Manufacturing Processes II
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Lecture No. 21
Mounting of Jobs & Cutting Tools in Machine Tools

Welcome to the course Manufacturing Processes II. Now you are going through Module-4 that is General Purpose Machine Tools.

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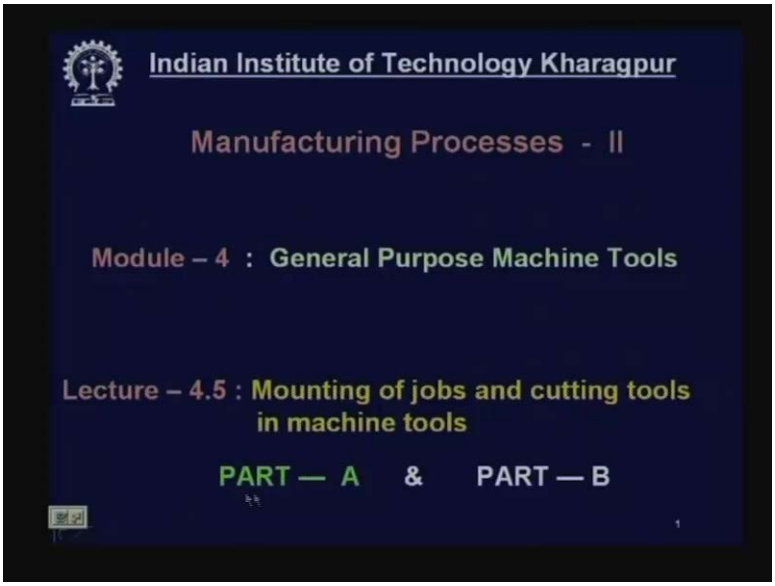

and now Lecture-4.5: Mounting of jobs and cutting tools in machine tools. This will be taken in two parts; part A and part B. Today in this lecture, we shall cover part A. In the next lecture we shall cover part B because it is a bigger course. Now the specific instructional objectives as whole of this lecture material:

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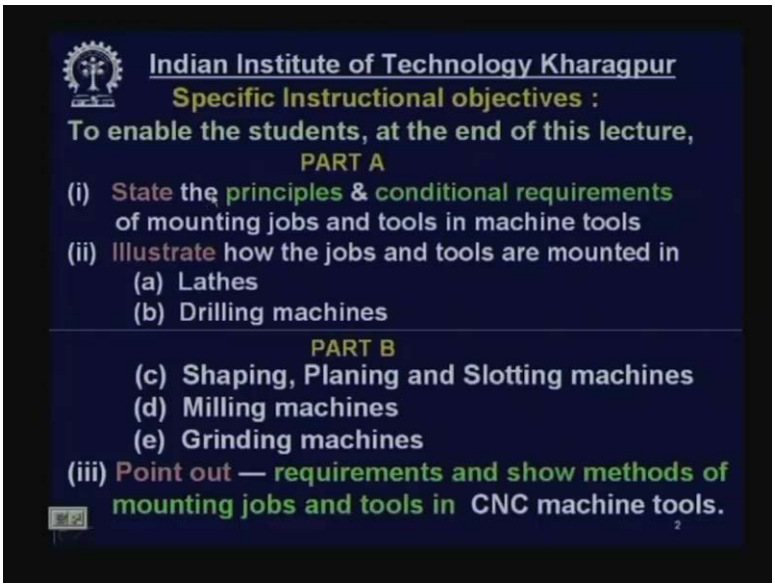

This will enable the students to state the principles and conditional requirements of mounting jobs and tools in machine tools. Now here you see that the performance of machining system is very much affected by or indirectly you can say that the perfection of mounting of job and the tool play very important role on the perfection of the working of the machining system. Therefore if you want very good machining performance from the system than the cutting tools and job have to be mounted very carefully judiciously methodically and accurately. Now this part A states the principles and conditional requirements of mounting jobs and tools in machine tools. These conditions have to be fulfilled to get good performance for the machining system. This course will also enable this lecture illustrate how the jobs and the tools are mounted in different machine tools like lathes, drilling machines. Now up to lathes and drilling machines will be covered in this lecture. In the next lecture we will be covering part B shaping, planing and slotting machines like reciprocating machines, milling machines and grinding machines.

Then next day we will also cover point out requirements and show methods of mounting jobs and tools in CNC machine tools because CNC machine tools are coming up in a large way because these are the machine tools of future. So how jobs and tools are mounted with a special care in CNC machine tools like milling machine or machining centre have also to be learnt. So today we shall cover point number (i) State the principles and conditional requirements of mounting job and tool in machine tools and (ii) illustrate in detail how the jobs and tools are mounted in lathes center lathes and other lathes say semiautomatic an automatic lathes and then drilling machines. The remaining part will be covered in the next one lecture one hour lecture.

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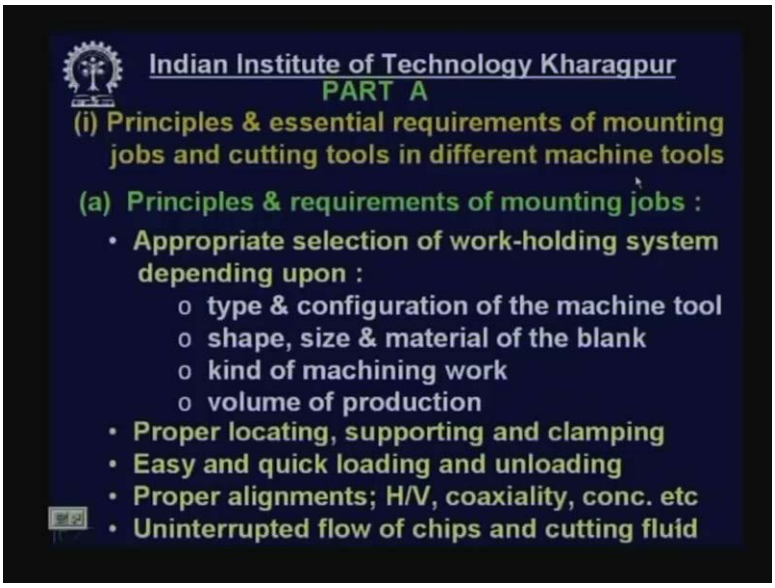

Now the principles and essential requirements of mounting jobs and cutting tools in different machine tools: This is the topic and it is very important because they play vital role on the performance of the machining system. First the principles and requirements of mounting jobs in machine tools. What are the conditional requirements and the principles? Appropriate selection of work-holding system; So there are various types of jobs and the holding methods in machine tools by chuck, by collet by clamps, by jig fixture and lot of methods are there. Now this has to be selected very carefully. Now depending upon the selection will depend upon type and configuration of the machine tool. So the mounting method in lathe is different from the mounting of job in say shaping machine.

So what kind of machine tool you are thinking of that has to be kept in mind. Shape, size and material of the blank; if the shape is very regular, simple, geometrical then one kind like vice should be appropriate. If it is very odd shape, then a different method if the size is very large, a different method of mounting has to be adopted and the material also. If the material is very strong rigid very say you can mount in any method but if it is very fragile or say not very strong than extra care has to be taken kind of machining work. What kind of machining work you are doing? Is it drilling or it is turning or it is shaping. Milling depending on that method of mounting of the job will vary. Now the volume of production: Now volume of production in respect of production volume you know, there are 4 categories; piece production or job order production. There may be only 1 or 2 pieces may be manufactured then batch production say 10 to 20 or say 50 pieces are to be manufactured that is called batch production. Then comes the lot production, let little bigger size.

