Ergonomics for beginners Industrial design Perspective
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Module No. # 09
Performance support and design intervention
Lecture No. # 36
Workstation design

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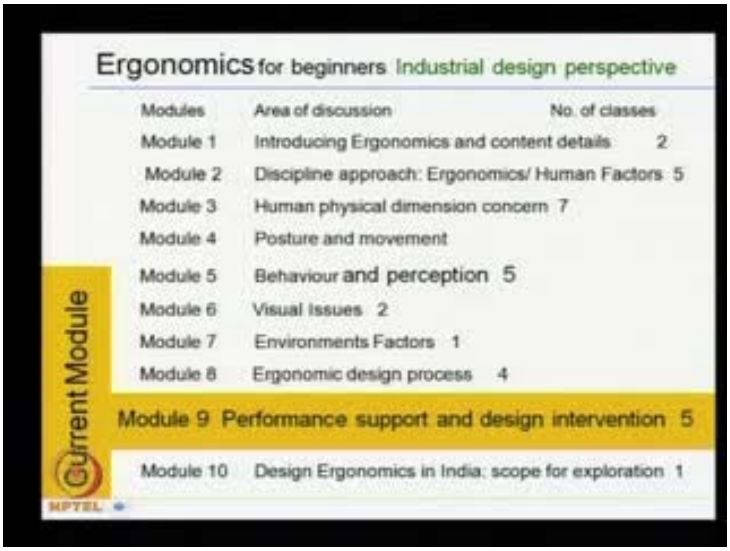

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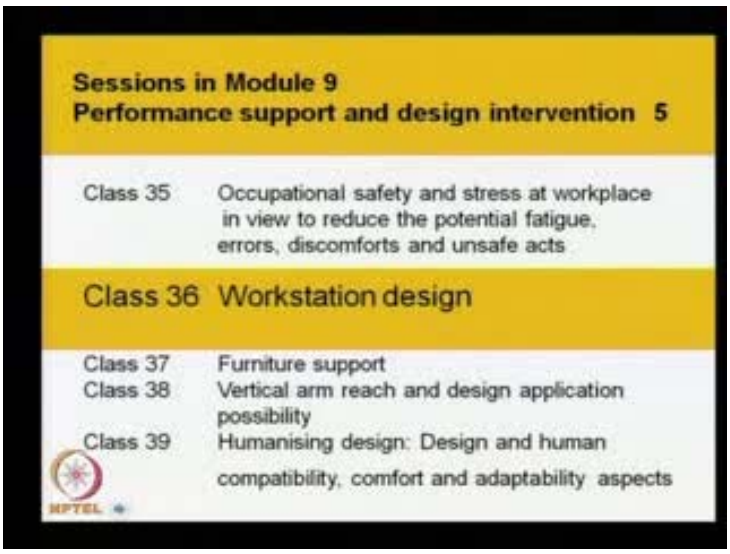

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Welcome to this thirty-sixth session of Ergonomics for beginners industrial design perspective. So, current module is the module number 9 - this performance support and design intervention. Today's session, out of this total 5 sessions in this, today is the class number 36 - the workstation design.

The gist of last session: last session we have discussed some issues of occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomforts and unsafe acts towards finding design development feasibility with examples of occupations that does not normally concern our sympathy, but potential growth cannot be ignored, that we stressed in last classes.

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We also discussed the risks are due to: the ignorance, self-imposed and casual attitude, constraints and work demanding atmosphere, remain unconcerned or apathy by the employers. With this, we concluded that there is a need for studies emphasizing benefits of both in terms of productivity and overall well-being of the users - as the workers or occupants like that. So, with this background, the today's session - the class number 36 is the workstation design where we are going to discuss some issues and concerns.

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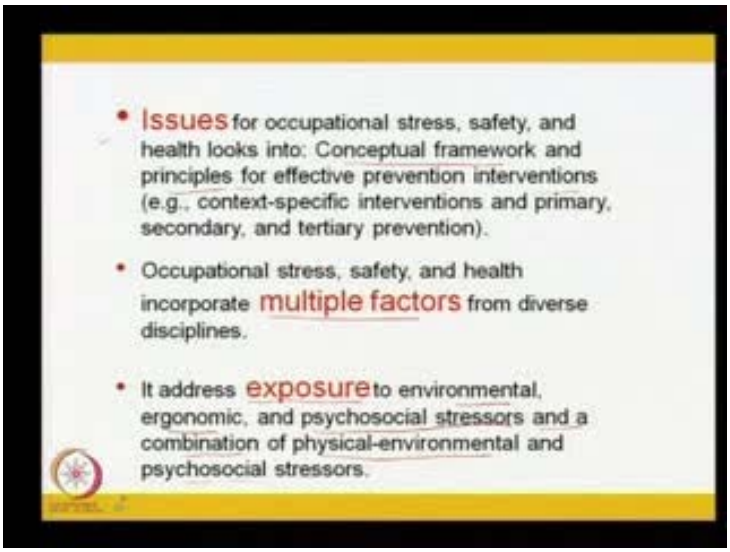

The issues for occupational stress, safety and health looks into: conceptual framework and principles for effective prevention of interventions. For example: context-specific interventions and primary, secondary, and tertiary prevention. Occupational stress, safety, and health incorporate multiple factors from diverse disciplines. It addresses exposure to environmental, ergonomic, and psychosocial stressors and a combination of physical-environmental and psychosocial stressors.

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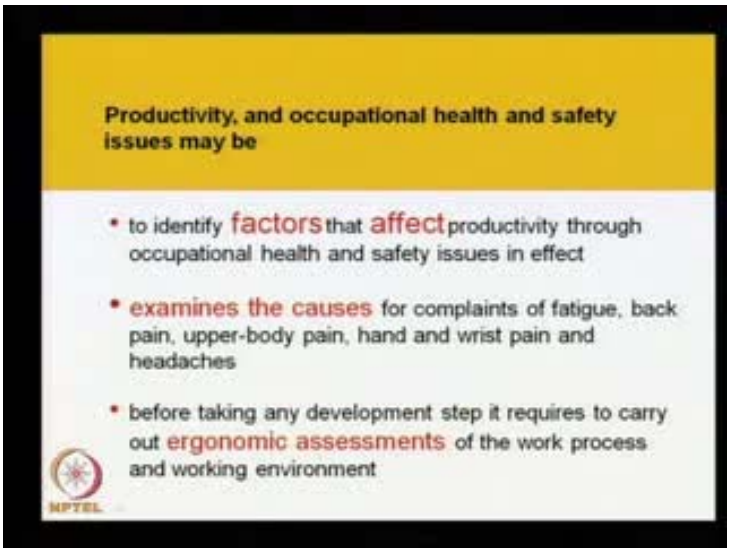

In this session, we examine lessons learned from earlier course materials in light of the conceptual model; for example: role of top management and integrating research and design intervention. So, productivity, and occupational health and safety issues may be: to identify factors that affect productivity through occupational health and safety issues in effect; examines the causes for complaints of fatigue, back pain, upper-body pain, hand and wrist pain, and headaches; before taking any development step it requires to carry out ergonomic assessments of the work process and working environment.

