Ergonomics for Beginners Industrial design Perspective

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Module No. # 10

Design Ergonomics in India

Lecture No. # 40

Scope for exploration

Welcome to this fortieth session of Ergonomics for Beginners Industrial Design Perspective and in this whole course this is the last concluding session.

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The today's session is the class number 40, the concluding session of the course. Here, we are going to specifically discuss, the design ergonomics in India and scope for exploration.

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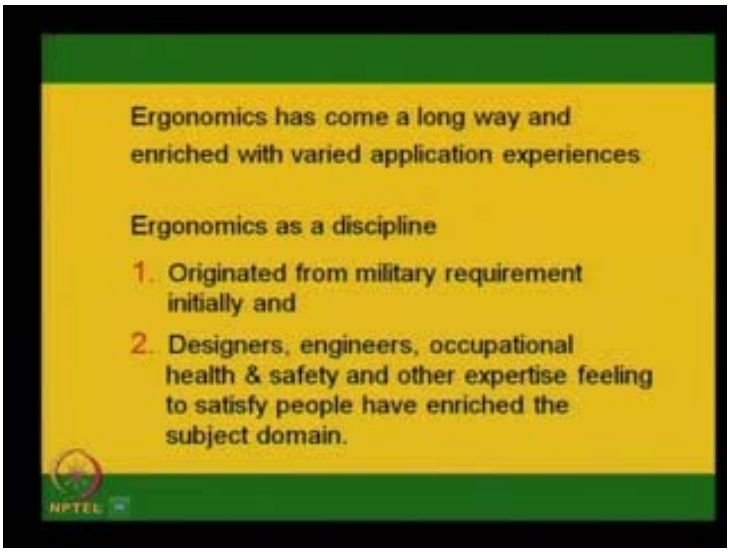

Ergonomics has come a long way and enriched with varied application experiences in time. Ergonomics as a discipline: it is originated from military requirement initially; and designers, engineers, occupational health and safety, and other expertise, feeling to satisfy people have enriched the subject domain.

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In this course, industrial design perspectives of ergonomics have been stressed: user-friendliness and compatibility - that is, man-product system match - between man and his surroundings and articles for his use, we try to establish.

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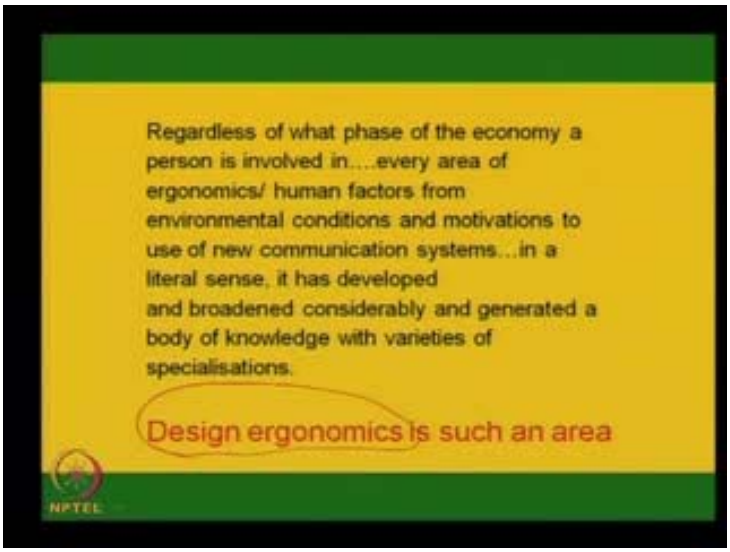

Regardless of what phase of the economy a person is involved in… every area of ergonomics and human factors from environmental conditions and motivations to use of new communication systems… in a literal sense, it has developed and broadened considerably and generated a body of knowledge with varieties of specializations.

Design ergonomics is such an area that we are stressing in this discussion and in this course as a whole.

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The application of best scientific principles and appropriate technologies may generate a design best to deliver its intended function, still its user - man is the prime system component - ultimately has to feel comfort while using it to qualify the same to be a good design.

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Now, the development is to achieve efficient and quality life. So, the issues are here: safety, performance efficiency, reliability, and occupational hazards to eliminate, so that people can use the product with trust and without any fear, doubt to use that.

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There are many unnoticed concerns: it may be in industries, it may be in normal activities, areas in day-to-day life, even while using modern technological developments in a corner of room to concentrate on something like in this figure, it is seen.

Many unnoticed issues relevant to modern day life requires to be looked into - whether this type of concentration, how it affects the performance.

In this figure, we are not discussing what are the factors that may cause some problem; it is just open, one can see from this figure and can get some idea.

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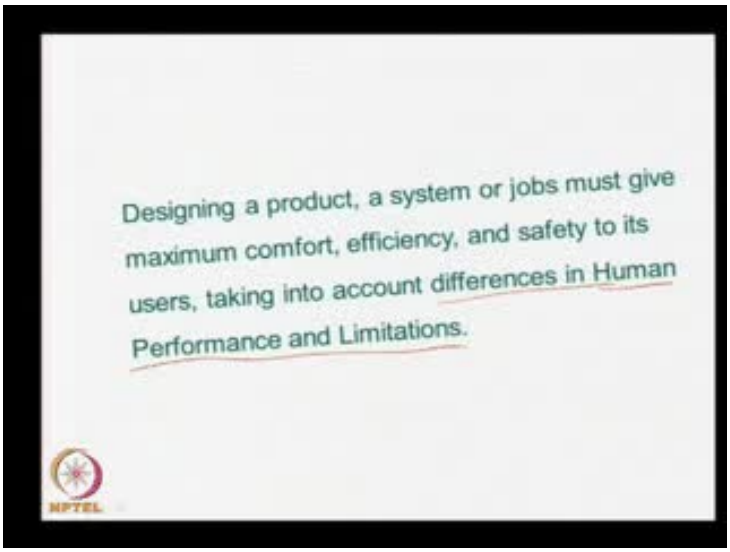

Designing a product, a system or jobs must give maximum comfort, efficiency, and safety to its users, taking into account differences in human performance and limitations.

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The progress leads complexity and there is a constant struggle to adapt changing environment with newer ambitions and life style aids with limitation of human capabilities. So, the development should be context specific. Design development needs justification - whether it is actually supporting the requirement.

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Design is an innovative process; it achieves a practical outcome and it should be reproducible. So, design is an innovative, practical, reproducible solution to conceive

various aids to human needs. Always a heavy thoughtful item need not to be put forward always for a good communication.

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Here a small thing is seen, that in a vehicle back it is mentioned that keep smiling; it is a tax free item. So, with this note, those who are seeing this figure, their total mind changes, it gives a small smile.