Now lot production again may be 3 categories say smaller production, medium size production, medium lot production and large lot production. So, the job mounting method will be widely different and if it is a mass production method a quantity large quantity

method, then method of holding will be different. Now the job holding method is also depends upon proper locating, supporting and clamping has to be assured. So it has to be job will be mounted in such a way that the essential requirements like locating, supporting and clamping have to be done. Easy and quick loading and unloading the job mounting methods should be such that the mounting in the machine tool can be done easily and quickly as well as after machining, the job can be removed easily and quickly. This thing has to be taken care of. Proper alignments of the jobs with respect to the machine tool, with respect to the cutting tool, for example, the top surface of a job tool machine has to be either horizontal or vertical or it has to coaxial with the spindle axis or it has to be concentric in nature etcetera.

We should also see that uninterrupted flow of chips and cutting fluid mounting of the job as well as the tool should be done in such way in machine tool. They do not hamper the flow of chips and ah the disposal of chips and the cutting fluid flow. All these points have gone in mind when you select and adopt the method of mounting of job in a particular machine tool. Similarly principles and requirements of mounting tools cutting tools what are those factors?

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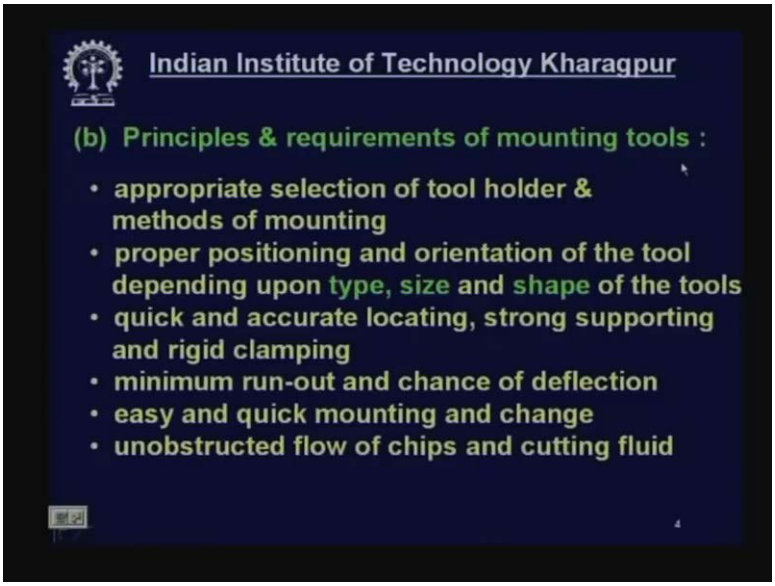

First of all, appropriate selection of the tool holder. Now the cutting tool may vary tiny. It has to be held in a tool holder all right. Now this holder has to be properly selected and methods of mounting of the holder in to in to the machine tool. Proper positioning and orientation of the tool; now this has got some important factor called geometry. Now if the tool is not properly placed say if it is by mistake put upside down a turning tool it will not work at all. So the positioning of the tool and the orientation of the cutting tool are very important which has to be taken care of during mounting the cutting tools and this have to be done depending upon the type of the tool size of the cutting tool and shape of

the cutting tools quick and accurate locating yes if the suppose the cutting tool is a drilling operation the drill has to be fitted in to the drilling spindle.

Now this has the spindle has got an axis and job the tool is are also fit in such a way they rotate coaxially concentrically and coaxially all right. So first of all the quickly quick and accurate locating of the tool in to the spindle strong support so that it does not become loose and rigid clamping so that under the cutting forces the tool does not come out or get displaced minimum run out and chance of deflection so it should be so rigidly held down correctly that there should not be any run out kind of thing.

If it is this can be run out in one way or it can be run out like this if not properly mounted and then deflection if it is not rigidly held at the tip than due to the cutting force the tool may deflect and that will effect the quality of production, easy and quick mounting and change now the cutting tool should be such mounted that it can very easily done without much effort and with the simple any unskilled worker can also do that and sometime for doing the job we need change of tool cutting tool say small drill has to be replaced by a bigger drill a bigger drill has to be replaced by a boring tool a boring tool by reamer and so on the mounting method should be such that this change of the tool can be done very easily accurately unobstructed flow of chips and cutting fluid yes while mounting the tool or selecting the method of mounting here also you should remember that the chips flow and cutting fluid flow should not be interrupted. Now come to methods of mounting job and cutting tools in general purpose machine tools.

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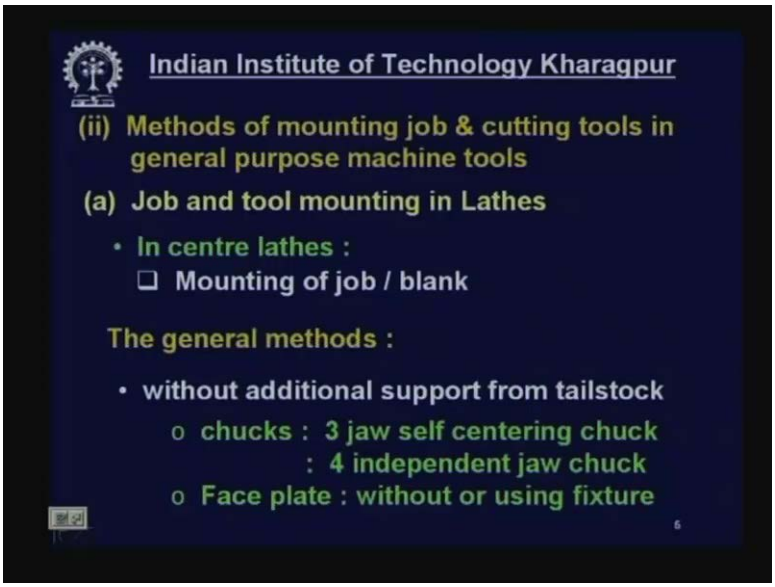

Now this will be in detail the second part the exact methods. First of all let us consider job and tool mounting in lathes all right. Now you know there are different types of lathes. It is categorized in different way general purpose lathe, single purpose lathe or multipurpose lathe or special purpose lathe, non-automatic lathe, automatic lathe,

semiautomatic lathe, single spindle lathe, multi-spindle lathe. There are different types okay. So space is limited most important and widely used are centre lathes. Now let us see how job and tool mounted in centre lathes. Now first mounting of job; now when you say job it can also be called work, work piece work piece job, blank they all mean same. Now what are the general methods of mounting job in centre lathe? Now this can be done again in a centre lathe you know there is headstock on the left hand side and there is a tailstock on the other side and the job is mounted either in the headstock and there can be support from the tailstock end also if the job is long and large and heavy, some support is necessary depending upon the configuration shape and weight or volume of the work piece.

Now first let us consider that mounting of job in lathe, centre lathe without additional support from tailstock. Yes job will be simply mounted in the headstock without any support from the tailstock, chucks most common. Now when you say chuck, there are 2 types of chuck basically. There are many types but most widely used common are 3 jaw self-centering chuck. Four independent jaw chuck, another method is face plate. Now on the face plate or the plate, the job will be clamped. It can be clamped directly or through a fixture additional fixture. This will be shown later on. Now here you see the mounting of jobs in centre lathes continuation.