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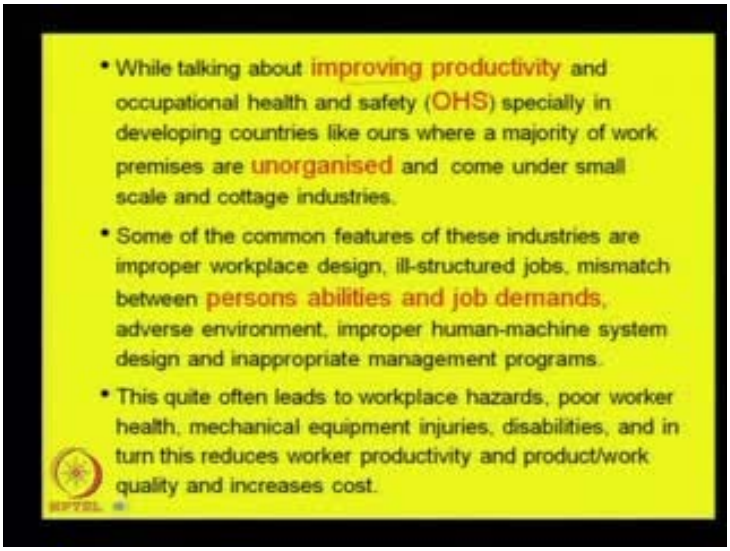

Now, while talking about improving productivity and occupational health and safety - OHS - specifically in developing countries like ours, where a majority of work premises are unorganized and come under small scale and cottage industries like that.

In some of the common features of these industries are improper workplace design, ill-structured jobs, mismatch between persons abilities and job demands, adverse environment, improper human-machine system design, and inappropriate management problems.

This quite often leads to workplace hazards, poor worker health, mechanical equipment injuries, disabilities, and in turn this reduces worker productivity, and product and work quality and increases cost.

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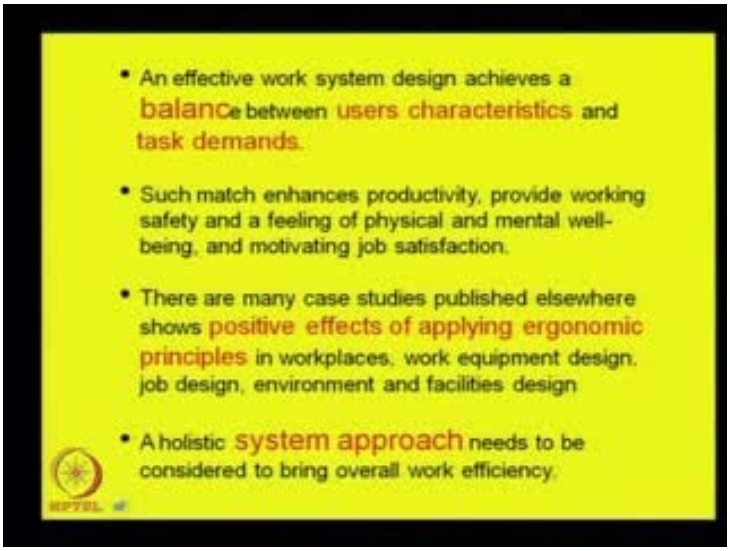

Now, an effective work system design achieves a balance between users characteristics and task demands. Such match enhances productivity, productive work safety, and a feeling of physical and mental well-being, and motivating job satisfaction. There are many case studies published elsewhere shows positive effects of applying ergonomic principles in workplaces, work equipment design, job design, environment and facilities design. A holistic system approach needs to be considered to bring overall work efficiency.

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It is believed by many concerns that many of the root causes of workplace health hazards, low level of safety, and reduced worker productivity and quality are due to ergonomic deficiencies.

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In developing countries like India, investigating ergonomics, worker productivity and OHS involved development of a checklist that included; number 1: demography of the organization, number 2: productivity and safety issues, number 3: ergonomic issues,

number 4: the environmental factors, number 5: organizational and management issues, accordingly the design development strategy has to be considered.

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Ergonomic risk factors that affect health related safety; while industrial engineering and other specific disciplines look into specific ways of solutions; it raises a design development need. Attempts for development may base on some keywords; those keywords may be: the ergonomics, occupational health and safety, environmental conditions and surroundings, and design development; and on that the strategy for such design development to be considered.

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Now, the ergonomic compatibility considerations to minimize work discomfort and safety-health risk through hierarchy of controls. This hierarchy of controls is composed of - number 1: the engineering control, that is, designing a machine;

number 2: administrative control or a job - a safety manager must consider administrative controls, emphasize minimizing the machine operator's exposure to risk rather - administrative control tactics may include: designing a job rotation schedule; decreasing the frequency of certain movements by adding more operators to a particular job; or changing job processes to lessen the amount of risk; number 3: the personal protective equipment, that is, guarding the self.

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How to achieve this goal? best We can consider, the identification and elimination of occupational hazards at the beginning in a system; then proper application of ergonomics principles and criteria, so that good compatibility will be there; planning and execution of good work design element; implementation of participatory approach to make it sustainable.

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Now, some concerns are there; those concerns like industrial engineering concerns are in: designing jobs - determining the most economic way to perform work; number 2:

setting performance standards and benchmarks for quality, quantity, and the cost; designing and installing facilities.

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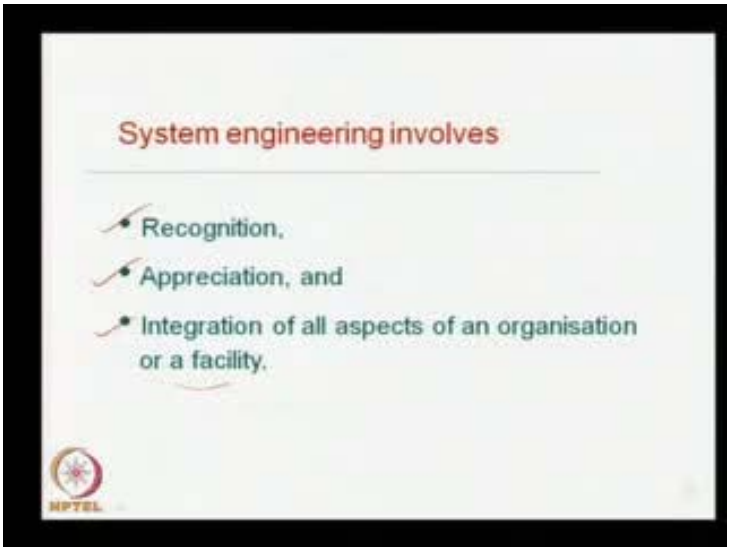

Under system engineering criteria, the system engineering involves: recognition, appreciation, and integration of all aspects of an organization or a facility.