So, what happens? Such information whether and how much effective - a concern can be developed and a series of studies in this aspect can be initiated.

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Now, in this figure, it is showing that the person is carrying his whole family - mother, wife and child in a same scooter; obviously, it is risky; so many concerns are there; so many restrictions can be put here, but the need versus many issues are here - the affordability. Just only implementing the rules for safety whether we are providing a good means for that - how people can use? How people can honor those rules? Then something has to be considered here. So, there are many issues while looking into a problem area.

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This figure, it says that the privacy and aesthetics; normally in bathrooms and etcetera, wherever it is there or it is tagged with wash like this is ladies, gents, males, females, men, women, and so many things; and then some figures - figures like that it would denote the men use a figure with moustache with a circle face, and for ladies without moustache may be some kind of other [bindi] or something that type of approach that figure is basically; but still people feel little awkward just to enter into those things unless displayed.

Sometimes it is a washroom type of new words have been used. Here, it is shown that in a corner of a corridor - the end part of corridor - this type of approach is there and for that you do not need to say anything that what for this is and which door one needs to enter - male or female; and aesthetically we present with that brooms and with some

creepers are kept in this. So, it says what purpose and then it gives a direction; you do not need to tell here, what for it is.

Now this type of applications, it needs the past knowledge may be and then the user's intelligence level, depending on that solutions to be given.

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Human compatibility factors in terms of limitations, and specific natural facilities of humans, and acquired needs to be looked into.

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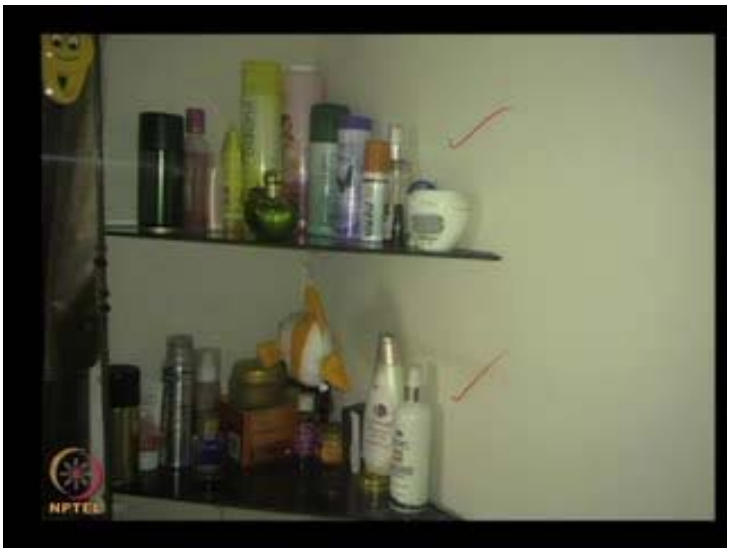

This figure says most of the houses near the dressing table, a corner is maintained, where all the required items are placed; so that the identity of a corner is there and it says that what purpose. If a need is there to use it, then you can come and can get all the required items within disabled limit and at a place.

So, the required items and its location in a space, it requires to be studied not only in this home area, but in some others like in machine condition, factory premises, and other locations also.

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This figure here it says that the image application; here, the right hand side, it says that the transparent body of this pen and the colour of the cap; it says that what colour ink is there, so it is seen; so this colour, it tells that. Here what about the colour red and so inside the ink is also red. So, the function when we need it, it gives an identity.

Now, here, another thing is that scent bottle - perfume bottle. Now we can say that this is a cap, it is closed and when the cap is open, then you can use it as spray. Now question comes, what is spraying purpose? Now, when you are using a muscle relaxing spray, at that time the spray should be easy to operate.

But in this case, when you are using the perfume, that liberal movement is not necessary; power pressure, a less amount of material have to come out. In that case, this type of

ornamentation may be permitted. Where ornamentation is necessary? Which context it is not? It depends on the requirement.

In this left hand area the image the soft skin and etcetera it goes with it this figure means it is a natural element kind of presentation. In this format, here, there may be written material or something, but giving this foot imprint, it says that the material inside is related to the foot care; so, simple representation, somewhere the simple direct representation is helpful and somewhere its abstract representation also gives a desired feeling.

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Here, it says that issue is delicate; the figure and the placement etcetera, say that it is a delicate item. You do not need to tell somebody how to operate, how to hold, how to transfer this item.

This ball is a broken glass made ball, empty ball, hollow; so after seeing the figure, it gives a delicate feeling.

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Now, in this case, issue delicate - it restricts from unsafe action; so, some inbuilt features to be there that will give you or us, some kind of information about it is unsafe or safe to operate that aspect.

In this case, the glass, it will be very difficult to drop this half water filled glass on this surface - in a glass surface or on the floor the hard floor surface - it is very difficult. Knowingly it is very difficult to throw it; what happens? Some inbuilt safety features are there. If we can identify all those issues and its related design elements, then it will be good.

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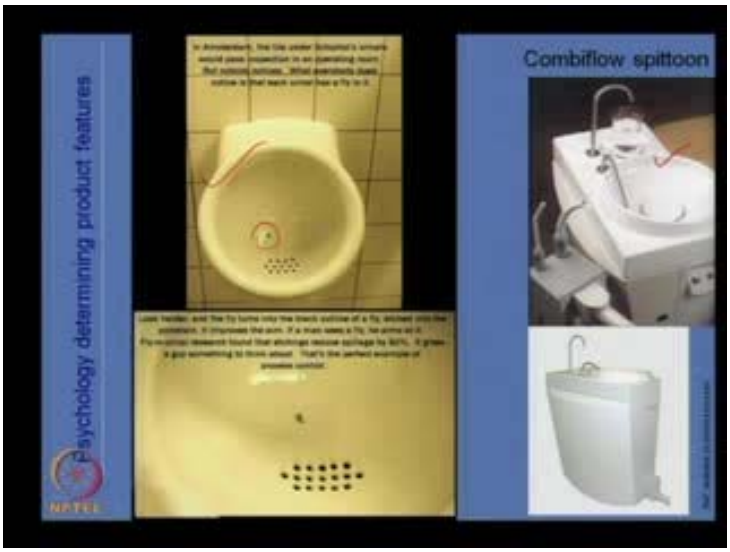

In this case, how psychology changes or determines behavior? This figure was taken from available resources in market - the available publications - it says that this urinal plan has a small fly here. So, everybody started feeling - because we have an idea or inbuilt habit, that if there is any bad thing, then I do not want to use it or see it, we want to throw it away - we want to keep it out from my closed devices.