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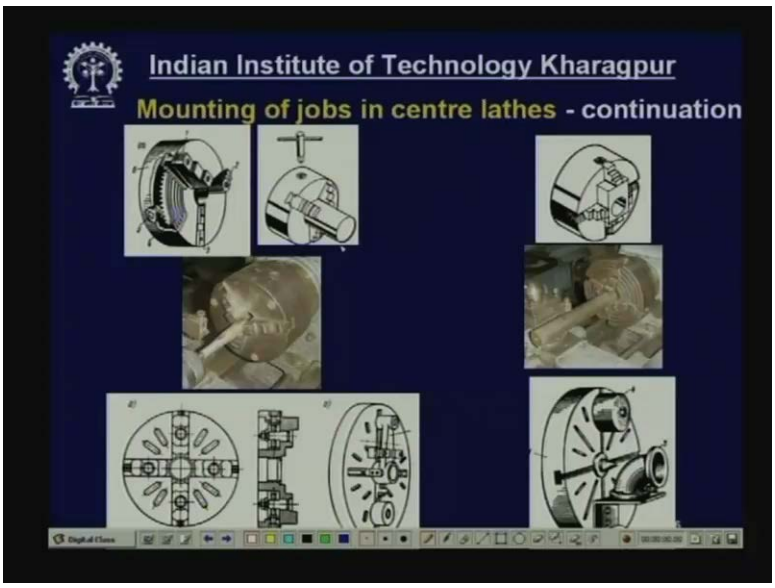

This is the chuck, this is three jaw chuck. You see, this is the work piece. This is the work piece which is mounted in to the chuck and there are three jaws. 1,2 and 3 and 3 they work radially. Now this is the true picture, this is the work piece, this is the one jaw, second jaw, third jaw three jaws like this. Now this is gripped in to the 3 jaws. Now this is called self-centering. Three jaw self-centering chuck because when this scroll, there is a scroll it is called radial thread the disc which has got an Archimedean spiral scroll continuous which is also called radial thread okay. Now here it is like this. Suppose there

is an Archimedean spiral scroll in a disc cut and now if there be a jaw like this this jaw has got rake at the back these are the jaws and now the job is held when this disc is rotated in this direction than all the jaws will move radially inside because this spirals are an Archimedean spiral.

So the rotation of this spiral will either bring these jaws concentrically towards the axis or away from the axis and all the three jaws will work simultaneously. Now this is the disc here shown here and this disc has got gear, bevel gear at the backside which is operated by another small bevel gear. So if you rotate this bevel gear, this disc will rotate and because of that this three jaws will move simultaneously either towards the centre or away from the centre and this is how the job will be gripped. So this is the method okay. Now next is four jaw chuck. Now one thing you have to remember that in these three jaws since all these three jaws are moving simultaneously, the strength of the grip is not that big then secondly the surface on which the job the grips will be made by the jaws should be pre-machined. So were the jaws will add that should be pre-machined.

So that when the jaws move together they grip perfectly even than the grip strength is not adequate not very strong for light work light jobs you can do this but when we need very strong grip especially the job surface is not regular it is not even circular it may be a square it may be rectangle it may be hexagonal and the job is very irregular and the grip has to be very strong than this four jaw this four jaw independent independent independent four jaw chuck is used. Now there are see there are 4 jaws. This is one jaw another jaw third fourth. So this is 1 2 3 4, 4 jaws and also the jaws are moved separately individually all right and then you can grip that job it will be held centre at the centre by operating these screws. Now this is suppose this is a screw okay and this is the nut. Now I can remove half of the nut. So only the upper portion will remain even only this part will remain and remaining all the parts will be thrown out.

So what remains is, this is the screw and this is the nut only a sector a nut sector and this one has got shape like this and there is rake sorry and this is the this is the screw and this is nut okay and this is screw on this side and this is the nut that is a jaw, so this is thread and this is called this is called rake. When this will be rotated about the axis, this will move this way or this way just like a nut. This is how all the four jaws are made to move forward towards the centre or away from the centre by rotating the screw clockwise or anticlockwise. This gives very strong grip for irregular jobs all right. Now this is face plate. These plates are very large plates these plates are very large okay. Large large plates which has got number of slots radial slots radial slots or the circumferential slot as shown over there and there can jaws also on this plate this is a large plate, the odd shape job will be mounted here you see a connecting rod or shape which is clamped on this face plate.

Now this face plate will be fitted in to this spindle. So when the spindle rotates, this face plate will rotate along with that job will rotate. Now you can do some work here this is the job okay. Now you can do drilling, boring. Similar work and this is these are the clamps. Now if the job is smaller and regular shape and you have to produce say ah twenty pieces in batch production so this is the work piece. This is difficult to mount so

you can take help of a fixture of course this is very simple fixture it is a plate like it can be a complicated fixture also. On the fixture, this job will be mounted easily and the fixture will be clamped on the face plate and this is the dead weight. You know for balancing purpose because this is heavy on this side. If you do not put any dead weight, so there will be centric force all right. So this is the face plate. So on the face plate, job can be mounted either directly by clamps or with the help of a fixture and this is done when you produce a number of pieces identical pieces that is called batch production. Now method of mounting of job cutting tools in general purpose: now without addition support this is the work. Next yes job mounting with tailstock support yes.

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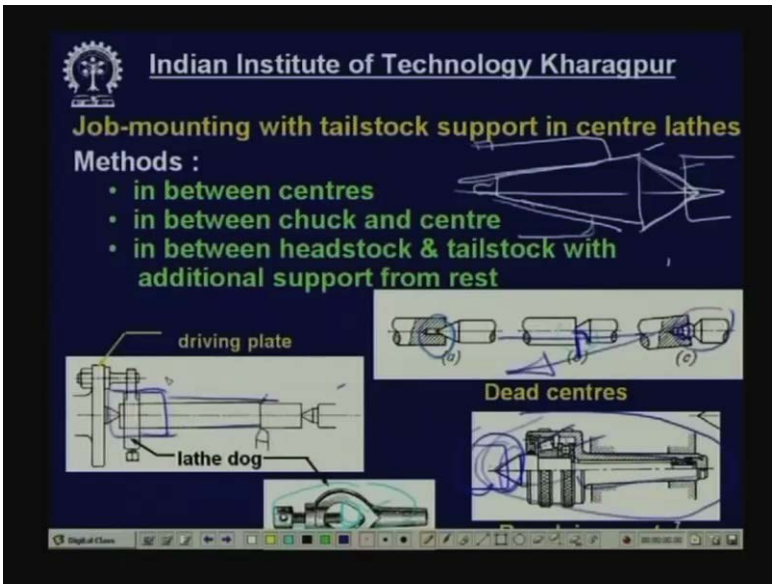

This is suppose the job is long a long heavy job. So if you grip it here by chuck, then this will be so long and cantilever beam and you do cutting action from this side. So if the force will act so this is the chance of bending or you know opening or this will be disclamped. So there should be an additional support from this side and this additional support by a centre which will be fitted in to the tailstock okay and just like this look at here job mounting with tailstock supports in centre lathes. What are the methods in between centers? Now this is a centre. What is a centre? Centre they look like this, a taper rod. So this is fitted on this side either in the spindle or on the tailstock which is on the taper bore. In the taper bore the taper shank is fitted and the other end is also tapered and a job is fitted here through which this has got a hole and this gives a support. You see here these are support given here. These are supports like that here.

Now this is the work piece which is mounted, this is another centre. Now this centre is called live centre, which rotates along with this spindle and this centre is fitted with a quill and quill is fitted in to the tailstock and so this is dead centre. Now the rod is fitted. Now this has to rotate, what is done on this spindle? A plate is fixed this is called driving plate all right driving plate. On the driving plate, there is slot line and this is called a lathe

dog or catcher. This is called lathe dog you see. So this job will be mounted here mounted here and then this end will be fitted here. So when this disc will disc will rotate this job also along through this catcher or lathe dog. So the job is made to rotate by this driving plate which is fitted in to the spindle and this is the dead center. So this is very common type of support and this is the cutting tool which gives in order to move in this direction or in this direction. So this job is held here and here. Life center at the headstock and dead center at the tailstock and this is called lathe dog.

