Ergonomics for Beginners Industrial Design Perspective

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Module No. # 04

Posture and movement

Lecture No. # 22

Work Counter

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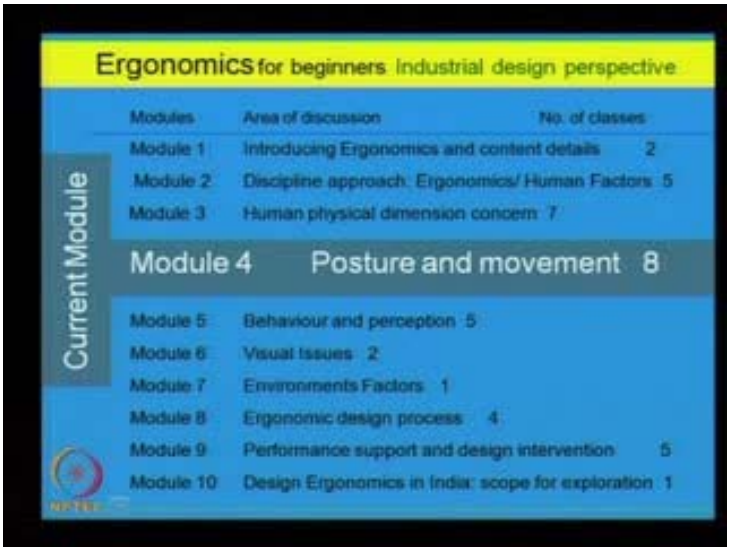

So, welcome to this twenty-second session of ergonomics for beginners industrial design perspective. So, today's current module is the module number 4 - posture and movement; out of the class, out of the 8 number of classes, in this module, so today's module is the last module, that is the work counter, and in the series, it is the class number 22; so work counter.

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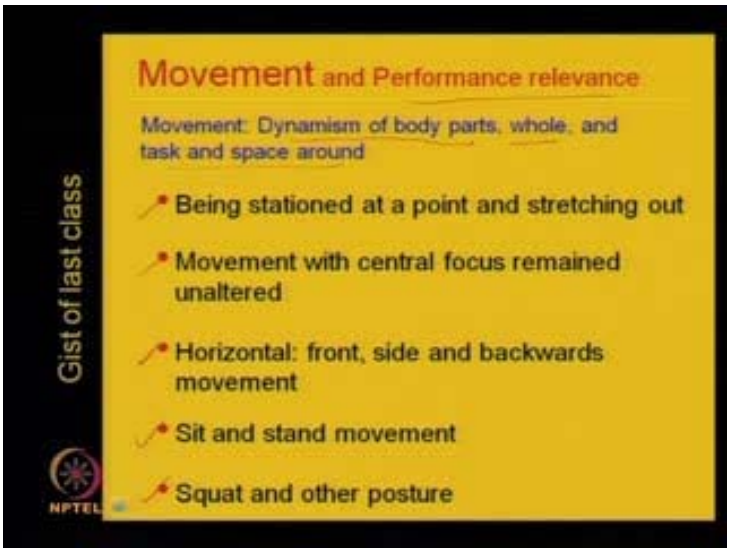

Now, the gist of last class where we have discussed the movement and performance relevance; there we mentioned that movement, that is the dynamism of body parts, as a whole body, and the task and space around that linkages. And few aspects we have stressed upon, that is, that being stationed at a point and stretching out, that considerations we have discussed.

Then we came to the movement with central focus remained unaltered, means, if we bend try to reach some point, it the, space, should be in such a way, that we should come back to the central work attention area. If we take more than one-step away from the central work attention, it is not easy to attend that central work attention area immediately; so, that needs to be considered.

Then the horizontal work surface, front, side and backwards movements; some work area where we require sit and stand movement continuously or the facility should be there; so that, the sitting seat and stand postures, facilities should be available. Not only sit and stand, but squat sitting on the floor, on a, with a cross-legged position, and also other postures we need to consider for that.

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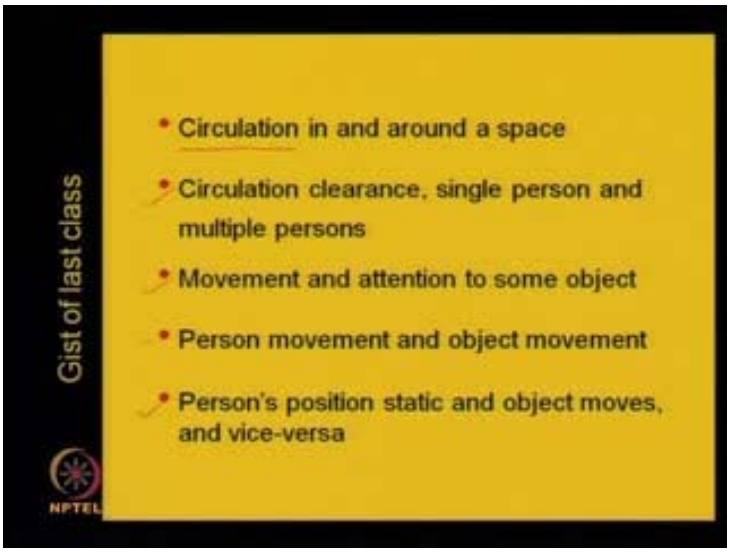

Now, the circulation is another point in and around a space, the total body volume and how it moves in a space; if there are some objects that we need to cross and how we take that. The circulation clearance that is for single persons use and multiple persons use. Movement and attention to some object, means, the person is in a static position, in a fixed position, but object moves towards the man or away from the man, that considerations are required and vice versa; means, the object is fixed, whilst man is moving.

