Manufacturing Processes II
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Lecture No. 31
Production of Screw Threads

Welcome to our subject Manufacturing Processes – II. Now we are going through Module number – 7: Manufacturing of Screw threads and gears.

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Today's lecture number 7.1 will be Production of screw threads by Machining, Rolling and grinding. Of course threads are produced by different methods but mostly by machining, rolling and grinding.

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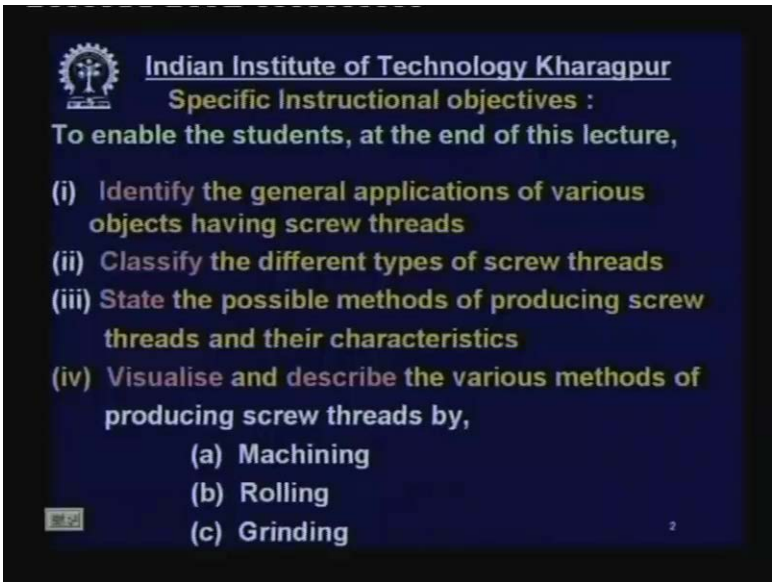

Now what are the contents of the lecture today? Identification of the general application of various screw threads. Before we are going to manufacture of screw threads, we must understand what are screw threads? What are the applications of this screw threads the screw threads? What are the different types of screw threads and what are the white spectrum of manufacturing methods of screw thread00000000s and then general methods with more description? So first is identification of the general application of various screw threads. Second, classify the different types of screw threads. Next, state the possible methods of producing screw threads and their characteristics and finally we should visualize and describe the various methods of producing screw threads by machining, rolling and grinding.

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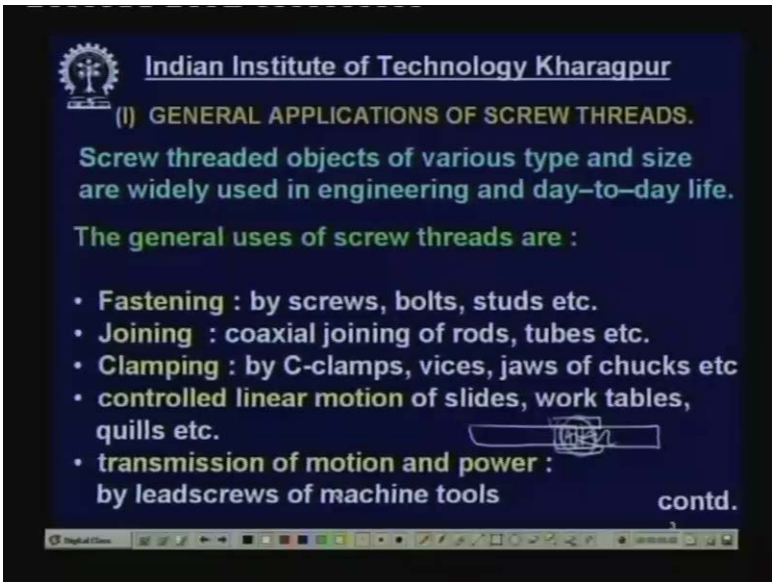

Now let us start with general applications of screw threads, screw threaded objects like nuts, bolts, studs, screws of various type and sizes are widely used in engineering and day to day life. Everywhere we will find screws or threads or nuts the general uses of screw threads are very large but basically for fastening by screws, bolts, studs. Suppose two plates have to be joined temporarily, so some hole has to be made and through the hole say number of bolts and nuts will be there for tightening and when required you can unscrew it, and dismantle. So this is called temporally fastening. So screws bolt stud these are used for you know fastening one part with the others. Joining: Now the two joining we say for example; two rods have to be joined coaxially two pipes have to be joined coaxially.

For example, say there is rod and there is another rod to be joined. We can join in various ways by welding that is permanent temporally by threads and so on and it can be pipes also. So there will be threads on the pipes and then you can join by another small piece threaded piece this is also temporally. Now clamping; holding something in a space strongly so that, it does not move under action of the forces and all this. So this is done say for example C clamps, by a C clamp we tighten this jobs on a clamp or we give keep the objects say jobs or blanks in machine tool in vices say in drilling machine, in milling machine, in grinding machine, we use different types of vices and many of the vices are operated by strong screws, then jaws of chucks. You know jobs are held in chuck say self-centering chuck or say four jaw independent four independent jaw chuck but there are the jobs are held by these jaws and the jobs have got partial threads and these threads are used to move and hold the job.

Another application controlled linear motion of slides. Say the fronts the cross slide; the cross slide of lathe is moved by a screw the compound slide that also made to move by a screw the quill of or the barrel of say tailstock that is also operated by a screw then, the tables of milling machines tables of sometime say grinding machines and another machine drilling machines are made to move by screws or lead screws. Transmission of motion and power: For example; the lead screws of lathe. So lathe has got a lead screw. What does it do? It converts rotation in to rotation from the motor or the spindle in to translation of the saddle. So the power and motion or transmitted to the tool from the job or from the motor with the help of a lead screw.

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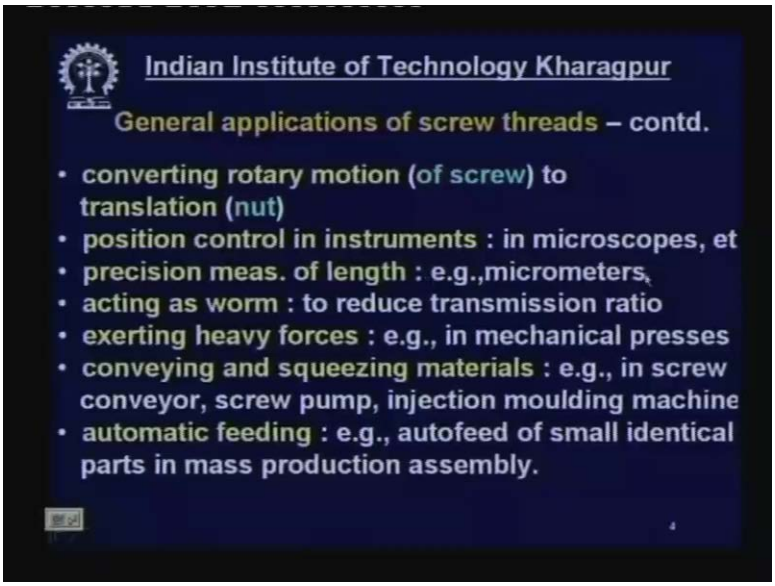

Continuation.. converting rotatory motion to translation; Suppose we want to convert you know rotatory motion into translation. Best example is say screw and nut; you rotate the screw and the nut will travel linearly. Position control in instruments: Suppose an object is put on a table a small table of a microscope and it has to be shifted either x or y direction and those are accomplished by screws or threads lead screws. Precision measurement of length: say micrometer. In micrometer, there is a spindle threaded spindle and when you rotate the spindle or thimble then this gap between the wheel and the spindle changes and we can measure the length or thickness of the job acting as worm.

Now what is screw thread? Thread and worm are same. What is worm? Worm is a single tooth gear which looks like a screw. So if worm is a screw then, screw is also worm. So screw can be used sometime for you know transmission of rotation from screw to the gear or just like the worm to worm wheel and there will be huge reduction. High speed will be converted into low speed reduction just like worm. But, this is not very widely used exerting heavy forces. Now sometime we need applying heavy force to compress or press certain things. So it have been press hydraulic press you know, there are the mechanical presses were the heavy things you know say a blanket or clothes that has to be pressed or other materials by screws and those screws have got strong threads. Conveying and squeezing materials screw conveyor: you are familiar with screw conveyor?