Now this centre is of different types. This is normal center. So this end of the job will have a hole this will have a hole here, taper hole. In to the taper hole, this pin will be fitted as shown over here okay or this can be if you want to phase this surface then this is called half centre and this is ball shaped. Now sometime you want say taper turning or for other purpose job need to be fixed in an inclined plain with respect to the main axis and then this ball n type centre is very useful and now here this is called revolving centre. This is a special type revolving centre what is that I told you that in this is called dead centre which does not rotate the job rotates, but centre does not rotate. As a result as a result what happens? Lot of friction takes place at the surface rubbing. So both the job and the centre undergoes wear and tear because of the relative moment. This is rotating, this is not rotating. Now if we can make the centre also to rotate with the same speed. So there will be no relative moment and sliding:

So this is revolving center this part of the centre is fitted in to the tailstock and the front portion that is fitted in to this with the help of bearing thrust bearing and taper roller bearing. So because the job is mounted here with the force, so along with the job rotation the centre will also rotate inside so there will no relative bend. So this is called revolving centre. This is used for heavy job, specially were this wear and tear should be avoided revolving centre. So this is how this job can be supported. Now, again in between chuck and center. So if the job is very ragged, now suppose here here you have seen the job is very simple rod like now in this case the job may be very large in diameter or step may be relatively irregular. So this side it has to be gripped by chuck and this side by centre this is in between in between chuck and centre. Now in between headstock and tailstock with additional support this will be discussed shortly okay. All these things we shall discuss now.

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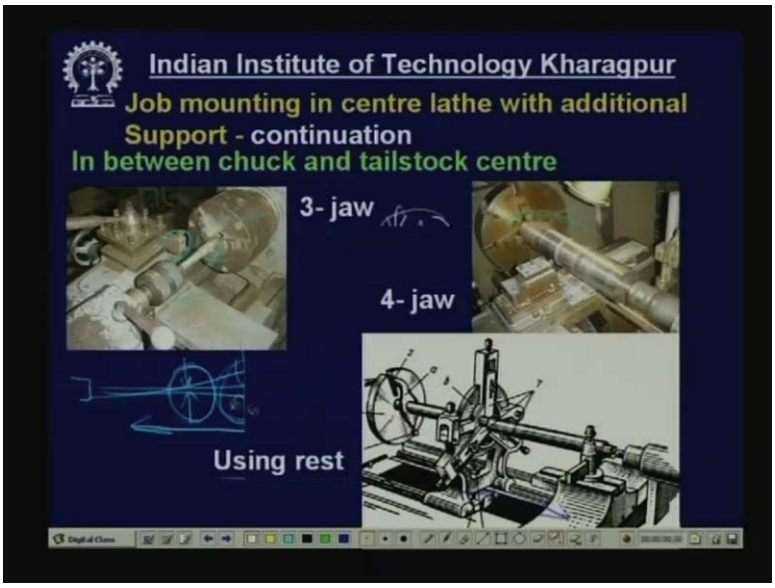

Here you see that this is the job held in between a 3-jaw chuck. This is a 3-jaw chuck, 3-jaw chuck self centering chuck and this is a revolving centre. This is a revolving centre and this is a cutting tool. Now of course, this job is small this can be very large job also. Here you can see a large job may be say 100 kilogram weight one quintal held in a chuck. On one side may be 4-jaw or like 3-jaw on the other side there is a revolving centre. So, in between chuck and tailstock centre, so this is 3-jaw for lighter job and 4-jaw for heavier job and irregular shape. Now the last one as I told that using a rest when we machine a very long rod, say a feed rod or lead screw. So we grip here and we grip here. If we machine straight way, because of the force the job will undergo bending. So to prevent the bending, there is support given additional support is given and this additional support can be stationary in one place or this support can move along with the tool. If it remains stationary in a position, then this will be called stationary rest okay, steady rest and if this rest follows along with the tool, then this will be called follower rest.

One example is shown over here. You see this one this job this is the job a slender rod may be feed rod which has to be turned straight. This is the cutting tool mounted and this is the tailstock and headstock driving plate and this is the catcher lathe dog. So this is the steady rest okay. So this is giving one additional support here in between the centre. So that, under the action of the four this will not bend. Of course this centre can be tied with this tool post and then this tool and this one will move simultaneously of course than the gap will be much less tool and the support will be very close. So this is the job if this will be the job than this is the cutting tool and the support will be also close to that and the support and the tool will move simultaneously. This is called steady rest. Now let us see the next, here this is done something wrong. So next is mounting of cutting tools in center lathes-continuation;

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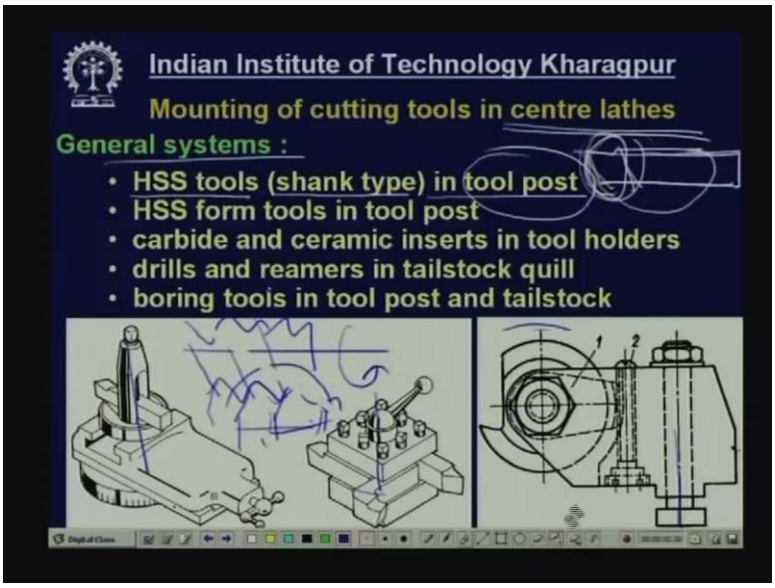

So long we have discussed about the mounting of the job in centre lathe. Now we shall discuss about mounting of cutting tools in centre lathes. Now the general systems; there are different types of cutting tools used in machine tool. Some tool is circular type, some tool is shank type, some tool is drill type, rod like. Some tool small is a piece or insert like. So depending upon the type of the tools the holding method will be also different it will also differ from machine to machine then say first let us discuss about say general mounting of cutting tools in centre lathes okay. What are general systems? High speed steel tools (shank type) and that will be placed in tool post. Now this is a turning tool with a long shank. This is called turning tool, so this is the turning tool portion and this is called shank portion. This kind of cutting tool, turning tool which is very common turning tool grooving tool and different types of tools with the shank. These are also single point tool, high speed steel tools shank type. This will be placed in tool post. What is tool post?

This is an example of tool post this tool post. This is compound slide mounted on the cross slide, which is mounted on the carriage and this is the tool post where the cutting tool this is the cutting tool this is the cutting tool all right fitted in to the tool post here and that is mounted on the compound slide. Compound slide is resting on the cross slide, cross slide on the saddle, saddle on the carriage, entire carriage moves along the lathe bed. So this is tool post. Now this is for single tool at a time. High speed steel form tools in tool post. Now this is before that, let me show another kind of the tool post. This is another tool post were one two three another. So this in this tool post you can mount one tool here, one tool there, one tool there, one tool there. So 4 tools and by rotating or what is called indexing or rotating you can bring suppose this is the job and by rotating, you can bring this tool in position. This tool in position, and this tool in position. So four tools can be mounted; so this this wide more versatile tool post.

