Functional and Conceptual Design
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Lecture No. 10
Laboratory Exercise – 2

I gave you a brief introduction in the last class. How do we do these experiments in all the classes? We will be following a common format of course the contents of what would be the actual work will be doing maybe slightly different, but in general, you will be having a common format. So, you will be seeing a product on the table. So, I hope you are actually following that group number 1, 2, 3, 4 etc.

So, there will be a product on the table and there will be tool boxes available in case there is a need for a toolbox, toolbox also will be provided. So, what we are going to do today in the first class, we will be just looking at a product that is given to you. The first thing, you will be seeing the product.

And if there is a product in working condition, the TA will show you the working of the product or he will explain to you what the product is doing, what is the main function of the product and what are the things that you need to know about the basic functioning of the product. So, that is the first thing TA will explain to you.

And then you need to look at the product, make a rough sketch of the product, whatever you can actually see, whatever you can identify, prepare a rough sketch of the product. And then as a group, you need to look at what is the evolution of that product. So, here you will not be doing a lot of survey or research, but basically you need to know what is, how the product evolved over a period of time that should be there in your report.

So, as a group please discuss it and then make some notes in your notebook about what was the first product and then how it actually evolved over a period of time, very briefly. And after that identify the tools that you need to start the exercise. Identify the tools, what is needed such as screwdriver, cutting player or spanner whatever is needed identify and make sure that the tools are with you.

And then note down what are the tools you need. And after that you need to start the dissection procedure. So, as I told you in the last class, you will start with the top cover or whatever it is and then make a note of it. What was removed? And if there is a name, you just give a name to that. Otherwise, you put the number sticker on the top of it so that, you know, which was the first one you removed and how many screws and how many nuts you removed.

So, whenever you remove a screw or a nuts, please put it in a basket or in a container given to you, a small container will be given to plastic one to put the all the screws in that one and then do this exercise one by one, sometimes you will be removing a whole assembly and then removing the parts. So, whatever you are doing please record what you are doing and then make a note of it. I want all of you to record this.

Do not give this to someone else and then just watch what he is doing. I want all these details in your notebook. And then each part when you remove, you identify the parts and then make a rough sketch of it. Look at what they manufactured, what is the method by which it was manufactured, what is it, what is it doing in the product? So, all those things need to be recorded.

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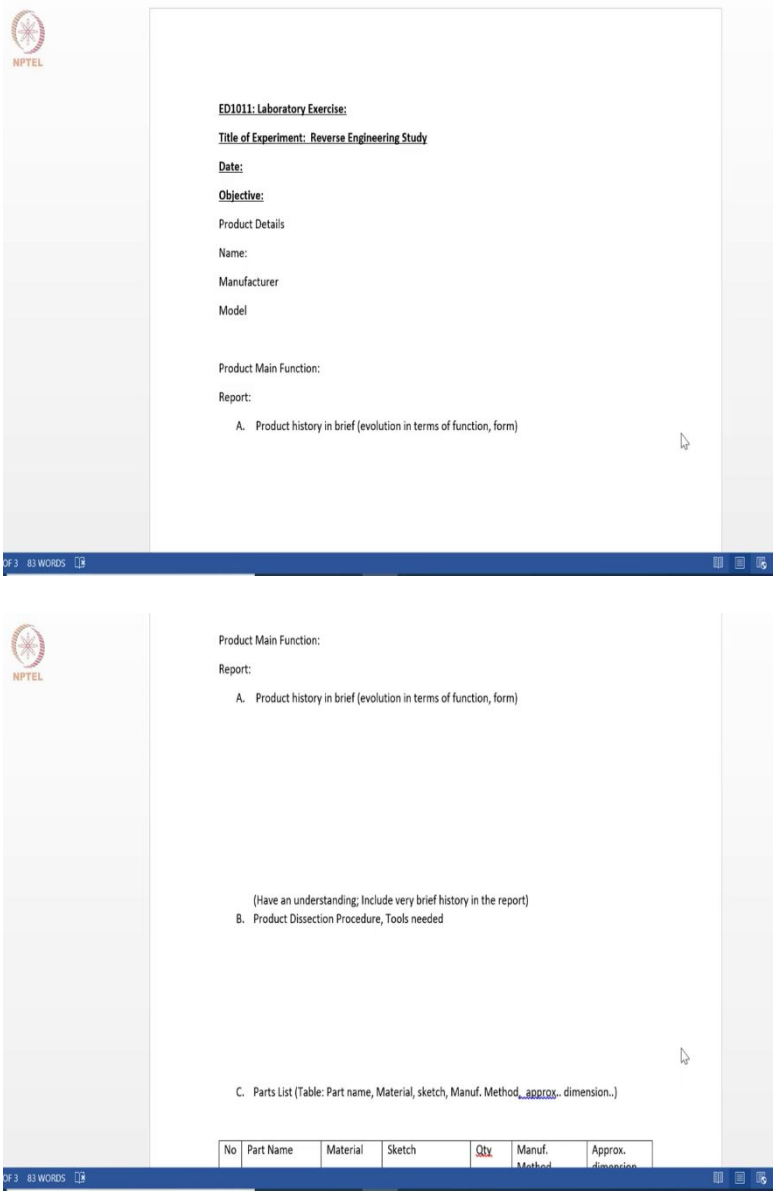

And then you need to prepare a report like this. So, in this report, you have a few things to be added to as you can see. The parts list, the part name, material, a rough sketch, and how many quantities are there in that particular product whether it is screw 4, two covers or whatever it is. What are the manufacturing methods so you may not be knowing all the manufacturing methods so you can ask your TA and if he is also not sure, you can go and search later and then add the data in the reports?