So this also be behaving like a screw or threaded object which is used to transport materials say removal of chips from the lathe by screw conveyer, screw pump. There are also used for pumping oil. Injection moulding machine: In injection moulding machine in injection moulding machine the plastic granulars are moved forward and then pressed and squeezed by a screw. Automatic feeding: So in automatic assembly say bearing or some other pieces, some small minute parts, identical parts have to be continuously feed in to the assembly very quickly and that can be done by screw all right. You can see books how it is done.

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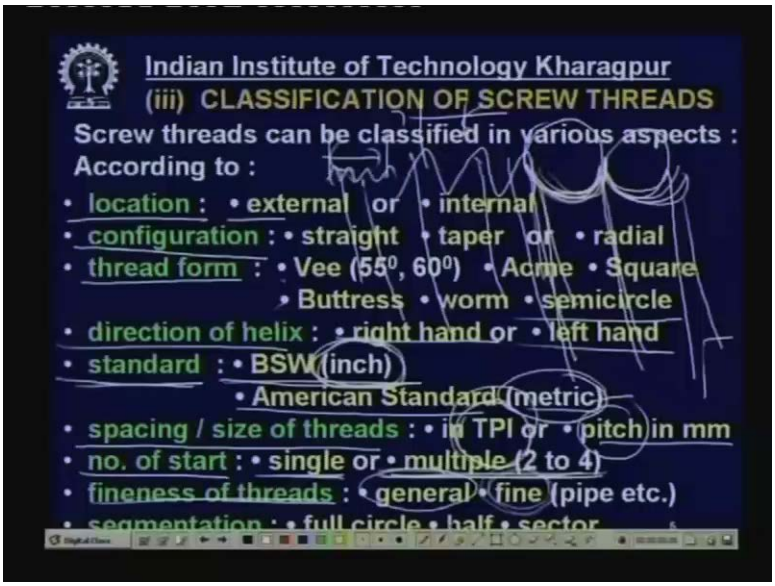

Next is classification of screw threads. Mind that, screw threads when we have different types, it is not as simple. There may be various types with various applications. The wide range of threads in size and shape in configuration in application and so on. Now you can see screw threads can be classified in various aspects in different respects they are different locations. For example, external thread or just like screw, bolt, stud. There we have got external thread. Here there is a bolt, so this has got external thread. If there is nut, then this will have internal thread. So according to location, threads may be external, threads may be internal. Next is configuration: This configuration really implies the threads can be straight, the bolt can be straight, it can be tapered like that or it can be radial you know Archimedean spiral type, radial type radial type of thread.

Now what are the examples? Most of the nuts, bolts, etcetera and lead screws are straight. So there the threads are cut on a cylinder and cylinder is a straight cylinder with continuous diameter. Now the taper thread: the threads are cut on the taper body. For example, in the jaws of drill chuck, these are called taper threads. There are taper threads on the spindle. There is nut in micrometer that as got some taper thread. So taper threads have got taper threads are also used for you know fixing pipes to make it you know the junction leak proof. There should not be leakage of gas or fluid for that some taper fitting is there that gives very strong fit, airtight, radial. For example; radial or scroll-type that is its self-centering chuck thread form. Now there are different types of threads. Sometime the threads are sometime B-type, sometime square type sometime acme type. It can be like buttress type.

Now B type most common it can be either 55 degree BSW British standard or it can be 60 degree say international standard or American standard. This V thread this angle may be 60 degree acme thread. This is a trapezium type and the angle is 29 degree this kind of threads are very strong used in worm and other lead screws heavy lead screws and so on. Square threads for this is very strong designed for press where heavy forces are to be transmitted. Buttress is a 45 degree angle, then worm is also similar to acme, but the angle here the angle is either 29 degree

that is double of pressure angle 40 and half or 20 degree pressure angle multiply by 2 gives 40. So in one thread, the thread of the worm single tooth gear will be 40 degree or 29 degree and then semicircle.

Sometime you know that the threads are circular type. The threads are like this and so this kind of threads are used for recirculating ball screw, navy cub gear, navy cub not navy cub but say semicircular group is done for recirculating ball screw type. You know, in all screw-nut system the threads are subjected to sliding. The lot of friction rise in temperature, wear and tear takes place. But, there are modern screws where the contract is through rolling a set of balls, roll in between the threads of the nut and screw in that case the groups of the threads of the nut and bolt both are made semicircular. Now according to standard, so direction of helix. It can be right handed, it can be left handed. If we put a nut and if it is a clockwise or right handed, then nut will come back or screw will go forward and if it is left handed, sometime it is left handed if we rotate this screw the nut moves forward.

Sometime left hand threads have been used. For example; say in the cross slide of lathe in the tail stock of lathe and so on but those are costly difficult to make standard BSW was most common British Standard Width were the the thread is explained by or specified by inch, the diameter, the gap between the threads and all this things are by inch BSW. American standard or international standard these are metric thread here the space between the threads are called pitch and this is expressed in millimeter. Now spacing size of thread: now threads can be very small threads or it can be large threads on the same diameter or on different diameter and this spacing can be expressed say number of threads per inch that is TPI. TPI - number of threads per inch.

If large number TPI is large that means threads are very small or directly pitch that is the gap between the threads. That is called pitch, the gap between or the distance between two consecutive threads pitch in millimeter. Number of start: It can be single start. Most of the threads are single start. There will be only thread in continuously moving helically, but there can be multiple start two three or up to four this also there can be four threads. So here the lead will be very fast. So, multiple threads are used for large lead. Now fineness of threads: Most of the threads are general type, but sometime fine threads are required in pipes for gas proof or water tightening and all this things there are fine the thread pitch is very smaller. TPI is very large and the segmentation: the segmentation of such of suppose this is a thread okay, this is a nut. Now this can be half. So you can remove the bottom half. So this will be called half thread or half nut or you can make only this small portion useful and remaining part you can remove. So this can be full circle type of thread. It can be half nut kind of half thread or it can segment small part segment but the effect will be more or less same difference will be in strength.

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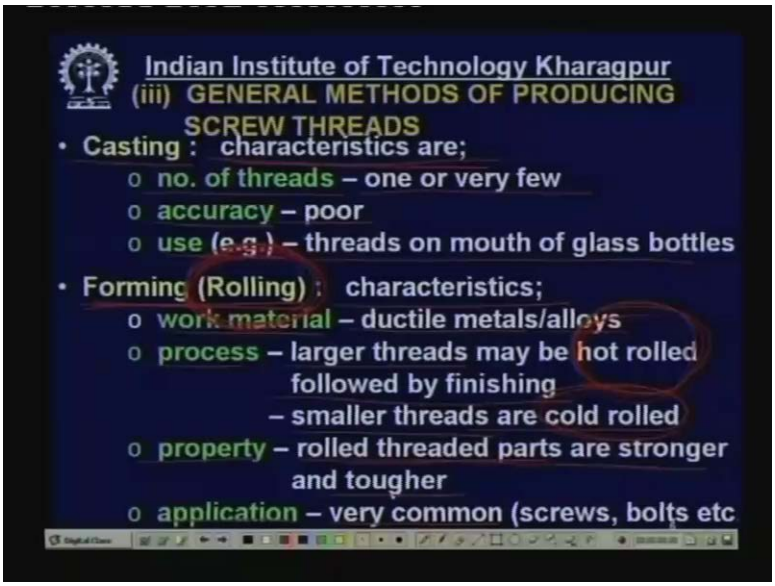

Now general methods or producing screw threads: There are many many methods of making screw threads. You will be surprised to see that, casting is also a method. You can produce threads by casting all right. What are the characteristics made by casting? Number of threads may be only one or may be maximum two very few threads. Accuracy: no question, very poor because this is a casting process and use threads on mouth of glass bottles. You can see there are beverages you know glass bottles for cold drinks and all these things which has got thread at the top and the cap the plastic cap or metallic cap which also got internal threads and tighten on this glass bottles. On the glass bottles, the threads are produced by casting. Forming: This is a very common method. Forming not all methods only rolling. Amongst forming, rolling is the process.