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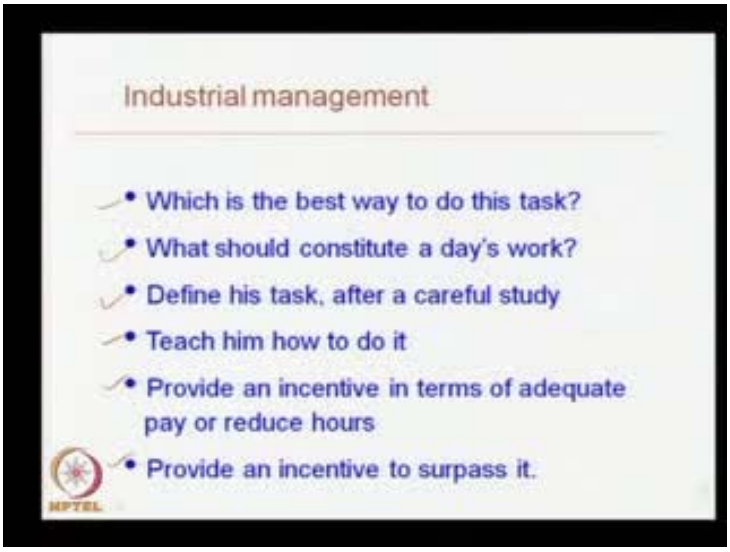

The industrial management issues concerns are to check: which is the best way to do this task? What should constitute a day's work? Define his task, after a careful study, teach

him how to do it - make him aware, provide an incentive in terms of adequate pay or reduce hours, provide an incentive to surpass it.

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The design approach when we take, then one person comes, whom to upgrade? we have seen many concerns earlier, take a system approach when attempt to develop even a single product, that is the answer.

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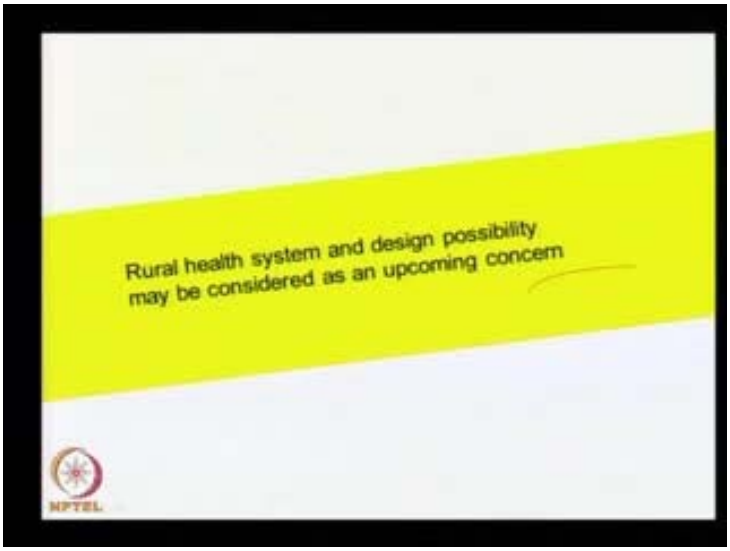

Let see how it works; we can take an example of the rural health system and design possibility may be considered as an upcoming concern. Now, if we take a rural health

system, where a lady health worker issues some medicine which carry it to the village and the specific houses she visits, some common medical check-up devices that she may need to carry with her, and after day's work with those people - village people - visiting their homes, administer the medicine, make the medical check-up, get the report filled, come back to the main office or centre and report it back.

If this is a concern, then after studying the whole system that how she collects, how she finds that what are the equipment devices she needs to carry, what type of medicines she requires, in field what are the problems etcetera, after studying each and every component, a design thought may come that if we can develop or design a special carrying system that can be fitted in her normal cycle, or if it is necessary, a special vehicle can be developed where the cost will be very less and it can be moved inside the rural path to go to each homes. At the same time, the carrier should remain on that vehicle while moving, either it may be in that same position when she visits some homes, or that basket or that design bag can be removed from that place and she can carry inside the home for medical check-up and etcetera or treatment.

So, in this whole system, if we can develop that product, it may be good in the whole system. This product will give reliability, safety, the functional requirement it will fulfill and if it is easy to carry and etcetera, the trouble that lady was facing - it may be minimized; so, by that way a system approach can lead to a specific product development.

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In this case, one can develop a kit or medical kit for that specific purpose; so that development would be context specific through a system design approach. Now, we will see some of the issues in this; what does it mean by system approach? Whatever we discussed in it just now, let see the components location and integrated function equal a system.

Defining system: a system is an aggregation of elements organized in some structure - usually hierarchical - to accomplish a unified system goal with many specific objectives oriented components within.

But, design over this an additional element is required, that is, design is said to be something more than the aggregate of the constituent components. Some other element that while making an integrated product, the trust value, pleasure value, to fill good value these things how it can come, that needs to be added; so the system design, it gives the components, requirement and everything and when the designing for the system matter, it gives an overall integrated matter.

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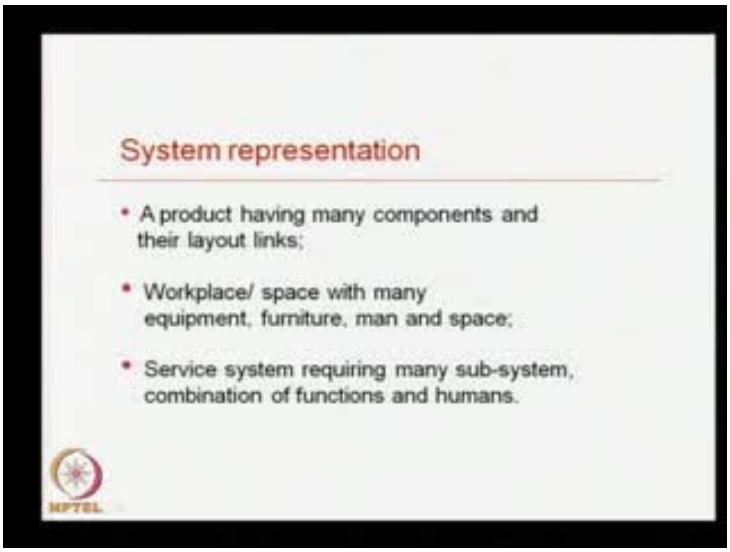

System representation: a product having many components and their layout links; workplace or space with many equipment, furniture, man and space in between; service system requiring many sub-system, combination of functions and humans.

