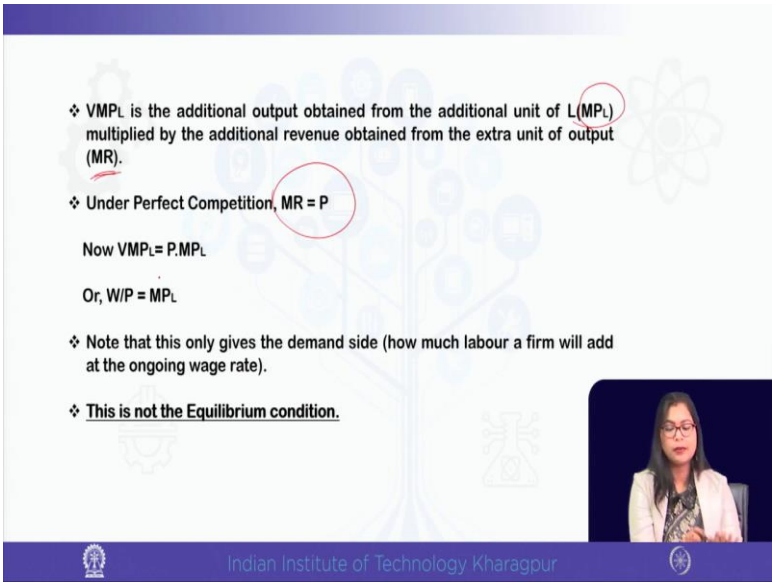

So, we are just sticking to perfectly competitive market structure for our theoretical model.

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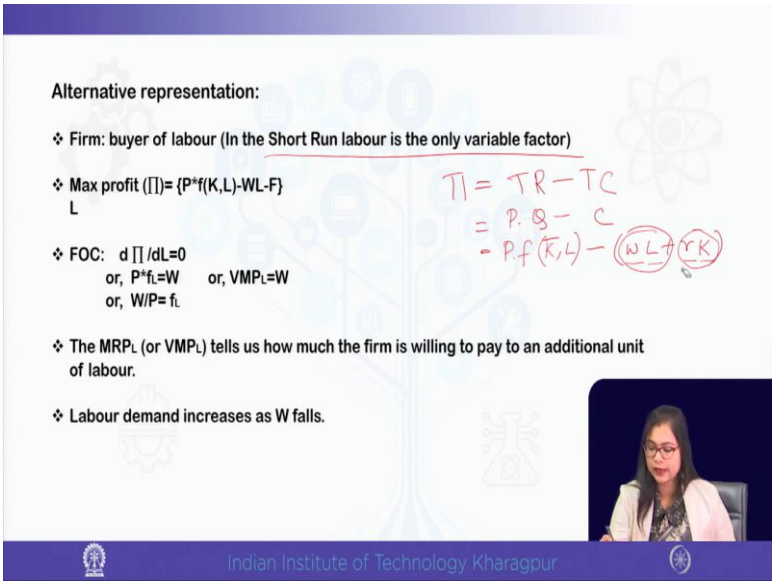

Now, we can also prove this, we can derive this VMPL value of marginal productivity of labour is equal to the wage rate, we can derive this mathematically also using a very simple proof. So, you see in the factor market as I discussed now firm is the buyer of labour.

Now, see we have also mentioned earlier that in short run labour is the only variable factor of production. So, now, if we want to write the maximization problem profit maximization problem of the firm so, profit is what we have earlier also written profit is equal to total revenue minus total cost. And what is total revenue? We know total revenue is price into quantity. And what is total cost? Total cost of is the cost of producing the good that means, the cost on the factors of production.

Now, you see what is Q? Q is basically the production function ok. F of K, L. Now, K is fixed in the short run you remember in theory of production we wrote the short run production function is Q is equal to F of K bar L. And what is the cost of production? C is equal to WL plus RK. If the firm uses two inputs labour and capital to produce the good and W is the per unit wage rate and R is the per unit rate of return to capital and suppose the firm is hiring L units of labour and K units of capital?

So, WL is the total payment to the labour and R K is the total payment to capital. Now, in the long short run you see capital is fixed. So, in place of RK we can also write this as what?

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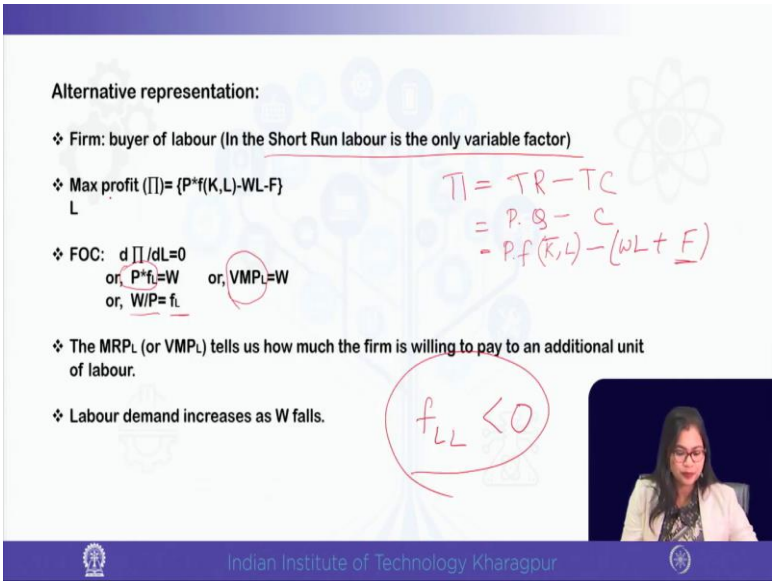