Now what are the characteristics of rolling is made? Work material has to be ductile material. So that it can be formed or alloys. Process: Larger threads if threads are very large with a large depth and width, then they have to be hot rolled because this will require lot of forces, if done in a cold state. Now, if you do it by hot rolling, then accuracy and finish will be poor. So they have to be finished by machining and grinding later on, but smaller threads are directly made by cold rolling process and no further finishing may be required. Property of the threads produced by rolling: Rolled threaded parts are stronger and tougher because in machining, the threads are cuts material is cut and lot of stress concentration can develop here and there. But, in case of rolling the materials are not cut. They are just formed or deformed or displaced. So strength and toughness remain. Application of rolled threads: It is very common for small components. Large screws or threads are lead screws are not made by rolling. Rolling is used for small components like screws, bolts, etcetera but they are very fast in production unlike machining.

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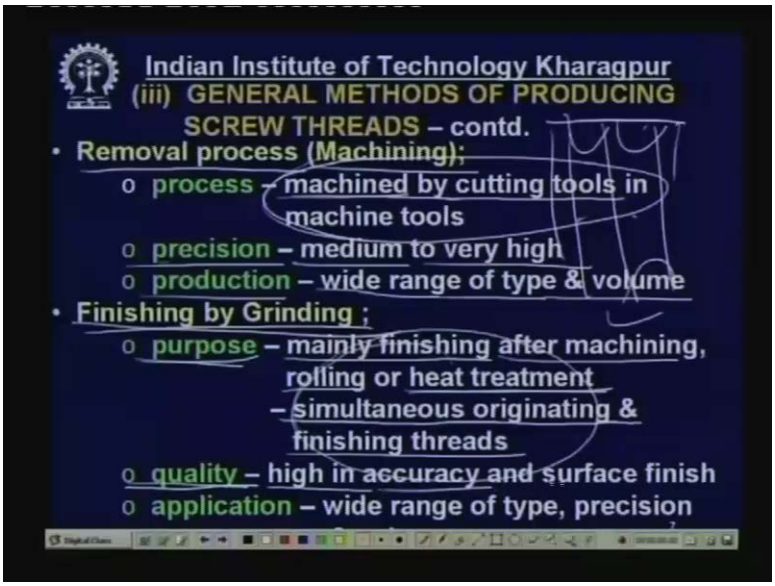

Now what are the other methods of manufacturing threads? Machining: Removal process or machining; now what is removal process, machining process? Machining is a process of removal excess material in the form of chips from the blank with the help of a cutting tool which will be moved relative to the job surface and this work will accomplished in a machine called machine tool. So, it is continuous removal of excess material slowly in the form of chips. That is called machining number one. So from a cylindrical surface, the material will be removed from the groove gradually. Precision: In respect of precision, machining produces wide range of precision. Medium to very high. Production: yes production rate also widely varies. It can be very moderate, it can be medium, it can be large volume or mass production all right.

Now finishing by grinding: Now what is the purpose of grinding? Mainly finishing after machining or rolling or heat treatment because after heat treatment, it becomes so hard that rolling and machine cannot do anything. Only grinding will serve the purpose even after machining or rolling we do not do treatment. If we do not do treatment, then finishing may be required for there functional requirement and that will be done. Finishing means dimensional accuracy and surface finish by form accuracy by grinding. But nowadays, grinding is a process which is as good as and as productive as machining. So simultaneously originating the thread and finishing the thread will be done together. So no machining will be required at all but this will be applicable for generally small jobs but for heavy jobs where like lead screws, this machining and grinding can be done. Finishing can be simultaneously done by grinding, quality of the thread you produce by grinding the fleet will be very high in accuracy and surface finish application wide range of type and precision.

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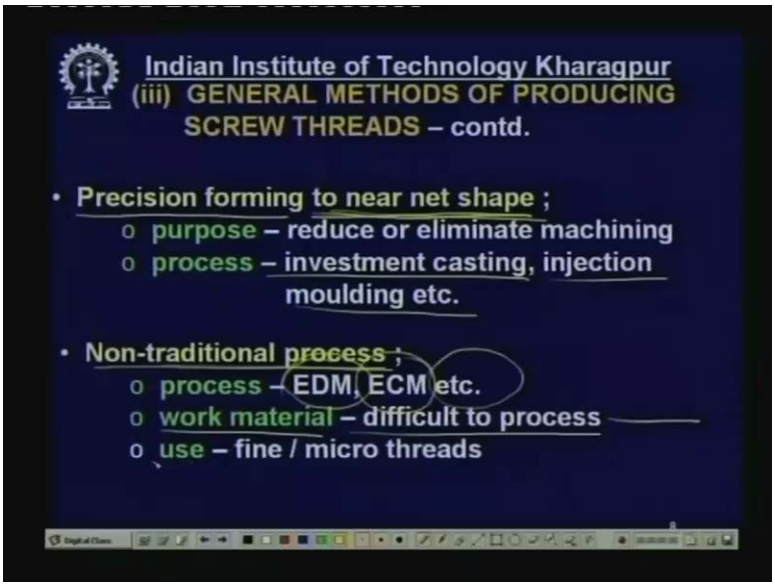

Now come to general methods of producing screw threads or sorry there are other methods also which I was to tell you that, so we told about casting, rolling, machining, grinding. What are the other methods possible? That is precision forming to near net shape. Near net shape means preforming very close to the final dimensions. So that, machining is not required. Grinding if required may be very small amount. This is called near net shape principle which is done by say investing, casting, injection moulding and so on but this process in this process also say small internal external threads can be produced. Non-traditional processes say micro machining and exotic materials. How will you do it? You have to do it by these non-traditional methods by electro-discharge machining, electrochemical machining; laser machining and similar process will be utilized. Work material has to be difficult to process which cannot be done by conventional method and use fine and micro threads precisions threads. So these are coming up this non-traditional process.

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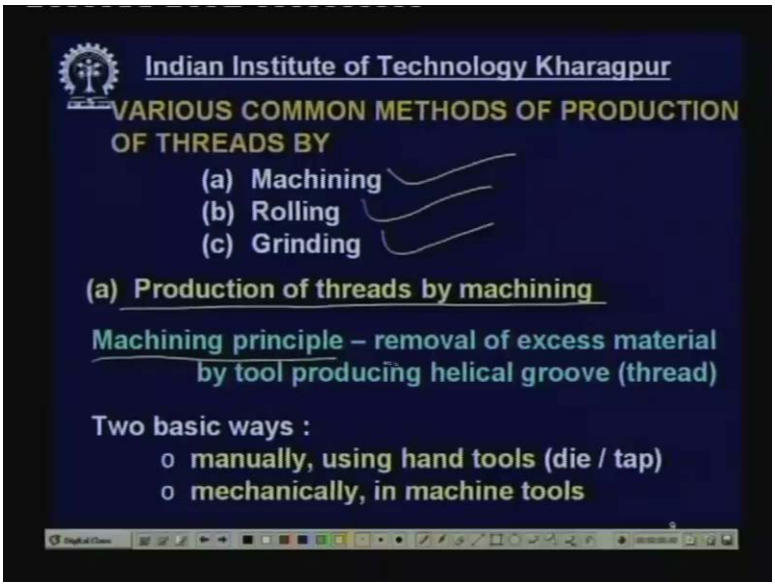

Now various common methods of production of threads: Now we shall discuss in more detail with a diagram as well as description. But we shall remain confined not to only machining, only machining, rolling and grinding. We shall not discuss in detail about the other methods only these three, which are very very common. 99 percent threads are produced by these three methods. Now let us come to production of screw threads by machining. Let us start with removal process. Now again what is the machining principle? Removal of excess material by tool producing helical grooves or threads. So it is a gradual removal process. There are two basic ways either do it manually, slowly using the hand tool like taps and dies or you can do it in machines mechanically like machine tools that will be much faster and accurate.