Here, what happens? To put this to the drain, the people will pee on it, people piss on it to remove the dead fly, but it is not a dead fly; it is a dead fly impression is given. So that the urination behavior would maintain or that behavior is controlled here.

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Now, the same figure, the same principle, can we use in this Combiflow in a dentist's chamber? In this case, what happens? Now, we also can have a dead fly or something in this; so that while sleeping and doctor is doing this dental care and then you have to spit on this spittoon like this, but in that case what happens? In this case, it was to throw it, but here in this case, what happens? I want to see whether in my spit that some blood is coming or not. So, here I want to see the thing; here, I do not want to see the thing. So, psychological issues are the same, but context wise it is a different application. Somewhere, it is necessary; somewhere, it is not necessary.

Here, in this combiflow, it will have a bad effect. If the combiflow is dirty, then we may not like to use that.

Now, the care: care for various physical and mental challenging issues are there; so for that we can have this type of guards, rails and etcetera.

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Now, the thing is that these things are ok, but in this case, where though the development Now, this person has a problem in one leg like this; so, he has been given an artificial foot to use it.

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But in reality, what happens? You can see that he is squatting and moving forward in this position and using a stick here, he forwards it as he proceeds like this.

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So the concern comes here - why he behaves like this way? Is this foot not matching with him? Or we are not sure what for it is or may be for small movement he does not feel to wear this foot.

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Whatever the reasons, these two figures says that this person though the facility is provided, he is not using it; what can be done?

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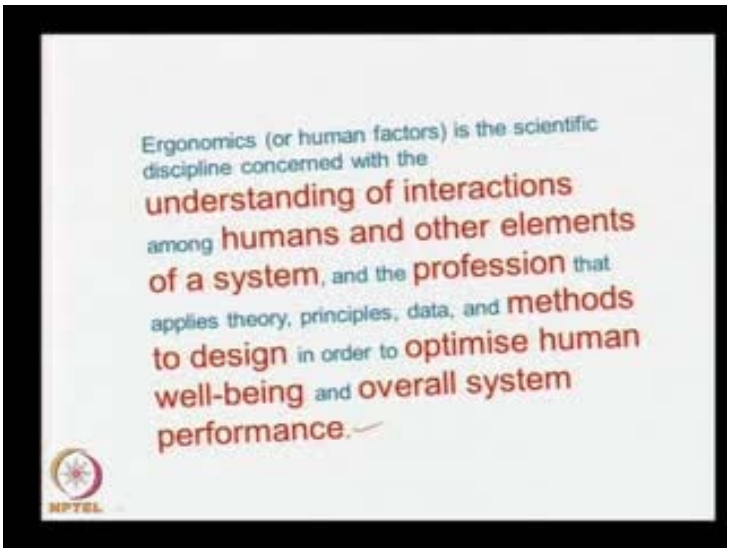

Ergonomics or human factors is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance.

So, ergonomics principles and criteria relevant to design need to be considered, while developing any product attempt.

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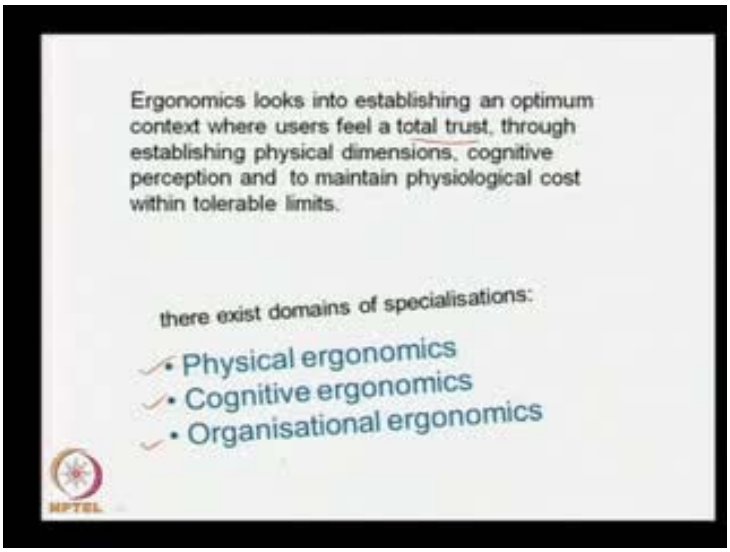

Ergonomics looks into establishing an optimum context where users feel a total trust, through establishing physical dimensions, cognitive perception and to maintain physiological cost within tolerable limits.

There exist domains of specializations: physical ergonomics deals with physical match - establishing physical match; cognitive ergonomics, establishing perception and judgment etcetera; and organizational ergonomics have larger application areas.

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Here, in this figure, an issue: is it a need to develop or to think on it. This figure is taken from a Nagaland area, where it is seen that the used tires are being modified for these type of buckets and some other vessels like that. It is mostly to be used for pigs to give the food and so to the pigs in the figure.

Now, whereas less people are engaged in this field, but still there is a need a certain group of people and its requirement. So whether can we concern it as a need to be looked into. There are so many social issues that remains unconcerned for common people or while doing a policy decision, but in that case it comes whether and how much - is to be answered, but for that we need to study it and we have to find its implications in society.

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Design development attempt must have proper need identification, followed by design ideation exercise and incorporation of context specific human compatibility and comfort issues.

Relevant need based and anticipated need based design ideation exercises may be initiated to meet our varied nature requirements.

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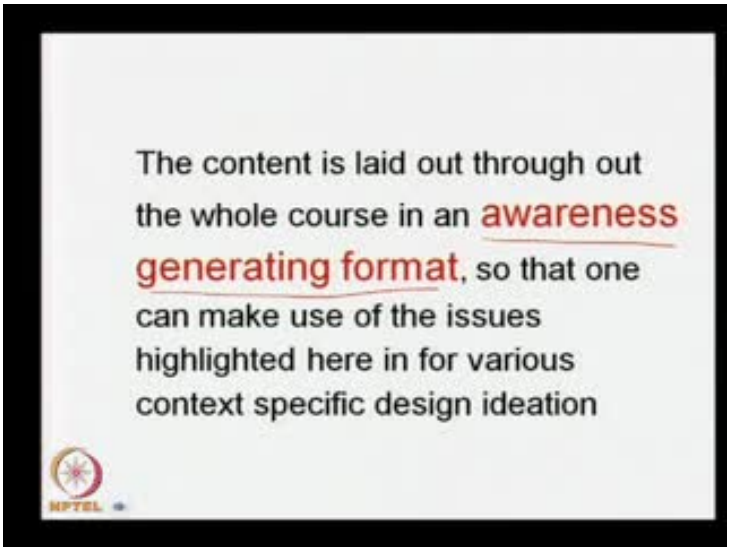

The content in this whole course - ergonomics for beginners - is laid out throughout the whole course in an awareness generating format, so that one can make use of the issues highlighted here in, for various context specific design ideation purpose.