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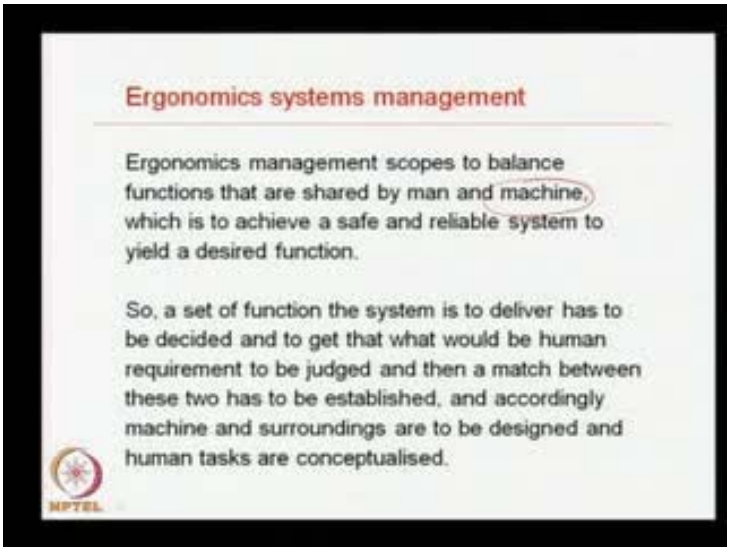

Ergonomics system management: Ergonomics management scopes to balance functions that are shared by man and machine, which is to achieve a safe and reliable system to yield a desired function; now, this machine is being gradually shifted to any kind of usable item.

So, a set of function the system is to deliver has to be decided and to get that what would be human requirement to be judged, and then a match between these two has to be established, and accordingly machine and surroundings are to be designed, and human tasks are conceptualized like this.

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System design approach: the considerations are overall system goal, to achieve that - require subsystems define that, subsystem characteristics, details of subsystems, functional links among them, role of humans users and operators, overall shaping to make a reliable system.

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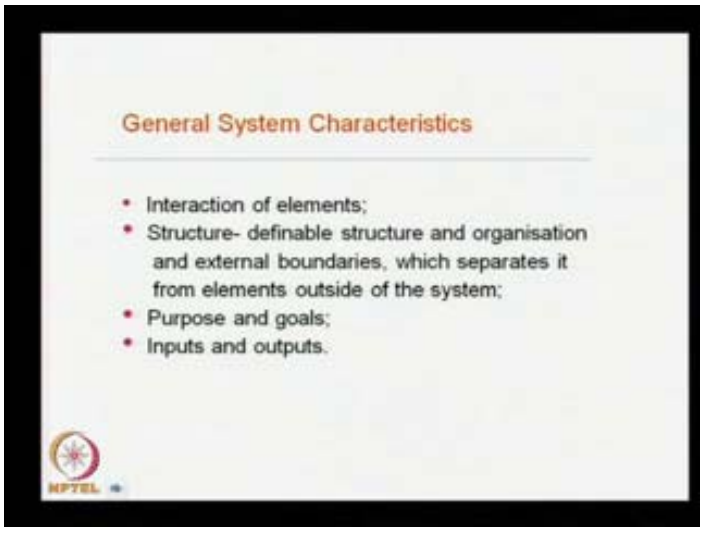

Now, general system characteristics: interaction of elements; Structure - definable structure and organization and external boundaries, which separates it from elements outside of the system; purpose and goals; inputs and outputs.

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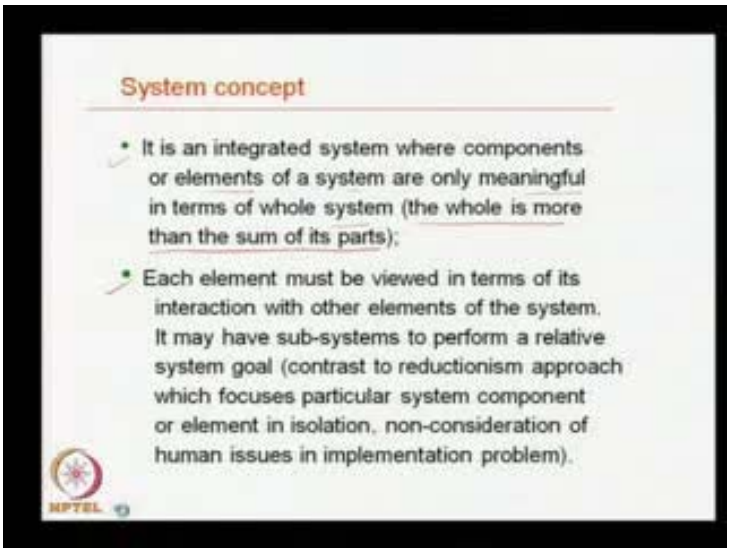

Now, the system concept: it is an integrated system where components or elements of a system are only meaningful in terms of whole system - the whole is more than the sum of its parts, we have to keep in mind while making any system design approach; each element must be viewed in terms of its interaction with other elements of the system. It may have sub-systems to perform a relative system goal - contrast to reductionism approach which focuses particular system component or element in isolation, non-consideration of human issues in implementation problem.

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Now, see some issues of office ergonomics applications.

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This figure I am showing again just to say that, it is a typical office workstation within a cabin.

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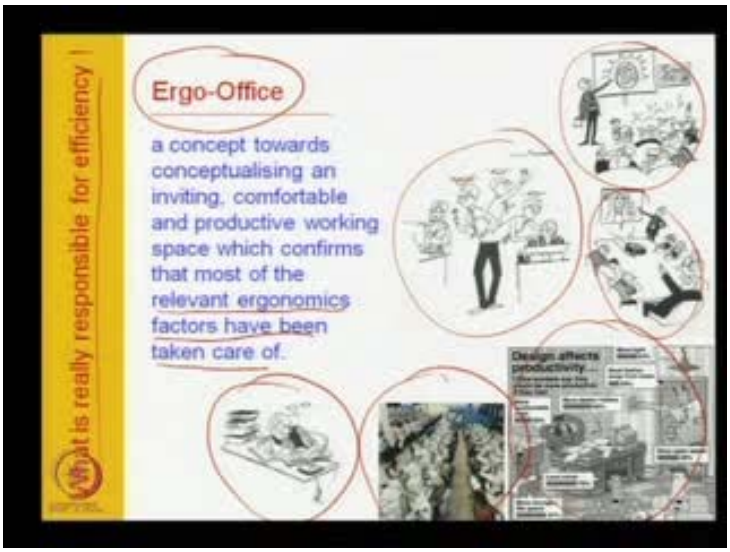

In other office atmosphere, what is really responsible for efficiency? While looking into this, a concept came Ergo-Office. Here, we can see some of the figures that people in meeting, multiple task performance, people demand, people in a specific arrangement - working arrangement, tiring work, so all these Ergo-Office concept - it says that a concept towards conceptualizing an inviting, comfortable and productive working space which confirms that most of the relevant ergonomics factors have been taken care of.