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Then next concept was that both moves, means, the object and the person in same direction and the crossover any one station and both moves with varied direction and speed; though details of the visual aspect we will discuss later, but as per the work surface concern, we need to consider all these things.

And human vertical movement: we also discussed, that is the steps at home, at different workplaces, and outdoor, some steps stairs elevator. And not only the vertical upward movement or horizontal, but there should be some spiral type of movement, then some concepts we require specifically.

Lift own body, own body has weight at a different lifting with and without load. And then movement and then safety concern: fall, slip etcetera, we need to consider while conceptualizing some work surface. And then finally, we discussed that body movement range and joint angles. So, whatever movement we allow, it should be within this; now it also effects with age and other circumstances and the physical body built.

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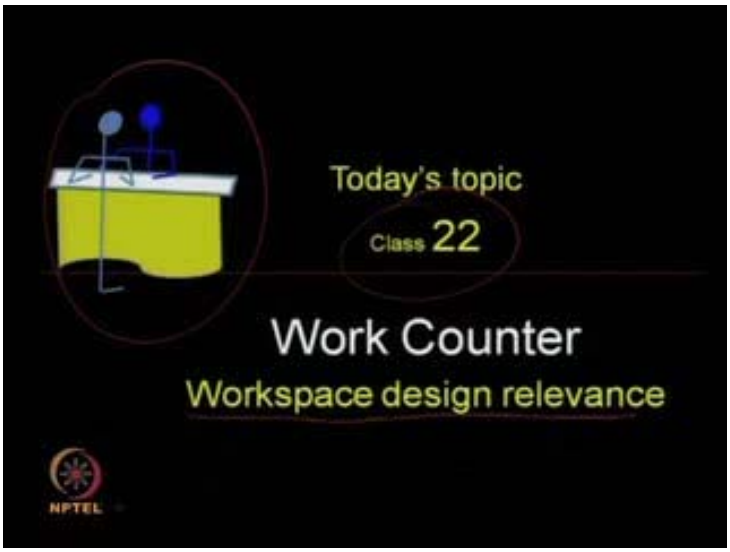

With this, that today's topic is a class number 22, that is a work counter, that is the work space design relevance. Now, with this we would like to concentrate on single person's workstation, as well as interaction with other persons across the work surface or the work counter.

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Now, this figure says that, the work surface for a seated person that is the occupant of this workstation or the main occupant, and the visitors concern; the visitors whether single visitor or multiple visitor that concern and accordingly the table top dimensions and etcetera.

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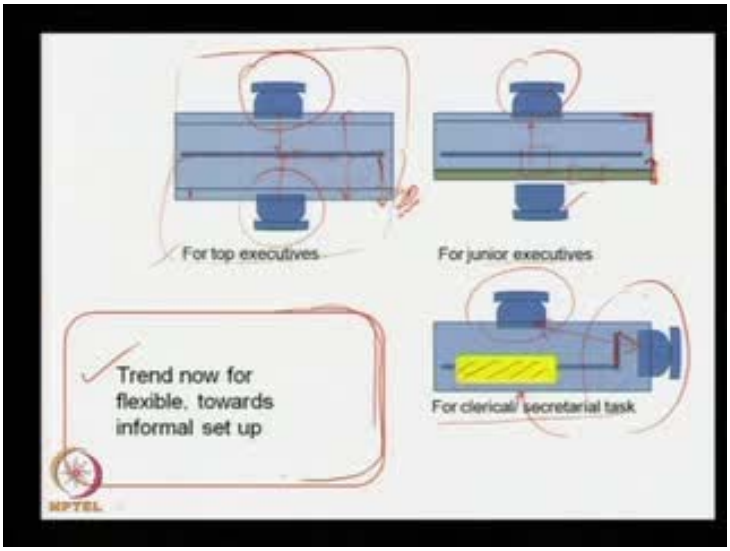

Now, the concern is that the status of the occupants and visitors. Now, if we consider a workstation or may be work area or a worktable for top executives, there, if we consider that this is the main occupant, the comfort, he requires his visitor is expected to ask for

the same comfort. So, whatever concerns are here, for this person, it should be repeated in opposite sides. Like that concerns, the basic concerns should be in such a way that with a seated person, they should extend their arm, and they can shake hand each other.