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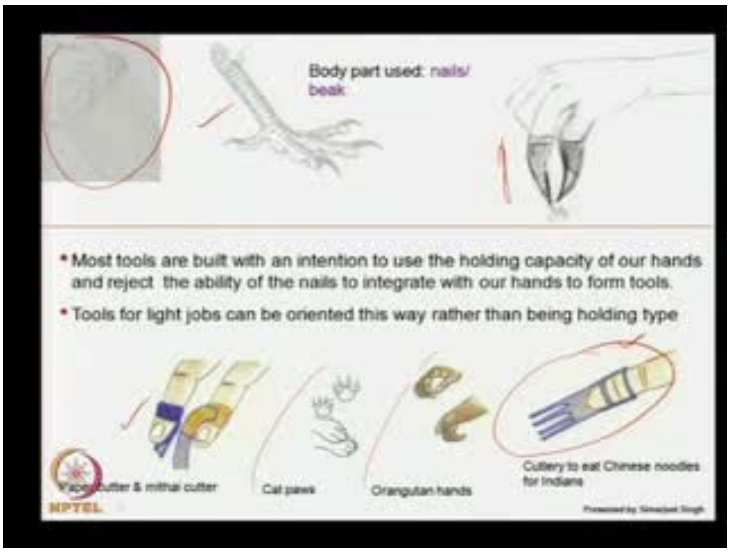

Now, here some issues are shown: taking some inspiration from some animal or from nature or from our own body parts like that; body parts used: nail and beak.

So, now, how does a bird foot looks like? How can it normally hold the things? From there, if it is done, that this type of application one can develop, so that we can put in our hand, in our finger and we can pick it like this. So, this type of small development can also be done. And another thing is that most tools are built with an intention to use the holding capacity of our hands and reject the ability of the nails to integrate with our hands to form tools.

Tools for light jobs can be oriented this way, rather than being holding type. Here, it is said that after studying the cat paws and the orangutan hands and our own fingers, a paper cutter or a mithai or sweet cutter, means that sweet cutter can be developed like this; so that what happens? After making a sweetmeat somewhere plate, then using this we can cut as per our own requirement like that; so moving finger is easier than afford to hold an knife and then do like this. So, it can give a more skillful motion; so, where more skillful motion is required but less pressure, less force, there this type of development

may be possible. So, these are some ideas we have to make it in prototyping and then give trial to have a good design.

Another thing is that when we eat some noodles type of food, then we normally use the forks; but the thing is that, it normally when you to eat, it slips off from the fork. So, if we can have a small plastic material type like this, that it can be put inside the finger and then with you can hold it using one finger; so, it will be easier to hold it like this. So, this type of product can be developed. So, cutlery to eat Chinese noodles for Indians, it is necessary, one can think of developing this.

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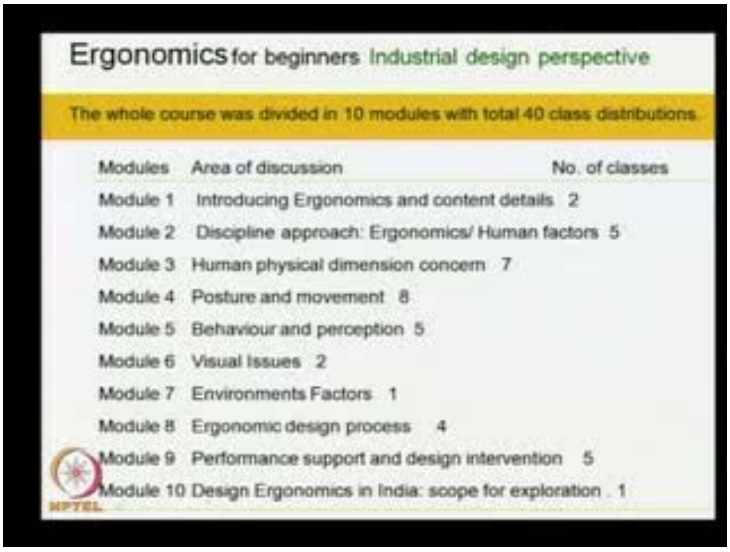

So, the ergonomics for beginners industrial design perspective, we have total 10 modules with 40 classes and these are the modules we have spread over in this course

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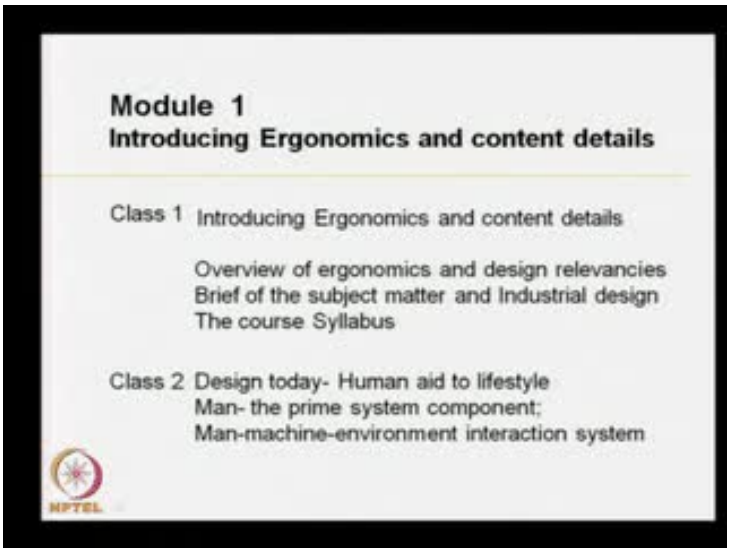

Now, the first module was introducing ergonomics and content details, where the first class was introducing ergonomics and content details where the overview are discussed. In class number 2 - Design today - The design human aid to lifestyle, man - the prime system component; man-machine environment interaction system was discussed.

