Fundamentals of Electrical Engineering
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Lecture - 61
Three Phase Induction Motors (Contd.)

So, now we will see the Starting right.

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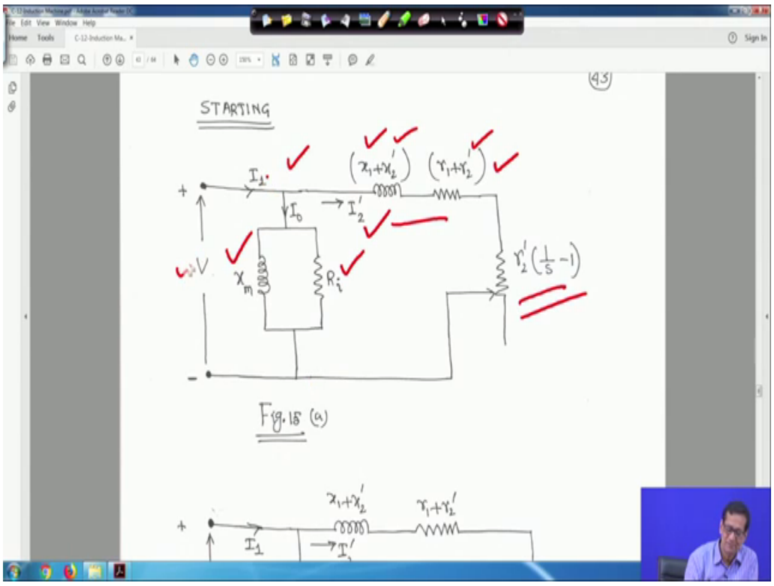

But this circuit if you look into this circuit right this circuit actually we have brought this magnetising component and the (Refer Time: 00:25) loss component just at the where at the beginning right. After that we are just for the simplification, but this kind of if you assume this kind of circuit, it will give it will not give accurate result whereas, result will be your calculation will be inaccurate

Because we have just for the simplification we have made it like this and that is why we have connected here it does not matter, but just for the sake of understanding. And this part we call already told you load resistance, so these two are added and these two are added and this is the current I 2 term this is I 1 and this is my V right. So, just let me clear it.

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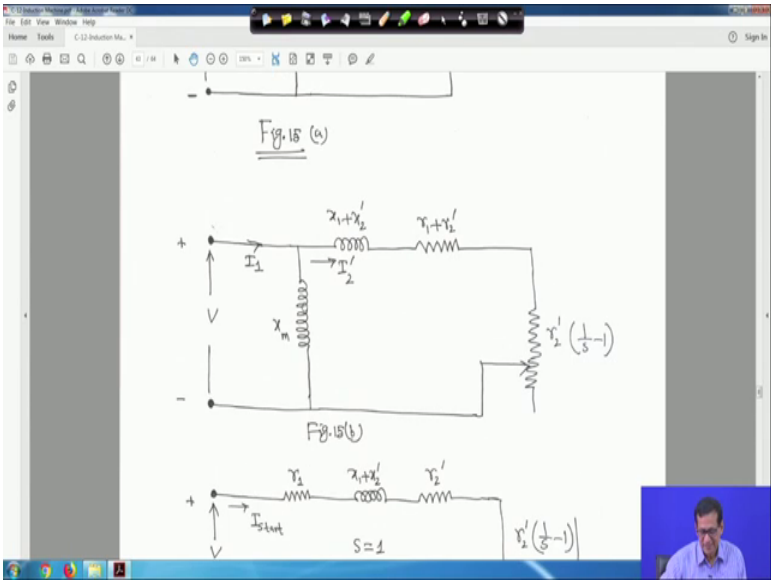

So, now if you go to the next circuit here R i is neglected. Suppose it is not there, if it is not there then this is I 1 only, this is X m and rest remains same right. And last one is that we are this part is also not there this part is also not there neglected right.

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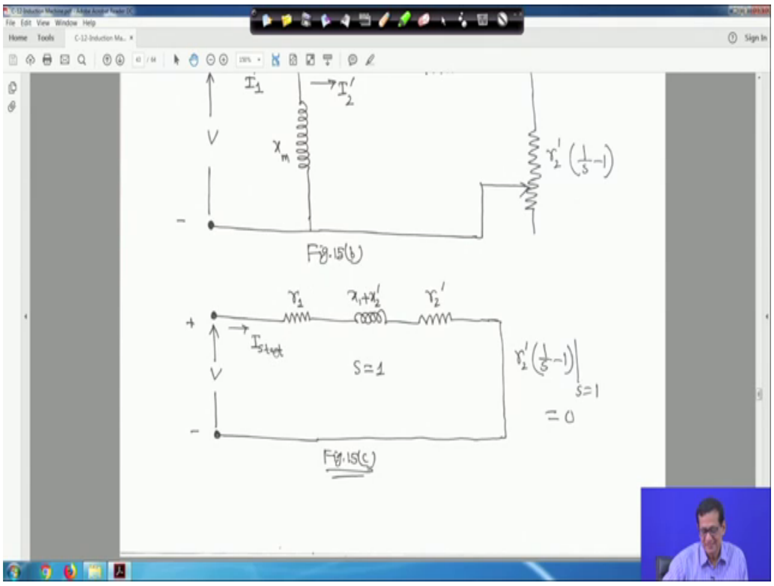

So, it is I starting S is equal to your 1, and this is r 1 right and this is x 1 plus x 2 dash this is r 2 dash and r 2 dash 1 upon S minus 1 S S is equal to 1, So this part is 0. So, at start this load at start S is equal to 1, so this part will be 0 right in that case this is here where I starting when S is equal to 1.

So, this is one approximation it does not give correct result. This is another approximations also it may not be a in a accurate right and this it is also not accurate and this one also at S is equal to 1 right. So, in that case this part is also we have not considered start this is this part is also neglected. So, S is equal to 1, so this part is 0 rights and this is the simple series circuit.

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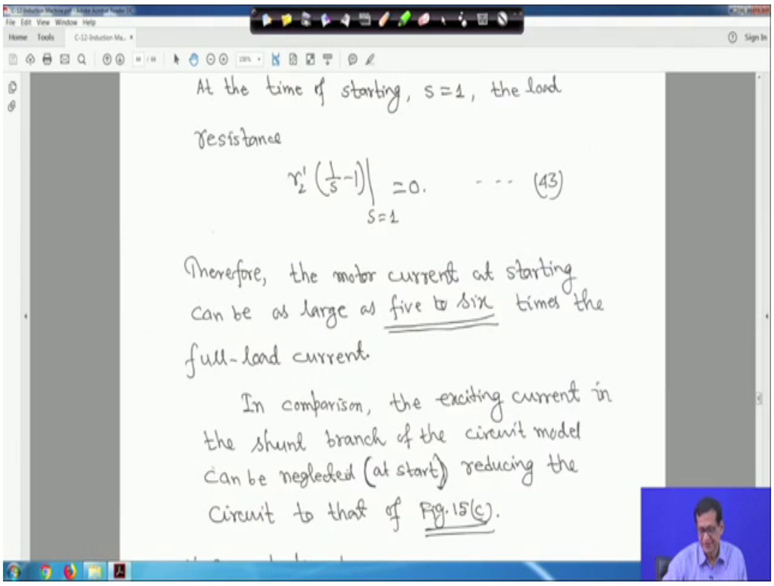

So, at the time of starting now S is equal to 1 the load resistance is 0. I told you there for the motor current at starting can be as large as 5 to 6 times the full load current. Because at the start this part is 0; that means, ultimately affecting impedance is getting reduced because of that starting current is higher because this part is 0 right. So, at start therefore effective impedance is getting reduced and current will be your current is equal to V upon impedance.

So, as impedance is getting reduced so current will be higher. So, at start current will be higher right. So, generally in a motor you will find this 5 to 6 times the full load current that is the starting current right starting current is 5 to 6 time the full load current. So, in comparison the exciting current in the shunt branch of the circuit model can be neglected at start reducing the circuit to the figure 15 C. So, at the start the start branch is neglected right just for the, it is a simplification right.

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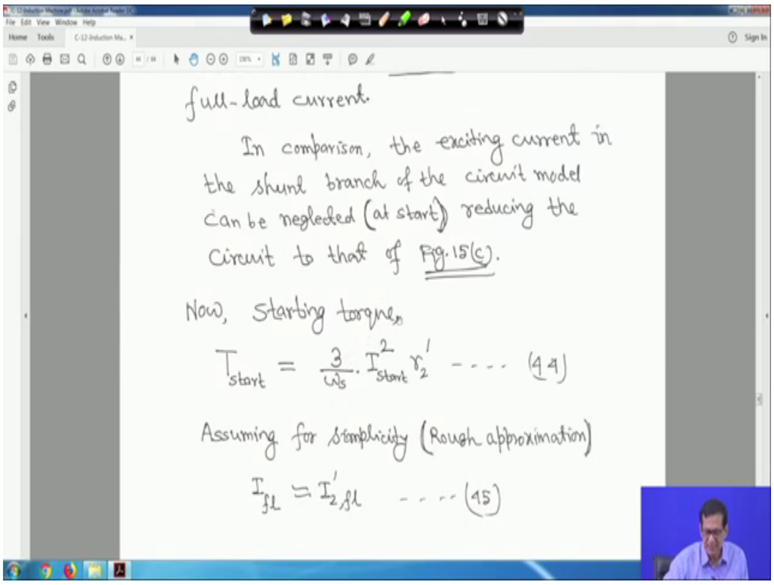

Now starting torque T start will be 3 by omega S then I starts square into your r 2 dash because we have we have this is from that expression we have all seen that start starting torque expression, maximum torque expression, torque expression everything. So, it will be 3 upon omega S into I start square into your r 2 dash right.

So, basically your torque expression you have seen that is your what you call your 3 3 by omega S P G you have already seen and P G equal to 3 your I 2 I 2 start square into r 2 dash upon S, but S is equals to 1. And in this instead of I 2 dash; it will be I start, so that is why T start is equal to 3 upon omega S into I start square into r 2 dash this is equation 44. Now assuming for simplicities or rough approximation, so I, f l is equal to full load is equal to I 2 dash f l right just a just for the your our assumption right.

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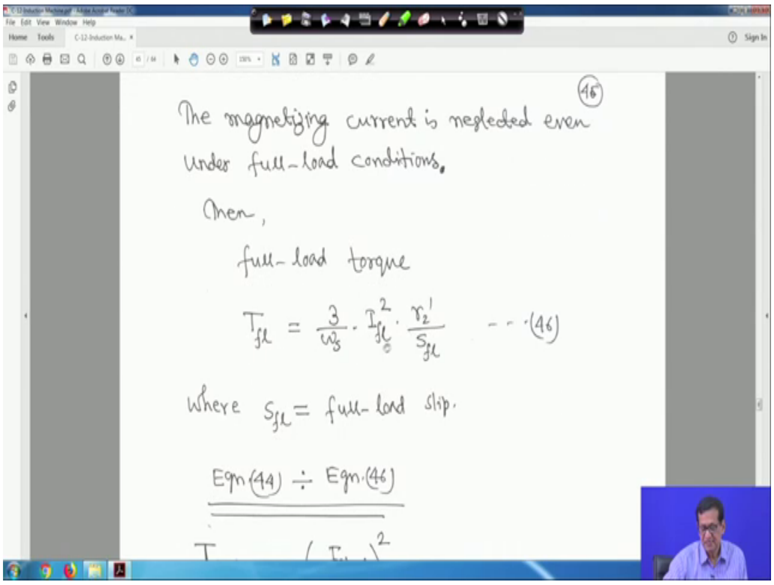

So, in this case the magnetizing current is suppose the magnetizing current is neglected even under full load condition. Then full load torque will be T f l will be 3 upon omega into I f l square into r 2 dash upon a S f l same as before. Use the same torque expression only this only this your, what you call this terminology of full load current. Full load your full load current and full load slip just replace by those things right. So, this is 3 upon omega S into I f l square into r 2 dash upon S into S f l, S f l is a slip at full load right.

So, a full load means suppose machine operating say 10 h p machine is there. So, it is operating at that 10 it is 187, 46 your watt. So, if you if r you say 10 watt machine for example, and if it operates at 10 kilowatt that is actually your call and corresponding current will be full load current, and that is the full load power and corresponding slip will be your full load slip. So, this is 3 by omega S into I f l square into r 2 dash upon S f l right and where S f l is equal to full load slip.