So, accordingly, with this type of behavior, the dimension of this tabletop is decided. And the modesty panel in between, this is the modesty panel, this modesty panel is kept in such a way, from both the sides; that both the person need to extend their leg, it should have the free legroom. And from the floor around 20 centimeter gap should be maintained in this modesty panel space; so that, if this is the modesty panel is placed here, then here around 20 centimeter gap should be there; so that, the mopping and cleaning would be easier.

And here around 7 to 10 centimeter, this must space should be kept free, so that the palm rest is possible. Now, the similar thing if we consider, for the, for junior executives, there we expect that the junior executives visitors will come, with some task that the junior executive needs to handle.

So, in that case, so in that case, it can be said that the comfort for a top executive, the similar comfort may be given to the junior executive, whereas the person visiting him, he may have little lesser dimension in this, because he needs to interact with him. So that, if he comes here, and he first, he should keep his files, and etcetera, in a little bit, below it table, a another platform; he will keep all his material there, and as, and whenever requires, he will take it out and he will place in this.

And if the junior executive requires, to use it, he will take it and he can use that. So, these types of interactions are necessary, and accordingly, the table top dimension may be decided.

Now, for a clerical or secretarial task where the person the main occupant, he may have some work items; in front of him files and papers or something like that. So, the visitors are not or may be, when may not be allowed to see at the front; though, normally it is seen in the offices, but it would be better, if an access is given on the side area; so that, the visitor can come and can interact directly, and the concerns here for foot, the legroom and etcetera, it should be kept with a smaller modesty panel.

Now, this interaction will be done like this. So, this type of concepts, one can keep in mind, while generating or while developing a desk, seat desk type of workstation, but now today's trend, is now for flexible towards informal setup. Now, the thing is, another thing is that when we are using the tabletops or something, we can sharp angle and the straight lines, it gives more authoritative as well as a constraints feeling. So, now a day, some smooth curves are used to have an organic feeling; so, today's trends are going into this aspect, but the concern the behavioral concerns one should consider.

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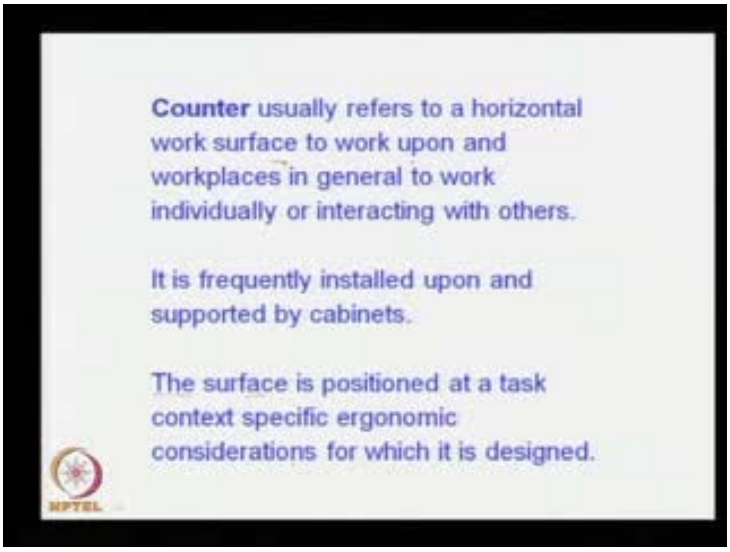

Now, the counter usually refers to a horizontal work surface to work upon and workplaces in general to work individually or interacting with others. It is frequently installed upon and supported by cabinets, for storage purpose. The surface is positioned at a task context specific ergonomic consideration for which it is designed.

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Now, if we see this figure, it is a typical kitchen with modern accessories. Now, if we discuss this, then things that the this height, whether this height is comfortable the storage inside, whether to keep material here is easier, how much bent of a person is necessary.

If sink and etcetera are here, the total layout of the things, then the depth of this table etcetera is concern. Another concern is that if a person stand and work here, and at that time, if at the same time, the doors need to be opened, then what would be the considerations here, it should not hit the person or while closing there should not be any problem; so, all these things are necessary to concern.

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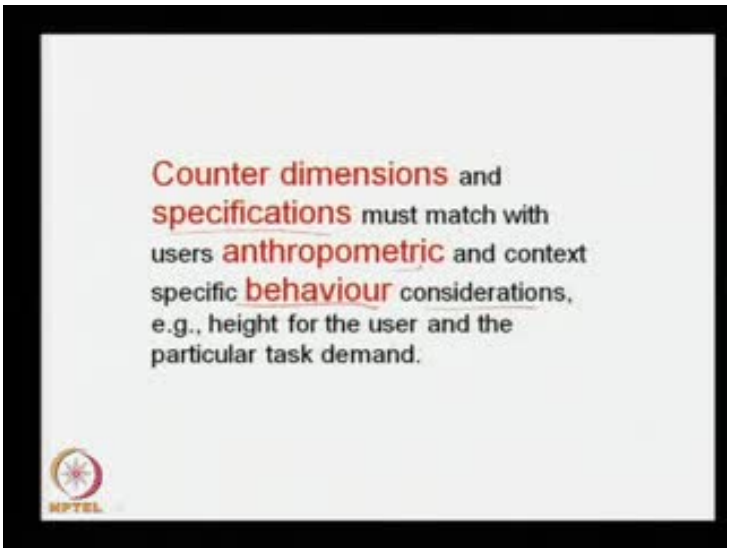

Now, with this we can said that, the counter dimensions and specifications must match with user's anthropometric and context specific behavior considerations, as per example, height of the user and the particular task demand.

