Human Factors Engineering

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Lecture - 31
Environmental Component in Worksystems, Ergonomic Design of Physical Environment: Basic Issues

Dear students and the participants this week is the 7th week of lecture sessions for this particular course of Human Factors Engineering we will be discussing a very important topic called Measurement and evaluation of physical environment and particularly during these lecture sessions we will be focusing on the just one type of Physical Environment. We will discuss the following in each lecture:

Lecture-1: Environment Component in Worksystems, Ergonomic Design of Physical Environment: Basic Issues.

Lecture-2: Ergonomic Design Framework for Environment, Importance of Illumination System and Visual Environment.

Lecture-3: Measurement of Illuminance, Luminance, and Contrast.

Lecture-4: Measures of Contrast, Contrast Ratio under Different Work Situations.

Lecture-5: Direct and Indirect Glare or Reflection, Illumination for Inspection and Quality Control Activities.

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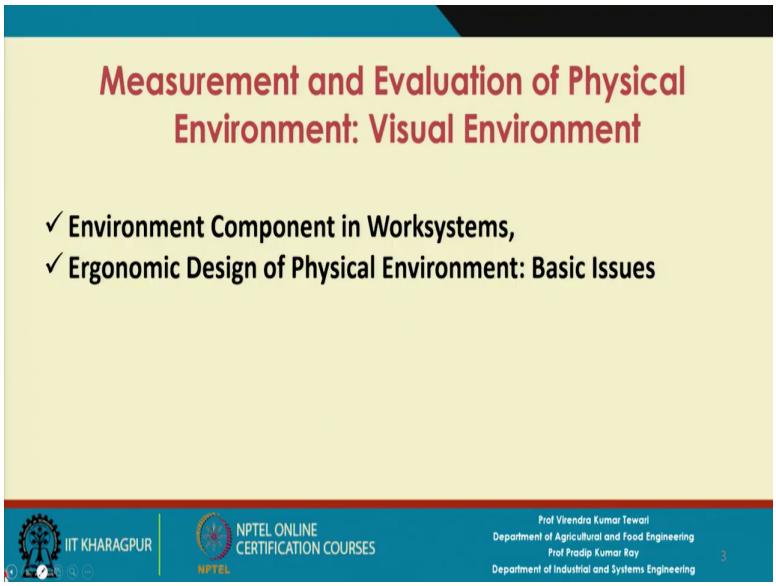

In this particular lecture session, we will be discussing environment components in work system and basic issue of ergonomic design of physical environment.

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Work system essentially have three components. Like human, the machine is also embedded in an environment. So, right now we will be focusing on environment aspects which is a physical environment. So, physical environment is considered one of the three elements of environment component of a work systems.

That means, right now we are focusing on the physical environment and the physical environment should be designed in such a way that the importance of the interaction component. So, physical environment actually influences the quality of interference.

Or quality of interfaces or quality of interaction and as we have been saying always that interface design is the key in ergonomic design. The other two elements or the sub components of the environment component- one is the physical workspace and the second one is the work organizations.

So, whenever we refer to the physical environment, there are some general issues related to physical environment. Physical work space has three-dimensional space in which a job or a work is carried out.

In simple worksystem, it may be a workplace with human moving from one location to another.

In complex worksystem, work is carried out at a fixed location and workspace remains fixed, and its dimensions to be determined.

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When we refer to the workspace dimensions or the design you specify the dimension, a number of factors you need to consider. They are as follow:

1. Machine size, shape, and dimensions

2. Human anthropometry

3. Activities required to carry out

4. Human-machine interface

5. Space for material handling devices/system

6. Machine layout including size and shape of physical sub-systems

7. Technical constraints

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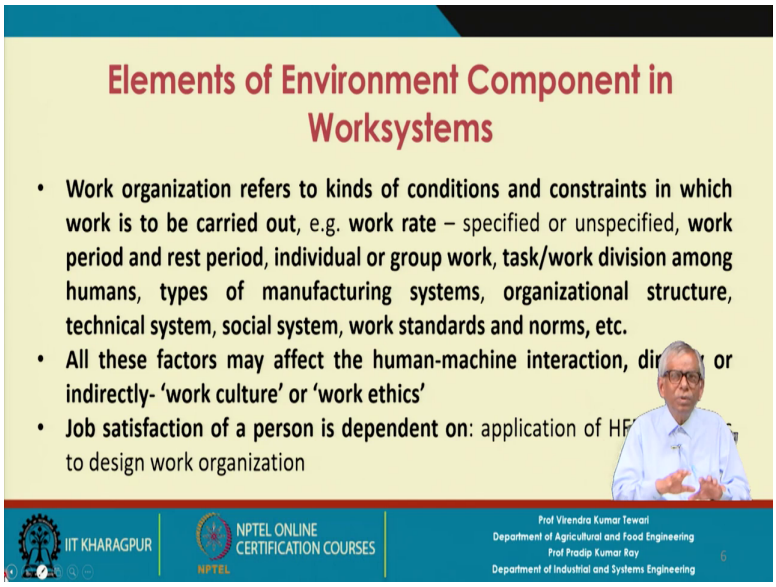

Against a particular workplace, you try to the design the workspace whenever we refer to the work organization. So, work organization refers to the kinds of conditions or the constraints, it is an organized activity.

