speed. And hence the relationship of movement gets disturbed and you will be cutting a different thread, because thread is defined by movement of this one per rotation of the work piece, work piece is moving slower now and you will cut a smaller pitch thread half the pitch will be cut now so it is a problem.

If you connect it here and if you are changing doing something with to the speed gearbox be very alert because your which you are cutting it will be changed you will say I am simply changing the speed because I want to want to cut faster no sir, if you make any changes here and you are having the tapping of the speed gearbox here you are in trouble. So by logic it has to be here because whatever changes you are making here should be shared by this line also.

Otherwise their relationship will be you know disturbed wherever you are doing something important as I were doing something where relationship relational motion is important you really cannot do this, so that is why you have to be very alert whenever you are doing something, what are you doing here you are cutting a thread how is thread pitch defined, so if it is defined by the linear motion of this one per rotation of this here is that relation that we are talking about.

So first thing we notice about location of gearboxes is this whenever you are relating some motions all these have the bifurcation of power after the gearbox which is defining the motion of the first one, so that is why we have taken the power tapping here, change the speed now this will become faster or slower this will also become correspondingly faster or slower proportionally faster or slower. So there will be no change in the relational movement which was taking place which defines pitch. So having understood the reason for putting a gearbox at a particular location we now go for the calculations, coming back to this figure let us have a look at it.

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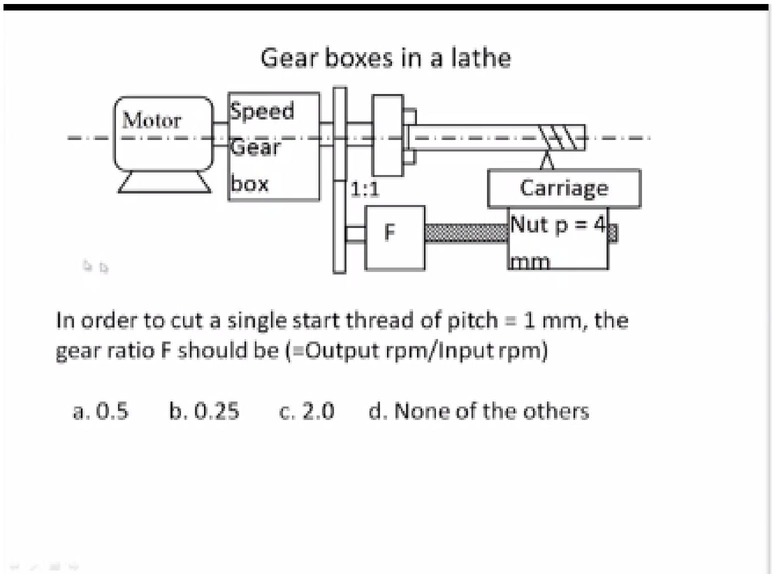

In order to cut a single start thread of pitch 1mm so by the time the spindle rotates once the carriage should be moving by one mm okay, the gear ratio F should be that is output rpm by input rpm equal to these, these, these extra, so let us have a look the nut is having four millimeters pitch, here there is 1:1 ratio so by the time the spindle rotates once this particular shaft will also rotate once.

So by the time by once it passes through F if this ratio of output rpm by input rpm be say F only so this will be 1xF as the output, 1 into F is the output, so 1xF is the rotational rate of this link screw and therefore if pitch is 4 millimeters the movement of the carriage will be 1xFx4 because one rotation four millimeters, F notations 1x F rotations, 1xFx4 millimeters of movement so we have if you come to this page.

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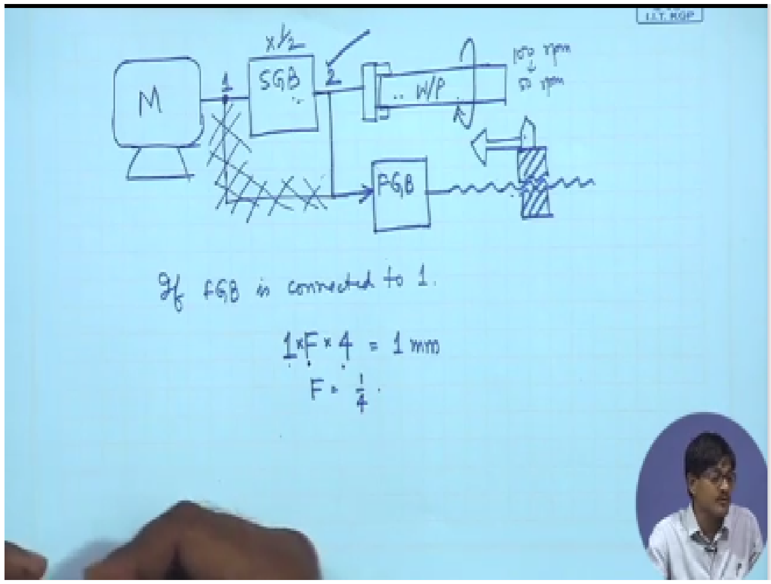