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Now, if the height is less or more, and so how compatible match is there, that we need to check. We also cannot say here that if this platform height is more than this person, then one can easily say that use a platform, here movable platform. But the thing is that in this context, if we use a platform when you step up, it is easier, it provides easiness to work

upon here, but when you need to take out some material from inside this cabinet, there will be problem or there is enough chance that you require frequent coming down and climbing up. And so, there will be it may be unsafe for working. So, then while conceiving this design of the kitchen platform, the matter should be considered the compatibility defectors.

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Now, if we see this small film let, here we can see that, then we may see that the person is the person working here; now, see the person is standing and working, she has to lift her arm at around shoulder level, and while, so a space, a pain will be developed at the shoulder joint. Now, what to be done, why it happens? It happens because the platform height is not considered fully.

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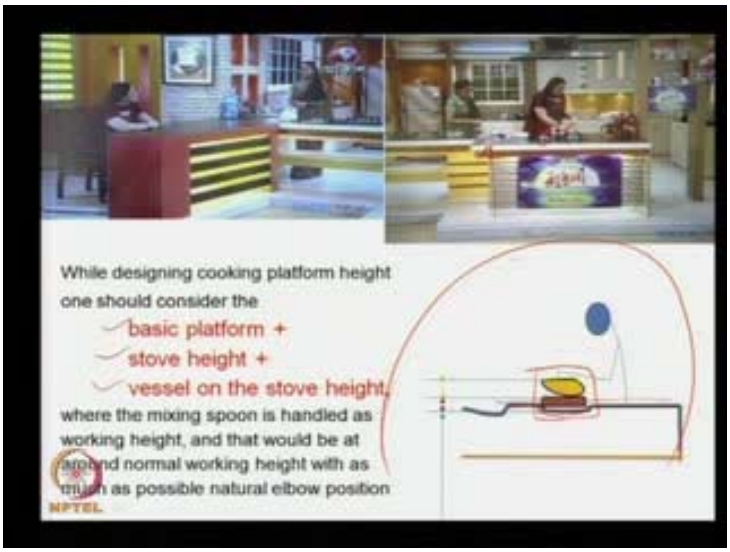

Now, if we see these figures, here it says that the person's height, the and the platform height is, well, we can say that it is almost matching, means, the thing would be like that. When we are working the platform height, while designing a cooking platform height, one should consider the basic height of the table, and then the gas stove on it, and then the vessel whatever is placed on that, and there someone is working; so, that height is the work surface height for that purpose.

So, what is happen, the basic platform height plus stove height plus vessel on the stove height, these three combinations gives a person, the normal working surface height, it should be consider. So, accordingly, the vessel height and stove height, the basic platform height should be decided, where the maxim, the mixing spoon is handled as working height and that would be at around normal working height, with as much as possible neutral elbow position.

If we see a schematic diagram in this, here in the right hand bottom corner of this slide; here, we can say that this is the total height of the main platform, then the stove height. Some concerns, also some people can think that, why not to make even line, why not to have a depressed area in somewhere, where the gas stove can be placed? So, the gas tops, a stove to top, and the platform will remain at the same height, one can think of this, if it is possible to have it, and on that the vessel that will be added. So, whether this much portion should be hidden, we put on below a surface; so that, the top area should be on

this or what would be the visible portion that depending on different task to be performed, it can be decided; so, these are the cases we must need to consider.

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So, a countertop, depending on various purposes and task to be performed, may be constructed of various materials, both natural and manmade, each with its particular attributes with respect to functionality, durability, and aesthetics, and may incorporate or house appliances or accessory items relative to the intended application; so, by this way a countertop length, breadth, height should be decided.

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Now, this figure says, a sales counter displaying the products; in this case, the context is to display the maximum products area; so, here the table height may be relatively lower, because here what is happen? The person supposed to check the material keeping on the surface; means, it is the enough space should be provided for that.

Now, if this tabletop is too high somewhere here if we place, then on this some material is here, then the interaction between the counterman, salesman, and the visitors or the guest, with this product may not be appropriate. So, in this case, the most important thing is to display the product, where interaction will be with the product and the work platform should facilitate this.

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This one, this slide says a medical counter with a semi-circular platform why semi-circular platform? Because the person is centered here; so, from any direction, he will be easy accessing, and the special guard is given but not fully with the glass type of thing.

Here what is happen? The airflow is maintained, easy airflow, and it is not necessary to have that type of guard; so, this is the matter issue. And now, here the outer side it is semi-circular, but inner side it is straight, because for inner side that person it would be a normal tabletop type appearance.

Now, the interaction is going on; so here, what is happen? The person from here, the, in main interaction is taking place, and so this platform height appears to be appropriate. Now, that for different purposes, the work height will vary, but obviously it should not be above the shoulder level or it should not be very below the waist level; so, within this some variations are there.