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Here, to make a person comfortable with this work, height, length, breadth and even the display are being adjusted. People working in an inappropriate workstation area - this need to be considered.

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For all this, now, another thing is there that there is a move from formal atmosphere towards and creating an informal work environment in an office even.

Now this formal to informal transition exercises, so these figures have been taken from some published material. Here it says that in a car one person can work within specific work area, now here like this way; in this office, a special ambience is created with this figure; now, this is a special table - work table; now, to make it clear, to come closer and specify the work individual spaces, a specific curvature of this table is formed like that, and even in office also some rest facility are being provided.

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So, challenge to make new workplaces on this; so, the workstation or workplace should be functional with freeness of movement and freeness of mental load. Now, from formal to semi-formal and formal feeling and informal feeling in home always - it is there, but how to create it in work area? So, some furniture manufacturing company they have developed something and even these type of furniture have been developed. Even in medical check-up system also something is being, so that patient and doctor cordial meeting is possible here; that type of things are developed in dentist also like that way.

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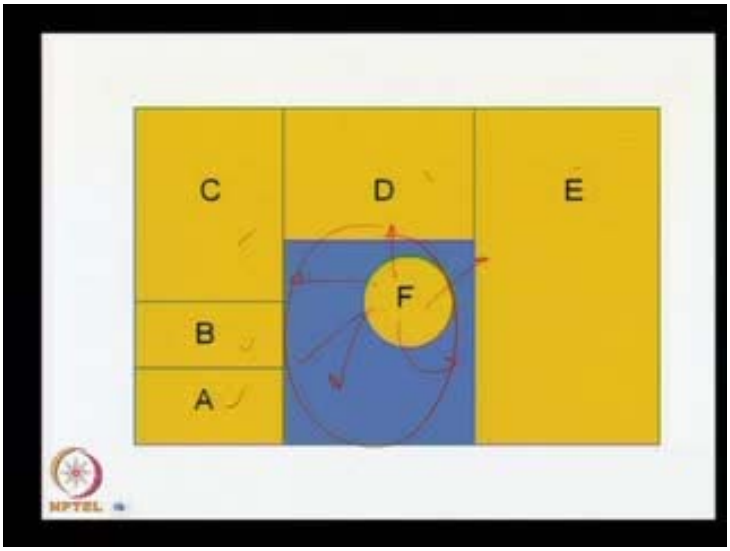

So, with this, it can be said that in an office or a single person work area, if a person sits here and A B C D E like this - if A B C D E, these are the working area suppose - then this person can move here and there and can touch all the things like this; so this is for his free movement space and these are the work area.

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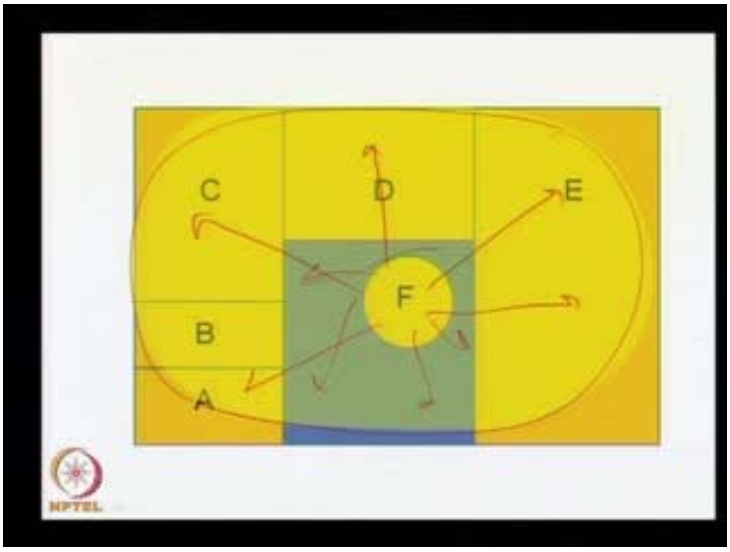

Now, looking into the horizontal work space - the horizontal work area, an area of this can be marked, where this person can move with his chair here and just only extending his arm, he can get - reach over all the things like this way; so, the physical dimension match has to be maintained.

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So, with these issues, these type of concepts have been developed by many furniture developer groups, till that person will be here, he can meet it for meetings, office work, for personal computer keeping place and etcetera here, personal computer keeping place and then other material place like this way. So, the person thus changing his position, he can make contact with various workplaces; so, by this way workstations can be developed.

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Now, ergo-office: workplace for new work style. Here are some published literature is there, it says that varieties of workplace possibilities are shown here as an example. So, from these examples, one can think that, no matter how a work place can be made, more inviting - very casual atmosphere with deep sense of responsibility. So, a special work area can motivate people to work and would be creative - to generate creative idea, constraints are not welcome.

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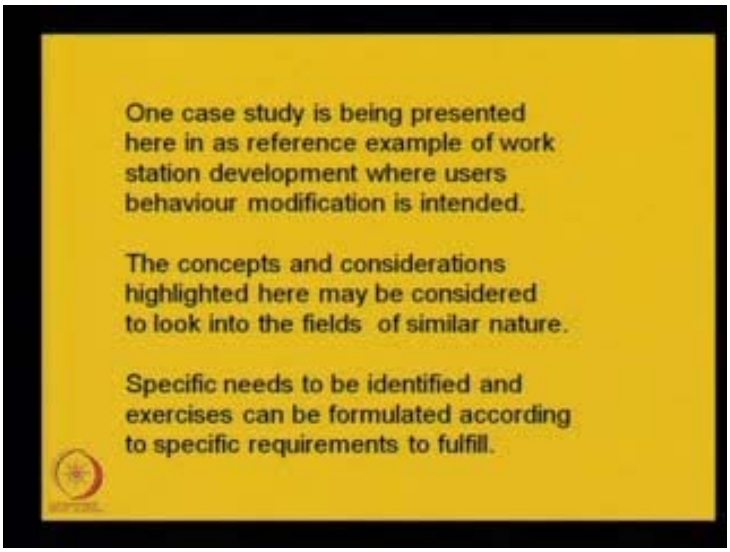

One case study is being presented here in as reference example of workstation development, where users behavior modification is intended. The concepts and considerations highlighted here may be considered to look into the this fields of similar nature; now, we are going to see one example and like this many other area one can see, if similar type of development possibilities are there. Specific needs to be identified and exercises can be formulated according to specific requirements to fulfil.