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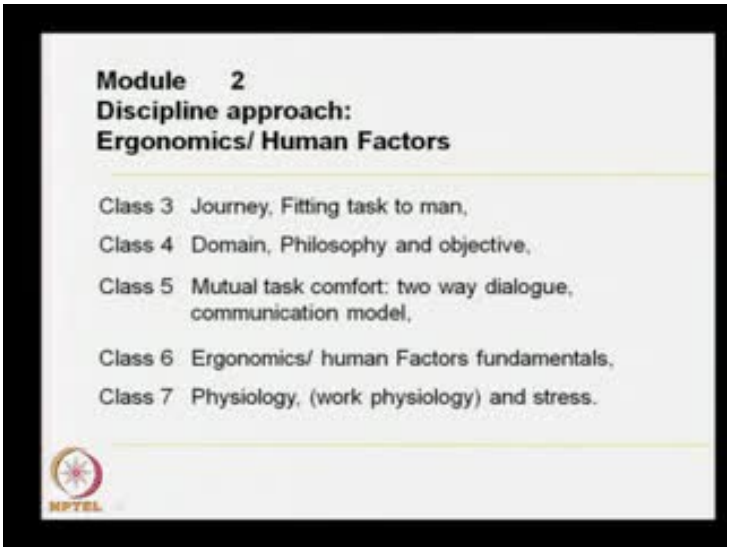

Module number 2 was discipline approach: Ergonomics and Human factors, where we have discussed journey, fitting, task to man, then domain physiology, philosophy and objectives, mutual task comfort: two way dialogue, communication model.

Class number 6: Ergonomics and human factors fundamentals.

Class 7: The physiology - work physiology and stress was discussed.

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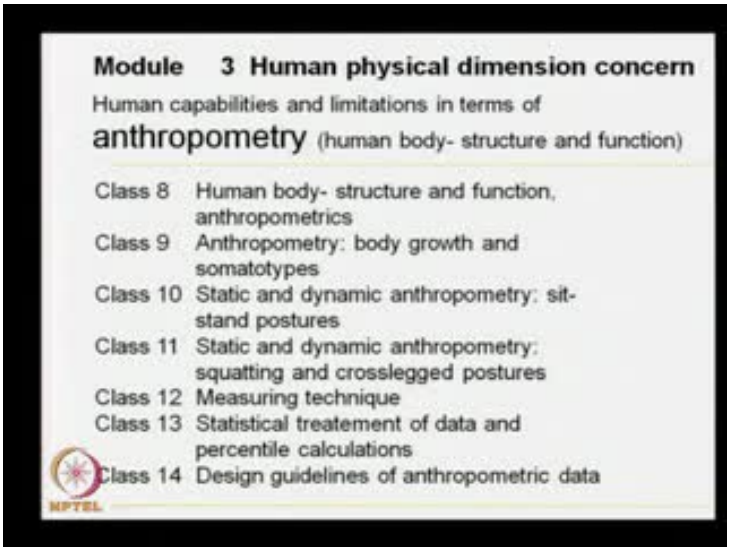

Now the module 3, where the human physical dimension concern was discussed. In there, human capabilities and limitations in terms of anthropometry, that is human body, and structure and function was discussed, within that in these courses 7 classes were there.

The class number 8 was human body - structure and function anthropometrics.

Class 9: Anthropometry - body growth and somatotypes was discussed.

Class 10: Static and dynamic anthropometry: sit-stand postures

Class 11: Static and dynamic anthropometry: squatting and cross-legged postures.

Class 12: Measuring technique.

Class 13: Statistical treatment of data and percentile calculations was discussed.

Class 14: Design guidelines of anthropometric data was discussed.

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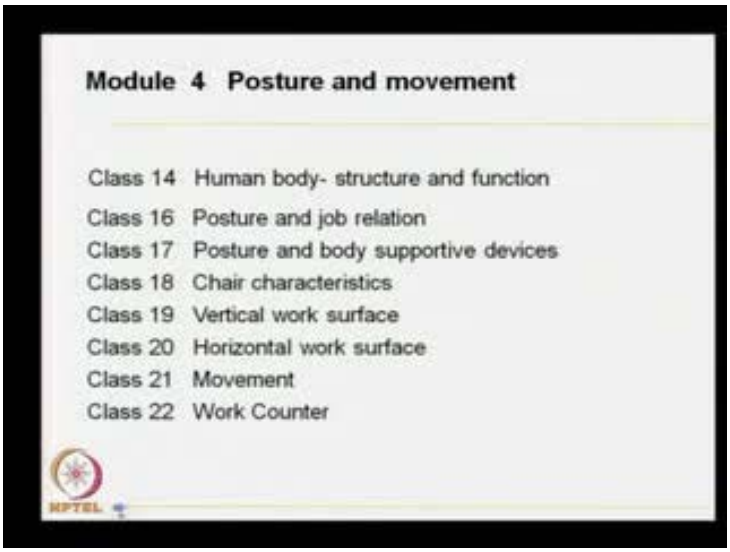

Module 4: the Posture and movement. In this Human body - structure and function, Posture and job relation, Posture and body supportive devices, Chair characteristics, Vertical work surface, Horizontal work surface, Movement human movement and work counter was discussed.

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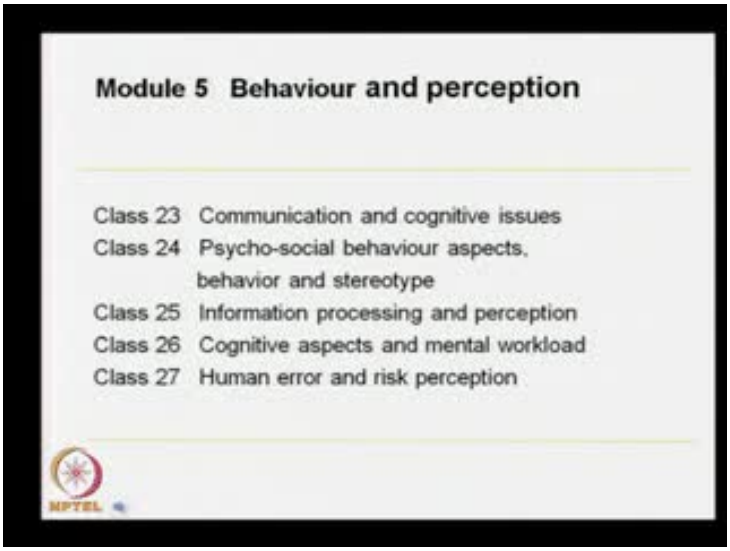

Behavior and perception - in this Communication and cognitive issues, Psycho-social behavior aspects, behavior and stereotype was discussed.

In class number-25: Information processing and perception issues.

Class 26: Cognitive aspects and mental workload.

Class 27: Human error and risk perception was discussed.