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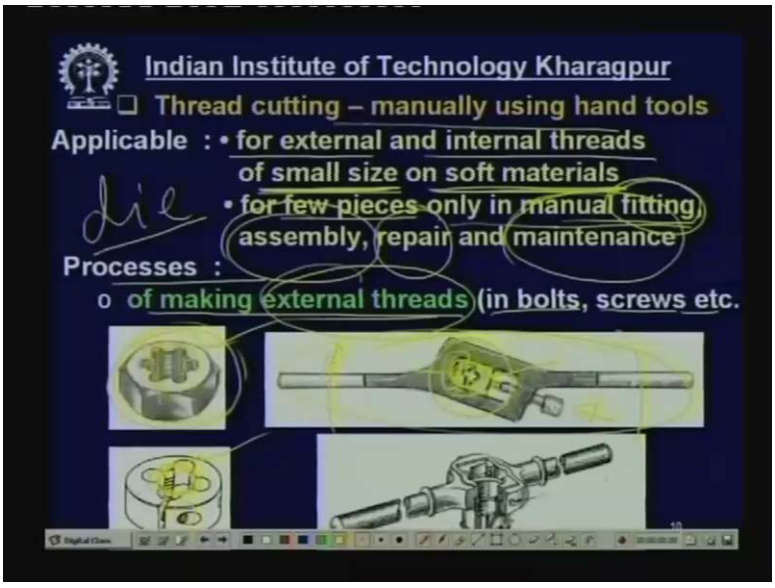

Now the thread cutting - manually using hand tools: Now rarely or occasionally you know sometime or sometime these threads are one or two pieces, few pieces are manufactured by manual process. Now when we shall do this manual process? We do this manual thread cutting for external as well as internal threads both of small size. Please note and soft materials which can be easily done with a manual force. For few pieces only, one piece or two pieces may be three maximum only for in manual fitting, manual fitting, assembly and repair and maintenance. So, it is under regular you know kind of production of threads manually, you produce one or two pieces as and when required for repair maintenance in tool room or fitting shop and so on. But what are the processes by which you can do this thread cutting.

Let us talk about making external threads like say bolts, screws, studs etcetera. There are different types of dies are used. These are called dies. External threads are produced by die. This is the die, now this die really, this is producing external thread. So, the die tool will look like a nut which has got internal thread. So, internal threads should be utilized to produce external thread. This is a die, this is called solid die which is basically which looks like a nut but the material is harder than nut. This is either tool steel or high speed steel. Basically tool steel having thread inside, but some actual grooves are cut called gushing to produce the thread. Otherwise it will be it will not act. So this is called gushing. This is a solid die, this is a spring die. The gap between this die has to be used only for once in one rotation the job has to be complete say in one spin but if the thread is slightly is bigger or harder you can do it manually in one pass.

So we have to use number of passes. For that, this gap has to be gradually reduced by tightening the screw and this slit will help you reduction in denting. Now this is called split die where the die is made in two pieces. One piece is fixed inside. Other piece is moved forward by the screw and the gap changes. So by number of passes, you can produce the thread. Of course it can be used other purpose also. Suppose you want to make another thread of different TPI or different pitch. So you change this two pieces and put another pair into this die stock and then you utilize it and rotate this manually this is called die stacker handle. Now for pipes for cutting the threads and pipes that is called finer thread that requires a bigger type of die. These are the special which is fitted into the handle through a bush and this is rotated manually to produce the thread in the pipe end. It is called external threads in pipes and generally external threads are produced.

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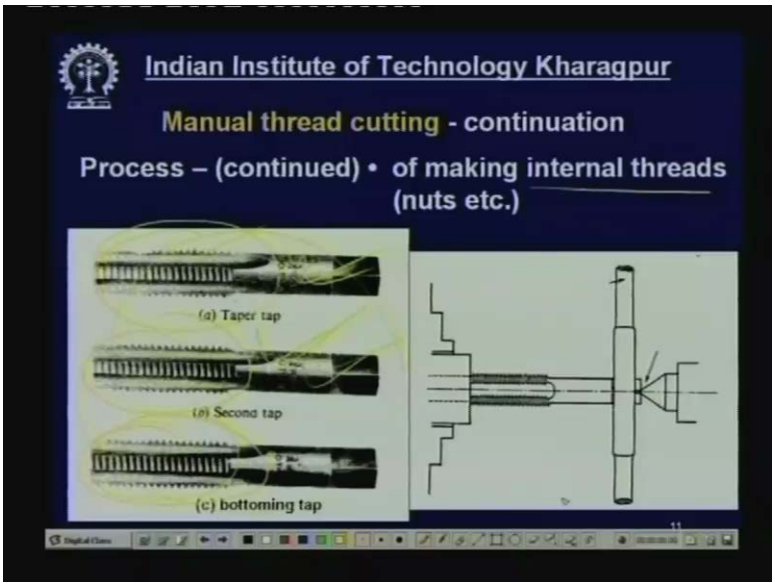

Now what about internal threads to be produced manually: This is process internal threads by taps these are called taps. Now when we cut external thread, we use internal threads. Now we are going to cut internal threads. Internal threads - we shall use tools have been external thread. You see these are called taps, which basically look like bolts or screws. But here, these are materials of high speed or say tool steel and there are gushing or slots. So there sharp cutting edges are developed now for making it over tap thread it as to be done in three stages. First a taper tap has to be put in and rotated and then withdrawn, then it has to be a semifinished by second type or plug type and finally it is finished by a bottoming tap. So these three taps are used in sequence to get a perfect through threaded hole. Now sometime this can be generally when we use tap manually, the job is held horizontally and the tap is held vertically and is rotated horizontally but it can be done in a machine to lathe you hold the job. This is the job and this is the tap and then this is a die stack you rotate is held in the tail stack center and you rotate this one manually and gradually push it you get the thread inside the job but still it is manual.

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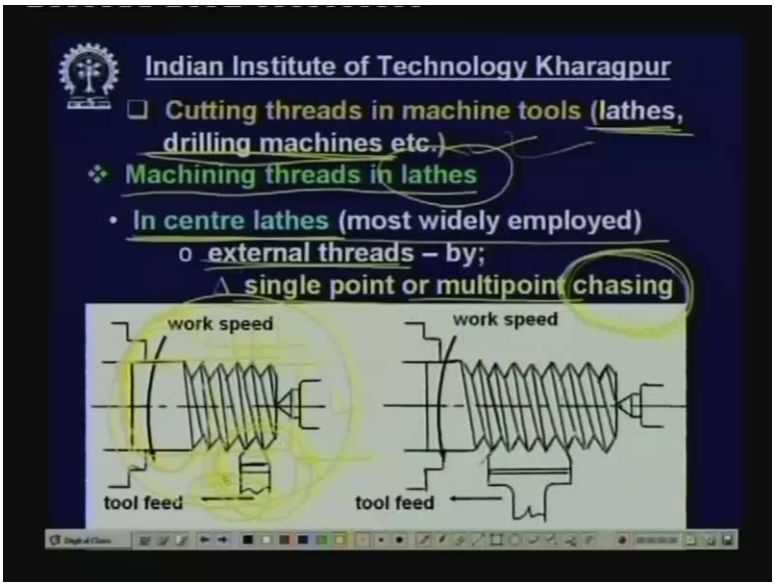

Now cutting threads in machine tools mechanically which will be little faster and large volume of production and wide range of production and with high accuracy. Now when you say machine tools, machine tools what kind of machine tools really are used? Lathes are most widely used and occasionally drilling machine and for very high production, sometime special purpose thread cutting machine tools are also used. Now let us discuss with machining threads in lathes. Now friend, there are different types of lathes see according to automation say non-automatic lathe, mostly central lathe and then semiautomatic lathe the capstan lathe, turret lathe and automatic lathe like single spindle automatic and so on. First, let us discuss the central lathe which is most commonly used most widely and commonly employed.