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Now, the example is that counter - workcounter that modifies behaviour and ideation approach.

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The concern: this is a typical counter, the counter person side, this side counter person, this is that other person's; one example area we can cite. The counter - it is not only the physical reach of arm, but also visual clearance is necessary.

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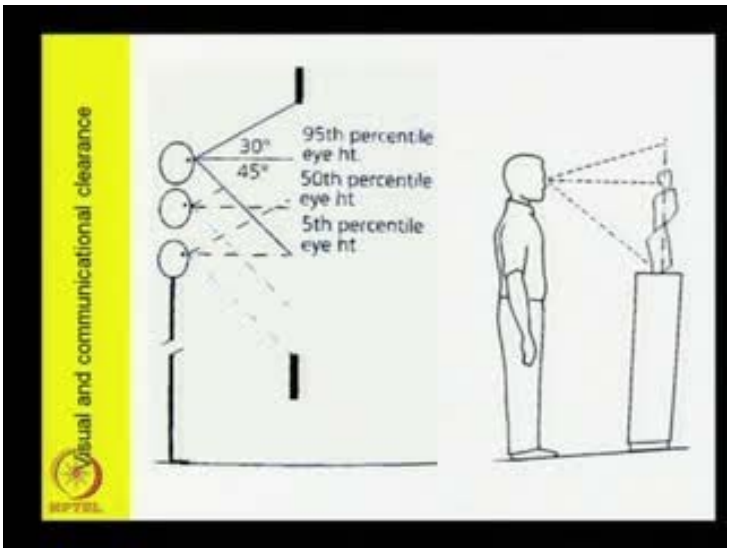

Visual and communicational clearance: here, one thing we have to consider that people height. So, when we talk to each other, the person's eye - the counter person's eye and the customer's eye, it has to be at the same level or it would be at a comfortable communication level. If a short height person, medium height person, tall height person is there, then accordingly that has to be considered. If something has to be seen, then around one third may be from the top of the eye and two third may be below eye level has to be kept and the distance of that object, it would be around one arm's length; these are the some of the concepts that we have discussed already in earlier classes.

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Now, we will just see one application; this figure is taken from a published source for the discussion as an reference. In this case, it says that it is a counter where the person is coming - standing outside and the counter person is looking at the computer.Now, this reminds us a specific work area that in a railways reservation counter. Now if we see our government In railway reservation counter, the counter person who sits inside, he has a computer and he keeps the computer monitor facing towards himself; and when he work with something, he see that computer; but those who are standing in a queue on the other side, their behavior is that there is a long queue, when the first person comes at a front - meeting with that countermen, he is asking some questions or asking for some availability of railway ticket kind of thing and the person - the counter person after telling one, that it is available or not, if not available, then the person asks the next one, after two three types of asking like this, the counter person feels irritated or he normally says that go to enquiry and get it checked where the rooms are available in which then. So, when this discussing is going on, the second person in the queue, his heartbeat gets increased and he feels that just as soon as the first person moves from the counter how he can approach; so, what happens? He tries to see from angle to the computer screen; obviously, the first person here also looking into the computer screen trying to see that; second person also doing the same, and at the same time, the third person, he is also getting energized, he also tries to see that what is happening inside means he is also getting ready. So, in the queue, these three – first, second and third person, there is a little chaotic position there.

Why it happens? Let see some of the issues, if we can target this.

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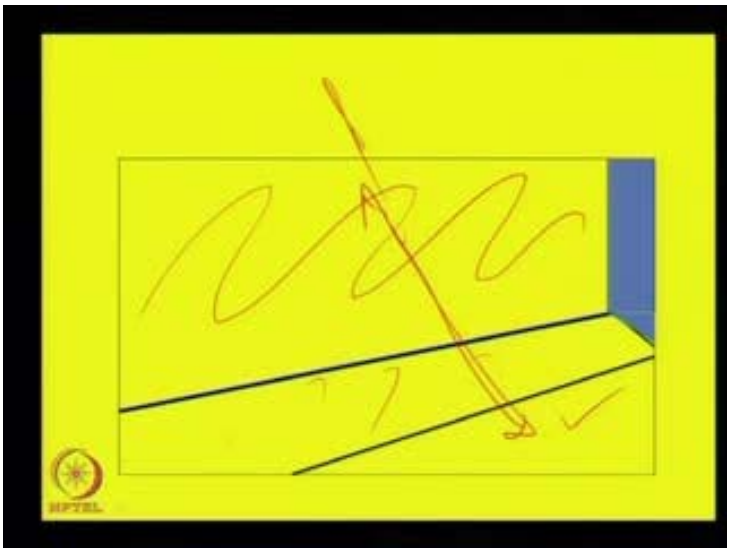

Suppose, this is a counter, this is the glass or opaque area, this is the counter table, this is the counter and person those who are in other side that long queue is there and they are supposed to contact through this (Refer Slide Time: 33.30).

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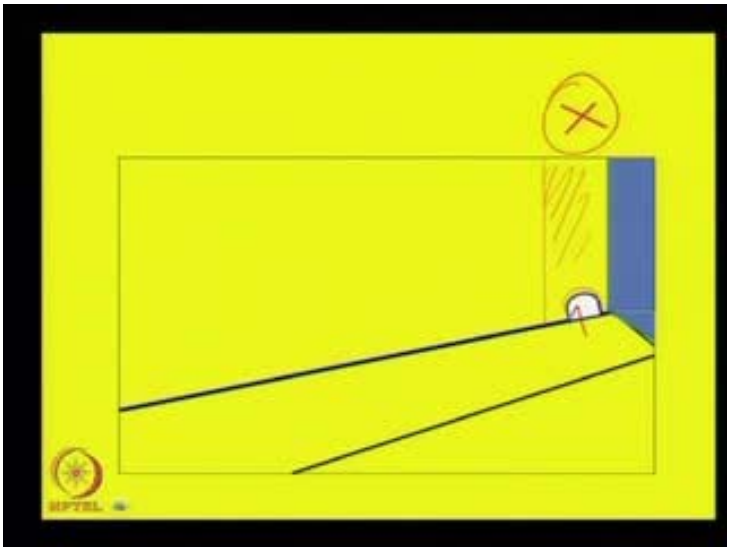