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Now, what would be the actual dimension requirement that we will discuss now. Now, another instance is that for nursing purpose; nursing purpose, the counter is here like this, counter height, it is a normal counter height. Now, the person you can see here that see her upper arm hangs normally, and she can work with this. So, it is easier for him or her to work, in this context and in this trolley also, the similar concerns is there. And here these one is more than 200 millimeter, so what is happen? When she wants needs to take something from this platform, she does not need to bend much here; so, this is the gap, it is being maintained more than this.

Another aspect is that for this nursing purpose, this bed is also a work counter for them, because the work surface, because when patients comes here either on a sleeping on sleep lying condition or in a sitting condition, for taking blood pressure or giving injections, and etcetera, for this it would be work table, kind of thing.

And here, the for patient, if it is too high, then we require to provide steps here; if it is too small, then for the nurse it would be little difficult, then what would be the appropriate height, so that, patient can use it comfortably, as well as the nurses also can have good access to the patients.

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In a same hospital type of atmosphere, the another thing is that, in that reception area interaction are not comfortable. Now, see here, only this much portion is the interactive area but others not, and then the way to into take some material, means, the papers and etcetera here, paperwork someone has to extend the arm here, and obviously it is not a good comfortable position; now, why it is made like this and question comes.

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If everybody knows this matter, then why it happens? It happens, because now from this, the one thing is that the usage of the space, in this space, this staircase and etcetera, this opens this area is being utilized for the reception.

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But the same reception, we are seeing from the backside; here it says that the counter is developed for the ease of the counter person, and they are having the storage, and etcetera like that.

So, to give priority, for towards these side activities, the other side activities we are not considered, we have not considered properly. So, then what would be the proper counter height; so that, the customers or the visitors other side of the counter, and inner side of the counter, the counter person, the salesperson, they should have good interaction as well as all the required things will be placed properly. Depending on different context, studies to be done, and accordingly design should be maintained.

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Now, another example that reception area of a guesthouse type of atmosphere, where this is the counter area, the visitors waiting area.

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Now, if we see the counter here, in comparison to earlier hospital case, the height is lower, now in good interaction is going on, at least for working the arm, you can have at this angle, in comparison to this angle.

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So, the heights are reduced here, so it gives good interaction; so means, moderate interaction is going on, moderate interaction. Now, we are looking from the backside of this same counter, here the moderate interaction is going on satisfying counterpersons all needs, means, all needs is being considered, so the chair is also provided here; so that, this chair if he requires he can use, in this case, position, and if he requires he can use for the computer use also.

So, instead of having many different types of chairs, here a single chair would be better, in this case with swiveling wheel and etcetera; so that, these are the concerns we should use for the counter design.

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Now, a shop, there are varieties of work counters are there, but we are discussing here few examples, so that it gives us some thoughts; so that, while designing similar type of counters, we should keep all these aspects in mind. Now, in this case, this is a coffee shop where tea, coffees and other snacks etcetera are available. Now, people are coming here, so in that case, the interaction is here; now, see the height is done, in such a way that the person, till the person's waist level, it is there; so that, while working and etcetera, this we do not require to lift your arm above the normal elbow position.

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Now, if we see from the inner side of this counter, the same counter; now, see the so many small, small, cabinets places are there for these things and the good interaction takes place. And this length, breadth and this depth also according to the total arm lower, means, that this arm distance a little more; so that, the proper, means, what type of activity supposed to take place here, accordingly the depth of the table top is decided.

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Now, another thing is that different types of people will interact and that facilities will be provided.

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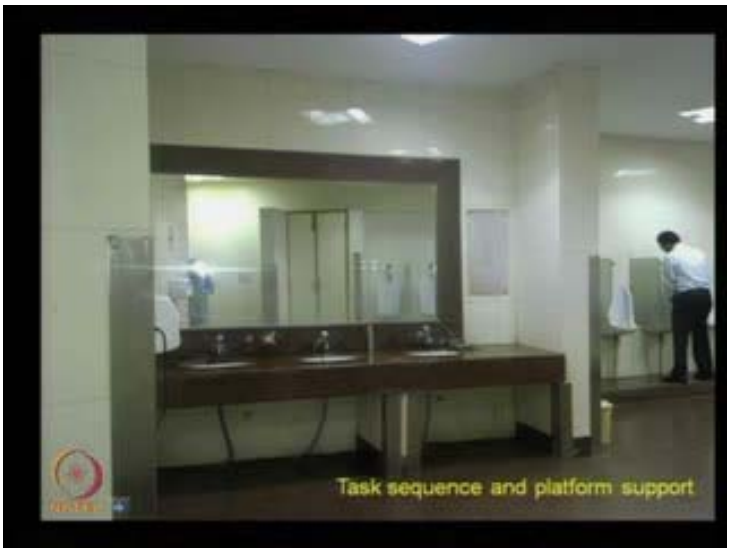

Now, another thing, now, when we have a work counter, we are not only concern of that work counter but with some context.