Now another high speed steel form tools in tool post. Now form tools you remember that, if the tool is like this you want to cut a groove like this in the form tool. This will produce a groove like this say job a groove will be formed like this. Say thread cutting tool you produce thread this is called thread cutting tool is a also a is also a form tool say we want to produce a thread like this so this job will rotate and this is the cutting tool single point cutting tool it can be two point cutting tool two points. Now at multi points cutting tool these are called form tools it can be rounded also for different forms are grooves. Now this this is one example high speed steel form tool this is one example, this is form tool, a circular type form tool. This is the cutting point and this is the rake angle and clearance angle are given rake angle and clearance angle and these are mounted on this type. Cutting tool is mounted on a lever, a frame and that is mounted on a tool holder. a large tool holder like this a large tool holder and that is mounted in to the tool post somewhere here or here so this is a form tool. Next is carbide and ceramic inserts in tool holders, drills and reamers in tailstock quills boring tools in tool post and tailstock. This will be shown later on in the next phase. Now tool mounting in centre lathe. This is continuation mounting of tool inserts.

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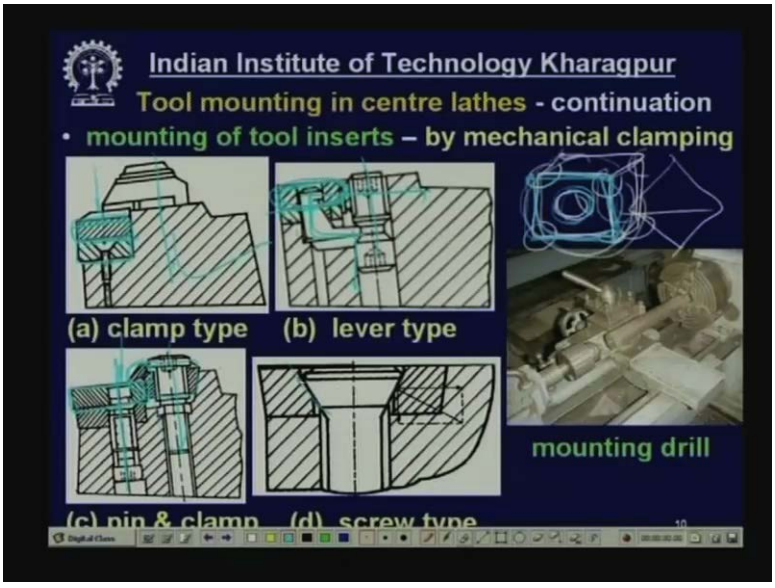

Now tool inserts you know nowadays carbide tools, carbide tools ceramic tool and CBN and different types of tools are used. Those are used in the form of inserts say square inserts very small square insert with a hole or without a hole and it can be like this all right and these are made of Carbide and after using the corners, all the 4 corners may be on the other side also more 4 corners 8 corners this will be thrown out. It can be triangular, different types of inserts are available. Now how this inserts will be mounted is a cutting tool. Now this has to be mounted. There are four different methods. One method is shown here. This is really the cutting tool insert that square shape without hole there is no hole all right. This is mounted here and this is mounted. This is called tool holder, this tool holder has a groove on that groove there is support, a sem.

On the sem, this tool insert is placed and then there is a clamp. This clamp is pressed hard by a screw all right so it is held rigidly. Another method this is the tool inserts okay, this is the tool inserts. It is hollow to the whole, there is leaver L shape leaver and when by the screw you move this leaver this side down than this end will push this insert against the wall and this bit will be held tightly in the position. Now this is another version. This is the tool bit okay, this tool bit and there is a hole as shown over here this through the hole, there is pin in addition to that there is clamp. So the clamp is pressed to hold. This bit by a force and this is operated by a screw the screw. So this gives a locating pin as well as clamping. Now another method were this hole is tapered, this hole existing in the insert is tapered okay. Now this is tapered. So when this pin is rotated, so this will grip this insert on the seat of the tool holder. This is a tool holder, it is a long tool holder. So this is how the tools are mounted.

Now next is mounting drill. You know sometime we need some drilling operation at this coaxial. This is the rod this is the rod were a hole has to be made okay. This is the rod in which a hole has to be made here axial hole. So this is the small drill, drill is held in the drill chuck, drill chuck is fitted in to the quill, quill of the tailstock this is a tailstock. So with that tailstock, there is a quill. Within the quill, there is a taper hole. Within taper hole, the taper shank drill chuck is fitted in to the drill chuck. Small drill is fitted and the drill will now moved along with this tailstock and make this hole. So this is the mounting of drill. So the rotary this this circular tools, a systematic tools like drill centre, drill reamer. Sometime boring tool are fitted in to the tailstock. So tailstock of a centre lathe is used not only for supporting the job giving a support but these are also used to hold some kind of cutting tools like drills, centre drill and so on. Now tool mounting in centre lathe continuation;

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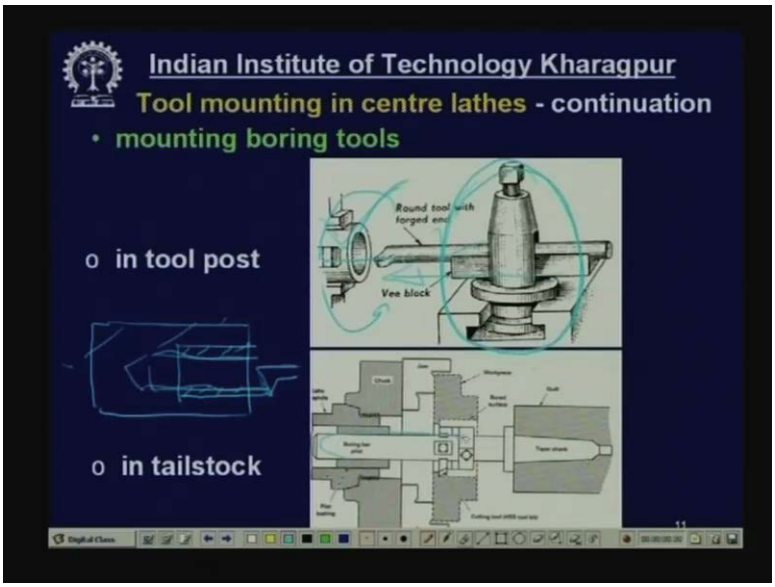

Mounting boring tools; you know what is boring again? Boring means enlarging hole. Suppose there is a job, there is a job held in a chuck and it has been drilled first. But you want to enlarge the hole, then by boring tool you have to enlarge the hole. This will be boring tool the hole will be enlarged gradually by rotational job. This this tool will move in this direction and the job will be removed from the surface boring tool so the boring tool moves axially. Now in turn the boring operation means enlargement of hole and finishing of a hole. But in case of drill sorry in case of lathe, when you do it in lathe, the job rotates always. Machine tools lathe are always characterized by rotation of the job and translation of the feed of the tool. But if the same operation is done in drilling machine or boring machine, the tool will rotate, job will remain stationary.

Anyway so this is the boring tool a shank type of boring tool. So what is to be done? This boring tool has to be mounted in to the tool post. This is a tool post which is mounted on the saddle, and then this will be pushed gradually inside while the job will be rotating and when it goes inside it removes, it cuts the material in this fashion. Again I am showing you this is the job and there is a hole drilled, suppose a blind hole that is the drill of pre-machine prepared by casting or somehow in the previous process and then now you operate a drill. So drill will move along this path. As a result that diameter will gradually increase by removing this material. So boring operation not only enlarges, it gives very good finish dimensional accuracy and you can get very good finish.