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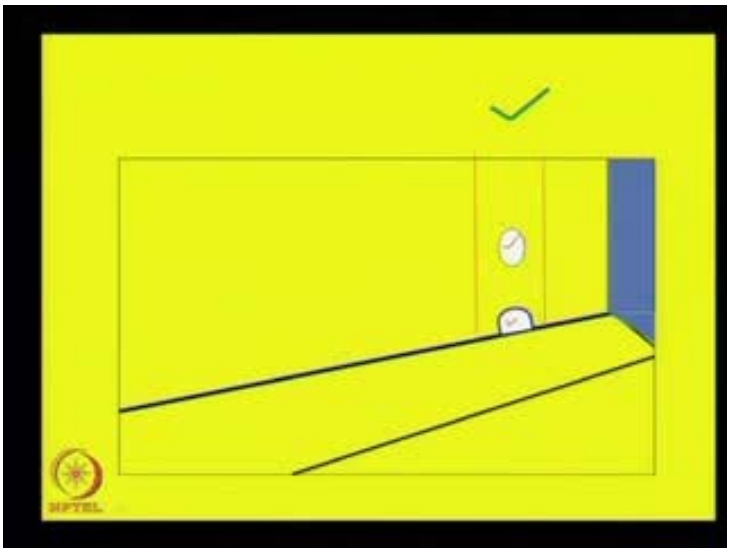

In certain cases, in some fair or may be somewhere that temporary ticket counters are made, these type of things are available. This is totally covered and one small opening is there. So, what happens? Through this hole, your hand as well as face - both you have to see this way and it is not very good; so, we can say that this is not proper. Then, second division may be one hole and another thing; it looks ok, you can speak and you can put your hand through this, but the fact is that everybody's face is not matching here. So, the short head people can extending face, tall height people are squeezing their face – bending; though it is good, but we cannot say it is very good in this context.

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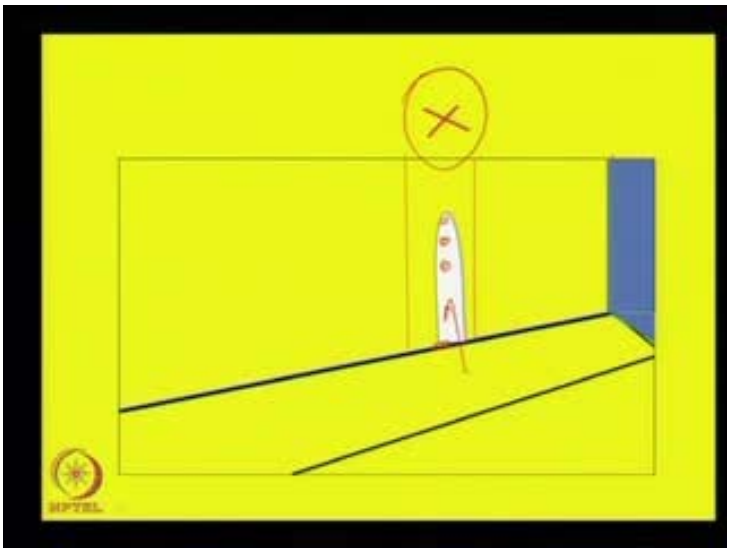

Next, for that, if we can have a total cutout like this way, then, what happens? Any face - tall height face, middle height face, average height face or low height face, it will fit there and then they can perform their duty through this, but there may be vandalism kind of thing, so people can put their hand in directly; so, that may be a problem. So, this type of structure we consider it may not be possible or feasible. Next thing comes ok, then do one thing.

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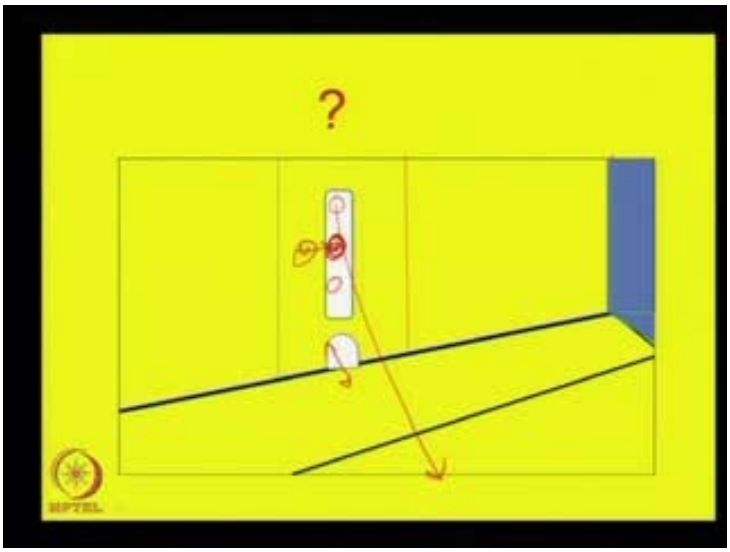

Instead of having a single cutout - cut, have little separation; so that tall height peoples' face, middle height people face, short height people face will be there, they can talk to the counter person and through this, there will be exchange of material by pushing hand inside it. Here, what happens? Still when you are in a queue in the railway reservation counter, you are doing something, from the side one person may come and can say that - just one minute one question i ask, is this train goes from this side? Can I get this ticket in this counter? like that So, then the task is going on there, it gets disturbed - the person who is talking. So, what happens? The person who is actually doing the business here - his face is here and from side he is also trying to come here (Refer Slide Time: 36.11). So, there is disturbance.

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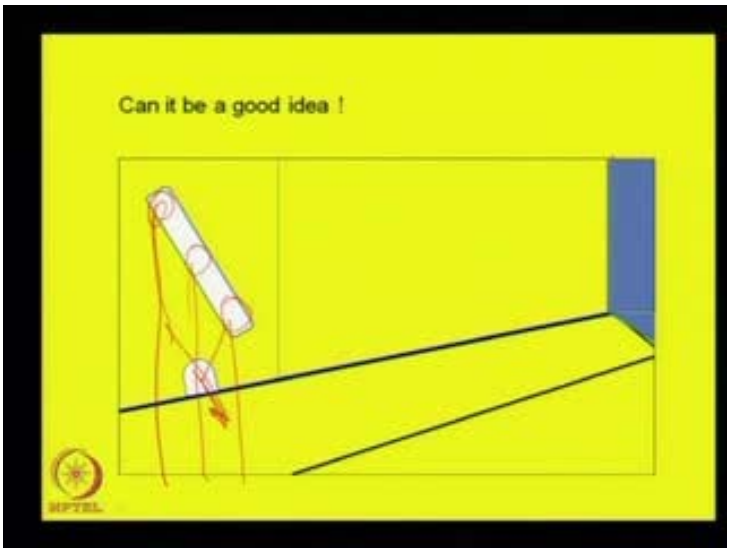

So, for this, can it be like this one? So that automatically as a behavior point of view, the principle is that we always judge the product or the space or the dimension as it fits to my body dimension - the product geometry fits with human body dimensions match and then accordingly we accept this product. In this case, automatically, if this is the cutout like this way, then a tall person will try to keep, obviously the natural selection he will try to stand here and average person's height person his face where will may matches, he will try to stand here and a short height person, he automatically he will try to stand here and while standing here, putting hand here, he can perform the job, he can perform the job and he can perform the job through this (Refer Slide Time: 37.15).