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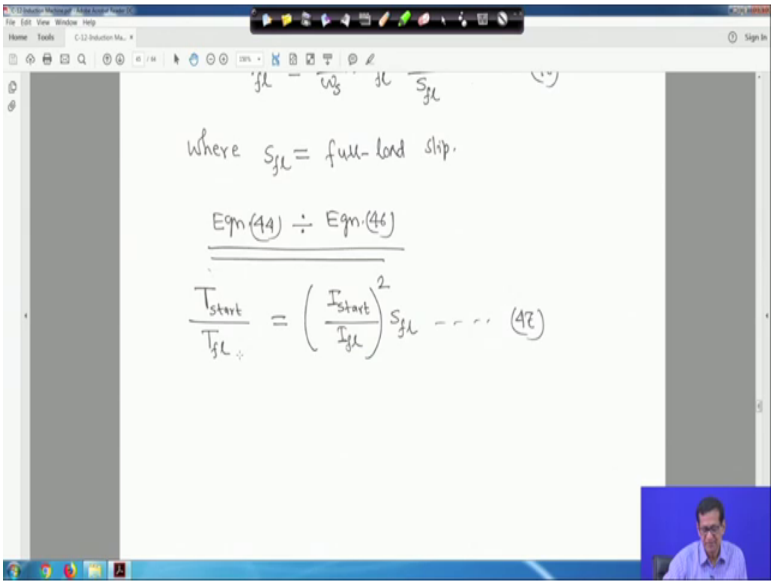

Now if you divide equation 44 divided by 46 right then you will get T starting by T f l is equal to I start square I start by I f l whole square into S f l this is a simple relationship right. So, with this with this whatever little bit is theory is there at least at least a first year level whatever little bit is there.

So, with this induction machine theory part is complete next we will see few examples. So, with hope there will be absolutely no problem for you just try to basic few things you keep it in your mind rest little bit of assumptions and all this things automatically one after another will come. And nothing is actually it is in as not at all difficult one right.

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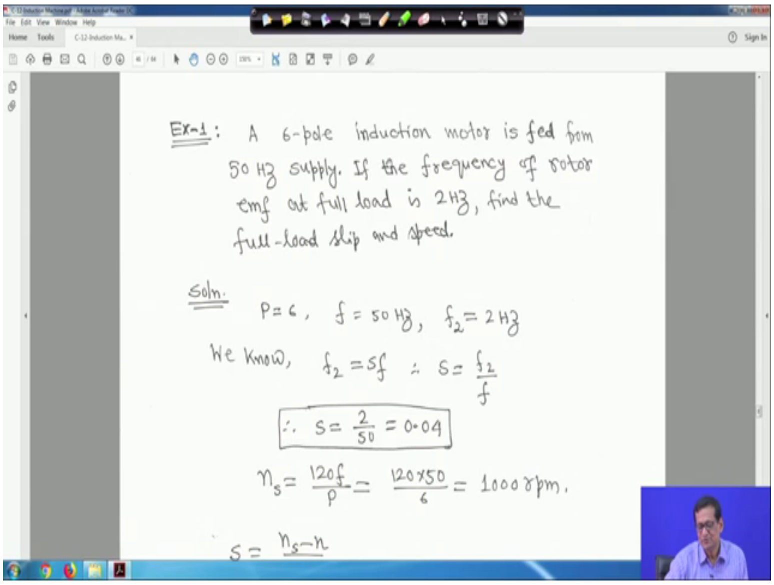

So, now take the example one. Suppose a 6 pole induction motor is fed from 50 hertz supply. If the frequency of rotor e m f at full load is 2 hertz right that is f 2 is equal to S f right. Find the full load slip and speed.

So, P is given 6, f is equal to 50 hertz, f is equal to 2 hertz and we know f 2 in equal to S f, so S is equal to f 2 upon f. So, f 2 is equal to 2, and f is equal to 50, so slip is 0.04 and n S we know is equal to 120 f by P, so 120 into 50 by 6; so 1000 rpm. And S is equals to n S minus n upon a n S right.

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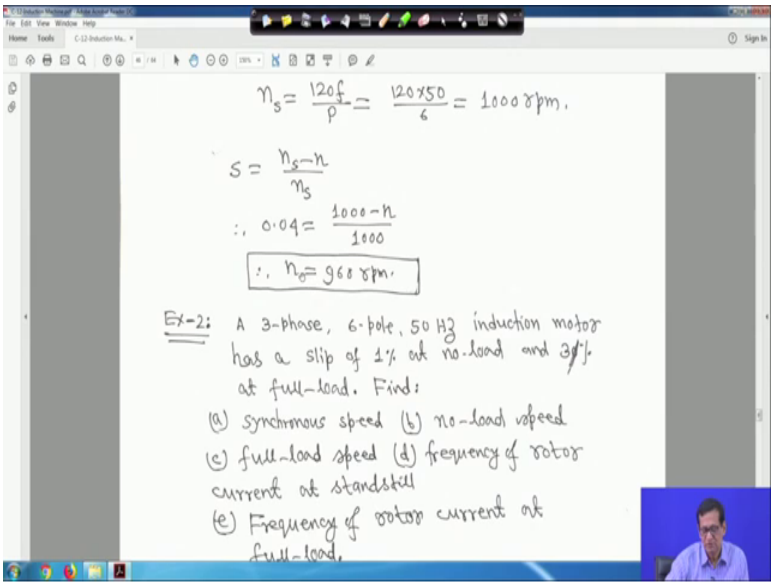

So, S we have got 0.04 this is 1000, so you have to find out. So, rotor speed is 960 rpm; so, simple example right.

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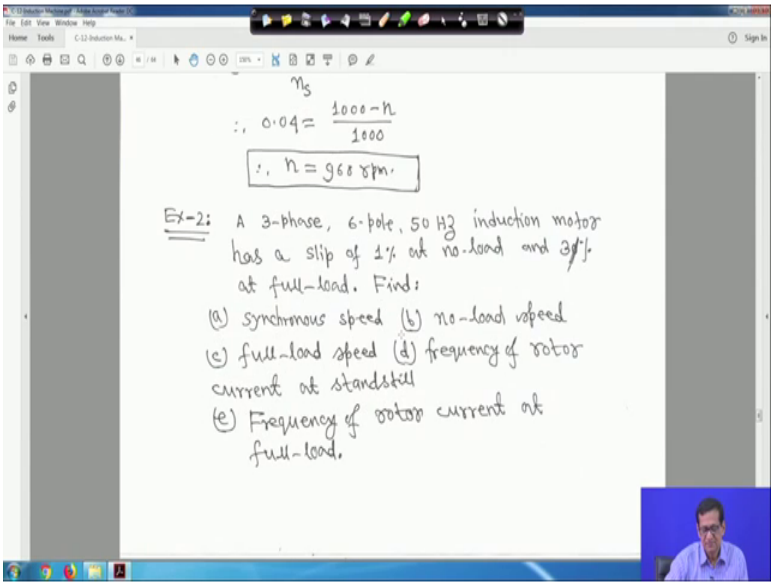

Similarly, example 2 is a 3 phase, 6 pole, 50 hertz induction motor has a slip of 1 percent at no load and 3 percent of full load right. Find the a synchronous speed, b no load speed, c - full load speed, d frequency of rotor current at standstill, and e - frequency of rotor current at full load right.

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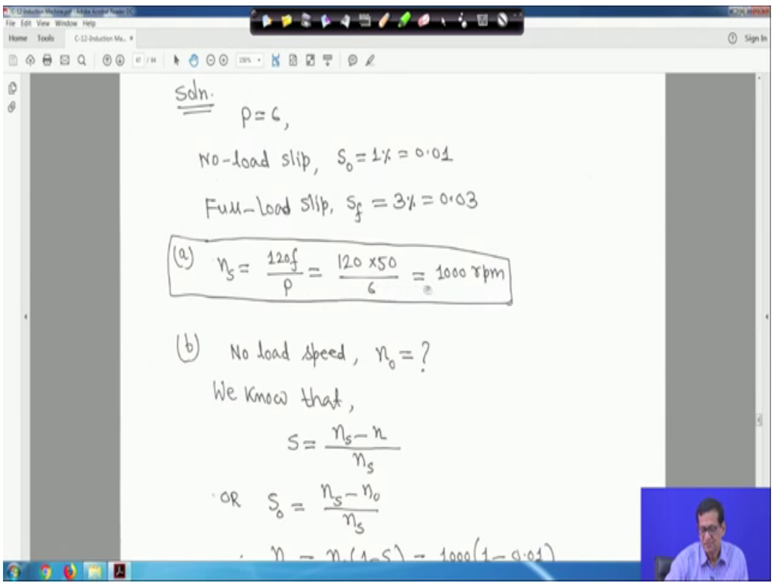

So, when P is equal to 6 no load slip given that is 0.01, full load sleep is given that is 0.033 percent, so n S physical 120 f by P. So, it is 1000 rpm substitute all these value it is 120; f is equal to 50 hertz and P is equal to 6 poles, so 1000 rpm do not make it p r right, then you will make a mistake here is number of poles right, so 1000 rpm.

Now no load speed n 0 is how much right? We know that is equal to n S minus n upon n, so here n is equal to n 0. Therefore, is S 0 is equal to n S minus n 0 upon n S or n 0 is equal to 1 minus S 0. So, S 0 is 0.01 that is your no load slip, so n 0 will be 99 rpm.

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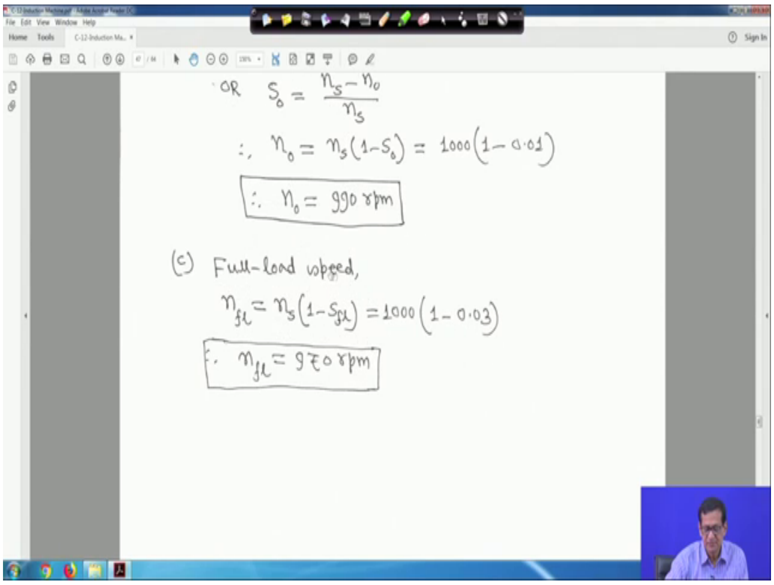

Now c is the full load speed, so n f l you can just replace this suffix 0 by f l; n f l is equal to n S 1 minus S f l this is your 1000 and S f l is 0.03. So, it is coming 970 rpm right.

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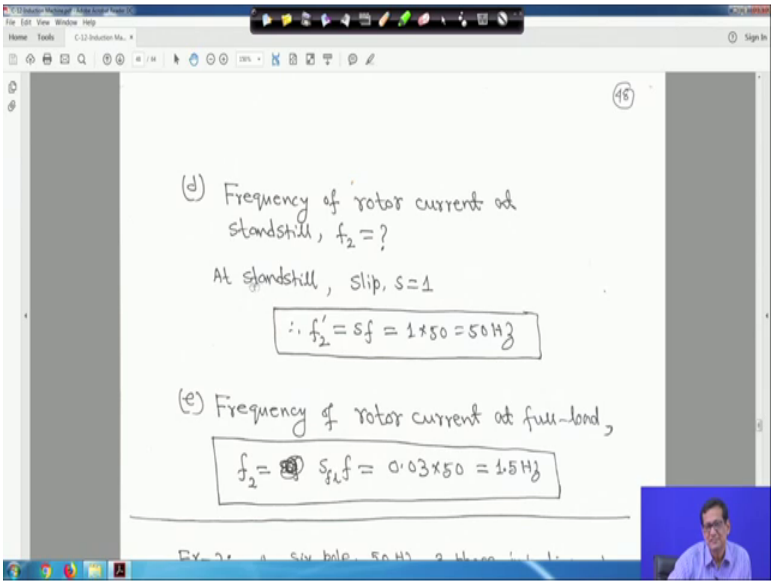

Now, frequency of rotor current at standstill, so f 2 is equal to how much? At stand still your S; S is equal to 1. So, naturally the rotor frequency the current frequency will 50 hertz your at standstill S is equal to 1, then that rotary stationary at that time at when rotor is stationary slip is 1.

