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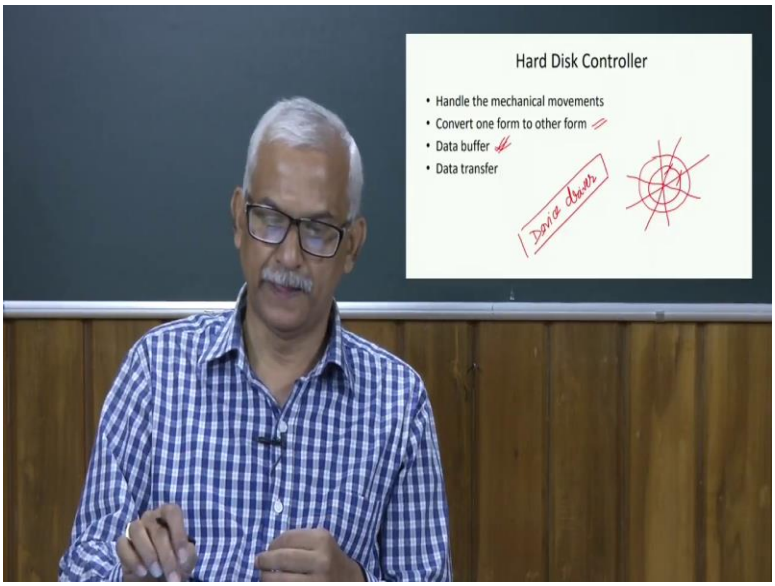

So, we have need to convert this information also from one form to another form, so from say magnetic signal to electrical signal or from electrical signal to magnetic signal. Then data buffer; now what I am saying that I am going to transport block version, what is a block? This is nothing, but the information in a particular sector. So, we are going to first collect the information and we are going to transfer it.

So, we should have some data buffering capacities also in this hard disk controller and along with that after that it should have this data transfer mechanism, we are going to transfer it from this particular data buffer to that time. So, this is the hard disk controller and to work with this particular hard disk we need a program ok. So, through that particular program we are going to control this particular hard disk controller. So that means, we need an device driver, so because for every device we need a device driver which is nothing but a software program.

So, we are going to have a device driver to control this particular hard disk controller. So, device driver is nothing but a software routine and we are going to control this particular controller with the help of disk device driver, so we are having a disk device driver which is going to control the controller of the hard disk and appropriately transfer the information from disk to processor or processor to disk. So, these are the things that we require when we are going to work with an input output devices and in this particular case we are just discussing about the hard disk, which will be used for input devices as well as output devices.

So, for input devices we are going to read file, I am going to process the information that process data again we have to store it we are going to store it in another file. So, this hard disk will be used as an input as well as output device. And these are the things required to work with hard disks so we are having a hard disk controller which is built in the hard disk itself. So, it is going to have going to control the mechanical movement and we are going to control this particular hard disk, with the software driven which is known as your device driver or disk device driver.

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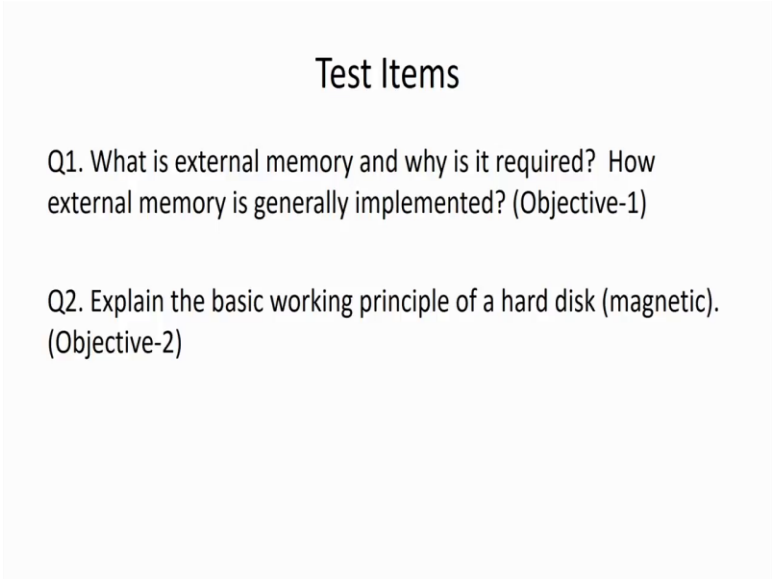

