Computer Organization and Architecture: A Pedagogical Aspect

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Lecture – 33
Input-Output Primitives

Hello everybody welcome back to the online course on Computer Organization and Architecture. So, in the introductory module we have discussed early.

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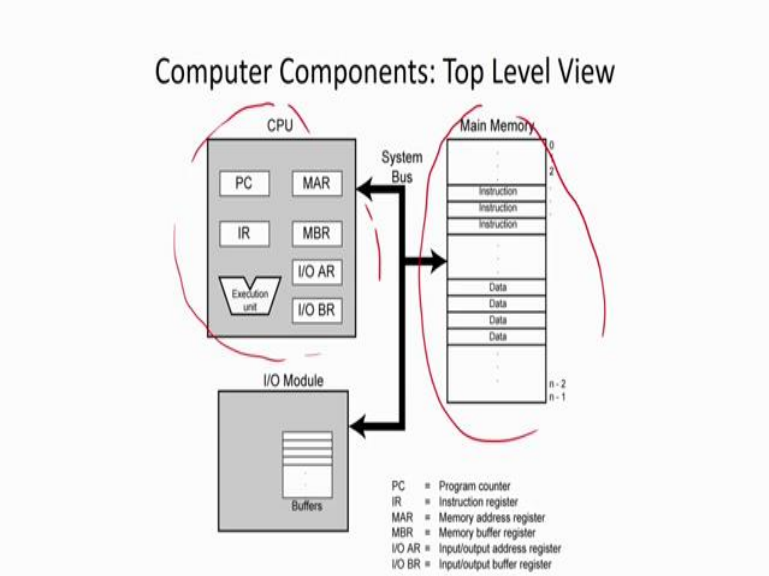

I have shown you that mainly in top level you can see the computer component as follows; we are having the CPU or a central processing unit which is the main component and main processing element of the computer, computer works on Von Neumann stored program principle. So, for that we need the memory unit ok.

So, till now I think we have discussed about the design issues of processor and we have seen how we are going to connect the main memory to the processor, what are the issues related the memory? Today we are going to look for the other component; that I/O module, basically we are going to see how we are going to connect input output devices to computer. So, this module is basically input/output subsystem.

So, in this particular module we are going to discuss about the issues related to input output devices and how those devices will be connected to the processor and how it works.

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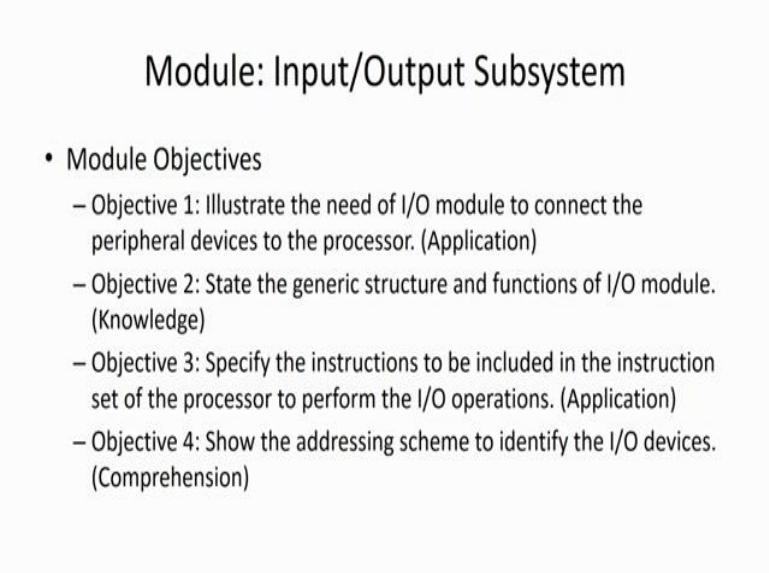

So, as usual now we are going to see what are the objective of this particular module? So, we are going to meet some objective. So, first objective I have mentioned it like that, illustrate the need of I/O module to connect the peripheral devices to the processor. So, this is the objective and we are going to touch it in application level. Objective 2, state the generic structure and function of I/O module.

So, this is in the knowledge level and we will touch, we will see what is the structure of the I/O module and what are the functions of that particular I/O module? Objective 3 specify the instruction to be included in the instruction set of the processor to perform the I/O operation.

So, this is in application level, we are going to see what are the instruction that will be needed for I/O operation. Objective 4; show the addressing scheme to identify the I/O devices. So, there have been lot of input output devices connected to the processor. Now how we are going to identify those devices and basically what is the addressing scheme for those particular devices. So, this is in comprehension level.