Now again, let us start with external threads. How we shall make external threads in central lathes? This can be done in various methods; one is chasing chasing or cutting by single point or multi point tool just like turning. This is a single point chasing or multi point chasing. You see the diagram this is rod which was mounted on the head stack supported by tail stack is a rod and this is a cutting tool which has got a definite thread form 55 degree or 60 degree and this is moved in this direction feed motion job will be rotated and the rotation speed that is rpm and the feed motion have to be synchronized such that in one revolution of the job, the tool will move by one pitch or what is called one lead. Now this is by single point. So this gives high accuracy but it is slow process. This can be used for small size to large size of threads but problem is productivity is low. Now this productivity can be increased by having a multipoint chaser which has got say four or may be six threads. So, four or six threads can be done simultaneously. So this will give slightly higher productivity but this is chasing.

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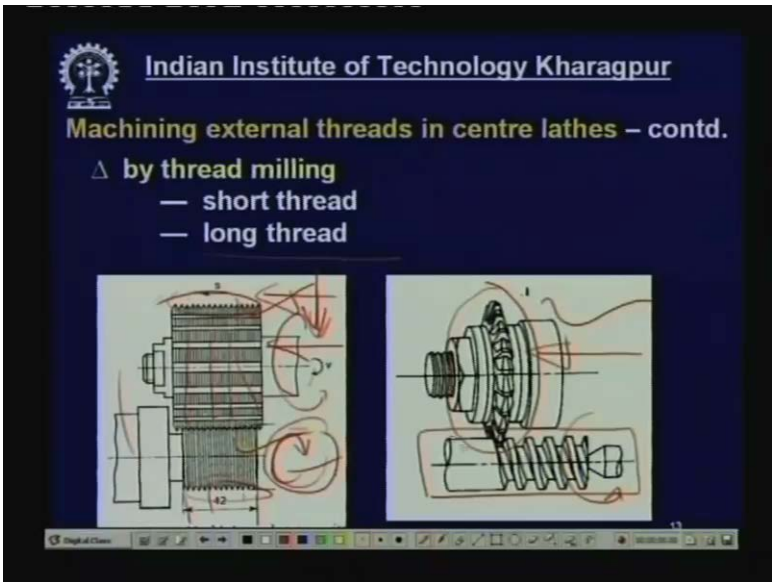

Now by thread milling, now you see in a lathe, we are talking about machining external threads in central lathe but the operation is milling. Yes, you remember that operations like long thread milling short thread milling or can be done in lathe by attachment milling attachments. Now here you can see that, this thread this is the product this is the product were thread has to be produced over a short length and fine threads have to be produced and this is the cutting tool. The cutting tool is made of a rod of higher harder material having angular ribs or grooves. This is not helical. These are not helical, this is straight angular grooves and the threads are exactly similar to the threads to be obtained.

Now this tool which will be rotating at high speed will be mounted on an attachment and this attachment will have a motor to drive it and entire thing will be mounted on lathe bed. So not lathe bed it is saddle and then this will be moved in this direction. This will be slightly moved in this direction and then the job would this will be rotated slowly the job and you get the entire thread done over the periphery. Here, the production rate is very high. The job has to be rotated by say only 1.5 revolution enough and the amount of movement radial movement and actual movement of tool will be also very small may be two three pitch only.

So these are high production methods, but used for small threads small diameter small pitch and finer threads and small length and so on. But, long thread milling. These are long thread milling when say long screws very long screws in large threads either acme thread or square thread or even v thread I have to be manufactured like lead screw of machine tools which is very long. How this will be done? This will be done by milling cutter. So the single point cutting tool will be replaced by milling cutter which will be mounted on the saddle as an attachment additional attachment and this will rotate and move in the forward direction and the job will rotate according in a synchronous fashion and you get the threads cut. This is called long thread milling.

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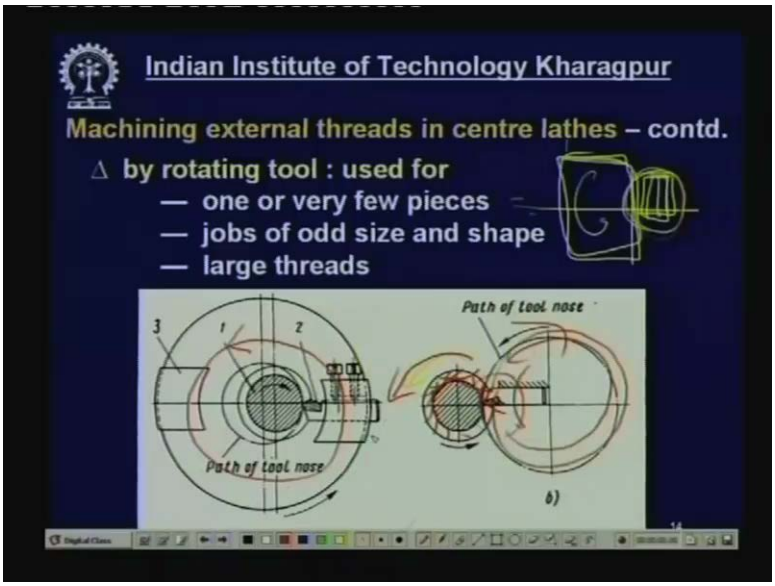

Now by rotating tool: this is another interesting thing. Now suppose, there is a job very odd shape job like this and the thread has to be, this is the odd shape job, very heavy job and odd shape and the thread has to be cut only in this region at one point. Now this kind of thread has to be done in a lathe. This job has to be mounted on a faceplate on a lathe and this has to be rotated slowly about the axis but the tool the cutting tool here you see the job will rotate in this direction rotate in this direction and the cutting tool will rotate in this direction. So, only this portion it will be in contact with the job and remove a layer of material but this will come back very quickly at high speed and remove little more material. So this with gradually remove the material from the groove and this will continue because this will move actually also.

Now what is the advantage? The tool will remain in contact will the thread for a short while. So it will get enough time to cool down and lubrication so for very large threads and odd jobs which have to hard materials have to be machined by this rotary tool which is very efficient will be better cooling and lubrication. Now this is external rotation and here the tool will rotate around the job like this and this will rotate in different direction. So here you produce the thread by removing the material intermittently. This also this also used for large threads and odd shape jobs like castings, like forging like that.

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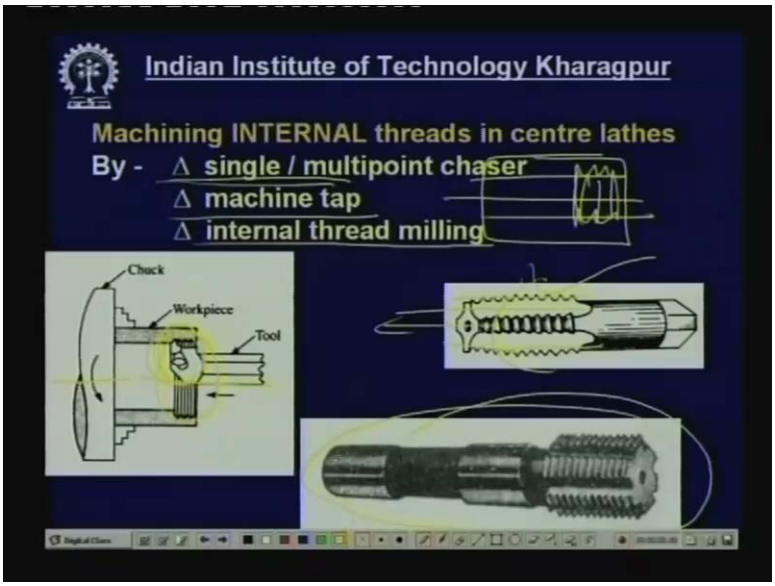

Now machining internal threads in central lathes that is very similar to the previous methods by single or single point tool. So this is the internal threads, this is the work piece, hollow work piece cylinder where internal threads has to be cut and this is a single point cutting tools just like boring then machine tap. These are machine tap. This is not tapered, straight and front portion is tapered, but the rear portion is straight. So by pushing, rotating and pushing this tap through the job, you get the thread done in lathe and internal thread milling. Yes, now we talked about external thread milling producing jobs on external body but if there are rods like jobs and there is a hole and to produced threads internally, then you can use this kind of tool. This will be fitted into the say tail stack and or in the saddle or in attach I am sorry in the attachment and this will rotate at high speed, this will be in working inside. This will be working inside and this will rotate high speed. This will rotate at slow speed and this will move gradually inside and then you take it out.