Now in case of very precision work, precision boring sometime this boring tool this is the boring tool okay this is the boring tool which has got a taper shank which is fitted into the tailstock and this is the long slender rod like. So the other end in this spindle there is bush fitted inside, so inside the bush this end of the boring tool is fitted and this is the work piece. This is the work piece which is fitted into the chuck. So the spindle rotates along with the job but this boring tool fitted in to the tailstock does not rotate. So the job is rotating but the tool remains fixed. So the tool moves in this direction and it enlarges the hole and it gives a very good finish. So this is done for very precision machining where the tool requires additional support from this end. So this is another method. Mounting of job and tools in semiautomatic and automatic lathes:

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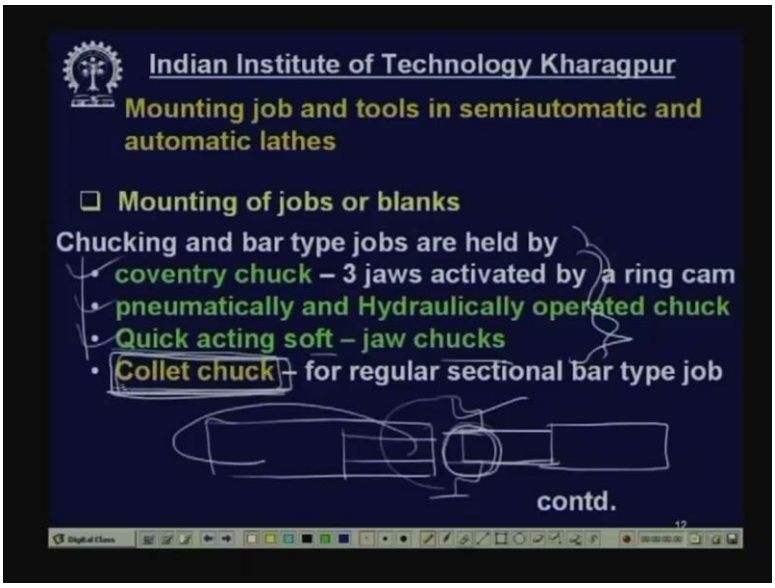

As I told you that lathes are of different type various type, we are not covering all those things all those machine lathes that is not possible it is a short time. But most widely used are centre lathes and then we shall discuss little bit about mounting of job in some semiautomatic and automatic lathe. Now, semiautomatic lathe; Example-capstan lathe turret lathe, reliving lathe say hydraulic lathe, copying lathe and so on but we shall confine our discussion with capstan lathe and turret lathe. Now automatic lathes may be cutting of lathe, switch type automatic lathe, single spindle automatic lathe, multi-spindle screw cutting lathe and so on. We shall discuss some of them. Mounting of jobs first okay jobs are blanks in semiautomatic machines automatic and semiautomatic machine tools.

Now how these are? Now what are the characteristics of semiautomatic or automatic machine tools? What is the purpose of making machine tool automatic? Purpose is or the purpose of automation is to get the work done easily quickly, that is rapidly and accurately consistently with minimum or no human intervention. That is the purpose of automation. So automation is a device or system which enables very quick, accurate and reliable, rigid, clamping, unclamping mounting or handling operations of machine in machine tools like mounting and un-mounting or unloading of jobs mounting tool and new other tool and moment of the tool these are the various handling operations which need to be automated. So quick acting accurate acting, repetitive acting or these are the features of automatic and semiautomatic machine tools. Now mounting of job or blanks chucking and bar type of jobs are held by coventry chuck is a 3-jaw chuck no doubt but all the jaws are activated operated not by rotating this pinion or bevel gear which takes little time.

Here a little movement either pneumatically actuated or hydraulically operated or mechanically operated a ring will be made to rotate little bit and that will enable all the 3 jaws move simultaneously okay and with the small amount of rotation because it is a lot production repetitive production. So the jobs are more or less same within the range. So

the job need not move with a wide range of say very from large gap to low gap because the same jobs are repeatedly done. So job has to be opened, the jaws have to be opened slightly and move we have to moments. So slight movement of the jaws will be enough and that amount of movement will be accomplished by a ring a cam ring. So all three jaws will move radially by this cam ring. So quick acting and accurate acting and repeatability are the characteristics of automation pneumatically and hydraulically operated chuck were the 3 jaws or 4 jaws will be operated very quickly by compressed air or by hydraulic force quick acting soft jaw. Chucks, now is there certain materials jobs which require suppose this is the job rod where some work has to be done here.

Suppose some here now the job has to be turned this side. So this end will come this side already machine and now we have to machine this side. Now if you grip this side by a strong chuck or grip then this surface will be damaged. In that case, the jaws have to be softer even at least softer, than the work material. This is called quick and these have to be soft as well as quick acting. Quick acting soft jaw chucks; this is another kind of chuck. Now next is Collet chuck which are very very widely used. Now remember this coventry chuck, pneumatic chuck and quick acting soft jaw chuck. These are mostly used this three in semiautomatic lathes like turret lathe and copying capstan lathe, turret lathe. But collet chucks these are mostly used in automatic machine tool and this can be used in these are all used in say capstan lathe also. Not turret lathe but capstan lathe because capstan lathe or turret lathe.

They deal with rod like job which need to be mounted in collet chuck or they deal with this turret or capstan lathe with chucking type say this type job were they are held in chuck but quick acting chucks but automatic machine tools. They say they always deal with bar type, long bar type. Those are held always in collet chucks. So collet chucks are used normally for regular section. But a regular section means either perfect axis symmetrical, either cylindrical or it has to be squared or it has to be hexagonal or it has to be octagonal and so on. This is called regular okay like this. Now we shall discuss things like this in detail.

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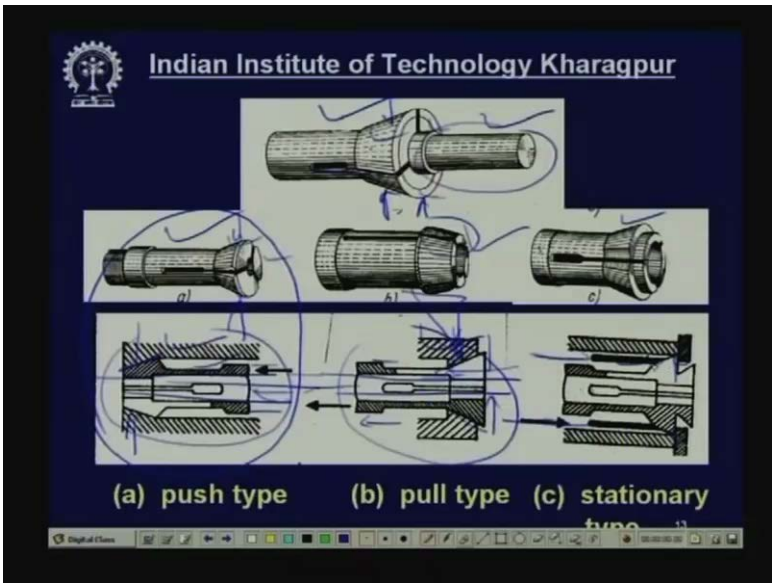

Now these are collets: chucks you have already seen 3-jaw chuck, 4-jaw chuck and coventry chuck and other chucks are more or less similar you can see, consult. Lot of books are there and you can see in to the machines also. But collets which are widely used mostly in automatic machine tools are also used in semiautomatic like capstan lathe. These have to be learnt in detail. Now how do they work? Chuck collet chuck a spring collet chuck is basically a tube, it is basically a tube okay and now in to the tube at one free end, the tubes are slotted okay slitted just like the finger the gap between the fingers. Now if we apply a radial force from there, then this grip will be closer okay. This will be closer. So if you put something inside that will be gripped that means this spring collet which has got 3 or 4 fingers produced by slits cutting slits have to be moved.