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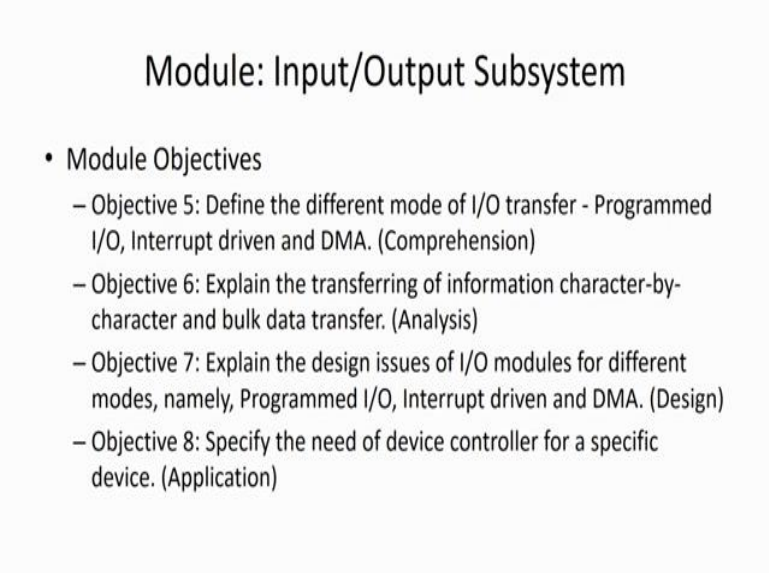

So, next objective is your objective 5; define the different modes of I/O transfer programmed I/O, interrupt driven and DMA. So, you having several ways to transfer operation and basically we have three modes. So, these are basically programmed I/O interrupt driven and DMA. So, we are going to elaborate these things.

Objective 6; explain the transferring of the information character by character or bulk data transfers. So, if we are transferring information character by character like from keyboard OR, how to transfer information in a bulk, so from one device to the other device.

Objective 7; explain the design issues of I/O module for different modes; namely programmed I/O, interrupt driven and DMA. So, these objective is in the design level. Now we are going to see what are the design issues for these three kind of transfer mode. An objective 8 specify the need of device controller for a specific device. So, for every device you will have a device controller. So, here in application level only we will see will specify what is the need of those particular device controller. So, as usual this module input output subsystem is divided into 4 units.

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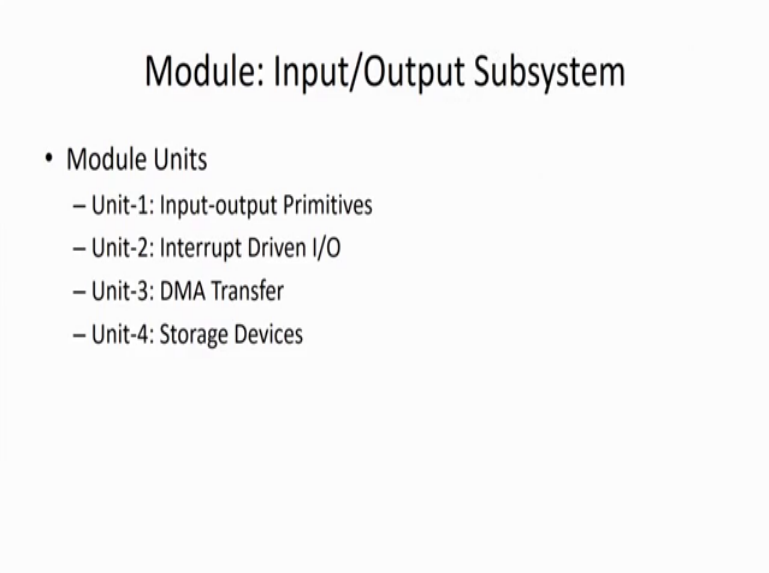

So, the module units is; so, the module units for this particular module are, unit 1 input output primitives, unit 2 interrupt driven I/O, interrupt three or unit 3 DMA transfer and unit 4 storage devices. So, basically we are having this particular 4 units.