So, the total cost of production becomes WL plus this is a fixed cost F. So, this is the problem of the firm to maximize profit. Now, in the short run suppose now the firm is maximizing profit by choosing the amount of labour how much to how much labour to hire ok. So, the first order condition becomes del pi del L equals to 0 ok because F is this is fixed the firm is operating with given some particular amount of capital K bar.

So, that makes what? Del F del pi del L equals to 0 is P into del F del L and del F del L is fL; fL stands for marginal productivity of labour. So, P into MPL is equal to W because this will be W into del L by del L is equal to 1 and why we cannot have I mean we cannot have del L into del W del L? Because, see, the firm is a price taken in the labour market. We are assuming perfectly competitive goods market and labour market.

Therefore, this W the per unit wage rate W is also given to the firm the firm cannot influence W by changing the amount of labour, ok. So, we have if we differentiate this with respect to L, we can write this as P into del F del L which is MPL is equal to W and again F is fixed and P is also given in the P is the price of the final good that is also given in the market ok.

So, this P into MPL is nothing but value of marginal productivity VMP L ok. So, MPL is equal to wage rate by the price of the good. So, you see MRPL or VMPL tells us how much the firm is willing to pay to an additional unit of labour, ok. And, you see we of course, have we known we have diminishing marginal productivity of labour, right. You

remember we discussed that the firm operates in region II that is the region of economic operation where MP is positive, but diminishing.

So, that means, what by diminishing marginal productivity fLL is negative. As we employ more and more of the variable factor labour output increases, first at an increasing rate and then at a decreasing rate. So, we already discussed that the firm will not operate in stage 1 where MPL is rising. Firm will operate in stage II that is called the region of economic operation where MPL is declining.

So, you can refer to the theory of production lecture just to recapitulate this part. So, by f LL is negative by law of diminishing marginal productivity.

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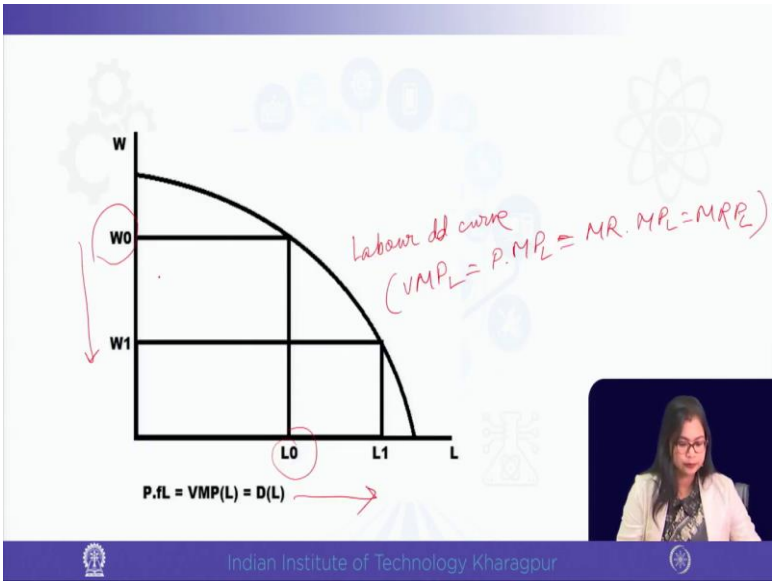

So, you see if we now plot demand for labour against the wage rate, as wage rate you can interpret it as the price of labour. So, we know that always price comes on the vertical axis and quantity on the horizontal axis. So, if we represent W this is the price of labour in the vertical axis and the amount of labour demand on the horizontal axis you see we get a downward sloping curve which is nothing, but the labour demand curve.

So, this is our labour demand curve that is the VMPL curve and under perfect competition this VMPL is equal to P into MPL and P is equal to MR. So, this is also the MR into MP L is basically the MRP L. In imperfect competition MRPL and VMPL will not be the same because there will be a divergence between MR and P.

And, you can see that if suppose initially wage rate is W0 then demand for labour is L0. If wage rate falls, we know by law of demand if price falls quantity demanded increases and of course, this is negatively sloped by the law of diminishing marginal productivity. So, basically you see this W equals to VMPL this condition that we are getting these you should not treat as the labour market equilibrium condition.

See we have not told anything about the supply side of labour because for our purpose at least we do not need that ok. Those who are interested you can go for some micro economic course to know how the equilibrium in the factor market is decided. We are just studying the labour demand because that will be required to understand our theoretical model.