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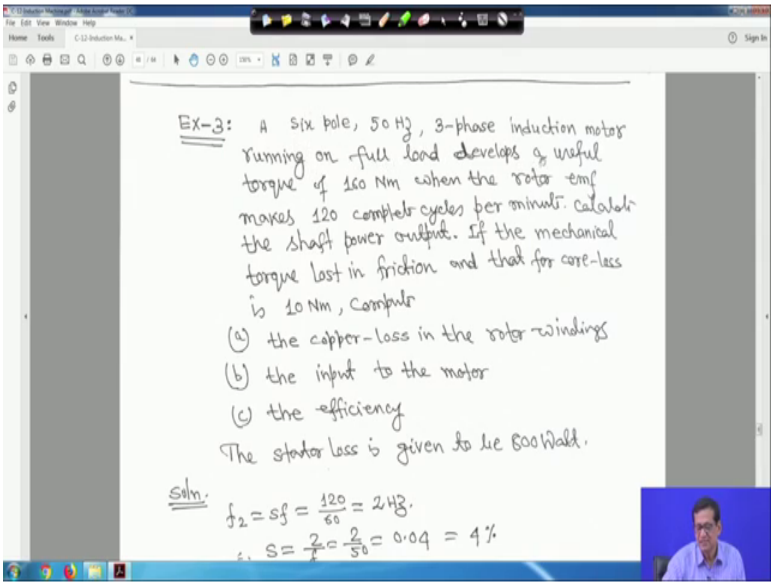

So, frequency of rotor current at full load f 2 is equal to S f l f. So, at full rotor S f l is 0.03 and this is 50, so it will be 1.5 hertz right. So, example 3 so a next one is a 6 pole, 50 hertz, 3 phase induction motor running on full load develops a useful torque of 160

Newton metre; when the rotor e m f makes 120 complete cycles per minute right; that means, it is you have to find out you have to find out the rotor frequency from this one?

Calculate the shaft power output that is your mechanical power I told you right. If the mechanical torque lost mechanical torque lost in friction and that for core loss is 10 Newton metres. Compute the copper loss in the rotor windings, the input to the motor, the efficiency, the stator loss is given to be your 800 watt, the stator loss is given 800 watt, so f 2 is equal to S f.

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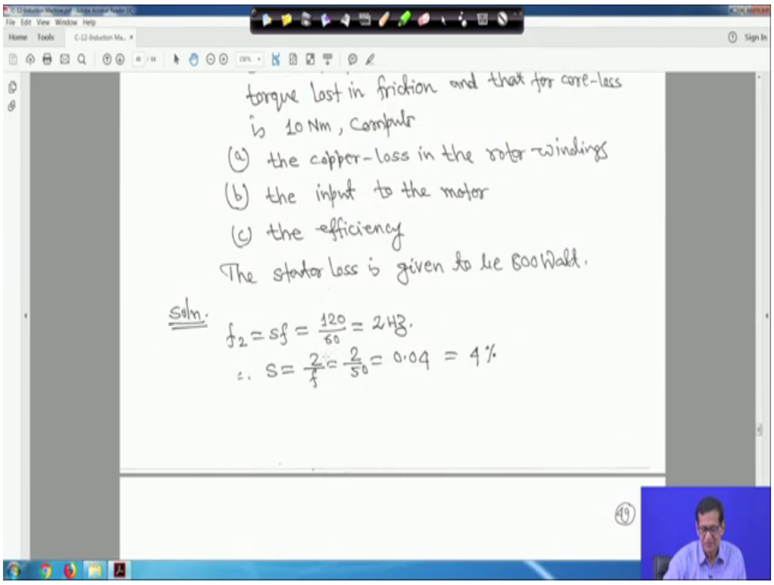

So, actually this f 2 is equal to S f is equal to this is given 120 complete cycles per minute. So, rotor frequency 120 by 60 right, so how many cycles per second actually that is actually 2 hertz cycles per second, so it is 2 hertz right. Now S is equal to then 2 upon f because S f is equal to 2, so S is equal to 2 by 50, so 4 percent, 0.04 right.

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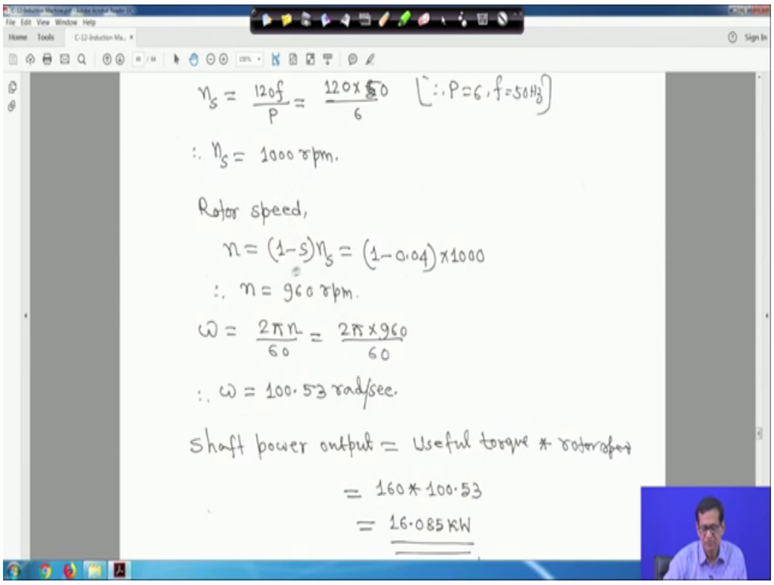

Now, n S is equal to 120 f by P; P is 6, f is 50, so n S is equal to 1000 rpm. Now rotor speed n is equal to 1 minus S into n S, so 1 minus 0.04 into 1000, so 960 rpm. Therefore, omega is equal to 2 pi n by because we need torque, so omega we require 2 pi n by 60. So, it is coming 100.53 radian per second right.

Now, shaft power output is equal to useful torque into rotor speed. So, useful torque is given 160 into your rotor speed you got 100.53, and this is your useful torque here. If you see in the problem it is given 160 Newton meter right. Therefore it is actually 16.085 kilo watt.

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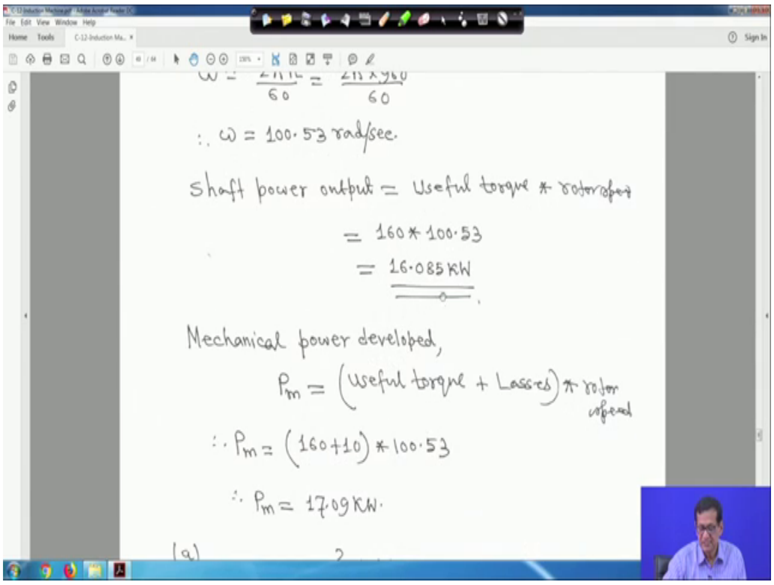

Now mechanical part developed is equal to P m is equal to useful torque plus losses into rotor speed, so useful torque is 160 and this loss is given 10. So, 160 plus 10 Newton metre into the rotor speed 100.53; so that is P m is equal to 17.09 kilo watt.

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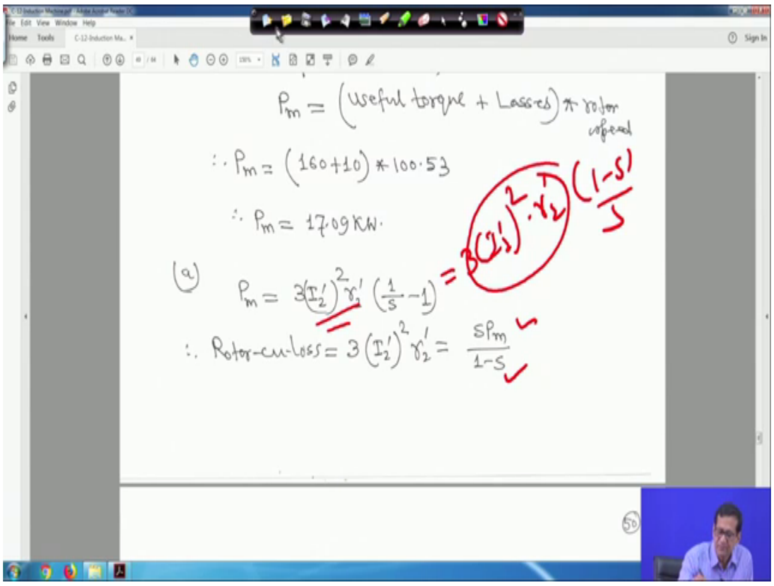

Now, next part is P m is equal to you know 3 I 2 dash square r 2 dash into 1 upon S minus 1 is the mechanical per output. So, 3 I 2 dash square r 2 dash is equal to you can write that is your S P m upon 1 minus S; that means, from this expression that means, from this expression you can write that your S P m upon 1 minus S we are writing and 3 I 2 this one is equal to.

So, basically this term is equal to 3; then I 2 dash square into r 2 dash then 1 minus S upon S right. That means this part is equal to S into P m divided by 1 minus S right. So, that is your rotor copper loss 3 I 2 dash r 2 dash this is rotor copper loss. The rotor copper loss expression is S P m upon 1 minus S.

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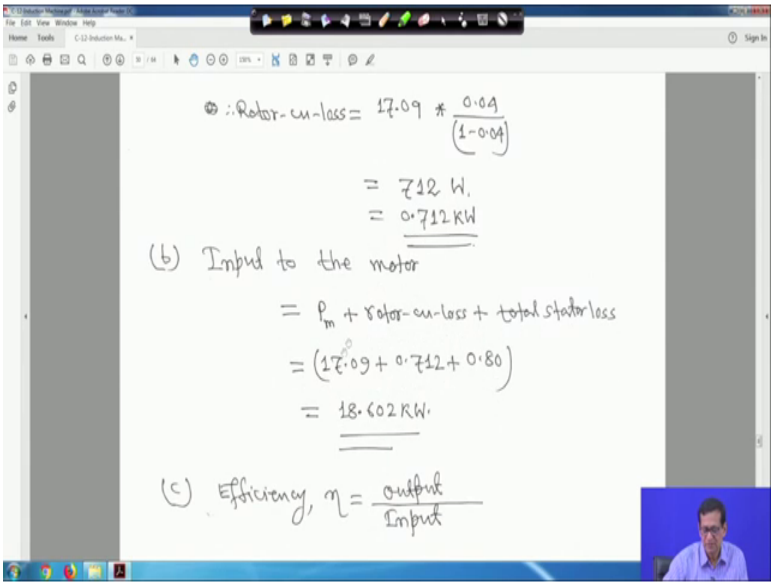

So, rotor copper loss will be 17.09 then your your that P m is equal to 17.09 is 0.04 by 1 minus 0.04. so it is coming 0.712 kilo watt. Now input to the motor input to the motor mechanical power output plus the rotor couple loss plus the total stator loss. Total stator loss is given actually 800 watt because in the problem it is given the total stator loss is equal to 800 watt here it is given 800 watt right.

So, that means it is converted kilo watt. So, here it is 17.09 plus 0.712 plus 800 watt means 0.8 kilo watt. If you add 18.602 kilo watt therefore efficiency output by input. So, output is equal to 16.085 you have seen and input is 18.608. So, it is 86.47 percent the efficiency right, so understandable.