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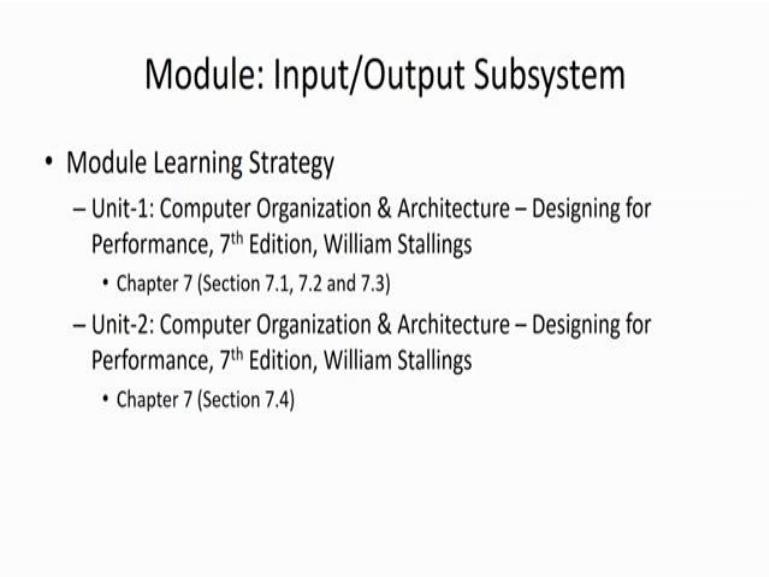

Now, what is a module learning strategies? Basically what are the resources or what are the reference material for this particular course, for this particular module. So, for unit 1 we are going to use that same book Computer Organization and Architecture design for performance by William Stallings. So, you need to look for the section 7.1, 7.2 and 7.3 of section chapter 7.

For unit 2 we are going to use the same reference book of same chapter. So, basically you need to look for section 7.4 of chapter 7 of this particular book.

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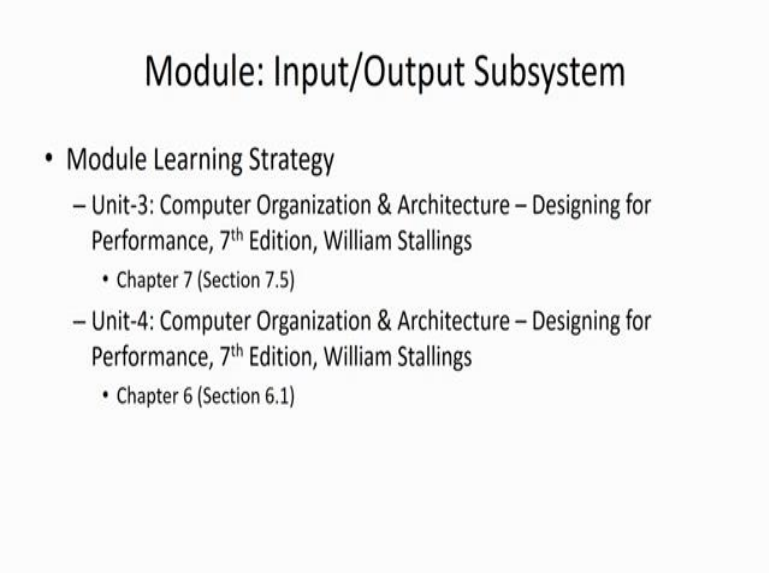

For unit 3, this is the section 7.5 of chapter 7 of the same book and for unit 4 this is the same book that we are using Computer Organization and Architecture Designing for Performance by William Stallings and for that we are going to look for the section 6.1 of chapter 6. So, these are the reference material that you can look into it, you can go through it to for better understanding of this particular course.

So, for this module input output subsystem. Now we are going to start the first unit and unit 1 is your input output primitives. So, the objectives that I have defined for this particular unit is as follows. So, objective 1; illustrate the connection of I/O devices to the processor through I/O modules.

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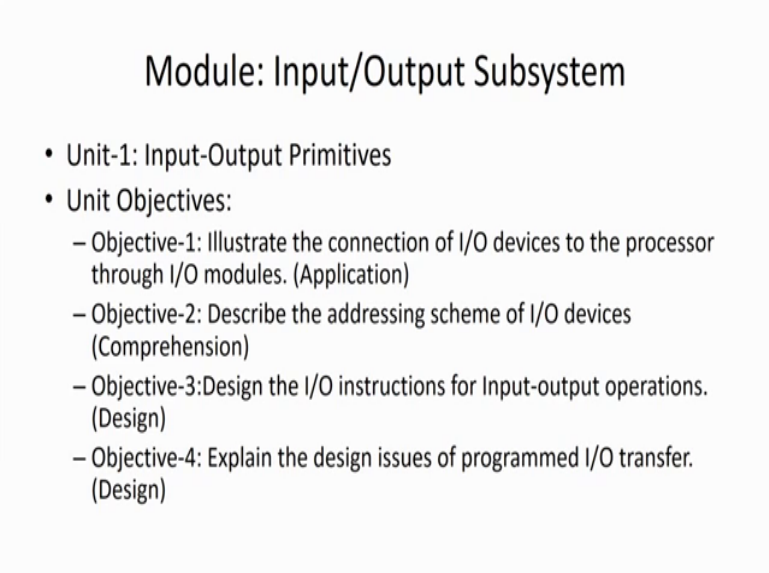

So, this is an application level. Now we are going to see how that I/O devices will be connected to the computer through the I/O modules. Objective 2 describe the addressing scheme of I/O devices. So, we are going to meet this objective also. So, how to specify the address of that particular device; objective 3 design the I/O instruction for input output operation.