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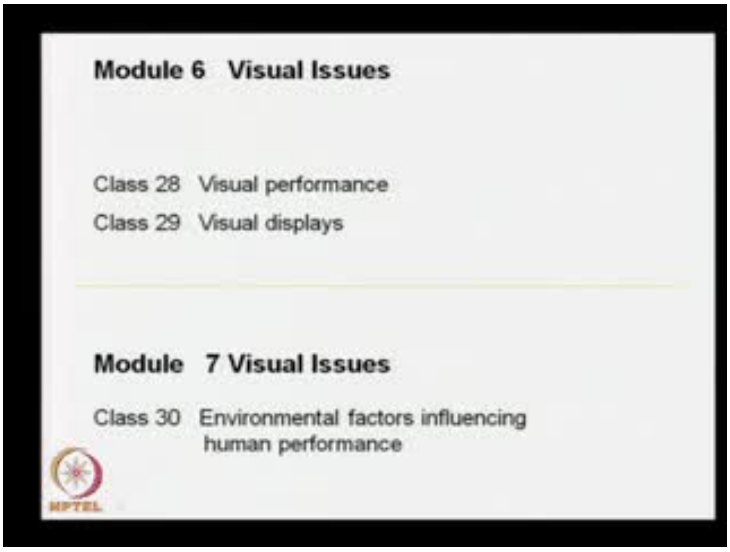

Module 6: the visual issues - Visual performance and visual displays are the main concerns in this module; module 7 - the environmental factors influencing human performance.

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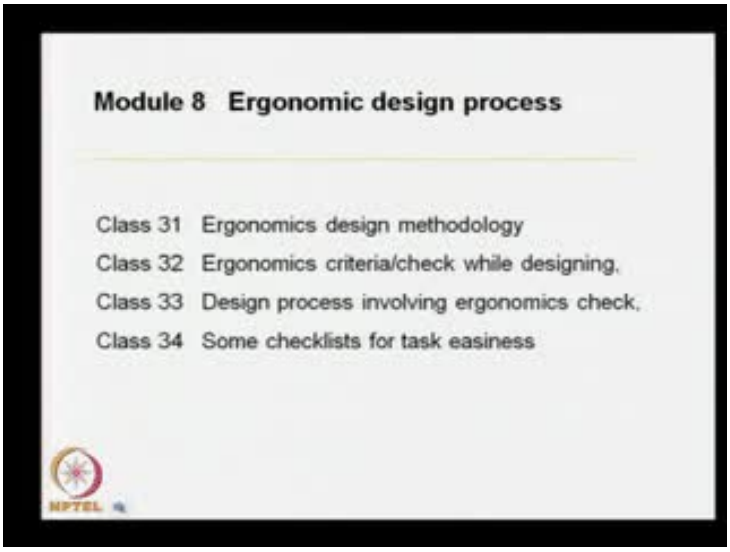

Module 8: Ergonomics design process was discussed. In class-35: Ergonomic design methodology; class-32: Ergonomics check criteria check while designing; class-33: Design process involving ergonomics check; class-34: Some checklists for task easiness was the main content

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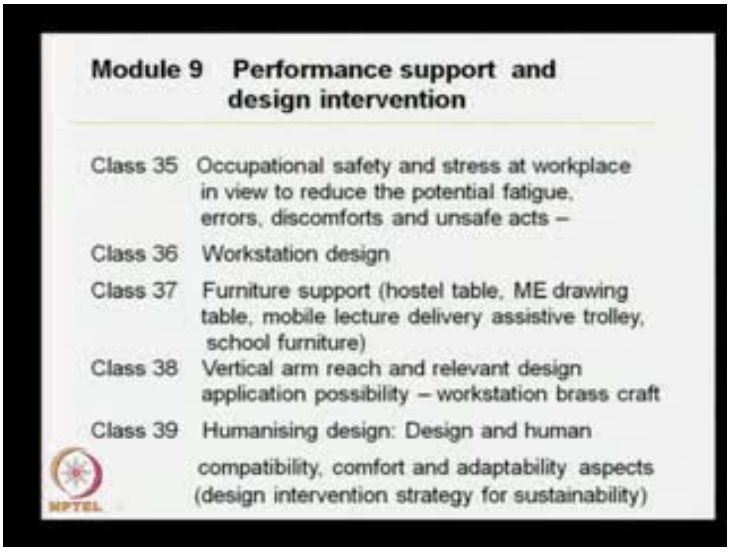

Now, module number-9 was performance support and design intervention. In this we have taken some design ideas; we have discussed through class-35 - Occupational safety and stress at workplace in view to reduce the potential fatigue, errors, discomforts and unsafe acts.

Class-36: Workstation design.

Class-37: Furniture support where you have discussed few design ideas - that hostel table mechanical engineering drawing table, mobile lecture delivery assistive trolley and school furniture designing issues.

Class-38 was Vertical arm reach and relevant design application possibilities - workstation brass.

Class-39: the last session was Humanizing design: the design and human capability, compatibility, comfort and adaptability aspects were discussed - where design intervention strategy for sustainability was main concern in that class.

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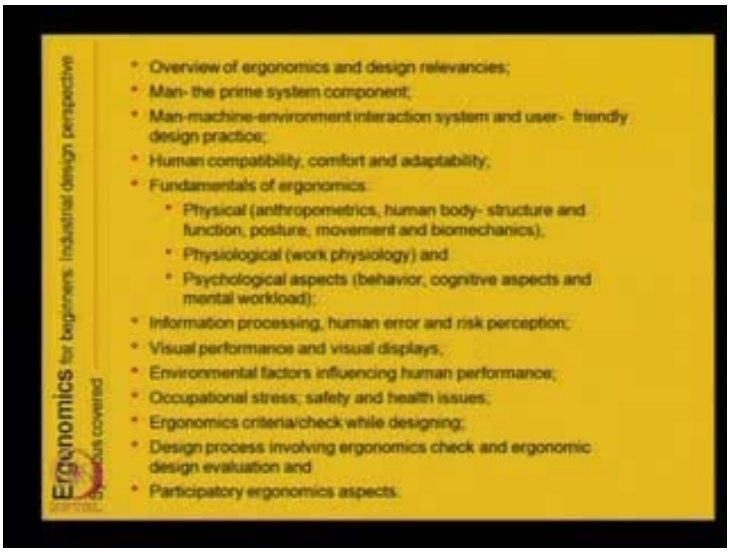

Now, the ergonomics for beginners the industrial design perspective - the total study material was covered through the syllabus with that; so the total course material was covered this area - that is overview of ergonomics and design relevancies.

Man - the prime system component; man-machine-environment interaction system and user-friendly design practice; human compatibility, comfort and adaptability; fundamentals of ergonomics: physical - that is anthropometrics, human body, structure and function, posture, movement and biomechanics.

Physiological - that is work physiology, stress was given and psychological aspects - where behavior, cognitive aspects and mental workload was discussed; this was the method.