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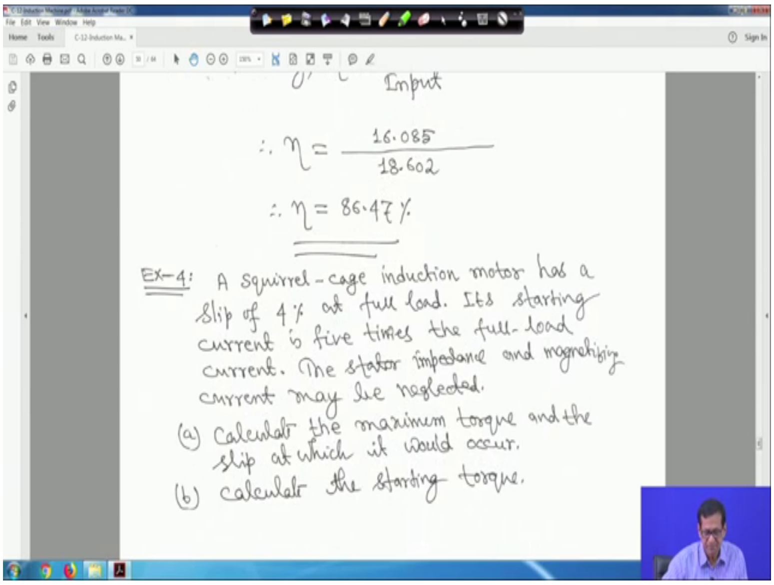

Next is a squirrel cage induction motor has a slip of 4 percent at full load. The starting current is five times the full load current the stator impedance and magnetizing current may be neglected. Even neglecting calculates the maximum torque and the slip at which it would occur and calculate the starting torque these two things right.

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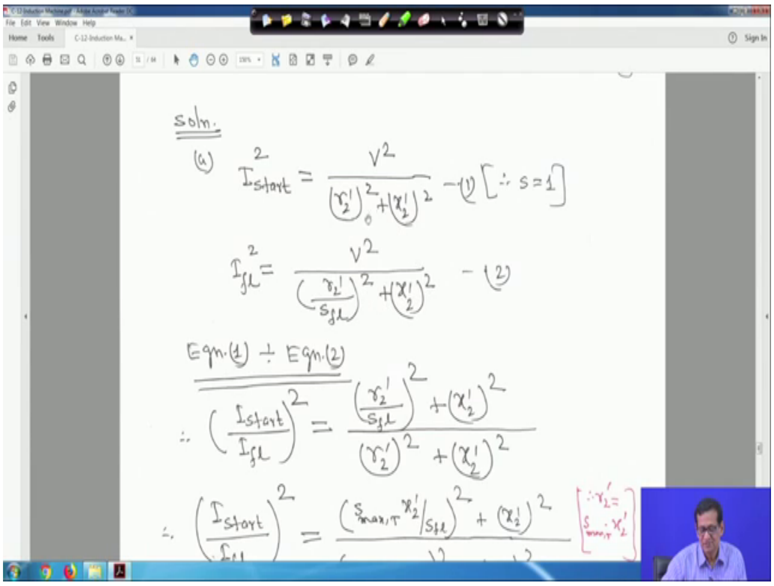

Now, we know that you are starting currents square is equal to V square upon r 2 dash square plus x 2 dash square because at start slip is equal to 1. Here no again and again I am not writing those previous equation number, but all these things are been given right.

Similarly and this is a start and at full load the I f l square the full load current V square upon r 2 dash upon S f l square plus x 2 dash square. Because a start slip is equal to 1 here it is written right. Now if we divide equation 1 by equation 2 if you do so you will get I start square by I start by I f l whole square is equal to this expression right.

Therefore, this one is equal to your what you call this for r maximal value what you call for maximum your torque right that that r 2 dash relationship is r 2 dash is equal to S max into x 2 dash, because we know r 2 dash upon S max T. So, r 2 dash is equal to S max T x 2 dash this we know. So, here we have substituting r 2 dash is equal to S max T into x 2 dash. So, here you subtract that is why written here in the red ink right here we are substituting.

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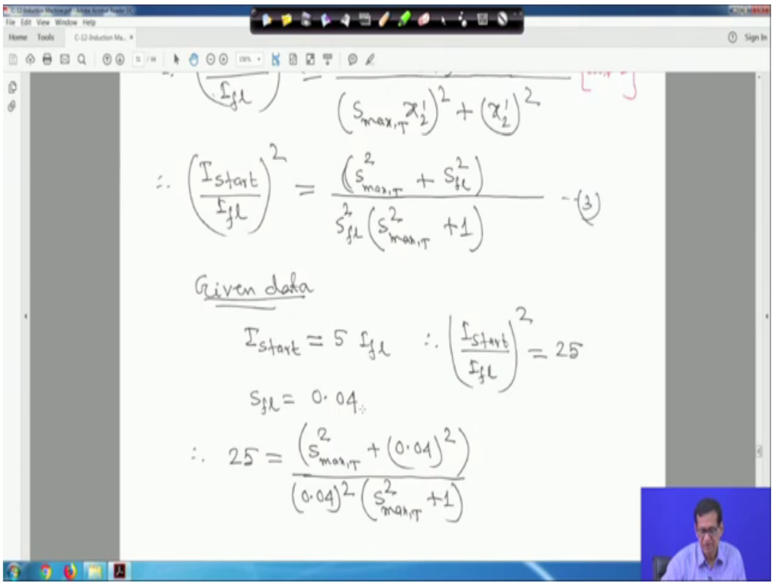

If you substitute and simplify the expression will be like this this equation right. Now the data given that I start is equal to given 5 times full load current starting current is equal to 5 times full load current that will be the I start square by I f l square will become 25 then, where I start is equal to 5 I f l full load slip is given 0.04 right it is given. So, this value is equal to we substitute all you will get this expression here you will get two values of S here, one may not be feasible, but another is your, another is feasible right.

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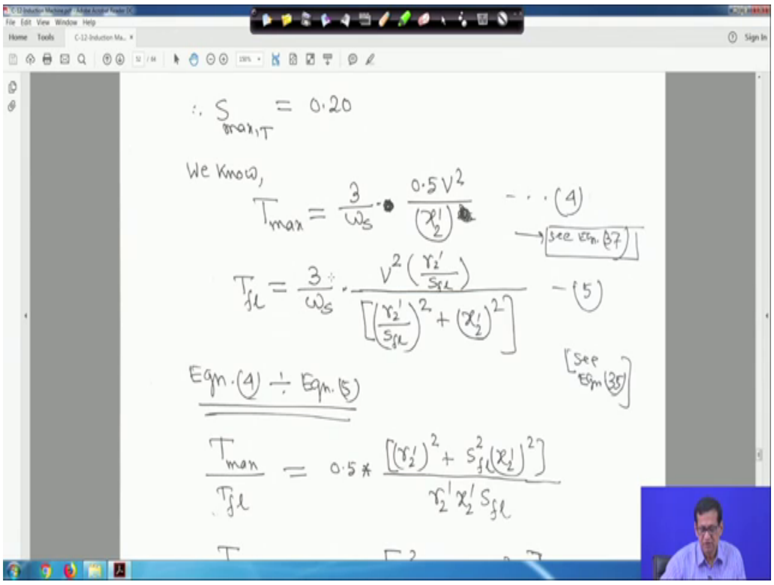

If you solve this one you will get S max is equal to 0.2 because other value is not feasible right. So, from S and you know that torque expression T max is equal to 3 upon omega S 0.5 V square upon x 2 dash here it is in detail c equation 37 right here it is in detail. So, here then; that means, you will get T full load torque is equal to 3 upon omega S into this expression here it is in detail from equation 35 right. So, all you have to keep it mind little bit you have to keep it in mind.

So, equation 4 divide equation number 4 by divide equation 5 if you do so, then T max upon T f l will you will get this expression, you divide and simplify you will get this expression right. So, T max upon T f l is equal to now you substitute r 2 dash is equal to your r 2 call that x max T into x 2 dash you substitute and simplify you here it is written here again and again that r 2 dash is equal to S max T into x 2 dash here it is written, and you substitute. If you substitute you will get this expression.

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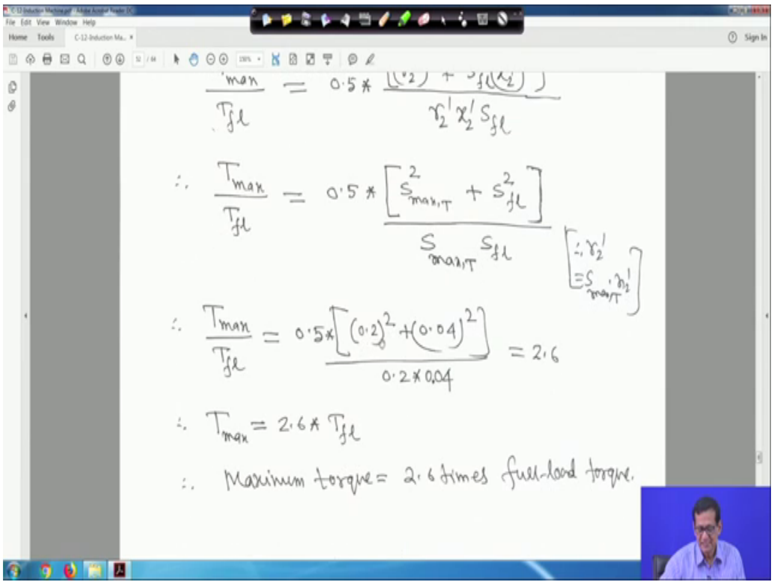

Now, that you put S max to you got 0.2 full load slip you know 0.04. So, it is a function of slip only and if you simplify it will be 2.6; that means, maximum torque will be 2.6 times the full load torque right. So, maximum torque 2.6 times the full load torque little bit practice is necessary right.

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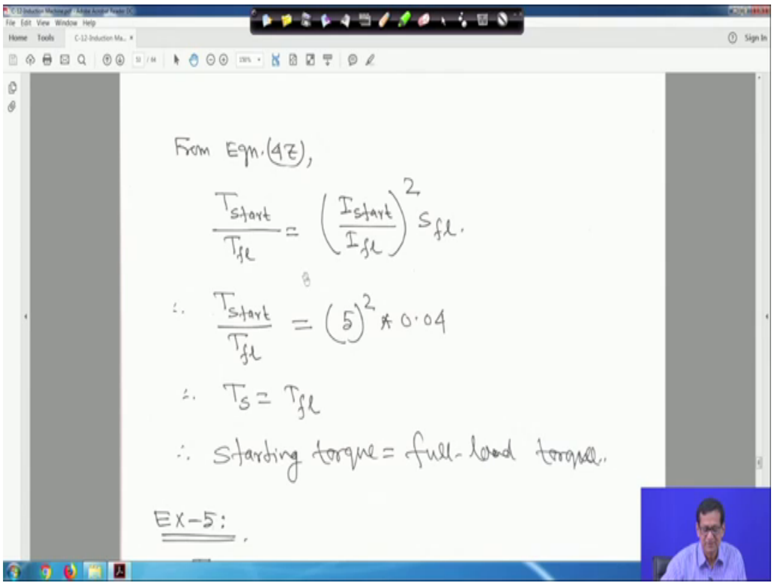

Now, from equation 47, we know that T start upon T f l is equal to this one right. So, I I sorry I I start by I I f l is equal to 5, so 5 square S f l is 0.04. So, starting torque actually will becoming full load torque for this problem right. So, next is example 5.