So, basically what will happen, when we are going to design a processor in the instruction set you need to give some instruction to handle the input output devices or basically to perform the input output operation on those particular devices. So, for that what are the instruction is required. So, we are going to explain those things and we are going to give emphasis on that and object 4 explain the design issues of programmed I/O transfer. So, this is in a design level.

So, I have mentioned that there are four ways, three ways to transfer information. So, we are going to discuss about the programmed I/O transfer and we are going to meet this particular objective.

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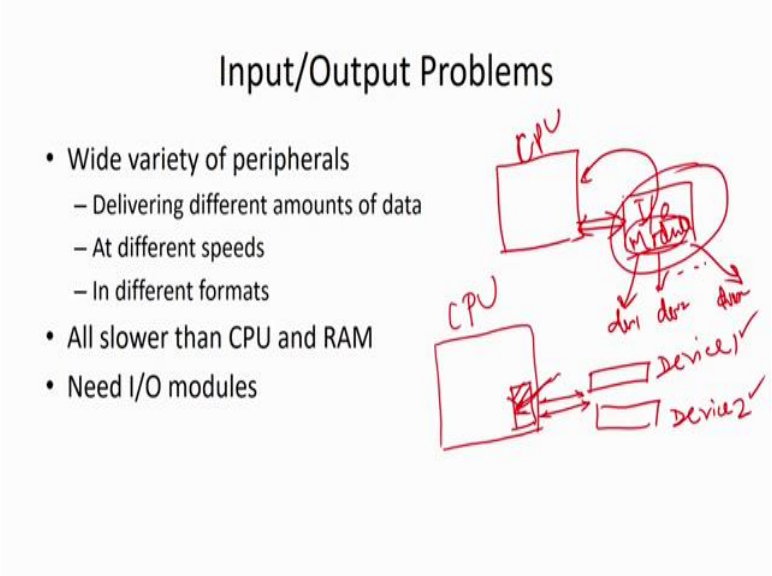

Now we are going to discuss about the input output subsystem; first of all let us see what are the problems involved in this particular input output devices. So, basically if you see that we are going to get a wide varieties of peripheral devices. So, these are different peripheral devices you are going to connect. So, you can see that we are having keyboard, we are having mouse we are having printer, monitor, hard disk, CD drive all those things. So, these are having a priorities of your devices.

So, those devices are not uniform at all, they are having different data format, they are delivering the, data at different speeds. So, again the speed matters, because if we are going to connect the slow devices to the processor, then we have to synchronize that particular slower devices. If the format of the data is different then we have to bring it to a uniform format. So, all those issues are there. So, for that we are having some problems that is why you have to need to look for this particular handling I/O devices.

And basically already I have talked about the speed and all are basically slower than CPU and RAM. Already we have mentioned that CPU is the faster one than the RAM, RAM is slower than CPU whereas RAM is the primary memory or the storage unit. When we come to the peripheral devices or input output devices they are much slower. It is not only electronic devices, but still they are having mechanical component also, we have to have the, we have to consider the movement of the mechanical component.

So, as for example, I think most of you have used the dot matrix printers. So, when you are using dot matrix printer we have to print the character by character and for that we have to move the head. When we are moving the printing head you just see that, it is having a mechanical movement. So, we having mechanical component. So, you have to control those mechanical movement also and when you are going to control this mechanical movement, it becomes slower.

So, since we are having a varieties of devices, they transfer the information at different speed, the working principle if is different for that we need this particular I/O modules input output module. So, what basically we are doing say, if you consider that this is my processor CPU; then what will happen? Directly I can connect the devices ourselves. This is device 1, so this is device 2.

So, if you follow this particular connection or say design procedure then what will happen? To control those particular devices all the control circuits for those devices need to be included in the processor itself. Since we are having varieties of devices, so this circuit will become more complex and it will become bigger and bigger, because you have to get to all the peripheral devices.

So, instead of pushing it inside this particular processor. So, why this, what are the design methodologies we are following. So, we are having this particular processor CPU, then we are connecting this particular I/O module to system bus and all the devices we are connecting to this particular I/O module. So, to perform those particular say device 1, device 2 like that device n. So, their functionalities are different, formats of data is a difference.