And these ergonomic principles or human factors engineering principles are applicable while you design a job where humans are working at a workplace and workplaces are the part of organization.

So, when I work at a workplace and it is a part of the organization; it is an organized activity and whenever you say it is an organized activity; that means, certain rules, regulations, norms we have to follow. You become a part of the system. So, work organization refers to the kinds of conditions and the constraints.

It is not like living in your house, there will be some constraints, in which work is to be carried out and many works you carry out in a group, individual level you work as well as the group wise also you work, So, one particular important parameter is that work rate (specified or unspecified), in certain cases it is very difficult to specify the work rate, there is lots of variabilities.

Work period and the rest period we refer to the mural formula that is widely used, that means, suppose you continuously work for two hours, you need rest period. So, there are different norms, particularly for in the factory laws, many tasks are referred to as the dangerous operations.

And for the dangerous operations the rule says that if you work for half an hour for e.g. suppose it is an underground work and you have to work under two to three atmospheric pressures, you can continue work maximum for half an hour. So, as soon as half an hour you work you have to take rest for half an hour at least.

So, there are many kinds of the jobs that these jobs are appropriately classified, the rest period you have to determine, there must be certain rules individual or the group work, task or work division among humans.

This depends on what sort of process plan you have use for producing a particular component or the product. You have to look into types of manufacturing systems, there are three kinds of manufacturing systems- one is the continuous processing, second one is the job shop and third one is the batch production as far as manufacturing system is concerned.

Technical system, social system, work standards and norms, etc. it is a very complex issues, and everyone is affected with all these factors.

So, you have to be very careful and you have to define them clearly. You also can check whether these factors are promoting the improved performance and the interface design is perfect or not. So, it is a very you need to consider a number of complex issues all these factors may affect the human machine interaction or the interface.

And ultimately it creates the work culture or work ethics. All these factors may affect the human-machine interaction, directly or indirectly- ‘work culture’ or ‘work ethics’.

Job satisfaction of a person is dependent on: application of HFE principles to design work organization.

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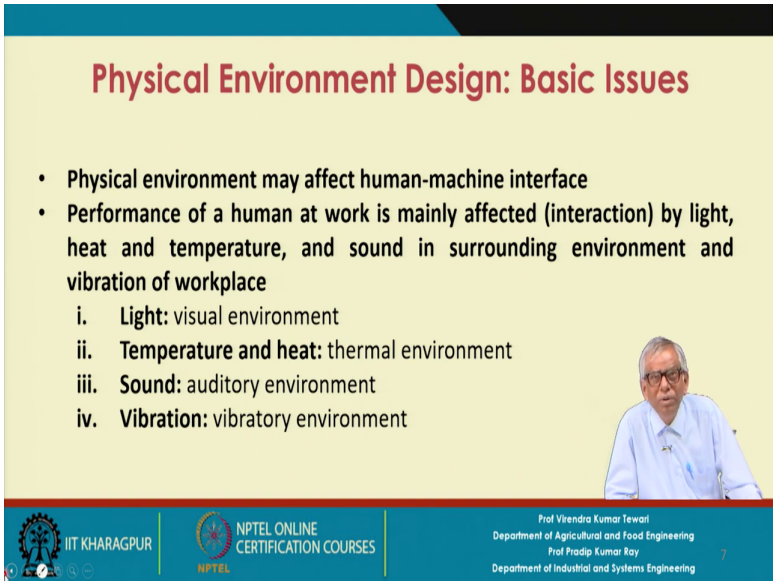

Physical environment may affect human machine interface.

Performance of a human at work is mainly affected by light, heat, temperature and sound in surrounding environment, and vibration of the workplace So, vibration cannot be avoided, So, to what extent the vibration in the workplace is affecting you and, the vibration of the workplace is a very important issue and that is why you need to design the vibratory environment,

So, there are four kinds of environments, they are as follow:

1. Light: visual environment
2. Temperature and heat: thermal environment
3. Sound: auditory environment
4. Vibration: vibratory environment