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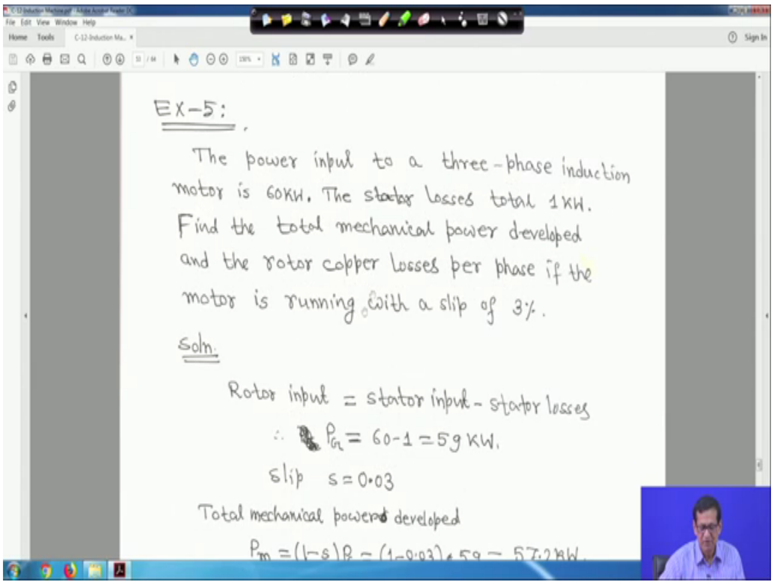

The power input to a 3 phase induction motor is 60 kilo watt. The stator losses total 1 kilowatt. Find the total mechanical power developed and the rotor copper losses per phase, if the motor is running with a slip of 3 percent right.

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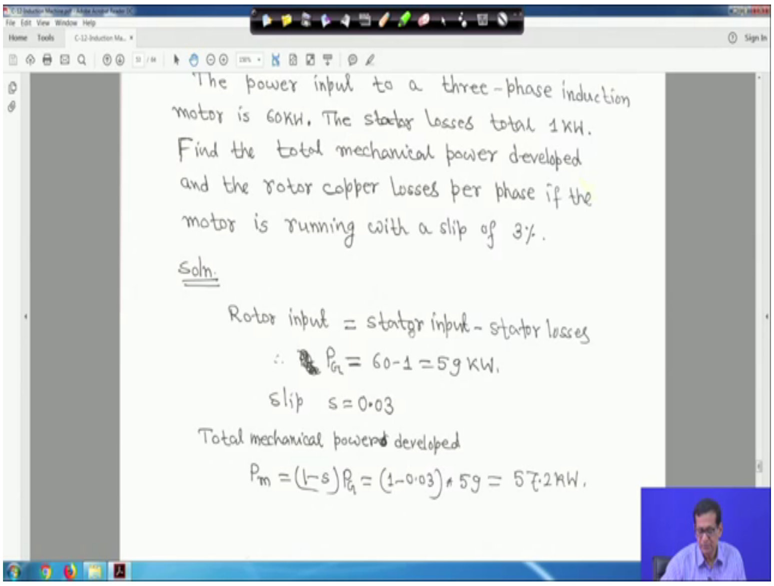

So, rotor input is equal to stator input minus stator losses in the beginning of the air gap power at that time I told you. So, it will be P G will be 60 minus 1 59 kilo watt and slip is 0.03. So, total mechanical power develop P m this expression you have also derived 1 minus S into P G. So, you will get 57.2 kilo watt right.

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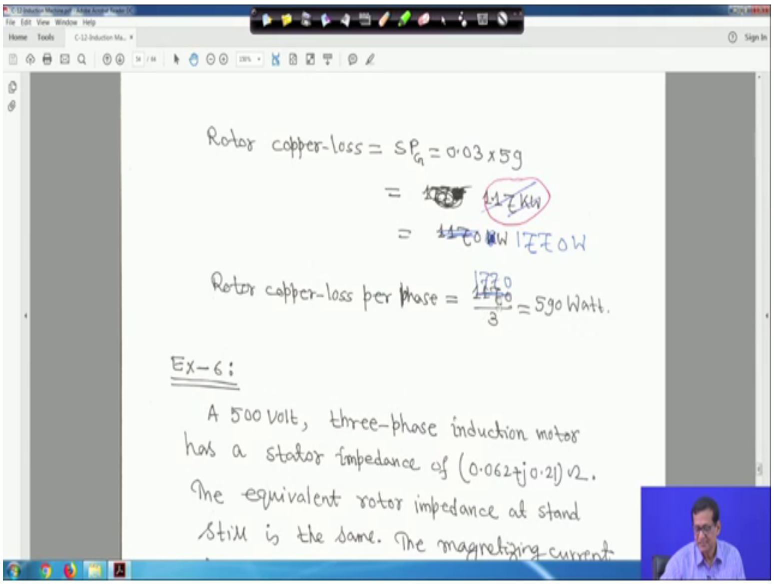

Now, rotor copper loss we also derived this formula S into P G. So, it is 0.03 into 59. So, it is actually your 1 11770 watt right this calculation this blue ink you see that 1770 watt right. So, rotor copper loss per phase divided by 3 it will be 590 watt is a simple problem only you have to keep it some formula in your mind right.

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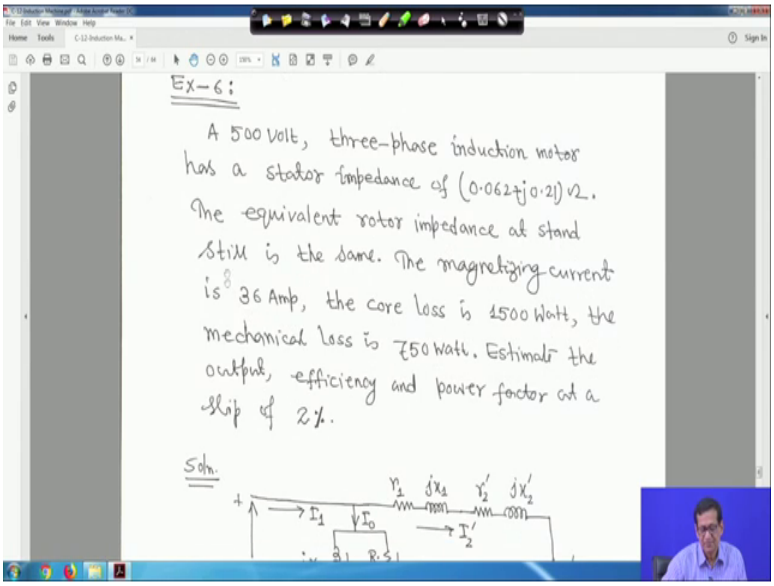

Next is example 6; a 500 volt, 3 phase induction motor has a stator impedance of this much. The equivalent rotor impedance at stand still is the same right. The stand still means when the slip is equal to 1, the magnetizing current is 36 ampere. The core loss will 15000 watt the mechanical loss is 750 watt, estimate the output efficiency and power factor at a slip of 2 percent this is the problem.

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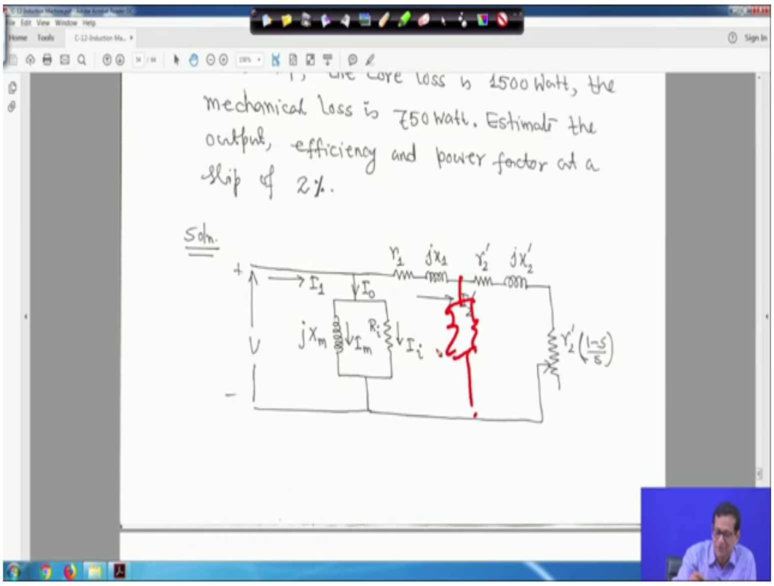

We have made a simplified circuit we have put this shunt branch at the beginning right and these are all these things. This is load resistance part, this is rotor part, this is stator part, and this is hand branch part just for the your what you call simplicity simple calculation right.

You can put it middle here, I mean if you want if you want more accurate calculation then you can put you can put the shunt branch is here, shunt branch is here. You can put a for things you will get calculation will be complicated right. So, anyway so here we have a for simplification we have made this your, what you call circuit like this and this is your load resistance part right. Just nothing r 2 dash by S had been made it like this r 2 dash plus r 2 dash 1 minus S upon S right.

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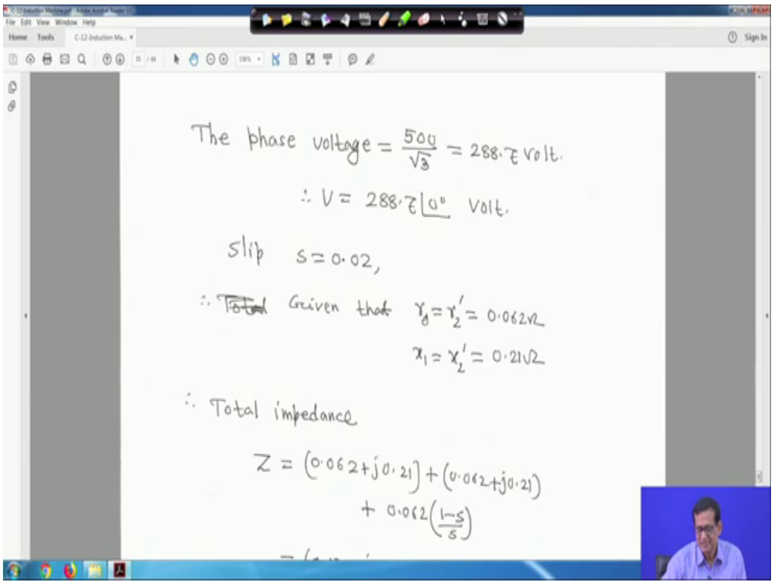

So, the phase voltage is it is given 3 phase voltage phase voltage is 500 by root 3. So this much of volt 288.7 volt, so take it a reference 288.7 angle 0 volt, now slip is given 0.02 and it is given r 1 is equal to r 2 dash 0.06 ohm, and x 1 is equal to x 2 dash 0.21 ohm from the problem itself.

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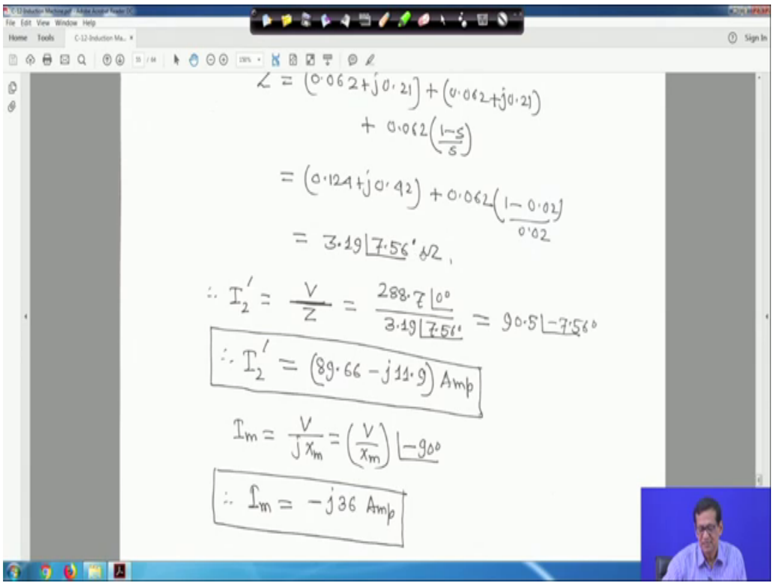

Now, total impedance if you add right, so it will be you just your what you call you add these two plus this one r 2 dash into 1 minus S upon S right. So, it comes actually 3.19 I mean total impedance of the circuit just you go on adding right. You can make it directly r 2 dash by S instead of this one and this one basically r 2 dash by S, but the way it is drawn here same way as made it right. So, it is 3.19 angle 7.56 degree ohm right 5 6 3.156 degree right, so angle and it is ohm.