1xFx4 must be equal to 1 mm because we have started with a consideration that I am rotating that is why I have written this one every time I am rotating the spindle by one rotation 1:1 ratio makes the shaft just before the feed gear box rotate by one rotation multiplied by F which is the factor output by input rpm of the feed gear box and multiplied by 4 because 4 is the you know pitch of the nut thread this was equal to 1 mm that is the requirement. So F is nothing but 1/4th okay, F is nothing but 1/4 let us look at the problem now.

Yes, b is the correct answer okay, so we have we will have lots of you know applications of this particular thing in our subsequent lectures that we actually discuss machining on gears this is just for practice.

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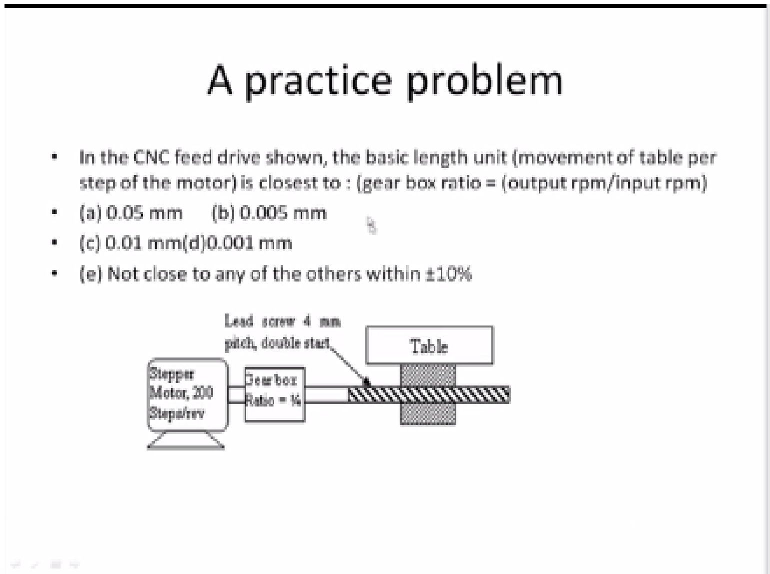

Another one slightly different configuration but this will also help you to understand the application of gearboxes later on. In the CNC feed drive shown the basic length unit that is the movement of the table per step of the motor so what do we have we have a CNC system in which there is a stepper motor which rotates in steps to cover one rotation in 200 steps.

So one rotation is 360° and 200 steps are making them that one rotation therefore first step it is moving by 1.8° so for that 1.8° movement we are asking what is the table movement, so what is given. If you notice stepper motor 200 steps per revolution is given, basic length unit is defined and given here movement of table per step of the motor.

200 steps making up 360° of movement and here box ratio which is always output rpm by input rpm that is also given 1/4th lead screw pitch is given four millimeters, double start mind you double start we have been discussing about double start, single start, multiple start so here is an actual application little so let us calculate this and find it out.

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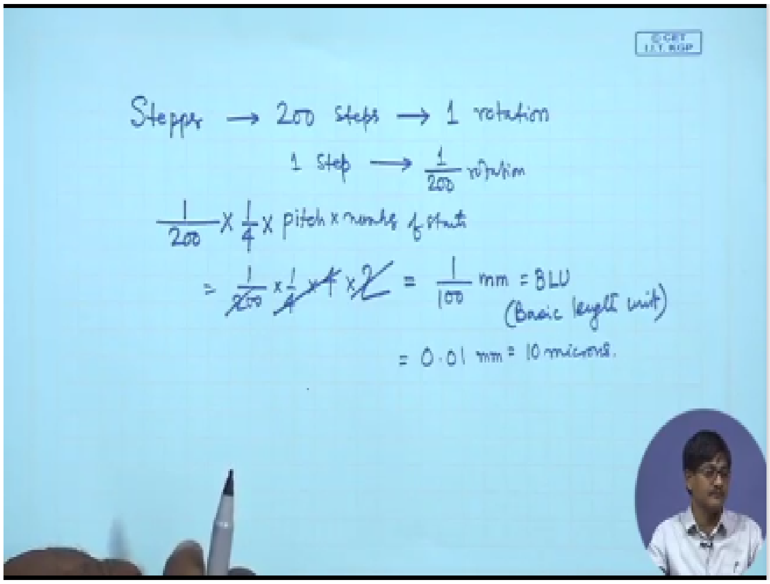