So, you see here this VMPL equals to W this is not the equilibrium condition. This only gives the demand side of the labour market, ok. So, how much labour a form will demand at the ongoing wage rate and if the wage rate changes how demand for labour will change ok. So, this is only this condition W equals to MPL which we are W equals to VMPL which we are plotting over here this gives the labour demand curve.

It only represents the demand side not the equilibrium condition. For equilibrium in the labour market, you need to bring the supply side, but we are not doing that. That is not our purpose or objective and we do not have the time also ok. So, this is how we derive the labour demand curve which is the MRPL curve and under perfect competition MRPL is VMPL, ok.

So, VMPL once again is the additional output obtained from additional unit of labour that is MPL and if the firm is selling this MPL how much revenue the firm gets that is the MR. So, MR into MPL is VMPL. Under perfect competition P equals to MR. So, that boils down to labour demand is equal to VMPL ok.

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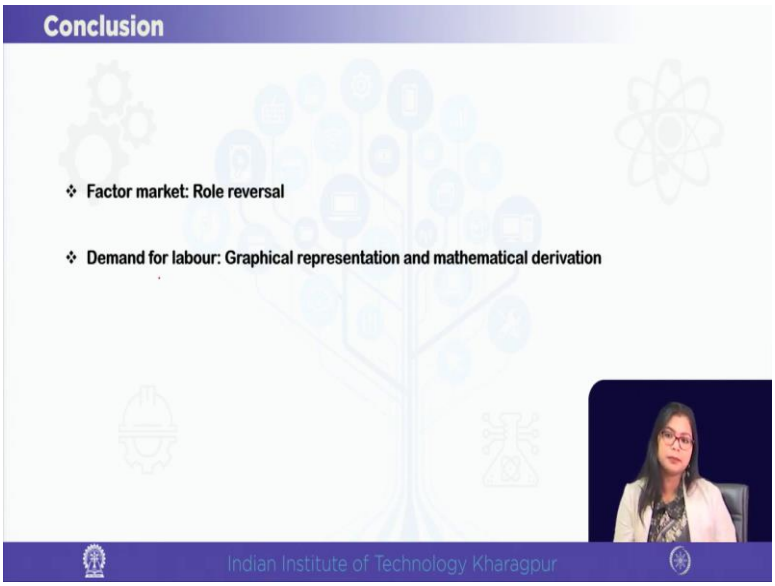

So, you see in today's class what we did? We discussed the role reversal, ok. So, far before today's class we just concentrated on one side that means, in the output market where firm is the seller of the final goods and services and the household is the buyer of the final goods and services, but how the firm will produce the final goods and services by using the inputs.

Now, where from the inputs come? The inputs come from the households. The households sell the input and that also gives the household the purchasing power to buy the output. So, you see in the factor market the firm is the buyer and the household are the seller.

So, we discussed about this opposite role of the firm and household in today's class. We discussed about the demand for factors of production why it is called a derived demand and finally, we talked about the marginal productivity theory of factor prices that holds under perfect competition and we saw that under perfectly competitive market the labour demand curve is given by the value of marginal productivity curve.

So, factors of production are paid according to their value of marginal productivity. So, this is very important result. So, and we derived the labour demand curve which is downward sloping. So, that means, if wage rate increases labour demand will fall, if wage rate falls labour demand will increase. And, the negative slope of the labour demand curve follows from the law of diminishing marginal productivity.

So, you see how important the basic concept that we are learning otherwise we cannot successfully complete our theoretical model and our rest of the modules.

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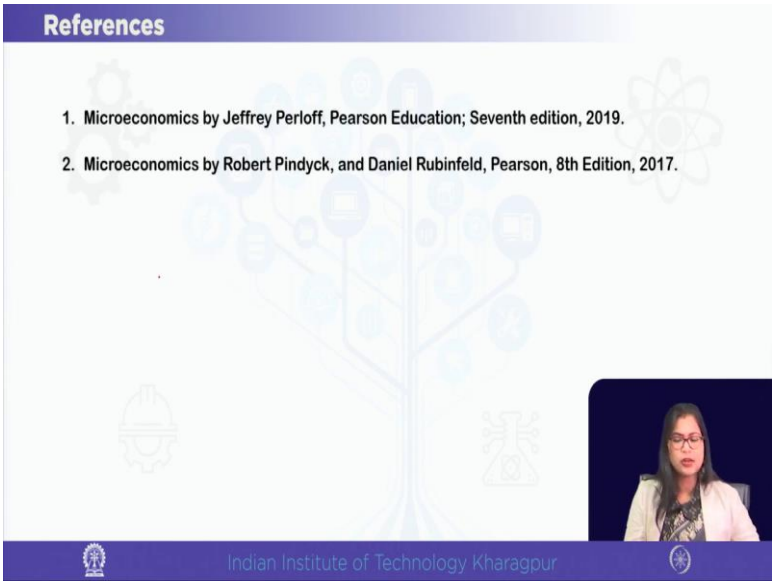

So, you can follow any standard microeconomics book for studying the labour demand part ok. So, with this we finished the basic microeconomics part that we required to successfully understand our theoretical model.

Now, thank you very much and I look forward for discussing the theoretical model with you in the next two classes.