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Context means some other activities; like, in this case, in this bathroom type of thing, this is the wash area and the urinals. So, when a person enters, he, what the task sequences he follows and accordingly the platform support should be given, like this, when he comes here, he feels that to be done like this way. So, now, here whether this posture is good required or this height may be lifted little more or there may be a

curvature kind of thing of all the things, so that it will obviously with aesthetics and etcetera; so that, it would give an another aesthetic dimension to this approach should be considered; not only functionality, functionality with some aesthetics appeal should be provided.

Now, what could be done actually, it needs lot of considerations. Also, we have to see here that the privacy is also another concern, not only the work area, work surface, but the mirror, and etcetera, it provides here. The, see, the from entry point of view, if someone looks here, then he should not feel that the reflection of this area or the opposite area. So, all this concern is necessary to have a good platform or work surface or a counter development.

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Now, another thing is that, for a shop, sweet shop type of thing, a snacks shop; this type of curvature this covering etcetera, it gives you good visibility. So, from anywhere you can approach, from this both sides you can approach, but that side approach, the formal approach where the normal counter height is provided, but in this, through this also one can approach just for talking and etcetera, but material in exchange, it should be done from this side.

So, the design itself it guides the people how to behave and which side of the design to be used actually, to do certain task. In this case also, the same things that counter height and counter height is not closed; this is not closed, this is the visible, but how much is visible that some gap here, it is kept like this. So that, the visibility and etcetera it should be above, so minimum this would be around 200 millimeter, minimum is required.

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It also gives not only the physical clearance requirement but also visual requirement concerns. The counter is not only for the exchange of the material over the counter, but it also provides another aspect, like this; so, that facility also we need to provide. Another thing is that, now see, it is being used as a body supportive platform the counter and the body supportive is also used.

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So, now, if there is no seating arrangement is provided, then this type of facilities may be there.

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With, this we can say that today's discussion aims at understanding the various work surface heights relevant to normal work platform, table kitchen platform, or any interactive work counters, with the reference dataset in Indian population, whatever that we discussed are about the Indian requirement and Indian population. So, from where we can get the data? Indian data; if we depend on other than Indian population data source, then it may not be good match with our requirement. So, Indian body dimension and our behavior should be considered.

The common features for selecting relevant work platform heights in standing posture, may be converted to sitting posture considering sitting elbow height. So, whatever we are discussing here, all the basic point is that elbow height from the floor, and the arm reach distances.

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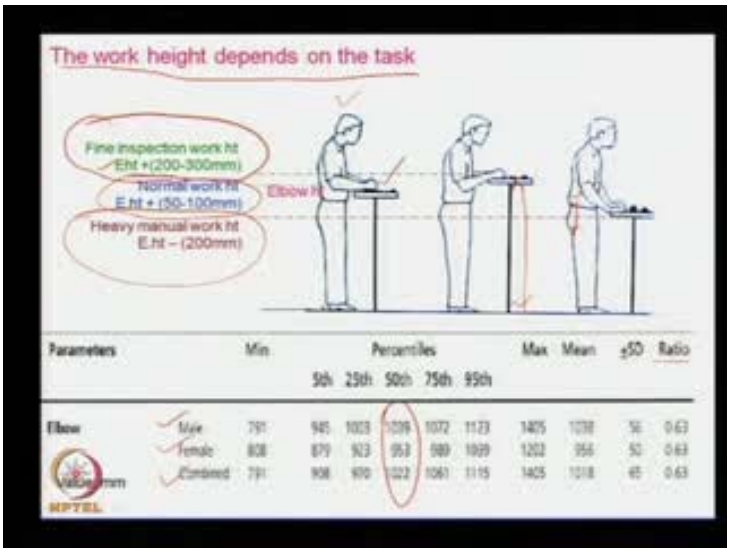

Now, when we said that elbow height is the main factor then we should see this slide, it says that the work height depends on the task. There are three types of tasks; we can say that height wise. Like normal working height, normal working height, if we see this the first figure normal working height; if we stand erect with upper arm hanging freely downward, and knee and the elbow placed at 90 degree angle with the upper arm, it is a ideal position.

But at this position, so and then the height of the elbow would be the good height, but at this height it is little difficult to perform any task; we little bent and then we also need to do certain skillful at work, we require elbow support. So, considering all these things, it is said that the normal working height is the 50th percentile value of elbow height, and 50 to 100 millimeter add to that; so, it will be the normal work height, this should be considered everywhere.

Now, if we want to see something very close for inspection purpose, then the platform height should be higher. How much height we can bring it? It has not only the arm but also vision matters; vision matter is that, if it, now, normally we require around 30 to 45 or 50 centimeter distance for the good vision. Now, if it comes very close, this height, then that would be less; so, focusing would be a problem, it is uneasy. So, it is considering all the things, it is said that - if a normal elbow height, for fine inspection work height, it will be 50th percentile of normal elbow height plus, 22, I am sorry 200 to

300 millimeter addition to that; so, this will be the maximum elbow platform height for fine inspection type of work.