So, now that is all about the working principle of hard disk and just we are discussing in a nutshell, how it works? And how we are going to store information? And how we are going to organize the information? Now just look for some questions over here. So first question I am saying that what is external memory and why it is required? How external memory is generally implemented? So, this is basically test the time to meet the objective one, already I have mentioned that that main memory is volatile in nature to permanent storage we need this particular external memory. And how they are generally implemented? It depends specific to the devices some are of magnetic in nature, some are optical in nature, so you know that magnetic disk or CD etceteras.

Now, question 2, explain the basic working principle of a hard disk. So, if you are talking about hard disk basically I am mentioning about the magnetic disk. So, this is the design principle I am asking, so working principle already we have discussed about the design issues

of hard disk, so I think you will be able to explain these things also. So, we are meeting this objective 2. Now question number 3 how is data organized and accessed in a magnetic disk? I think we have explained it. It is a sector, track, and surface.

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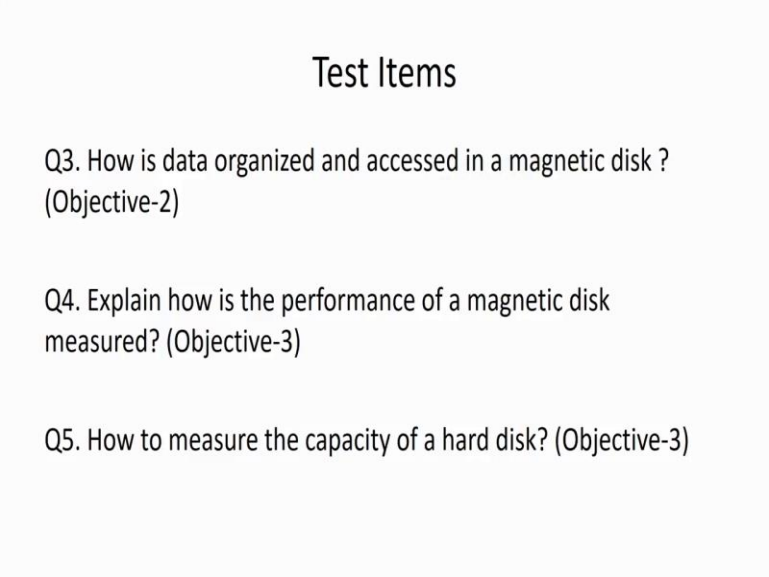

Explain how is the performance of a magnetic disk measured? So, this depends on the data transfer. How to measure the capacity of a hard disk? So, again you just see how we are going to measure a capacity of a hard disk; we know the number of track, number of sector, number of surface and the block size depending on these things we can calculate the capacity of the hard disk. How performance of a magnetic disk is measured. It is basically related to the time required to the transfer a information. Now I think when we discussed about the addressing format I have mentioned something that we are having two format.

Now, again I said that effect of performance; now either we can use this particular format, or in this particular format. Whether does changing the format addressing format whether it is going to have some effect of performance? You just see when I am talking about sector number, surface number and track number, in that particular case what will happen? I am reading complete information of a track. Then after completion of this particular track we are changing the surface number; that means, from surface 1, we are going to the surface 2.

So, when we are going from surface 1 to surface 2; you just see this is a switching only; I am changing the head, now these things read write head number from this particular read write head to this particular read write head. So, this is only a circuit switching. We are having a

circuit to just make it out and make it on, so it will hardly take any time. So, once you complete all the surfaces of that position; that means we are reading the complete cylinder. Once we read the complete cylinder then we are going to change the track number. So, we are moving the read write head.

So, this is a mechanical movement it will take time. So this is the way we are organizing our data and we are transferring it. Now second format you just see; first sector numbers, I am completing all the sector of a track. Then after that what will happen? I am changing the track number. When I change the track number from this track I am going to the next track, then there is a movement; mechanical movement.

So, for every track we are moving it, so it is having a mechanical movement. So, changing of track is going to take slight time ok. So you just see that I am changing it after completion of all the track, now I am changing a surface now which is nothing but a electrical switching only. So, here you just see that a more number of movement of the head, so it will take more time. So, this particular format is going to take slightly more time when we are going to access the data from the disk. So, performance is less over here because access time is more now after completing every track there is a mechanical movement.