Apply a radial force okay and then they will be closing and grip the job. So with the collets are spring type in nature, spring action and they has got fingers produced by slots and by applying radial force, they are made to come closer and with a small gripping hole and they grip the job held inside and while releasing this radial force has to be withdrawn and they will go out and job will be coming out so this is the basic principle. Now here you see, this is the collet okay. This is the collet this is the collet and this is the work piece. The work piece is held in to the collet. There one finger, two finger, three finger, and these fingers are produced by cutting slits here. So when we apply a radial force then this will move inside and grip it. But there are basically three types of collets. What are those? This is the push type. This is the one push type that here you see that all these collets. These have called slits like radial slits up to certain length axial slits to make three fingers. One, two, three; here are four fingers three fingers are there.

Now the question is, the difference lies in how this will be made to close down or how the radial force has to be applied. In this case in this case this is the spindle. This spindle has got a taper hole and this collet is pushed from this side the collet is tapered like this. It is not like that. It is like it is wrong. One this should sorry, this one is this is actually push

type here you see this end. This end of the taper end comes in to the taper end. When you push it, so there will be a force acting radially and that will make these fingers going closer to the axis and if you put a job here that will be gripped so this is push type. Now this one is pull type. This one here you put it like this, this is the spindle. This is spindle has got a taper opening outside. This is the opening inside. You see opening inside, this is opening outside then the quality it is pulled in this direction. So this will be pulled against this one. So a force will act which has got a radial component that will make this fingers close down and if you put a job inside that will be gripped. Now the push and pull makes little movement of the job because of the movement of the collet.

So collet moves slightly in this direction in this direction because this push or pull. As a result the job also moves slightly which may not be allowed in some occasion were this push and pull will not be allowed. This is one example. This is called stationary type. This is a stationary type where this is also a taper surface. This end is flat is arrested by this plate fitted in to this spindle. Now by a tube by a tube this is the tube extra tube which will be pushed. The collet will be not directly pushed or pulled but this, there will be tube. The tube will be pushed which will apply force on the taper surface. So this will apply a force in this direction that will have radial component and this will move in direction this will move in direction and grip the job. So this is how the collets work in automatic machine tool. Now mounting of cutting tools in semiautomatic lathes, capstan lathe, turret lathe and so on. First let us discuss with semiautomatic lathes like capstan lathe turret lathe and so on.

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On cross slide now in semiautomatic lathes: suppose this is the job this is the job held in chuck or collet, so there will be a tool. This is called front slide which will move in direction, rear slide and there will be one hexagonal turret and this will have a tool. How many tools? Six tools will be mounted on the 6 faces and time to time, these cutting tools

move only radially. So they are used only for radial work say which require radial feed like say facing grooving, forming, recessing parting and so on and these tools are mounted on the turret. Turret moves axially, so turning, drilling, boring, reaming. This thread cutting this kind of tools will be mounted on the hexagonal turret. So how many tools we can mount in the semiautomatic? Mind that in semiautomatic machine tools, time has to be saved by automation, so mount lot of tools.

Now this is the turret hexagonal turret you see hexagonal turret which has got number of tools mounted this is the job ring type job which is held here and this is the type and this is another turret which is called this rotates about hexagonal this is a different drum type. A drum type one rotates about this tool comes in to action. This tool will come in to action because of the rotation all the tools will come and this is the real picture. This is actual turret of turret lathe and this is the work piece. So by indexing motion the appropriate tool will come and do the necessary action. So in cross slide on cross slide for transverse feed, this two in front slide this is the front slide this can be a one tool type or a indexable type were 4 tools can be mounted in rear slide only one for parting operation. So in the radial one the five cutting tools can be mounted on the turret mostly hexagonal six cutting tools so 6 plus 5, 11 cutting tools can be mounted. Now, mounting of tools in automatic lathes:

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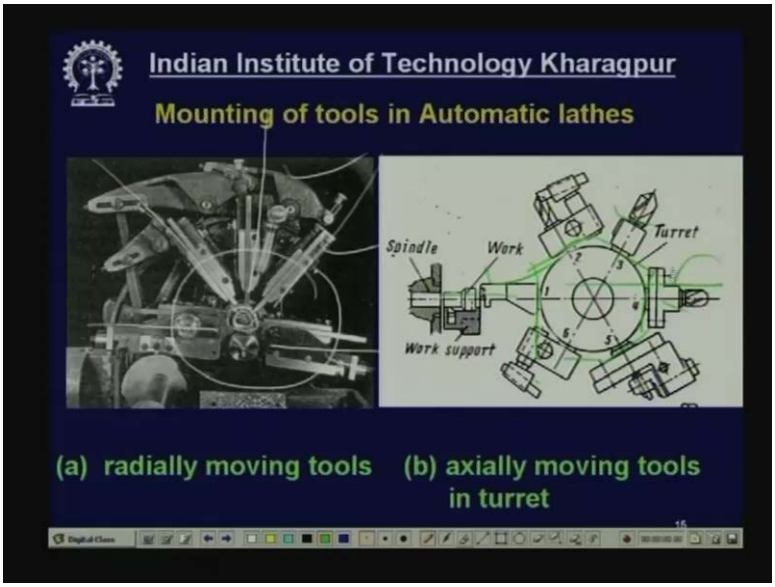

In automatic lathes it is the job is mounted in the collet. Now here you see that this is the job a rod like fitted in to the collet all right. It is a long rod like and then this is the job this is the job and now these are the tools these are the tools. Front slide, rear slide, these are vertical slide and two angular slide. So 5 cutting tools move radially to cut the job for various machining operations in addition to that there is a hexagonal turret or this may be assumed to be an hexagonal, hexagonal turret were like this the tools are mounted different tools are mounted and then after machining work this will go back and then it

will rotate indexing it will again come back. This is how the tools are mounted. These are the different types of tools are mounted radially moving tools and this is axially moving tools in turret. Now mounting of job and tools in drilling machines:

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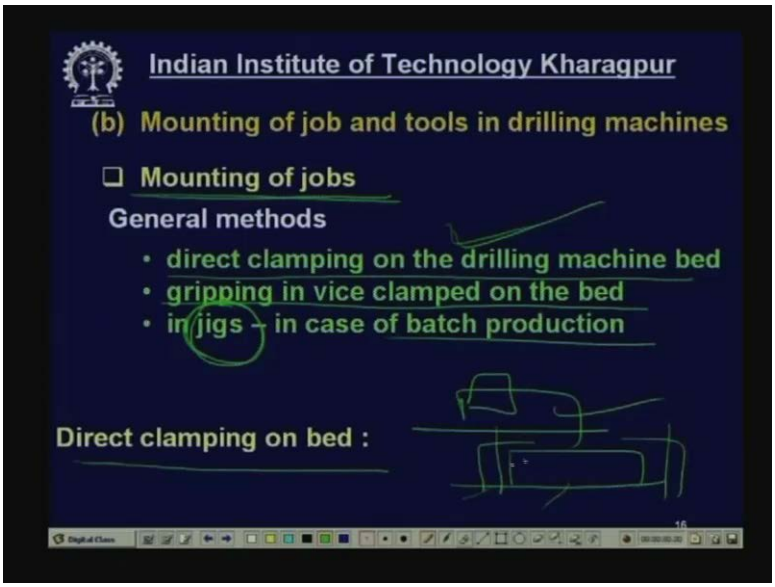

Mounting of jobs: General methods: What are the general methods in drilling machines direct clamping on the drilling machine bed. Now sorry mounting of the job first how the jobs are mounted very simply in drilling machine direct clamping on the drilling machine bed by clamps nut bolt T's T bolt etcetera or these are fed for large and odd shape jobs.
If the job is small and irregular shape then a vice can be mounted on the bed. On the vice the jobs will be fitted or sometime for batch production, a special jig will be developed or used which will be clamped on lathe bed and job with be mounted in to the jig and now I shall show you the direct clamping on the bed so this is the bed and the job is here and by clamping from this side the job is held now you can do the drilling operation. These are different types of vice.