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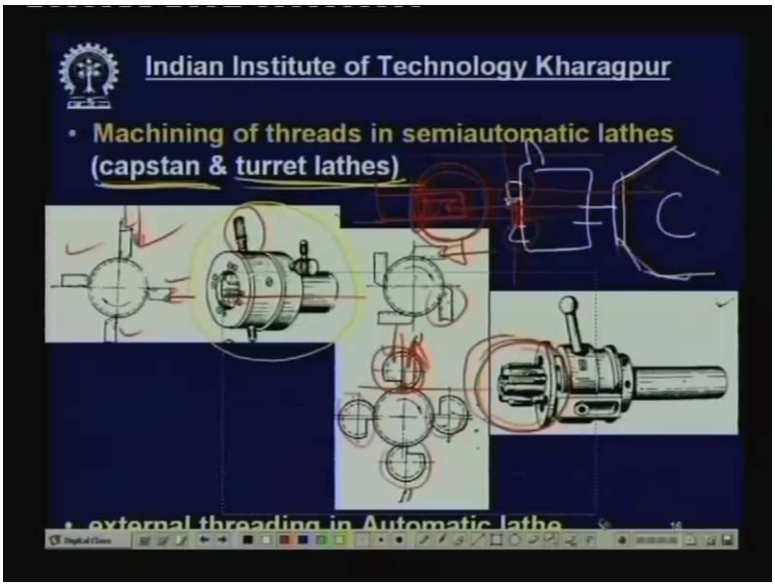

Now machining threads in semiautomatic lathes like capstan lathe, capstan lathe, turret lathe. You remember the capstan is a smaller, low duty and turret lathes are heavy duty. But, both of them are semiautomatic and have got a turret with six faces to hold six cutting tools and addition to say few slides front slide, rear slide and so on. What you find here? We use self-opening die. self -opening die. So this is the hexagonal turret. Suppose this is the hexagonal turret and there will be a self opening die with a handle and this has got cutting tooth. Now this is a block like a cylinder and there are chasers. These are called chasers thread chasers. So, the job will rotate and they will remain in position and the threads will be cut.

Now this will move radially these chasers will move radially radially. Now this can be, so when this will move forward, suppose this is the job fitted into the spindle and thread has to be cut here. So this will move forward and with a larger opening. So this it as got this die as got a larger opening and this will move forward and then this will move forward with the space small deviled amount. So it cut the thread and after that after reaching the end position, the cutting tooth will move out radially outward radially. So this will open and then this will be brought back without stopping or reversing the rotation of the job. So this will save time. Now this cutting tooth, the cutting tool can be radially feed. This can be tangentially and this can also be radially feed and these are circular type. These are flat this two and this is circular type.

So there are different types of tools and all this cutting tools are placed inside and all the cutting tools move forward towards the center or away from the center simultaneously by manually by this one and after it reaches the end, it automatically opens because of the force. So this is self opening die which is little faster working, then other dies are used for semiautomatic lathe for best production but how to cut internal threads in semiautomatic lathe say in turret lathe by a tap. You remember the internal taps internal threads are produced manually by say taps, collapsible tap or machine tap but in this case this tap is called collapsible tap. Now it goes inside for cutting the thread it goes inside for cutting the thread after cutting the thread, all this cutting edges they move radially in by operating this lever, there is cam which make all these things radial screw

cutting pieces radially move inside. So the diameter becomes smaller and this can be taken out easily without stopping the job or reversing the job. So this also much faster working the other kind of dies and taps.

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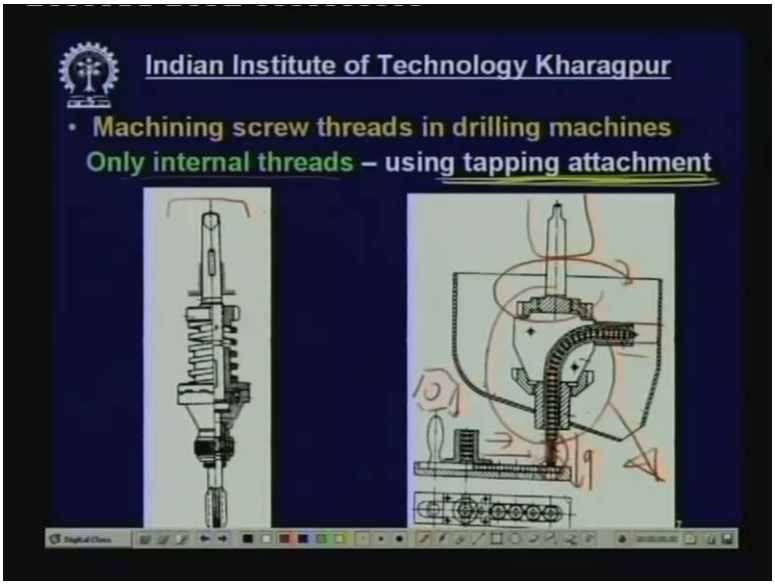

Now machining screw threads in drilling machines: Yes, you remember that in drilling machine what are the uses of the drilling machines? Drilling machines are used for mainly originating hole in solid bodies. But, this can also be used for making say counter sinking, counter boring and similar operations. But thread can also be cut internal thread only. Mind that, if you cut thread in drilling machine, they will mostly external threads sorry internal threads only internal threads are cut in drilling machines, not external threads and this is done by using tapping attachment. So this is very faster production. So this is the tapping attachment. This was discussed earlier also. This part looks like shank is fitted in to the drilling machines spindle and it is rotated.

So this is the tap at the rear end, which goes inside the job. So there is job fitted into the table and there already a hole has been drilled previously called tap size drill and then this tap. This tap will be now here which will be gradually pushed and this will be rotating and then this will be moved in this direction. While going inside, this will produce the thread that is good. But how to return? How this will come back? For bringing it back first of all, it has to be rotated in the opposite direction then only this will come and then immediately this will not return if you try to bring it back immediately, then the threads will be spoiled. So this one, this tapping attachment is made in to two parts. One this is the one part which is fitted into the spindle and there is a clutch and this part is separable by the spring not exactly separable. But, there is small gap can be created and there are held in position by the spring.

Now during return, there will be small gap in between the clutches and then this will take little time to return. This will return and then the spring will bring it back and there will be again clutch joint and there will rotate simultaneously for bringing back. So this slight gap between the

rotation of this one and this one is a necessary to bring the tap back you know without there much spoiling the thread. That is the characteristic of tapping attachment. Now this is a faster production. Now this production rate can be further enhanced. In this how this will be done? This is you see that a tapping attachment, this is a tapping attachment mounted into this spindle and this is a tap, this is the nut like jobs nut like jobs simpler smaller jobs hole. This will be pushed one by one from the magazine and the thread will be this tap will go inside and when the tap will come out, thus the job the particular job will come up and will be accumulated here. So you keep on sending the blank and doing this work. So all these nuts will be accumulated on this bend shank and because of the centrifugal force, this will be thrown out and they will drop out on this spot. So, this way you can produce nut like component with internal threads very fast with a tapping attachment.