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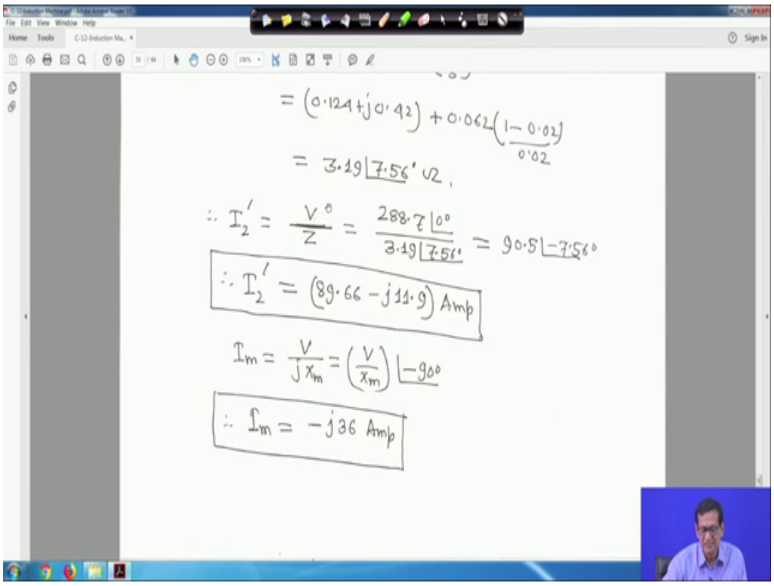

So, I 2 dash is equal to V upon Z, so this is V this is Z 90.5 angle minus 7.56 degree right ampere. It is not written here ampere it is ampere, so here it is written here right. So, and therefore for I 2 dash is in this is real part this is imaginary part. Now I m is equal to V upon j X m. So, V upon X angle minus ninety, but at is given 36 ampere. So, basically I m is equal to minus j 36 ampere right because in the problem it is given, it is given 36 ampere. So, so instead of making the directly you can write that I m is equal to minus j 36 ampere.

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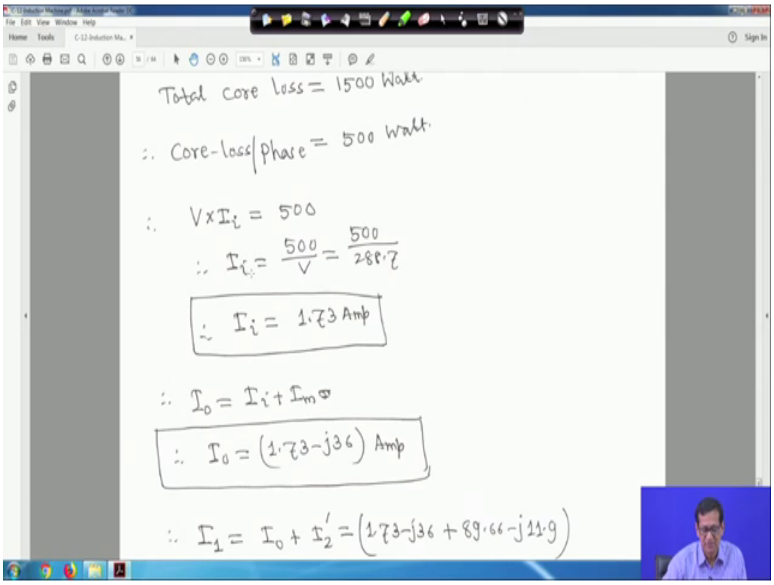

Now, total core loss is given 1500 watt. Core loss per phase 500 watt that therefore, core loss we can write V into I is equal to 500. So, I i the core loss component of the current 500 by V, so 500 by 288.7, so 1.73 ampere therefore, I 0 is equal to I i plus I m, so it will be 1.73 minus j 36 ampere right.

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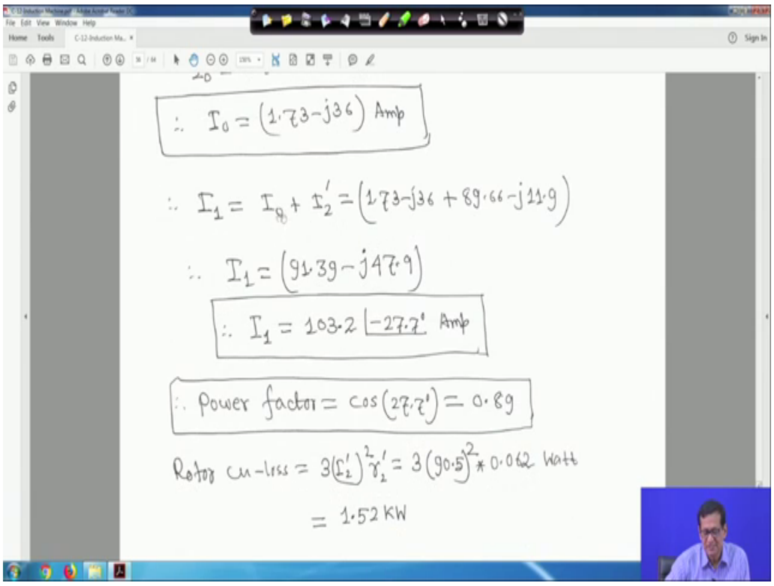

Therefore I 1 is equal to I 0, I 0 plus I 2 dash you see the circuit. If you add these it will be I 1 is equal to 103.2 angle minus 27.7 degree ampere. Now, power factor will be then cosine of 27.7.89 because voltage angle is therefore, taken as 0 and this is the stator current I 1. So, angle between these voltage and current is 27.7. So, power factor is this 1.89, right. Now rotor copper loss you know 3 I 2 dash square into r 2 dash, so 3 this is my I 2 dash square, this is my r 2 dash, so 1.52 kilo watt right.

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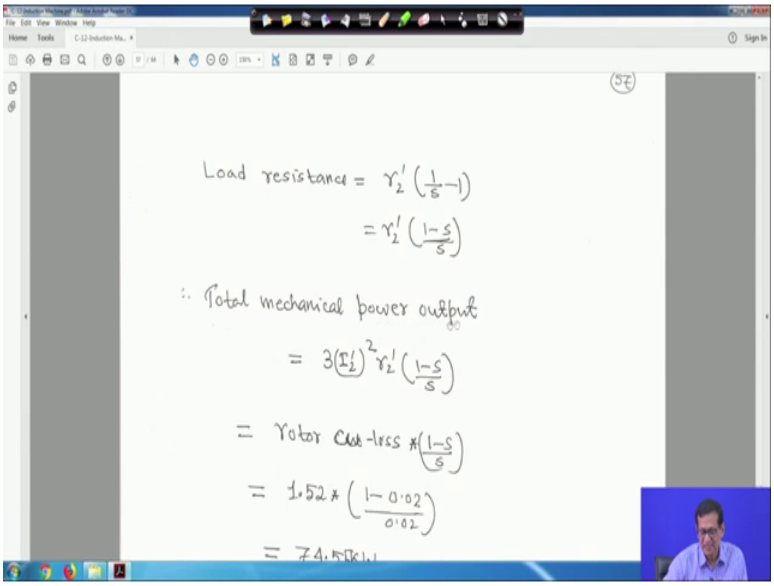

Load resistance we know r 2 dash into 1 upon S minus 1, so this much. Now, total mechanical power output will be 3 I 2 dash square into r 2 dash 1 minus S this all we have developed right. So, is equal to this part is rotor copper loss is equal to rotor copper loss into 1 minus S upon S. So, rotor copper loss just we have calculated 1.52, this is my rotor copper loss right.

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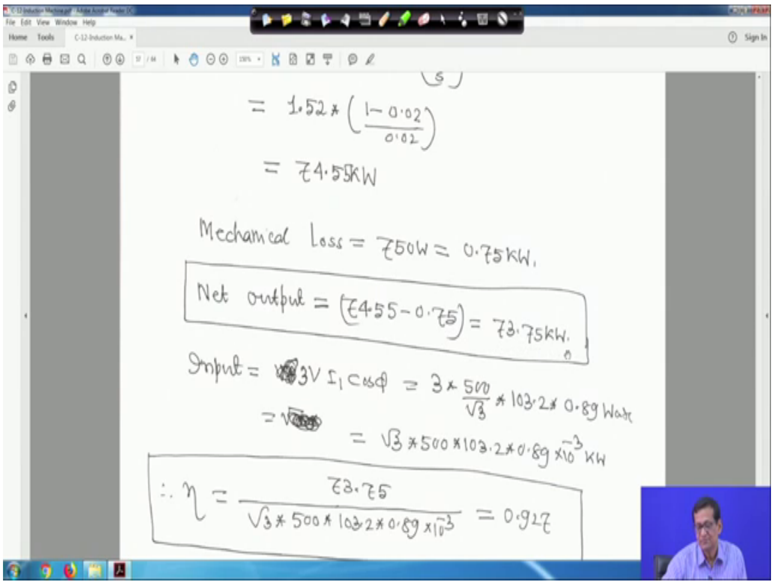

So, this is your into 1 minus 0.02 upon 0.02 slip is 0.02, so 74.5 kilo watt right. Now mechanical loss is equal to 70 750 watt it is given mechanical loss is given. Therefore, net output will be this 1 minus this 1 is equal to 73.75 kilo watt right.

Now, input is 3 3 phase it is, so 3 V I 1 cos phi, so 3 into 500 by root 3 into 103.2 this is I 1 into the power factor 0.89. It is coming actually this one into this one just you root 3 root 3 root 3 and this is 3. So, root 3 V, this is I, and this is cos phi and divided by 1000, so 10 to the power minus 3 so it is kilo watt right. So, efficiency will be output by input we just this is output and this is your input, so it is 0927 efficiency right. So, just you have to keep it certain thing in mind.

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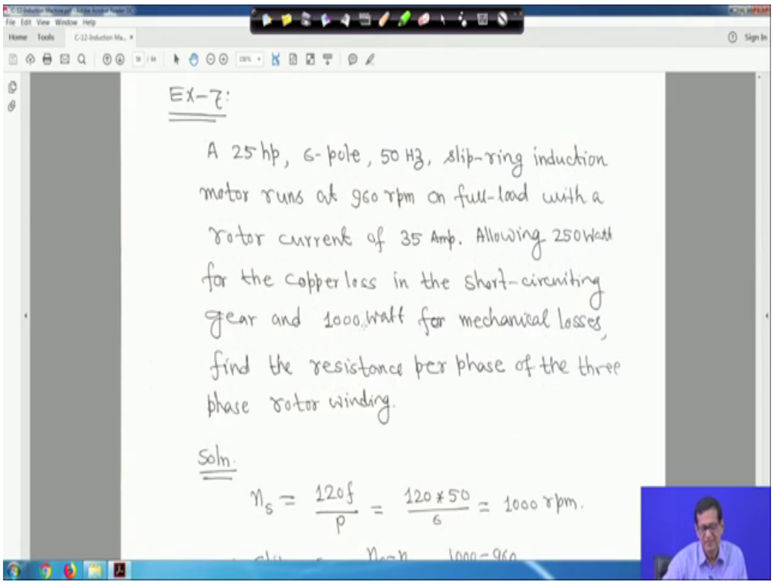

Next is example 7, a 25 h p, that is horse power 6 pole, 50 hertz, slip ring induction motor runs at 960 rpm on full load with a rotor current at 35 amp of 35 ampere. Allowing 250 watt for the copper loss in the short circuiting gear and 1000 watt for mechanical losses, find the resistance per phase of the 3 phase rotor winding right. So, in this case what we will do? That n S is equal to 120 f by P. So, you will get 1000 rpm right, slip is S is equal to n S minus n upon n S. So, slip you are getting 4 percent, 0.04.

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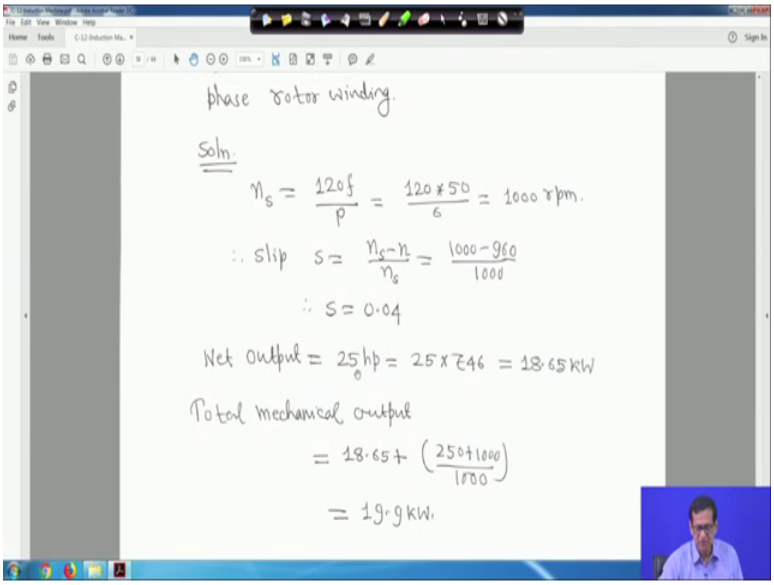

So, net output is 25 h p 1 horse power is equal to 746 watt. So, it is 18.65 kilo watt, so total mechanical output will be then 18.65 plus this two that are given your here it is you are here it is 250 watt for the copper loss in the short circuiting gear. And 1000 watt for mechanical losses right, so this is watt divided by 1000. So, I have to converted in to kilo watt right, so that is 19.9 kilo watt.