So, what happens? Though three persons are there, by automatic height selection the beginning three persons will take the automatic space, and if they are standing here and if someone tries to enquire something to the counter person also, best space is there. So, the person who is standing in front of the counter, he does not need to give space to the other person. So, by this way, can we say that by design we can modify human behavior? In this case, the queuing behavior? These are the some issues that workstation itself can give. Here, the privacy, the work easiness, freeness, postural change possibilities, etcetera are to be considered.

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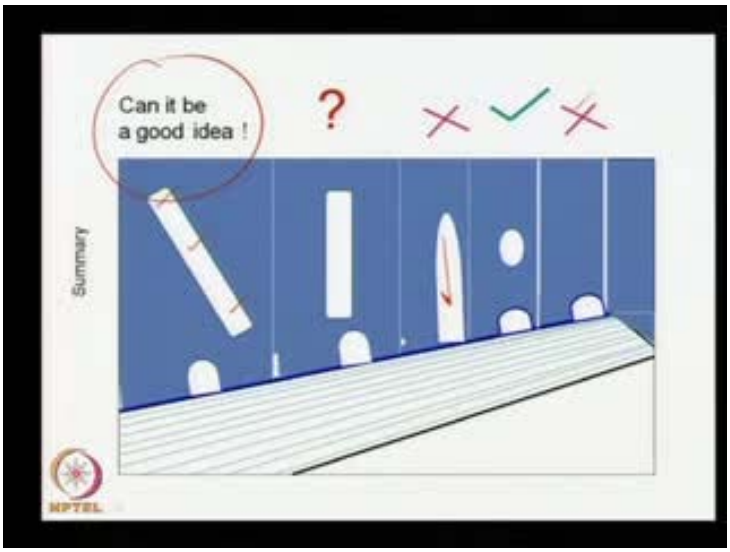

Now, here as a summary, this is not permitted - not good - there are some problems; here, it works but it is not appropriate; in this case, safety is a problem, vandalism may be there; in this case, though it looks good, but the concern that the only one window - small opening space is there; in this case, it may serve that purpose. Can it be a good idea to practice? let make it, see it, it give trial. So, this is one example which is being shown here as an idea generating issue, but a similar type of concerns one can find from our own surroundings and then get that things done.

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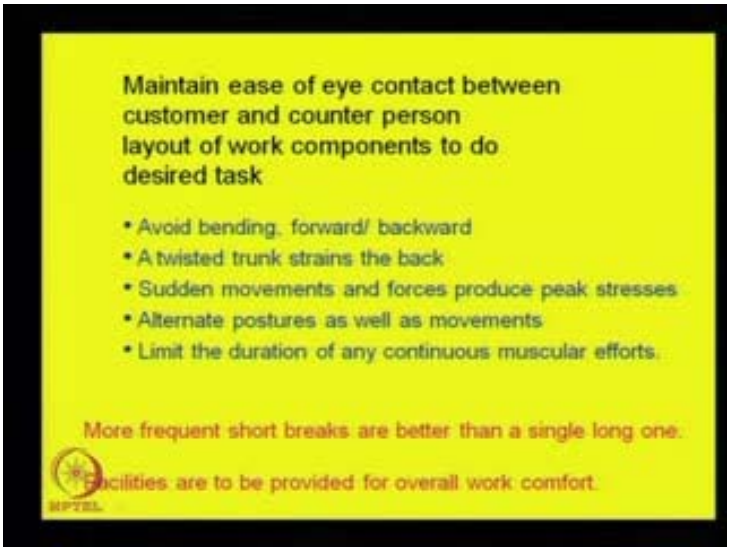

Maintain ease of eye contact between customer and counter person layout of work components to do desired task: avoid bending - these things need to be considered - avoid bending, forward and backward; a twisted trunk strains the back; sudden movements and forces produce peak stresses; alternate postures as well as movements; limit the duration of any continuous muscular efforts. More frequent short breaks are better than a single long one. Facilities are to be provided for overall work comfort.

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Summary of today's lesson: the below five key points that is discussed in this session may form key to similar workstation development trials; one is that workstation design - the need to be identified actually, design development strategy has to be looked into, system approach can be taken, overall work comfort has to be considered, and finally, design ideation - make the design solutions, alternates, give trials, get feedback from likely to be the users, and then finalize it.

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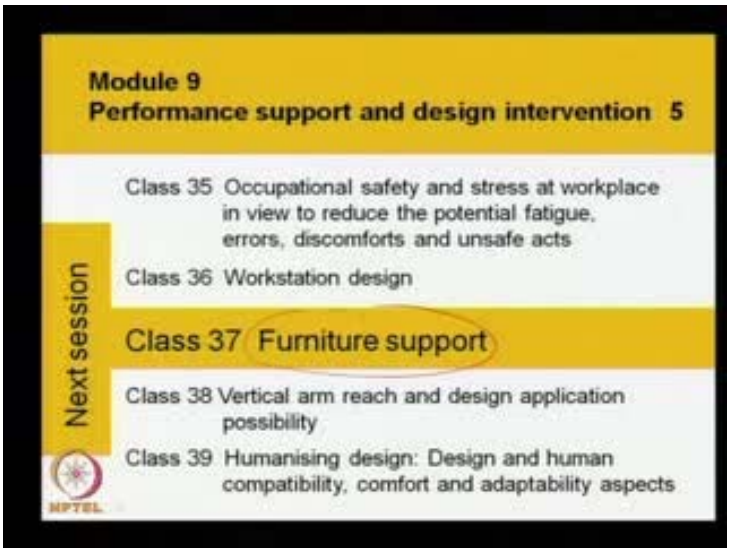

So, with this, we are concluding today's session. Now, the next session will be the class number 37 - the furniture support and relevant issues. With this, we are concluding today's session.

Thank you.