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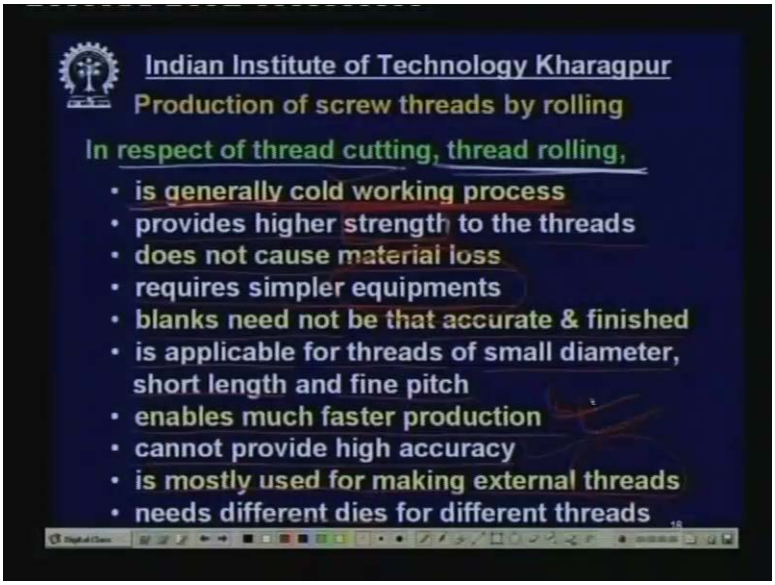

Now production of screw threads, by rolling in respect of thread cutting so just now we discussed the thread cutting process like machining that is called thread cutting. Now we are going in to thread rolling. What is the difference between this two? Now the difference is in comparison to or in respect to thread cutting, thread rolling is generally is generally cold working process, but occasionally hot rolling is also done for large threads and stronger materials but mostly is a cold working process. So thermal damage is much less provides higher strength and strength to the thread because there is no cutting action, there is no question of stress concentration or cut due to cutting action only deformation or shifting of material under plastic state, so the threads and the threaded component remain strong compared to threads cuts by machining.

Now thread rolling does not cause material loss. So this is only shifting of material. There is no removal of material like machining. So there is no loss of material required simpler equipments if is to a machine in machine tool then, lot of costly equipment will be necessary but in thread rolling simpler equipments with simple movements the work can be done in thread rolling. In thread rolling, blanks need not be that accurate and finished because after all the material will be

shifted plastic deform shifted. So the blanks outer surface need not be that accurate and finish. Thread rolling is applicable for threads of small diameter, short length and fine pitch like screws, bolts, studs and similar things not for lead screw or press screws etcetera.

Now thread rolling enables much faster production. Very fast production, all fasteners are manufactured by say large volume and faster rate by rolling. Thread rolling but thread rolling cannot provide high accuracy. Yes, it cannot high provide high accuracy because it is a forming process, is a mostly used for making external threads, internal threads are also rolled sometime but very occasionally, very rarely and say for short length and for soft material and for small threads, sometime the internal thread can be done by rolling but mostly it is done by external threads and is also thread rolling needs different dies for different threads. Now one single point tool can cut screw threads of different pitch, different TPI, different and different diameter different length. But, if you want to do thread rolling manufacture thread is rolling, then a particular TPI particular form of the thread or particular diameter of the thread, you have to use a particular die. So large number of dies you have to procure. This is one limitation of thread rolling unlike machining.

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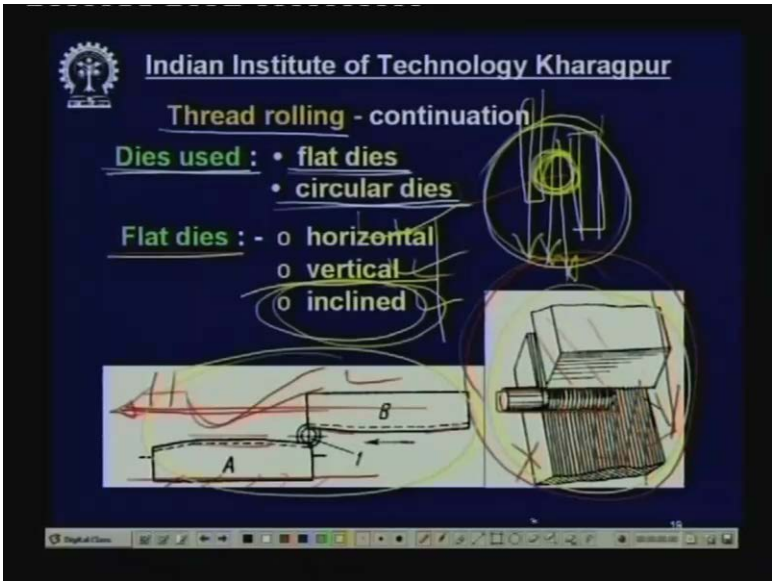

Now what are the different methods of thread rolling? Thread rolling die is used for different purposes. These are dies and thread rolling is done by these dies okay. Now flat dies or circular die, there are two kinds; flat dies and circular die. What is the principle? Here you can see the principle. This shows the principle of thread rolling. There is one blank, one block or plate which has got you know grooves, inclined grooves like this and the other part has got inclined grooves and this is the blank machine blank placed inside and then this is fixed and this one is moved tangentially. So you get the threads produced. This threads which were there in the die, they will be reproduced on to the job by deformation material deformation. Now this is a say bottom die. This is a bottom die which remains fixed and this is top die which moves like this and is slightly tapered so that, it enters gradually and take the full depth. Now, there can be circular dies are also. There we shall discuss flat dies. When you talk about flat dies, this is a flat die, these are all

flat die can be three types: horizontal, vertical and inclined. Now this is the example of vertical sorry this is the example of horizontal. This is the horizontal movement.

This is very common, very convenient and very common. Verticals are also used so one die is fixed like this with thread and this is blank and other die will be moved up and down. In case of vertical flat die, there are some advantages, the gravitational the gravity can be utilized for lubrication purpose and cleaning. So whatever debris that will be produced will automatically fall under gravity and the cutting fluids and also will also fluid the lubricants will also fall under gravity. Secondly the vertical systems always occupy less space. So, space saving is also possible. Only operation will be slightly difficult and it can be inclined also. If you want to derive the benefits of both horizontal and vertically inclined system is also provided.

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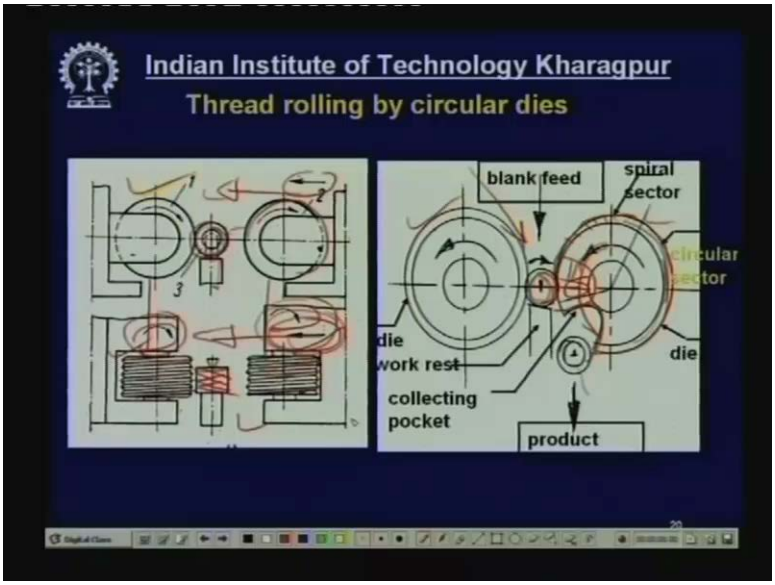

Now let us come to circular dies: Circular dies are very common and these are convenient. You remember you know that wherever possible this sliding system should be replaced by you know rolling or rotating system because rotary systems are easier to manufacture, design, operate maintain and all these things unlike sliding. The lot of wear and tear takes place in sliding action. Now here you can see the principle. There are two dies. There are two dies, die is nothing but two you know discs having threads say right hand thread identical and both of them are rotated say in the same direction clockwise and the blank is placed inside. This is a top view and this is a front view. This is the die and this is another die and this is blank placed on the rest.

Now this will be moved forward. Now when this will be moved forward and coming to contact the threads this threads will be reproduced on the blank gradually and you get the thread on the on the job like this. Now here, what are the movements involved? Rotation of these two dies and the top of that one radial feed; Now, if you can reduce the motion, then it will be more economic and convenient. So, this movement can be reduced by this method. In the second method, there are two dies but this is very similar to this but, in disc the other one where the threaded portion here the threaded portion is gradually increasing by an Archimedean spiral and then it becomes

straight like circle. So when this will rotate in this direction and in contact, this portion of the thread will gradually penetrate in to the job and then this will continue. So the whole area will be threaded. Now after when it comes like this, when it comes rotates in this direction. Now this slot will come in this position and the blank will go into the slot and this will automatically fall down. Now you put another blank here for the next operation. So, this improves improving the production rate.