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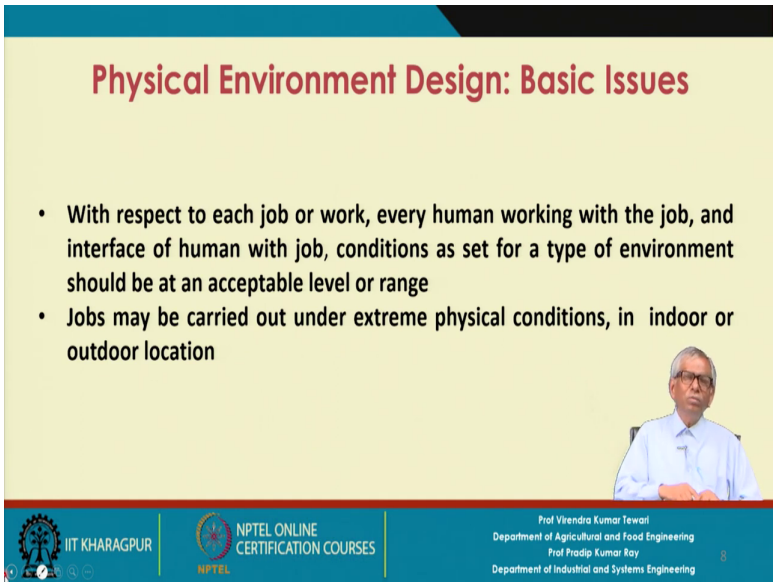
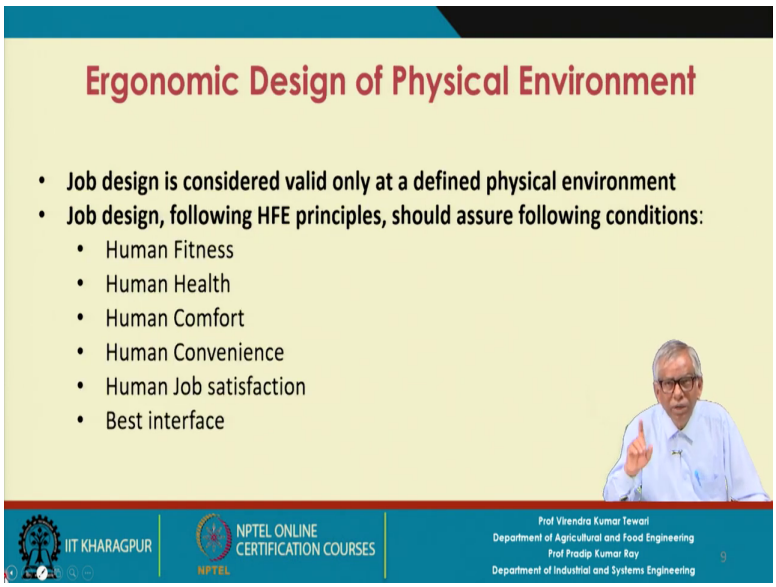


And you create all these environments in such a way that ultimately you get the best possible interface as well as you get the best possible. So, human performance with the scope for its improvement with respect to each job or work you every human working with the job and interface of human with job.

With respect to each job or work, every human working with the job, and interface of human with job, conditions as set for a type of environment should be at an acceptable level or range. Jobs may be carried out under extreme physical conditions, in indoor or outdoor location (Refer Slide Time: 26:36)



Job design is considered valid only at a defined physical environment. Job design, following HFE principles, should assure following conditions:

1. Human Fitness
2. Human Health
3. Human Comfort
4. Human Convenience
5. Human Job satisfaction
6. Best interface

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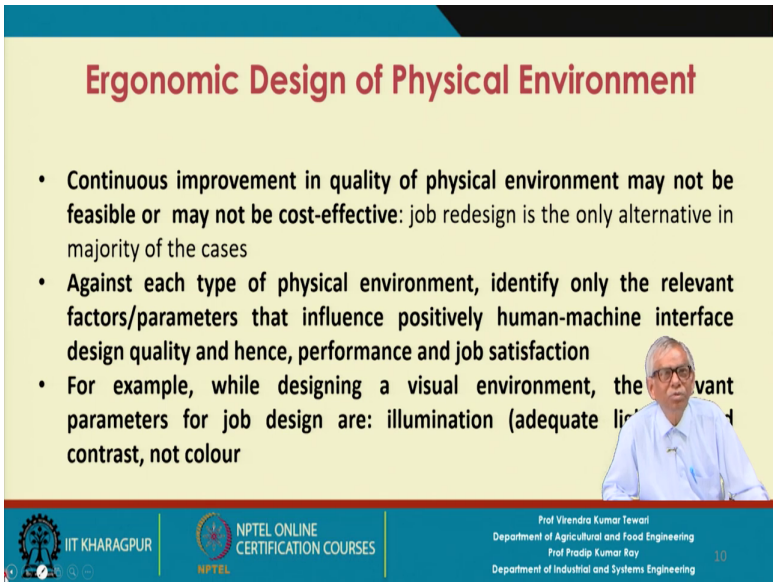

Continuous improvement in quality of physical environment may not be feasible or may not be cost-effective: job redesign is the only alternative in majority of the cases.

Against each type of physical environment, identify only the relevant factors/parameters that influence positively human-machine interface design quality and hence, performance and job satisfaction.

For example, while designing a visual environment, the relevant parameters for job design are: illumination (adequate lighting) and contrast, not colour.

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