So we have stepper 200 steps one rotation, one step 1/200th of a rotation all right, therefore I start with 1/200th of a rotation multiply it by the gearbox ratio 1/4th multiply it with the lead screw lead, lead screw lead is pitch which is let me write down here pitch into number of starts equal to 1/200x1/4th into which is 4 mm and it is double start so multiplied by 2 equal to 1/100, 1/100 millimeters.

What is 1/100 millimeters the basic length unit that means the smallest distance or rather the distance moved per step of the stepper motor, okay. How much is this therefore this is equal to 0.01 mm= 10 microns okay, so this way we understand how the location of the gear box can be decided and how calculations can be done in order to find out the output which particular gear box is providing, okay if you have a look at you know, if you have a look at the typical problems that we are going to discuss.

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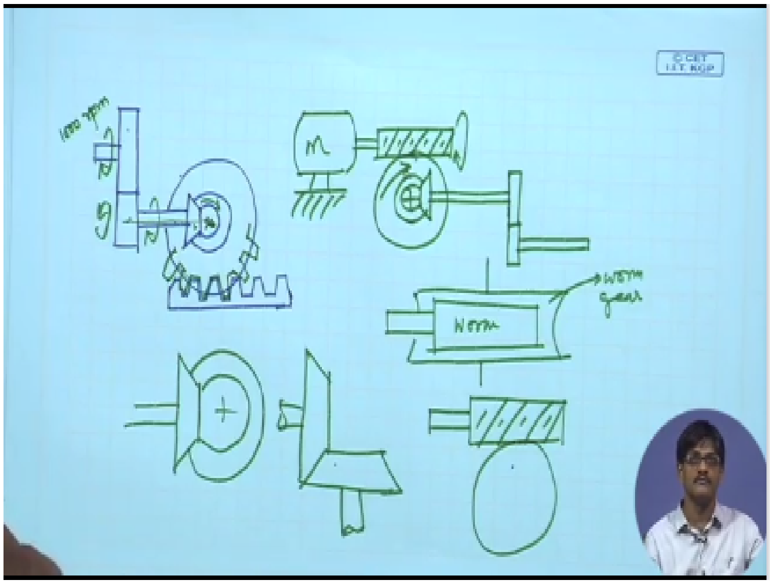

I will discuss a very short problem which you can solve your selves, so see here we are having a gear connected with another one with this, so let us see what sort of configuration that we are talking about, I might say that here I am providing you 1000 rpm okay, these are spur gears so they are rotating say this way this one is rotating that way, now this one I have just I wanted to introduce some typical figures these are two bevel gears which are connected with each other.

Bevel gears will transfer power from one axis to another axis which are generally intersecting and while transmitting power from one axis to another these might be intersecting at 90̊ degrees so that when this is rotating this way this is rotating say this way extra, and this one is having on the same shaft another gear which is in connection with a rack.

So I wanted to introduce these figures so that you are conversant with this sort of configurations there might be yet another one where I can have say a motors shaft is coming out I put a warm gear here with the warm gear I put a sorry, I put a warm here with a warm gear I put I get a configuration like this I can have bevel gears here, bevel gear this one is taken on this side, so this motor is rotating this warm gear so in this warm this warm is rotating this warm gear, this warm gear is rotating on its own shaft a bevel gear, this bevel gear is rotating this bevel gear, this one is rotating this shaft this year and together with that tag gear.

So as you can see bevel gears can be drawn this way okay, one bevel gear another bevel gear they can be drawn this way, one bevel another one warm and warm gears can be drawn this way, this is the warm, this is the warm gear they can also be drawn this way, this is the warm and this is the warm here okay, many times what happens is we include these drawings in a figure and ask a question and the student in the very beginning is that a loss to understand what has been depicted.

So in this case now after seeing these you can easily recognize yes, this is a warm and this a warm gear, this is a bevel and its pair, this is a rack and it is connecting pinion that pinion is connected to the bevel gear on the same shaft that bevel is connected to this bevel this bevel is connected to this per gear, this per gear pair and then it is ultimately getting some input of 1000 rpm. So we when we discuss for the problems we will have applications of these figures very frequently, so that this we come to the end of the fourth lecture, thank you very much.