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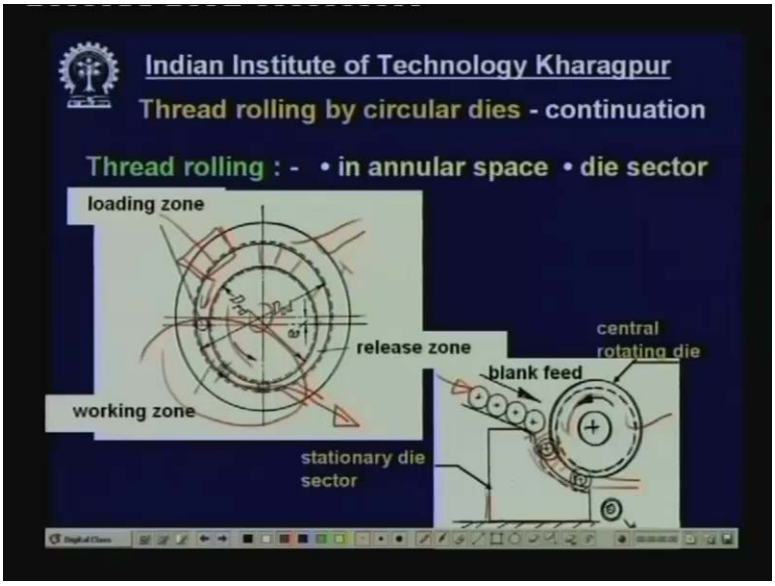

Now the thread rolling: Another process in angular space between dies between two dies here you see that, there is one external. This is a ring which has got threads inside to be produced and this remains fixed and there is another die or a cylinder which has got external threads and the space is angular and this is tapered eccentric. Here you see the eccentricity. So this gap is changing. Now there is an opening. Here through the opening, the blanks are dropped here and now when this rotates, this gradually moves through this endless space constricted and the threads are produced on to that and there will be an opening, through this open this will come out. So this is the faster production. Now you can see that only this portion is utilized if so, then this is the die which has got external threads and this is only where part of the outer die which has got thread through thread here and this space is gradually tapering. So, from blank will be placed machine blank will be placed one by one in to the space and because of the rotation, this job will roll through the consisted passage and will get the thread, full thread and then drop out through this pores. So this is a very faster production by die sector.

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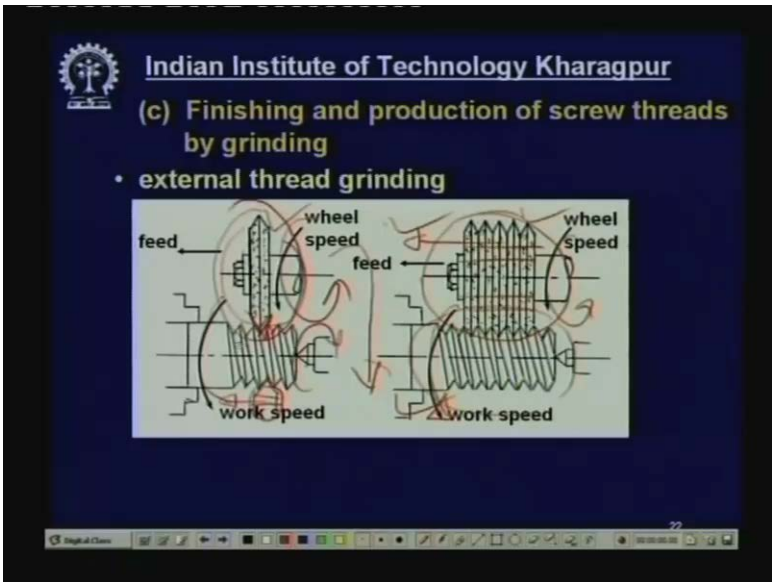

Now come to grinding: Finishing and production of thread. Now I told you I remind you again that screw threads are normally finished by grinding but nowadays threads can be originated by grinding and finished by grinding and simultaneously originated and cut there is cutting and finishing. So machining will be not required at all. Now here this principle is very simple. Now you remember that, in case of single point chasing, we use a single point tool. The job rotates and the tool travels in this direction. Now, in thread grinding this cutting tool is replaced by a grinding wheel this is single rib, which has got a form a fifty-five degree or say sixty degree is a large diameter. This will rotate at very high speed and this will rotate job will rotate at low speed and this grinding wheel will mounted on a grinding attachment and that will be fitted onto the lathe bed.

If it is done by attachment lathe or this can be done in straight in thread grinding machine or grinding machine, cylindrical grinding machine or thread grinding machine. Now if you want to increase the productivity, then this is called multi ribbed. Just like you know say single long thread milling cutter and short thread milling cutter. The milling cutter is replaced by grinding wheel since is a grinding wheel the gushing is not required like thread milling. So this will rotate at high speed and will move gray slowly in this direction and this job rotate slowly. So this translation and this rotation are synchronized and you get very high finish in dimension, accuracy, form accuracy and surface quality threads and you can use this technique for small threads as well as very large threads and different types and forms of threads, grinding is applicable.

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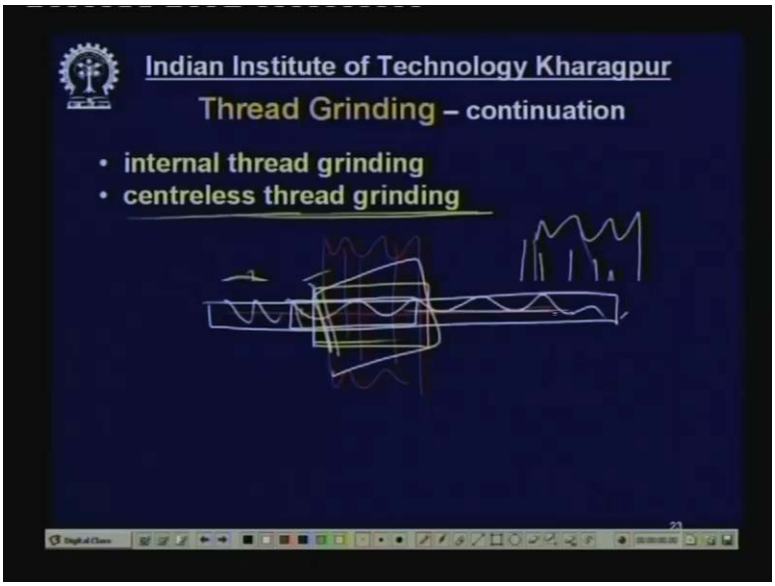

Now internal threads grinding: Here, this also possible for small. Suppose, this is a job and there threads have to be finished or cut here. So, what you do? You put one grinding wheel here, ribbed grinding wheel and you rotate at very high speed and then this will rotate slowly about axis and then this will move in turn. So then this way you can produce internal threads, very similar to external threads were multi ribbed threads, it can be single ribbed also. Now centerless grinding: Now you remember what is centerless grinding? There will be a grinding wheel. This will be the job on a rest and there will be a guide wheel okay. This will rotate at high speed; there a job will rotate slowly because of this roller okay guide wheel may be rubber hard rubber. Now in this case, is a thread rolling, thread grinding by center less method.

This wheel will have this will be threaded; this wheel will be just like angular threads not as the helical thread but angular groves like. So this kind of wheel, so this has got threads. Now this is hard rubber without thread. So when this will rotate about this axis and a job will be in contact these threads will be reproduced on the job. So job will be threaded. So this is called centre less grinding. Now how it is done? What is the other view? So this is the grinding wheel and this is the work piece and this is the grit. This is the guide wheel, now so this will rotate and this job will be threaded. Now if the job is very long and you have to cut along through threads, then the guide wheel has to be placed in an inclined fashion and this will be automatically feed and you will get the thread cutting. So this is how you can produce the threads.

Thank you.