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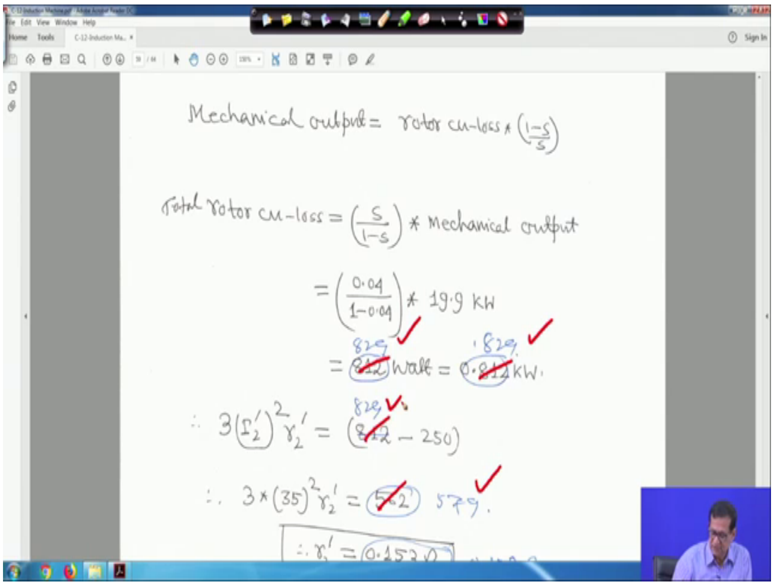

Now, mechanical output is equal to rotor copper loss into 1 minus S upon S that you have seen. Therefore rotor copper loss will be S upon minus S into mechanical output. So, this is S is 0.04 substitute here, mechanical output you substitute here. You will get your, this one will be 829 watt, not a this is a not 12, 829 the blue ink you see the blue ink, so 0.829 kilo watt right.

So, here it is actually not this one, this is blue one right, so 0.829 kilo watt. So, here also it is your 0.829 right minus 250. So, 3 I 2 dash square r 2 dash is equal to 829 minus your what you call 250. So, I mean all this case the blue one right this is you need not consider, this is you need not consider right, this is you need not consider.

So, in this case your what you call that your 3 I 2 dash square r 2 dash will be 8 your 29 minus. if you look in to the problem, if you look in to the your what you call problem that your allowing 250 watt for the copper loss right in the short circuiting gear.

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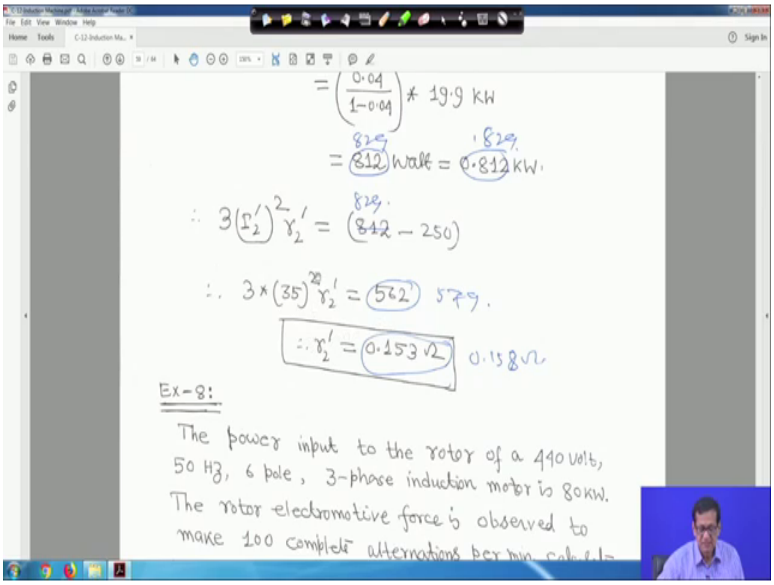

Therefore here your 3 I 2 dash square r 2 will be 829 minus 250 because that you have to make it, because that will be your actually rotor copper loss. So that means, 3 into 35 square into r 2 dash equal to 579 right. Therefore r 2 dash will be 0.158 ohm this blue ink one you see right this is the correct answer.

And this 250 you have to subtract because here it is here it is written in the problem allowing 250 watt for the copper loss in the short circuiting gear which is excluded from the resist equivalent sorry resistance of the total circuit. That is why this has to be you have to be when we solve their, solve the numerical this has to be subtracted from this one right.

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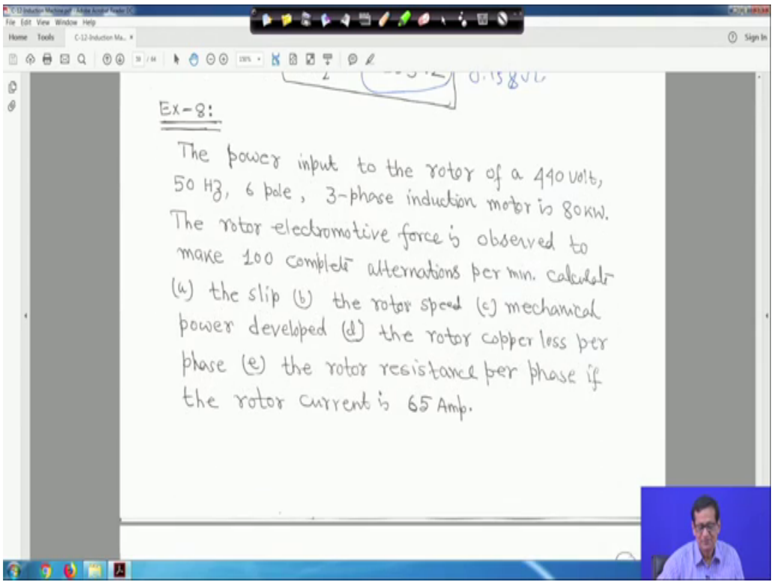

Now, next example the power input to the rotor of a 440 volt, 50 hertz 60 pole, 6 pole, your 3 phase induction motor is 80 kilo watt. The rotor e m f your is, are that your electromotive force is observed to make 100 complete your alternate your alternation what you call alternation per minute right. That means, it is your what you call rotor frequency that is that you have to find out. Calculate the slip, the rotor speed, mechanical power developed, the rotor copper loss per phase, the rotor resistance per phase, if the rotor current is 65 ampere.

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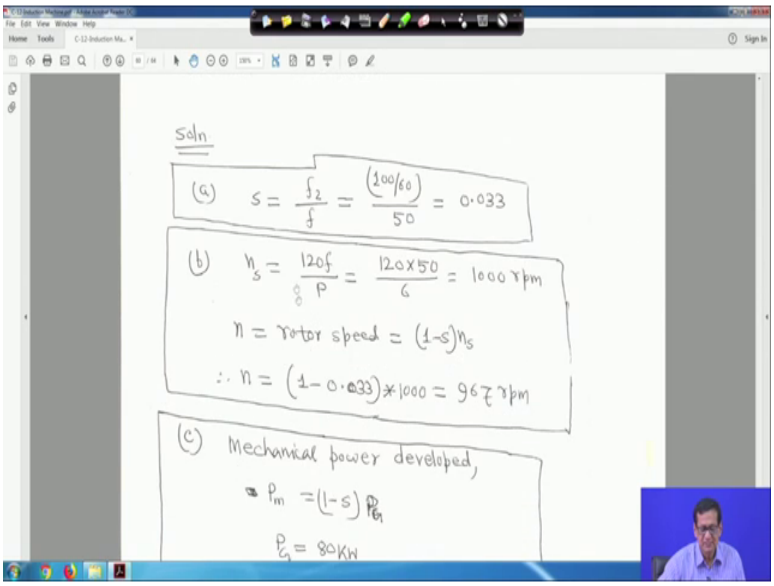

So, in this case solution is equal to it is given S is equal to f 2 upon f. Because f 2 is equal to except, so it is f 2 is equal to 100 by 60 because it is making 100 cycles per minute, so 100 by 60 cycles per second divided by 50. So, S S is equal to 0.033 3.3 percent right, n S is equal to 120 f by P. So, it is as usual 1000 rpm putting all these data n is equal to rotor speed is equal to 1 minus S n, so 1 minus 0.033 into 1000, so 967 rpm.

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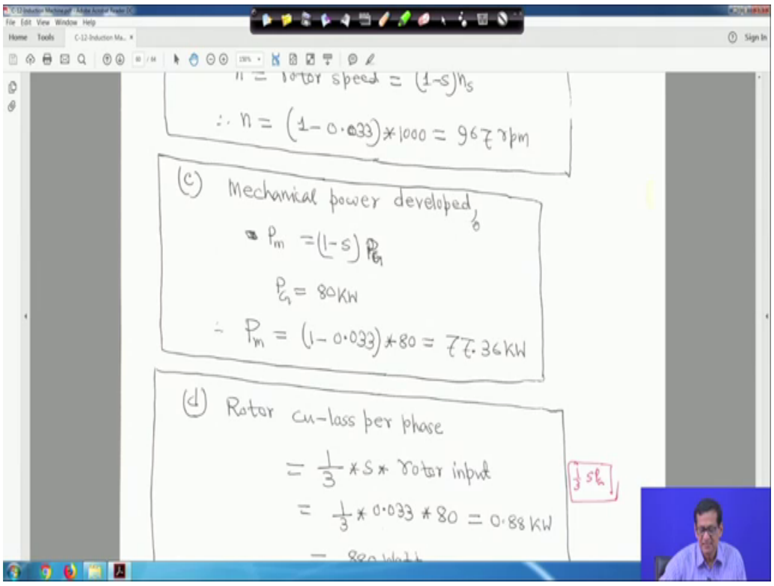

Now, next is mechanical power developed P m is equal to 1 minus S into P G. So, P m is equal to 80 kilo watt, so P m is equal to 1 minus 0.033 into 80, so 77.36 kilo watt right. Next is rotor copper loss per phase, so per phase that is one-third into slip into rotor input, so it is one-third into slip into 8. So, it will become 88 watt that is 0.88 kilo watt right.

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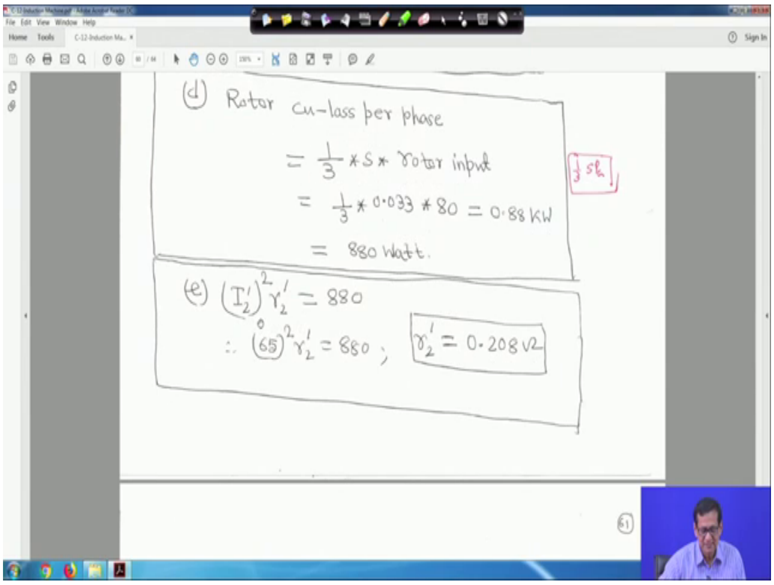

And that and this one is I 2 dash square r 2 dash because per phase, so 3 is not there, it is per phase. So, I 2 dash square r 2 dash is equal to 880. Therefore, r 2 dash you will get 0.208 ohm very simple problem very simple problem. Now, next is this one right.