Information processing, human error and risk perception; visual performance and visual displays; environmental factors influencing human performance; occupational stress; safety and health issues; ergonomics criteria or check while designing; design process involving ergonomics check and ergonomic design evaluation and participatory ergonomic aspects; these were the main content of this whole course. Through this, what we try to achieve? How much we have achieved? In which context we have discussed this? Where it can go?

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Now, if we see in India, state-of-the-art of centers with specific inclination of ergonomic applications and ergonomic. We can say that in Delhi, the defence institute of physiology and allied sciences, they are performed - conducted or they use this ergonomics for defensive purpose.

Aligarh Muslim University in here for that specific purpose for mechanical engineering courses; then SAIL Bokaro unit, that's for health management they issue; MRI Mine Research Institute, for mine safety purpose they use it and then national institute of design, where mostly the design aspects are concerned.

National institute of occupational health, it is occupational health issues; then IIT Bombay, under the industrial design center, the design issues are discussed and NITIE Bombay - the industrial management issues, central labour, institute labour oriented aspects, these are concerned; BHEL Thiruchirapalli, health management and etcetera are being used.

Now, specifically as a course - basic ergonomics course. So, all these whatever we discussed, it gives a specific emphasis but as a total course under physiology, Masters degree as a specialization, it starts or which offered in Calcutta university, Vidhyasagara university, Coldana university like that; there are many other institutes also using ergonomics for specific purposes.

At IIT Guwahati, what we are doing? That design deals with design technology that is bachelors, masters level input to design curriculum and also conducting the PhDs; list continues to some institutes of home sciences, agriculture engineering, etcetera and related disciplines, and some leading industries have their in-house facilities, they also use this ergonomics issues or ergonomics relevancies in their specific area.

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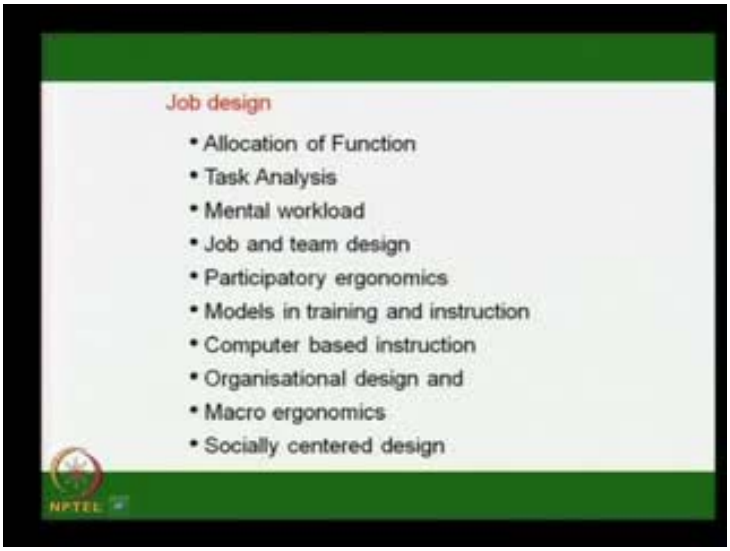

Now, specifically, we can say that how in job design area, the issues are relevant where ergonomics are being used. The allocation of function, task analysis, mental workload, job and team design, participatory ergonomics issues, models in training and instruction, computer based instruction, organizational design and macro ergonomics, socially centered design.

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Design for health and safety: there occupational risk management, work schedule and sustained performance, psychosocial approach in occupational health, manual material handling, work related musculoskeletal disorders of the upper extremities, warning and risk perception. In these issues, ergonomics principles and criteria are being used.

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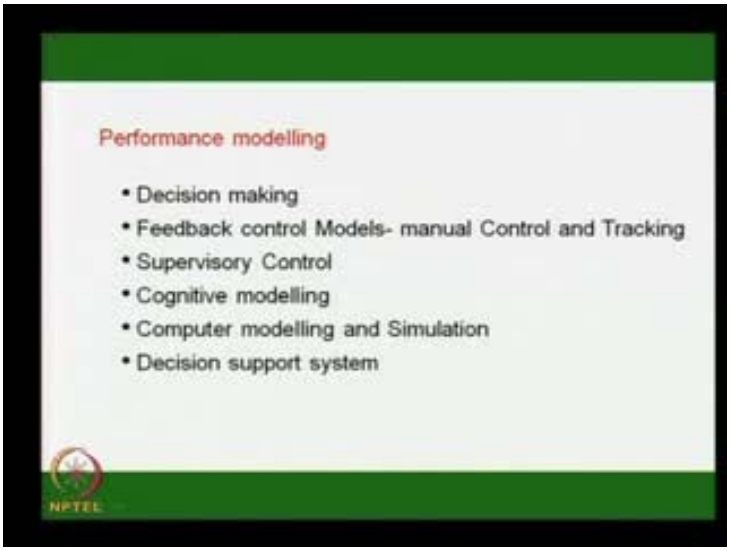

For performance modeling: decision making, feedback control models - manual control and tracking, supervisory control, cognitive modeling, computer modeling and simulation, and decision support system.

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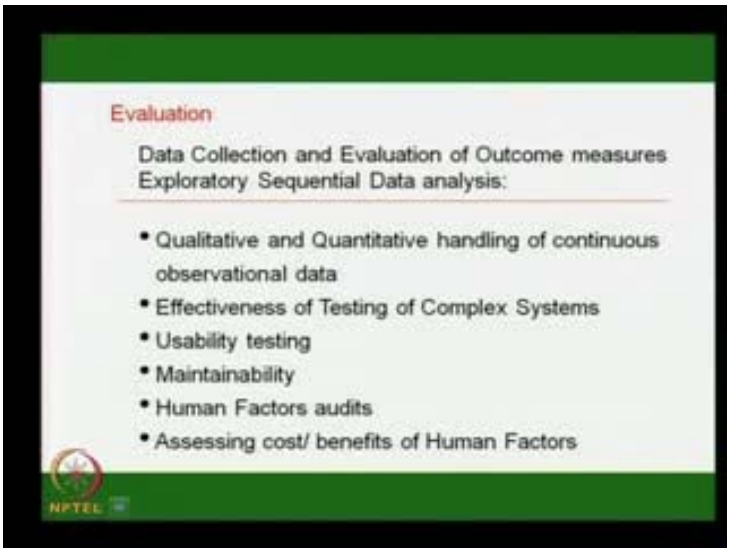

Now after designing or implementing ergonomics issues in practice, you have to evaluate this. How far is it really beneficial? So, data collection and evaluation of outcome measures exploratory sequential data analysis are necessary. There the qualitative and quantitative handling of continuous observational data is necessary, effectiveness of testing of complex system, usability testing, maintainability, human factors audits, assessing cost and benefits of human factors.