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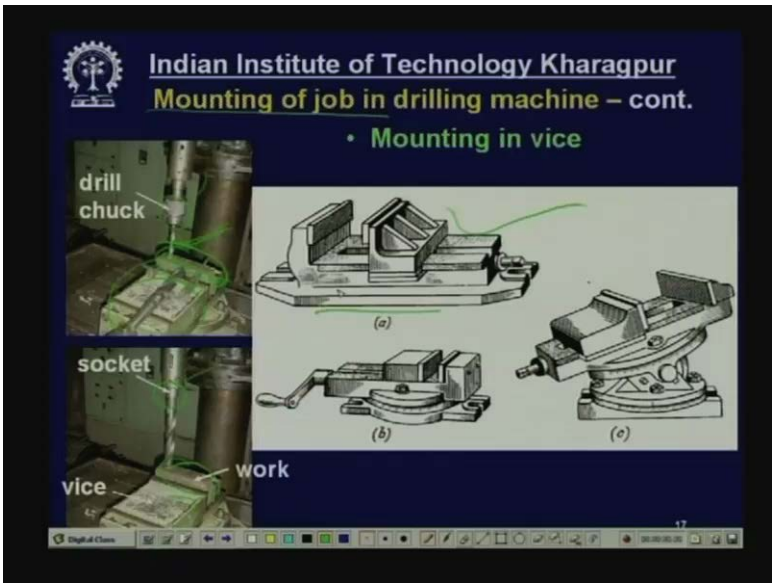

Here you see that this is the drill bit okay, this is the job this is the job this job is mounted in to the vice. This is the vice okay in to the vice, the job is mounted and this is the drill bit and the drill is mounted in the drill chuck that is fitted in to the spindle. So mounting of job now in to the vice. This is also this is the job mounted on to vice and this drill is fitted directly in to the spindle with a socket. There are different types of vice. This is called general types of vice simple vice one dimensional. This is a vice which can rotate about this axis is called swiveling vice and this is called universal vice were the vice can this is the vice mounted on a table which can allow, rotate about this axis and there is another vice which can make a rotate further. So this is called universal vice. So you have mount the job and you can rotate this one fix it a different orientations. Mounting of job in jig and fixture:

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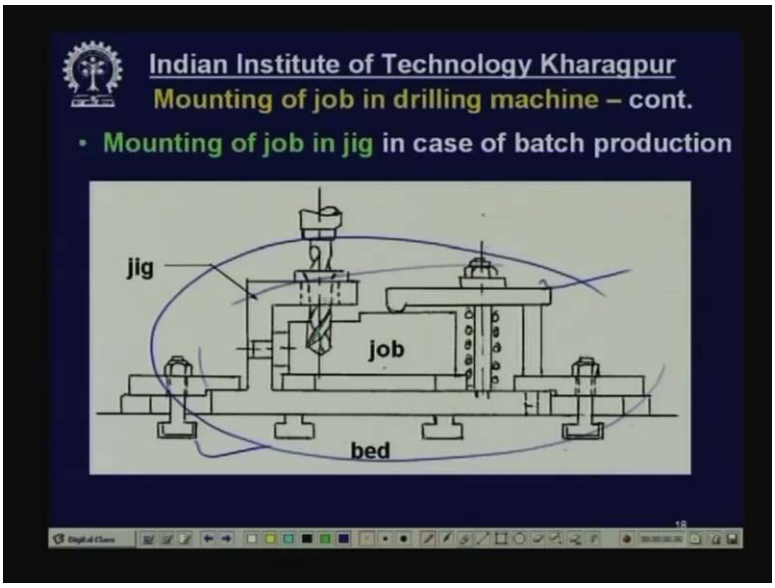

If the job is to produce in say batches batch production then sometime a jig plate, this is a jig plate. This is the machine bed. This is the machine bed on that this is the jig. This is entire jig which is mounted on the bed and this is the bush and this is the drill bit coming and this is the work piece mounted inside. After drilling, this will be taken out after unclamping this one so this is how it is done in batch production. Mounting of tools in drilling machines:

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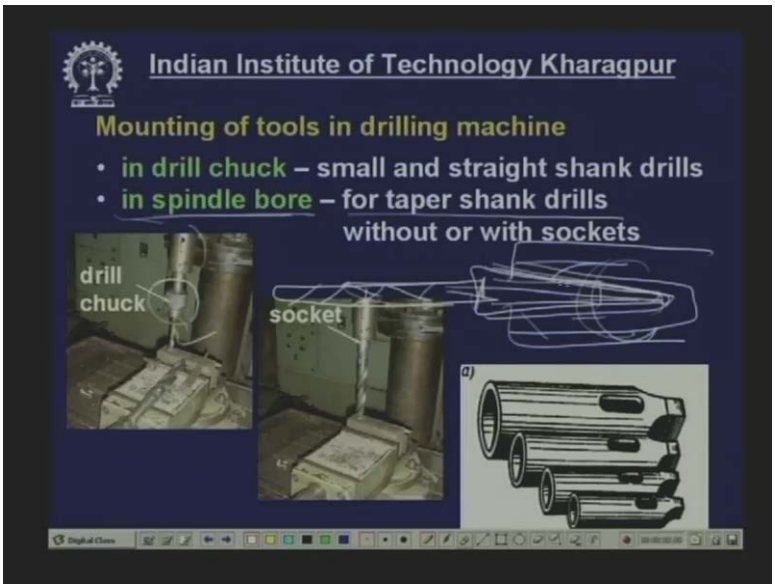

Very simple as I already told that drills are mounted in drill chuck for small drills; for small drills and straight shank type, the drills are fitted in to the drill chuck as I showed earlier, this is the drill chuck here and by opening this chuck has got taper shank that is fitted in to the spindle which has got taper bore and this is the drill bed. So for small drills and say taper shank, sorry straight shank drill this is fitted in to the chuck and chuck is fitted in to this. For in spindle bore-for taper shank drills, now the drills have got taper shank drills okay. These are drill bed, these are called taper shank. These are used for large drills were the grip was large griping, griping force. These are fitted directly in to the spindle and now this bore of the machine may be larger than the taper shank. In that case, another socket an adapter is put in it is called adapter or socket which has got internal taper to accumulate the taper shank of the drill and external taper to be fitted in to the taper bore of the spindle. So these are the sockets you see. These are the various sizes of the sockets various size of the sockets and which are fitted in to that taper shank of the drill that is fitted in to the spindle. This is the example. Now solid carbide drills; mounting of carbide drills:

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Now carbide drills may be solid type carbide drills may be solid type, small drills. These are held in chuck brazed. These are the small if it is a small it is called straight shank. This can be held in a chuck. Brazed tip type spade drill, now in this type of drill say spade drill only the front portion of there is a steel but this front portion will be carbide brazed tipped type and this will be placed. This will be fit in to chuck straight shank drills or directly in to this. Carbide inserts; these are the carbide inserts which are mechanically clamped at the tip. So this is the carbide inserts which are fitted. These are widely used. So today is this much. So, next part of the lecture will be covered in the next part next day in the next lecture okay.

Thank you