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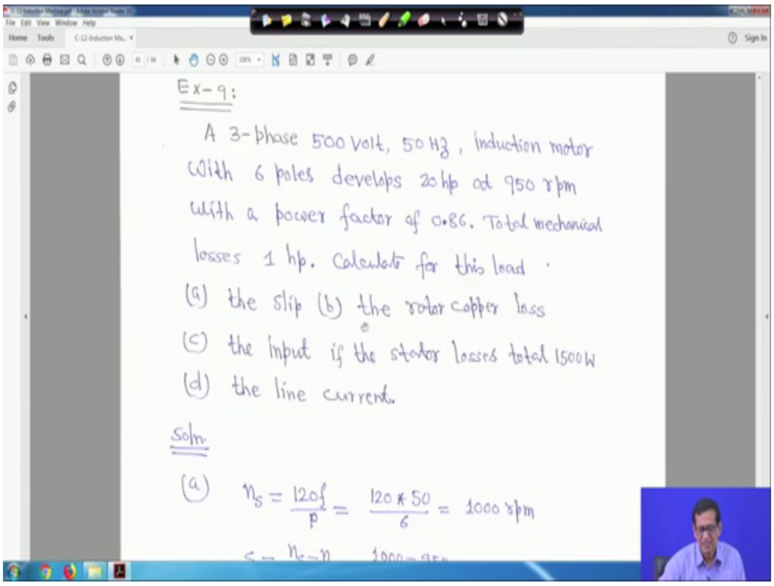

A 3 phase 500 volt, 50 hertz, induction motor with 6 poles develops 20 horse power at 950 rpm with a power facto of 0.86; total mechanical losses 1 hp that is 1 horse power. Calculate for this load, the slip, the rotor copper loss the you are the input if the stator losses total is 1500 watt the line current right, this you have to make it. Whenever you will solve all these numerical another things; we will first write down the problem and then you solve it right.

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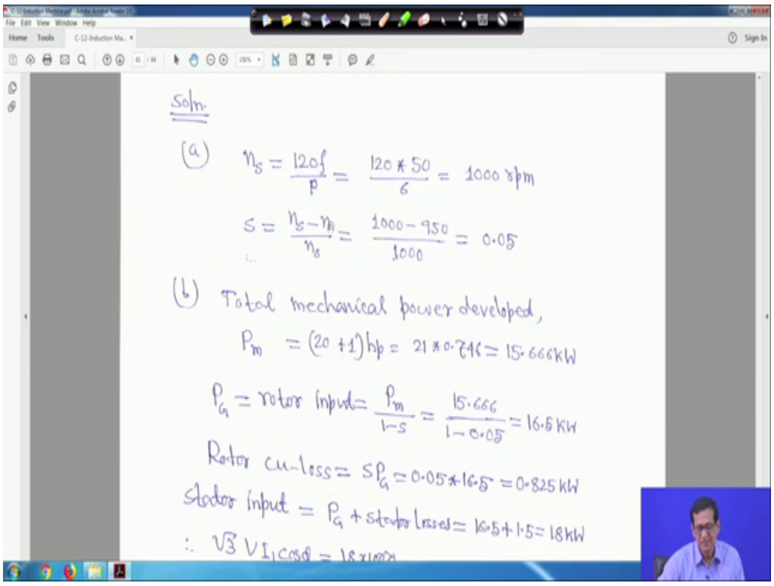

Now, we know that n S is equal to 120 f by P. So a 1000 rpm it is coming as usual and S is equal to you knowing this formula, so from this you are getting 0.05 right. So, total mechanical power developed will be 20 plus this one you have to add right h p, so 21.1 h p is equal to 0.746 kilo watt. So, it is 15.666 kilo watt right, so P G is equal to rotor input is equal to P m upon 1 minus S this is you know. So, put P m, put S here you will get 16.5 kilo watt right.

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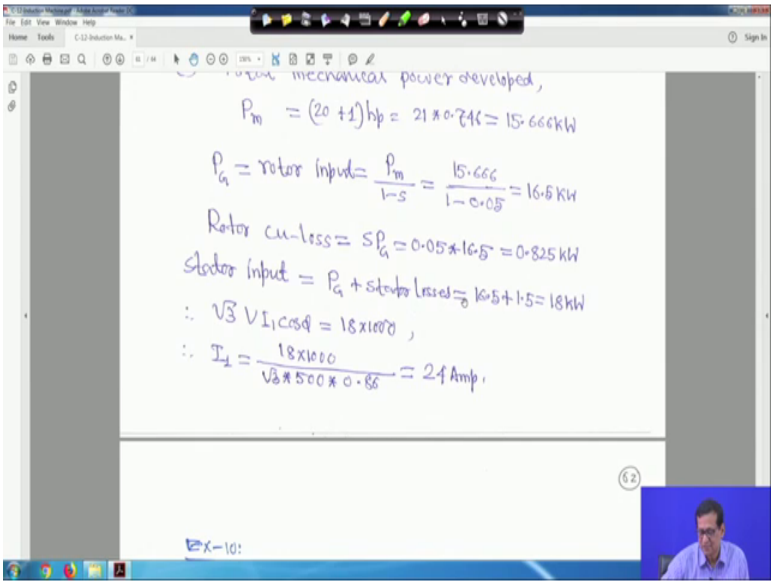

Rotor copper loss will be S P G, so S we know, P G we know. So, it will be 0.825 kilo watt right. So, because S is equal to 0.05, and stator input is equal to P G plus stator losses. So, P G is 16.5 and stator loss is 1.5, so it is 18 kilo watt right. And root 3 V I 1 cos phi is equal to 18 kilo watt.

So, 18 into 1000; so that means, I 1 is equal to all the data are given, so it will be 24 ampere right. So, if you look into this problem that your power factor is given 0.86 right power factors is given, and S P G is given and all these things are computed. So, here it is your, what you call that I 1 stator current you will get 24 ampere right. And this is your last problem for this last problem for this chapter.

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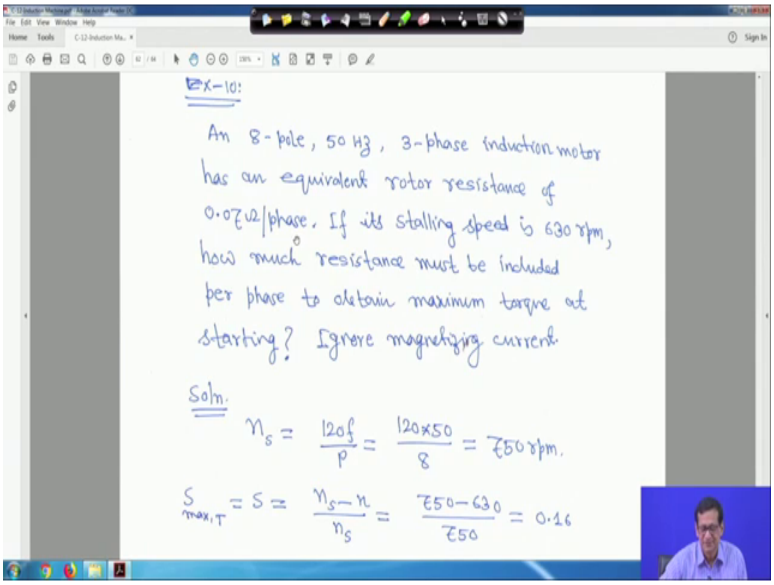

So, an 8 pole, 50 hertz, 3 phase induction motor has an equivalent rotor resistance of 0.07 ohm per phase. If its stalling speed is 630 rpm, how much resistance must be included per to obtain maximum torque at starting? Ignore magnetizing current right. So, n S is equal to you know 120 f by P, so in this case it is 8 pole machine right.

So, it is coming 750 rpm because f is 50 hertz slip that is the torque for which the slip your what you call slip for which torque is maximum, so S max T is equal to n S minus n upon n S. Because this n is a actually stalling speed right stalling speed means it is the speed for which your torque is maximum right, so this is 630 rpm. So, in this case your 750 minus 630 upon 750, so S max T is 0.16 right.

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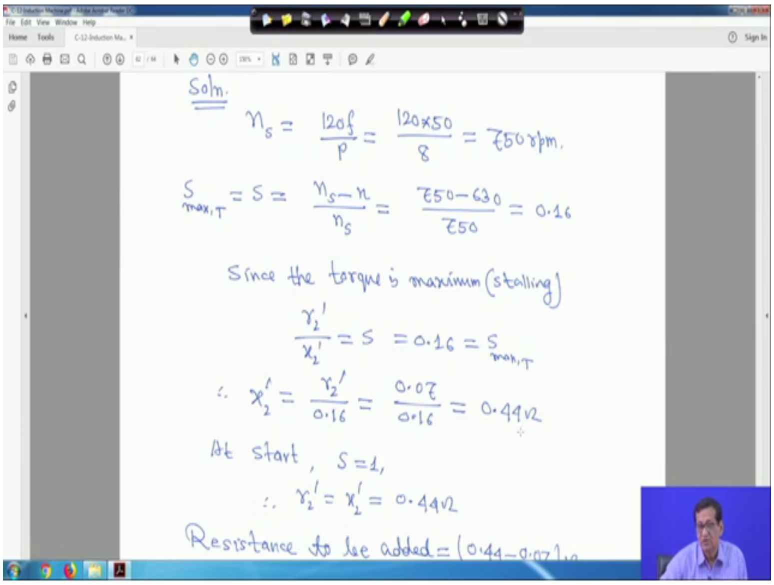

Since the torque is maximum that is the stalling torque right. So, r 2 dash upon x 2 dash is equal to S is equal to S max T this you have studied. Therefore, x 2 dash will be is equal to r 2 dash upon 0.16, so 0.07 by 0.16 so 0.44 ohm right.

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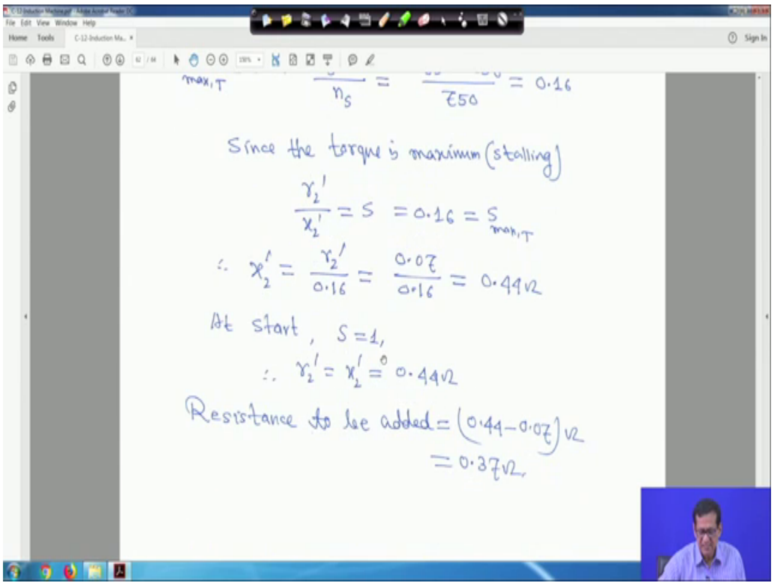

At start S is equal to 1 we know. Therefore, r 2 dash is equal to x 2 dash is equal to 0.44 ohm right therefore, this we got resistance to be added 0.44 minus 0.07, so 0.37 ohm. Because here it is given that your have an equivalent rotor resistance of 0.07 ohm per phase, but we got that your we got 0.44.

But this 0.074 has to be subtracted for that it is becoming 0.37 ohm. Therefore, in the problem it is given how much resistance must be included per phase? So, a 0.37 ohm resistance have to be your what you call has to be in inserted in that in that right. So, this has to be otherwise answer will be wrong you have to subtract this right.

With this I think this induction machine is I have to we have to close this right. Because it is a first year level, so little bit little bit practice is necessary right. And I do hope that all of you will under and if you have any problem if you have any sort of problem particularly solving new (Refer Time: 30:33).

Initially perhaps when you will do it for first time maybe you have to be little bit your not to call concentration on it. But if you have that any problem anything you please put any sort of thing please put the question in the forum we will clarify all your all your queries right. And any doubt any numerical doubt anything you have you please just put it and for that I suggest you take a reference book and other things given. You follow any book any machine book you will find all these things are there with this.

Thank you very much we will be back again.