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Now, equipment workplace and environmental design: In this ergonomics are being used for visual display, controls design, non-conventional controls, biomechanical aspects of workplace design, noise - multiple noise, vibration and motion, illumination, toxicology and thermal comfort, climate and clothing, design for macrogravity and microgravity environments, architecture and interior design. In these specific areas, ergonomics principles and criteria are very helpful.

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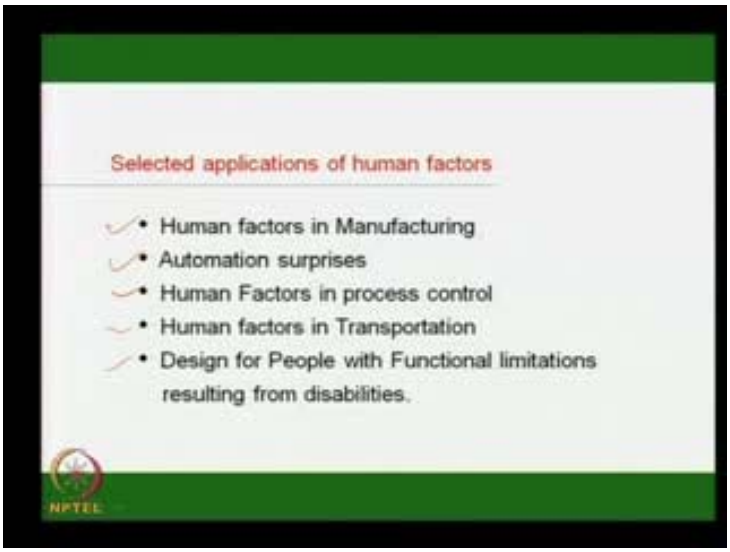

Now, selected applications of human factors: human factors in manufacturing, area automation surprises, human factors in process control, human factors in transportation, design for people with functional limitations resulting from varieties of disabilities.

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Now, with this, we can see a good ergonomic design - a good ergonomic design creates a context for experience that fully respects user's all inbuilt capabilities and acquired skills, and understands users and their requirements.

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When a usable item and space is conceived with interface matching between users' compatible physical features and how our body behaves the design would be well accepted; evaluate the match. Here, the skill of the person who is using this information is a criteria; for that, practice is necessary.

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Now, the elements of design through different treatment and applications create different identity. In this figure, the lines in background what it says? Simply we can say that it is a pregnant woman. Now, all the figures of pregnant women whatever come in our mind, it comes here; so, the real to abstract: symbolic representation of theme and essence we have to identify and if we apply, then it will give you the identity of that.

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Now, in this figure we have added this portion here. After adding this portion, what it says? It changes its identity as a whole; identity changes to a Ganesh figure, that god idol - Ganesh figure with an elephant trunk.

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So that appears here, if we give a little - just only this much portion - if we add in it like that so variously this form a so what this is an pregnant women abstract. Now just only adding this element, it changes the identity. So, where the identity lies, that information

is necessary and this is the perception. So, cognitive issues one need to concern and to study this for different application requirement.

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Another application now earlier slide we show that abstract. Now here, the exact replication of using a real object - like Gandhiji the use his figure if you see that, he keeps a watch on his lap; so, Gandhiji item to express that feeling. If this Gandhiji - ji replaced with that watch, then it gives that identity - it creates an image format.

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Continuity as operation clue: if we see it, now here what happens? it matches with the whole form; no problem. Now, when we are turning it, it changes the set continuity. Now finally, when it comes back again, it comes to close. So, if it is not tight fully - close fully or something - after seeing the image, the form - its continuity of the form, it gives an operation clue that whether this lead or cap is closed or not. So, the continuity of form shape, it gives an operational clue.

Scope for users creativity - everybody is creative. If we give a very rigid design solution, whatever good it may be, but people will try to use that as per the his own creative need, whether it fulfills that. At home, we always change our cot position and sofa-chair position because to make newness or some kind.

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If a design is made in such a way that you cannot change anything in the interior, then we are not honoring the occupants' creative nature. Here one design is showing that - here this is a metal plate made metal. So what happens? In this product it was all flat, but all has the cart marks, were there so and an instruction was given - inbuilt instruction - that how to open it; so, you can open this thing and you need to have this structure or the total structure.

Now, this holes are given here, it says that either you may hang it; if you hang it, then this can be used as a cloth hanger. Now, if you place it on a flat form, then it can be used as a cassette rack or may be some kind of plate rack kind of thing. So, the product is

same, but by giving some small features, you are telling the intended users that how the two operational modes we can choose. So this type of creative issues if we can add, then probably design will be well accepted.

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In conclusion we can say, this figure, the ice cream utterly delicious – shape, size and colour - it says, not only the material quality and quantity to taste, but colour and shape, and mode of presentation creates total appetite to accept this product.

When we're talking design it is probably to evoke good feelings with within people: feeling of comfort, love, satisfaction, etcetera. Feeling follows form: an interesting concept and anyone designing for humans should pay attention to. The emotional content of design is gaining more and more importance for design science.

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Colour, texture and form play importance roles in our life in many ways - in terms of utility and aesthetics. From this entire journey, it is clear that we can extract the basic essence of traditional elements that can easily be transformed in a context of contemporary art and design.

Various levels of input from every presence and also absence stimulate our senses and we judge and accept accordingly. These may be of utility items or items of appreciation; when these two requirements meet it comes to pleasure acceptance.

Various context specific applications of design elements; for example: line, texture, harmony, balance, etcetera makes the identity. Enough scope are there we need to explore

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Studying meaningful application of design elements in nature gives clue to use while creating man-made objects for human utility towards total trust to fulfill functional need as well as aesthetic appealing.

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Role of ergonomics in design development to establish pleasure beyond usability is the trust. Design features are not only to divulge ease of use and start safety, but pleasure of use enjoyment of the experience

Design ergonomics balances aesthetics and functionality with human compatibility features. Now keywords of the whole course can be summarized in four items - four points: design and human compatibility factors, ergonomics risks aspects of design, usability pleasure-ability and trust issues

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So with this, we can say that the whole course concentrates on design ergonomics issues, criteria and principles, context specific application, and creative ideation scopes. With

this we can say, take risk of initiating - if you win, you can lead if you loose, still you can guide. Wish you all the best for this whole course.

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So, what we are pleasing? What we need to [concern/consider] consider? Quality design through design ergonomics. So, thank you very much. I think we wish this course material - the content - will be used for developing newer products and designs and newer idea sense for our own need.

Thank you.