Now, what would be the lower height then? It is said that for heavy manual lifting when arm is at around 150 degree angle at the elbow, at the elbow level around the 150 degree angle, it is the where we can exert maximum force 150 degree to 120 degree type of thing; so, it is considered with all the things. It is said that if the elbow height minus 200 millimeter, this would be the safer lower platform height for heavy manual work.

And for that elbow dimensions is given here, where elbow dimension value in millimeter male, female, and combined data all are given here, with the minimum value and percentiles 5th, 25th, 50th, 75th, and 95th percentile values, maximum value, mean value and standard deviation and in ratio; ratio means the elbow height and the stature height, that ratio is given here.

So, from this data, one can consider this, and for that purpose, normally a 50th percentile value we consider; when we are not sure, who will be the intended user for a mass any purposes.

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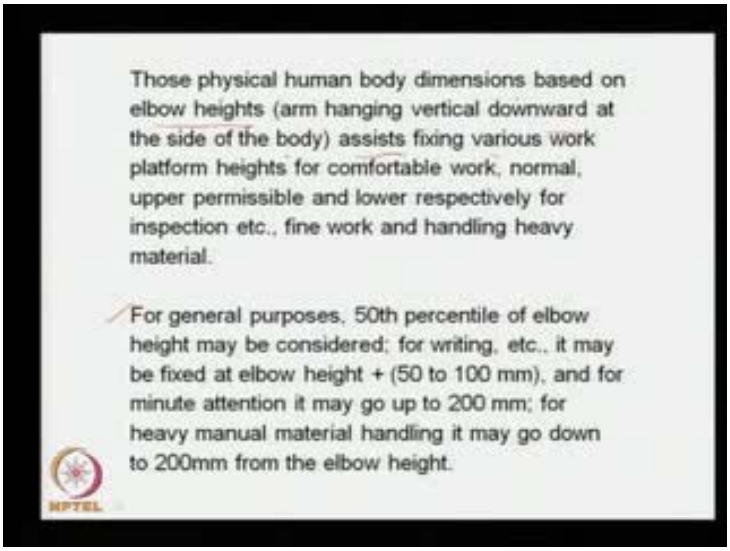

But depending on the safety requirement and etcetera, we need to consider various percentile values of elbow heights. Like those physical human body dimensions based on elbow heights - arm having vertical downward at the side of the body - assist fixing

various work platform heights for comfortable work, normal, upper permissible and lower respectively for inspection etcetera, fine work and handling heavy material.

For general purposes, 50th percentile of elbow height that is roughly around 1 meter for Indian case may be considered; for writing etcetera, it may be fixed at elbow height plus 50 to 100 millimeter, and for minute attention it may go up to 200 millimeter; for heavy manual material handling it may go down to 200 millimeter from the elbow height.

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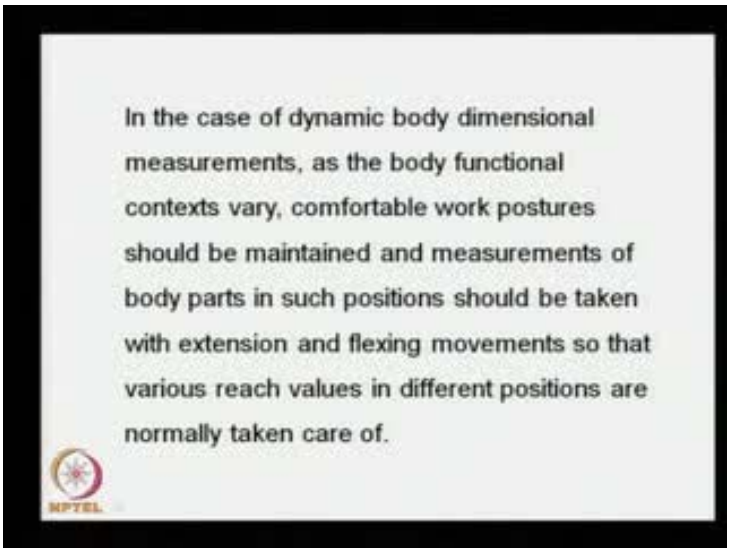

In the case of dynamic body dimensional measurements, as the body functional context vary, comfortable work postures should be maintained and measurements of body parts in such positions should be taken with extension and flexing movements so that various reach values in different positions are normally taken care of.

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Now, in this figure, it is seen that work platform, work counter and the workstation, now this is a small room, where the two different activities are going on, means, it is divided in such a way; so that, the lower, this thing one man just can stand, and upper also one man just can stand, now like this. But in this case, the, so like this, the two different activities are going on in a single room with a ladder to go in.

Now, in this case, if it is necessary a special design may be developed that if this is a room, so this may be something like this, where or may be something like this, in this case, like this. So that, a person can stand and can have the worktable here, and in this case, the man can stand, and can have working table somewhere, here like this. And then this area may be a staircase type of things. So, this type of development concerns or may be there are some other activities systems, one can develop.