So, all those things will be handled by this particular I/O module and finally, this I/O module is going to transfer the information to the processor. So, that. So, I we need the I/O module we cannot put everything inside the processor, then the design issues of processor will become very complex. So, we are simply being, bringing it out from the processor and putting it 1 unit called I/O module. So, this is the need for the I/O module.

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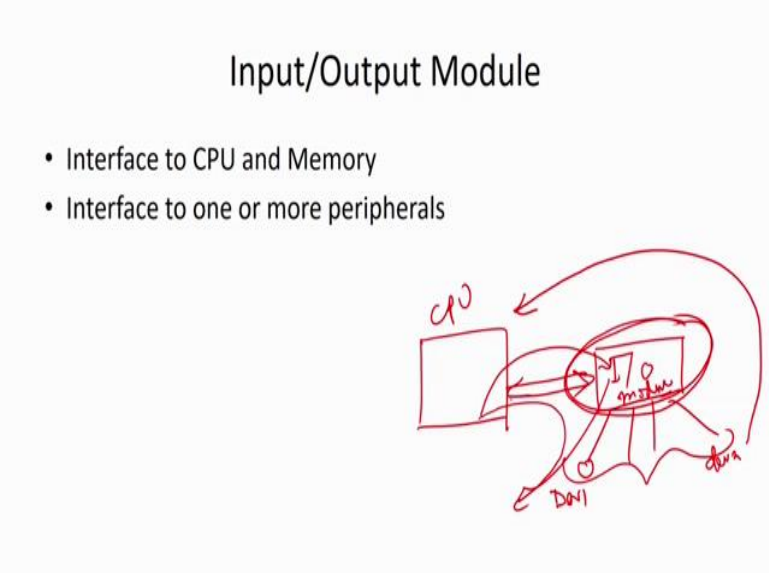

So what, that I/O module does this is nothing but an interface to CPU and memory and interface to one or more peripheral devices. So, we see what will happen, already I have mentioned that this is the processor CPU. So, you are connecting the I/O modules to the processor and to it we are connecting the devices and this is my device one, this is my device n. So, now, this I/O module can now connect or it can get service to more of the, more number of devices and after that it is going to just work as an interfacing unit between your processor and devices. Well we are going to transfer information from devices to processor. Then what will happen that I/O module is going to collect information from this particular devices, then I/O module will transfer it from this buffer of the module to the processor.

So, when we want to transfer something to the output devices, I/O module is going to take the information from the processor and finally, I/O module will transfer it to the output devices. So, this is act as an interfacing between processor and I/O module.

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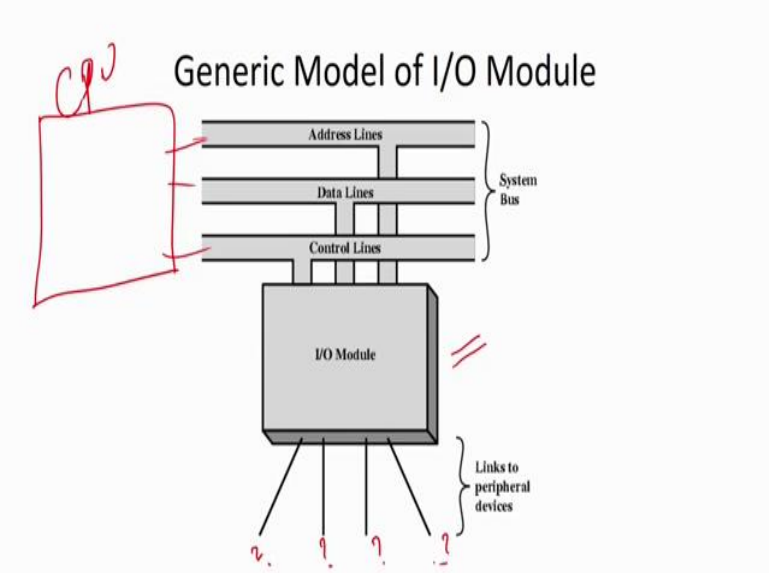

So, this is the way that you can think that this is where you are having the system bus. In system bus we are having three component address bus, data bus and control bus. So, this system bus now we are having a processor. Now this CPU is connected to this particular system bus and through this particular system bus we are connecting this particular I/O module. And to this I/O module now we are going to connect several devices.

So, the I/O module is going to act as an interfacing between my input output devices and the processor, and it will be connected through this particular system bus. Now, what are the external devices that we are going to connect? So, the external devices now we can say one part is your one category is your human readable, so that we can at least read it or we can understand what basically happening through the computer.