But in this particular first format we are avoiding this particular mechanical movement; movement of the head after completion of one cylinder we are changing this particular head. So, you can now understand we are reducing the number of mechanical movement over here, so that'ss why this is going to give me a slightly better performance. So this is the things that what we are having about question 4; explain how the performance of a magnetic disk measured ok. So, this is basically you have to find out those particular component seek time, rotational delay, and transfer rate; transfer rate depends on the rotational speed of our ok.

Now, with this I am coming to the end of this particular module input output subsystem. So, we have discussed about the input output subsystem, we have seen that there are three ways of transferring information programmed I/O, interrupt driven I/O and DMA. Along with that I have just discussed about one particular storage device, how we are going to store information, and how it is become permanent and what is the organization of this particular hard disk.

So, once you understand the organization of the hard disk I think if you slightly go through the text book you will understand how we are storing information in our optical disk or CD.

Because you are storing mechanism is optical, but other addressing and other format we will almost remain same because you have to identify the start of a sector. So, to discuss this particular input output subsystem we have divided the modules into 4 units.

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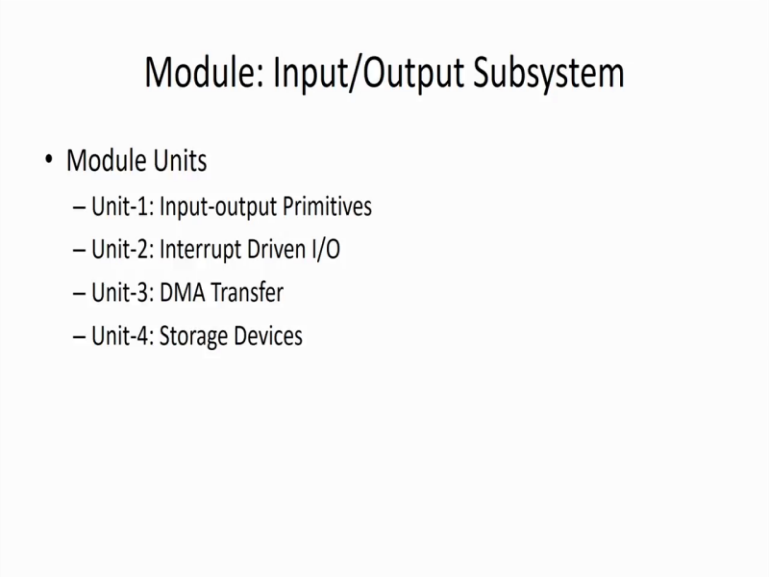

So these 4 units are basically like that, first unit is input output primitives, unit 2 is interrupt driven I/O, unit 3 is DMA transfer and unit 4 is your storage devices. So, this module we have addressed with the help of this particular 4 unit. And in every unit I am giving some test item and question to see what are the concept that we have learned in that particular unit. Now after combining those particular unit or if you look the objective of all the units I think we have achieved the objective that we have cited at the very beginning for this particular module input output subsystem. So, again I am just citing it what are our module objectives that we have cited.

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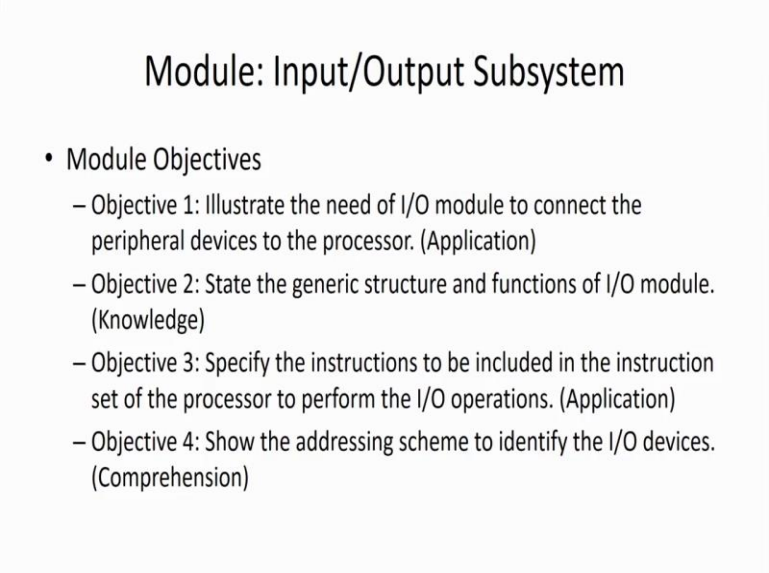