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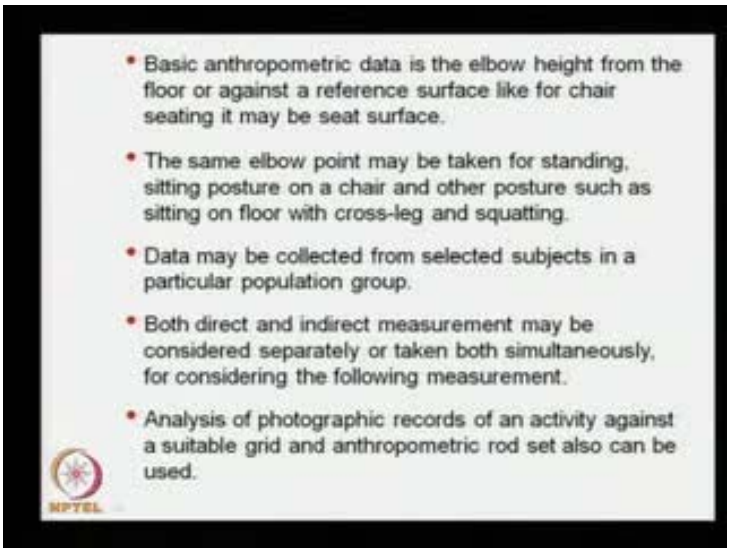

Now, the basic anthropometric data is the elbow height from the floor or against a reference surface like a chair seating it may be a seated surface. The same elbow point may be taken for standing, sitting posture on a chair and other postures such as sitting on floor with cross-legged and squatting. Data may be collected from selected subjects in a particular population group. Both direct and indirect measurement may be considered separately or taken both simultaneously, for considering the following measurements. Analysis of photographic records of an activity against a suitable grid and anthropometric rod set also can be used.

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Not only the fitting in a seat a chair desk type of activities, but this type of activities sitting on a bed and working, this also is there. So, in that case, what would be the considerations, this also needs to be thought of.

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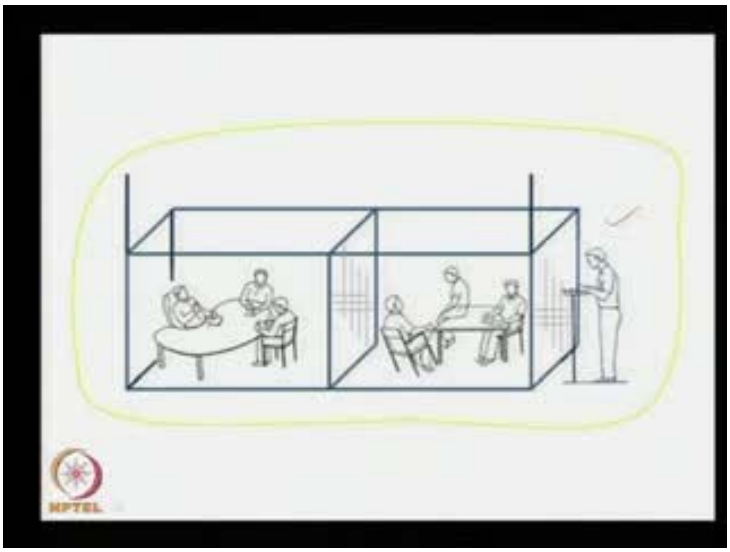

Now, there is another aspect in the counter etcetera, here is not only the human body dimensions, but the behavioral requirements are there, and this behavioral requirement, we are going to discuss in next class sessions.

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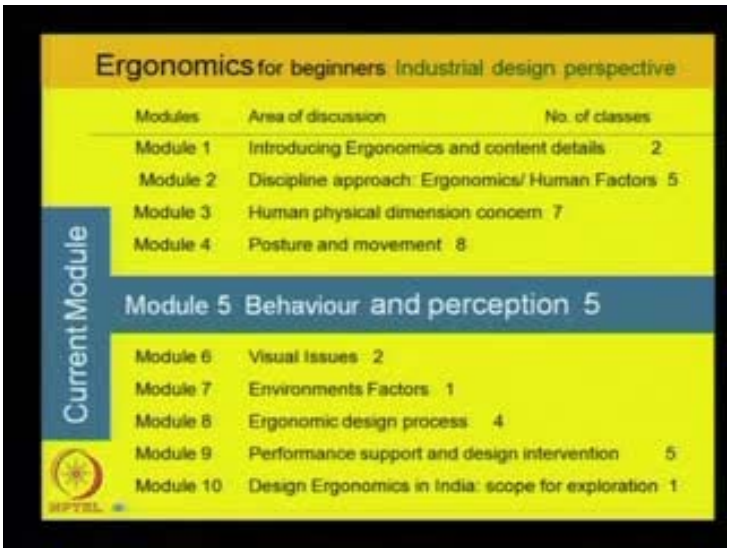

With this, we are concluding today's session of posture and movement, today's module we are concluding here. And the next module would be the behavior and perception; so, now onwards, it will be behavior and perfect and perception there are total five sessions will be there. So, with this we are ending today's session; so, we will meet the next day till that time good bye. Thank you.