So, objective 1, we said that illustrate a need of I/O module to connect peripheral devices to the processor, it is in the application level, I think now you have idea why we need that I/O module? Why we are directing or connecting all the devices. Objective 2, state the generic structure and function of the I/O module, thus in knowledge level we have discuss it that what are the components that we have and how it is going to interface the processor with the I/O devices and how transfer takes place.

Objective 3; specify the instruction to be included in the instruction set of the processor to perform the I/O operation. So, we need some I/O instruction, already I have discuss it. We are having two ways of mapping it; memory mapped I/O and isolated I/O. So, for that we need instruction and we have said in which cases we need separate instruction, in which cases we can use the same sort of memory read and memory write operation. Objective 4; show the addressing scheme to identify the I/O devices, we have explained it I think in unit 1 itself because after giving the addressing scheme then we have discussed about the programmed I/O techniques.

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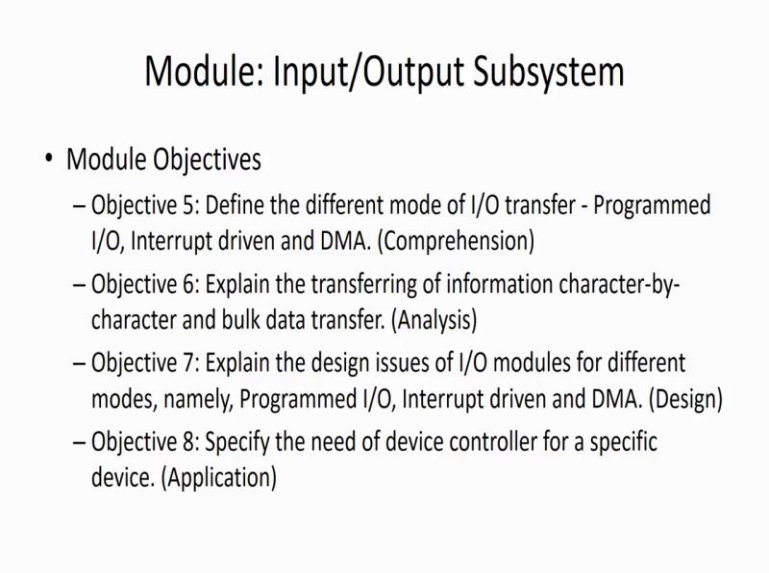

Objective 5; define a different mode of I/O transfer like programmed I/O, interrupt driven and DMA. So, in comprehension level we have discussed those things, objective 6; explain the transferring of information character by character and bulk data transfer. So this is in the analysis level, we have seen if it is basically DMA when we are going to use DMA, when we are going to look for a bulk data transfer but for character by character it may be your programmed I/O, and interrupt driven I/O.

Objective 7; explain the design issues of I/O modules for different modes namely programmed I/O, interrupt driven, and DMA. So, it is in the design level and I think we have explained about the design issues and I have mentioned that since we have discussed about the design of the control unit of the processor which is a more complex one. So, by knowing those particular design issues of the control unit of our processor these are very simple one; you can follow the same similar approach and you can design this particular control unit also.

Objective 8; specify the need of device controller for a specific device. I think we have mentioned about the device controller for your hard disk like that for every devices we need a device controller and this device controller will be controlled by a device service routine. So, whatever objective we have cited at the very beginning of this particular module I think we have met this particular objective after going through the units of this particular module.

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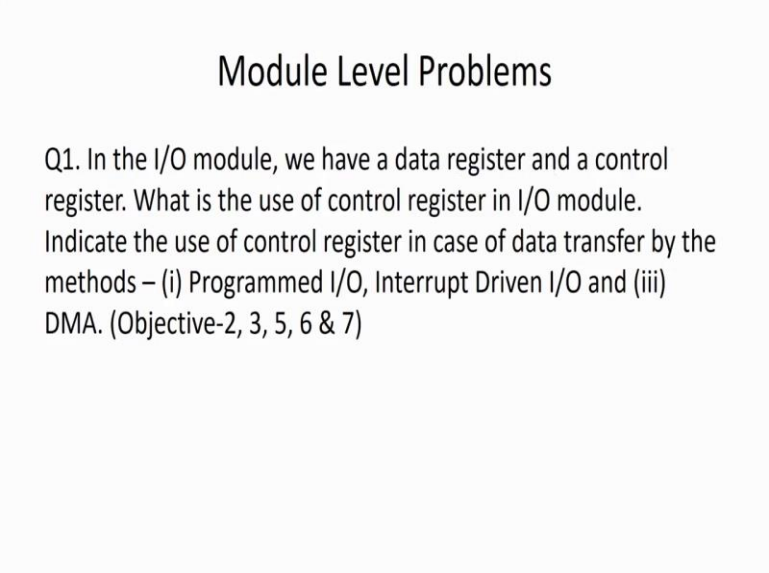

You just see we are having in some module level problems; let us see now to solve this particular program, we need the knowledge of the entire module; that means, we need the knowledge of those particular 4 units. I think very simple question I am putting over here so that you can visualize it; it's a question 1, what I am saying. In the I/O module we have a data register and a control register.

What is the use of control resistor in I/O module? Indicate the use of control register in case of data transfer by the methods, programmed I/O, interrupt driven I/O, and DMA. So, if you can able to solve these things and to solve these things we have made the objective 1, 3, 5, 6, and 7. So, these are the objective already I have cited over here. So, you can solve this particular problem basically you are meeting the objective those particular objective.

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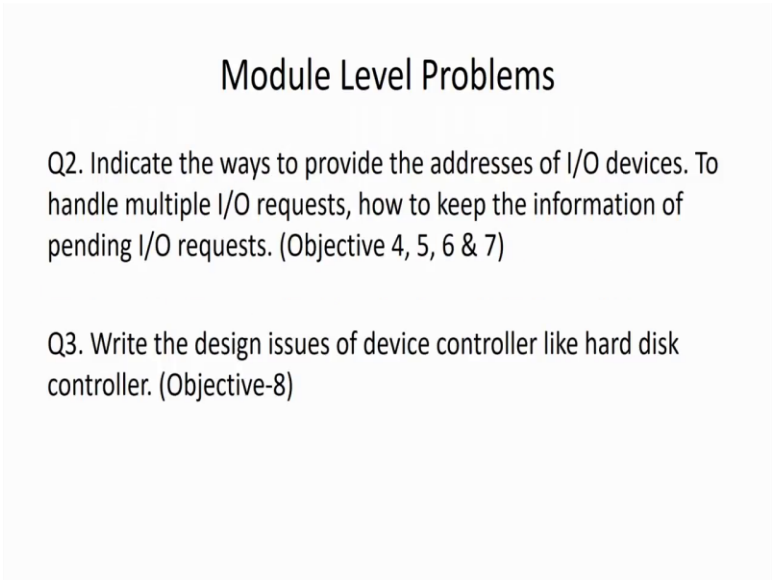

So, similarly question 2 I am saying that indicate the ways to provide the address of the I/O device. To handle multiple I/O requests, how to keep the information of the pending I/O request. So, already we have discussed it how to handle multiple interrupts or multiple I/O devices. Sometimes we have to assign priorities, so we have to maintain everything, so for that we have to design the appropriate controllers. So, if you can able to do this thing then we are meeting the objective 4, 5, 6, and 7.

Question 3; write the design issues of device controller like the hard disk controller. Now we have discussed about it I think this is a simple question I am giving just see what are the design issues that we have. Basically when we are going to design the controller for hard disk at least you should have mechanism to move the read write head, you should have mechanism or you should have a motor to rotate the platters and all those things need to be controlled appropriately by a control logic, so this is the issues that we are having.

And if you can do this thing; that means, you are meeting the objective. So, with that we are coming to the end of this particular module input output subsystem and if you now go to the study material that already we have mentioned in the module learning strategy I think you will be able to understand and I think you will able to grab the need of input output subsystem. And what are the functionalities of those input output subsystem. So, with this I wind up here today.

Thank you very much.