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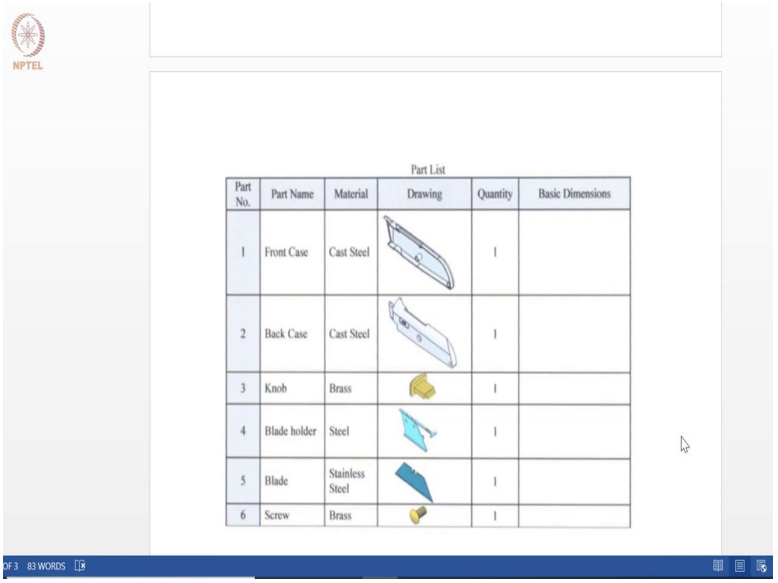

So, like this, you need to make a report table. So, it is just an example here. So, we can see an example, the front case cast steel, the drawing, quantity 1 and basic dimensions. So, this is also important to make a basic dimension. What is the width, what is the length, what is the height and what is the thickness of that particular image, roughly not an exact measurement?

But whatever you if you have a scale you can use or you can make a rough measurement and then make the dimension. So, this is the first step. Identify all the components of the product and we prepare a table. And then once that is completed, you look at the way you disassemble the product and try to identify the subassemblies within the product. So, what are the few things which add up to a particular subassembly and then how many subassemblies will be there and how they are actually combined together to form the whole product? That is basically the assembly charge.

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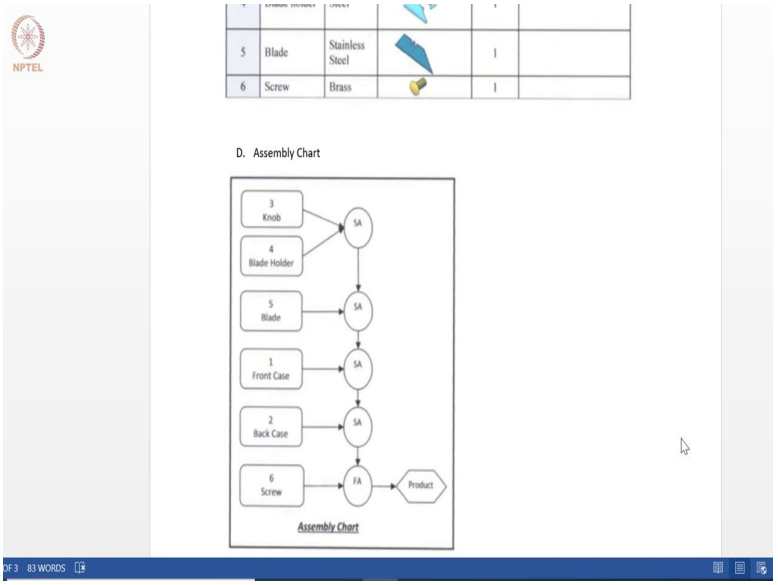

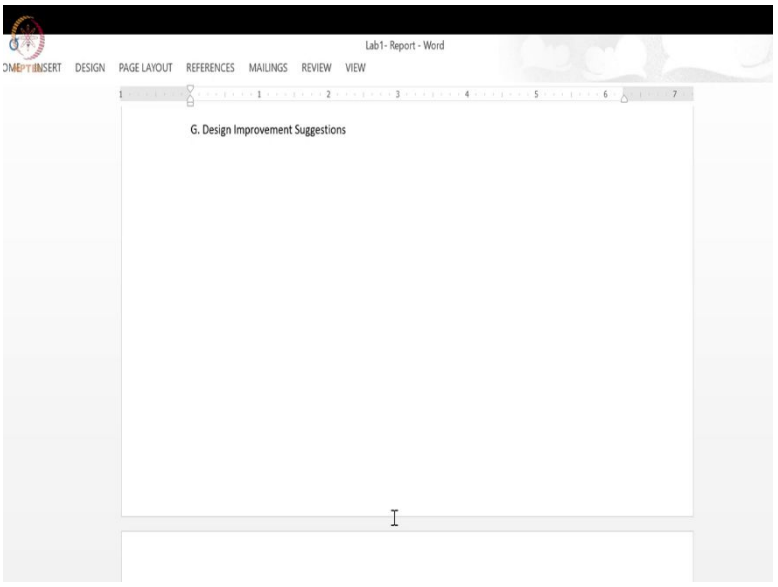

As you can see here. So, few products will become a subassembly and like there will be many subassemblies and all these subassemblies finally get into your final assembly you will get a product. So, you will not always be in the same kind of sequence, there will be multiple parallelly you can identify many subassemblies and then they actually bring together as the final assembly.

So, this structure also you need to identify in the product. And then prepare an assembly chart like this, so that is basically from the component point of view, now you look at from the assembly, the top product. So, if you take the printer, the printer will be at the top one. And then what are the different modules you can identify? Like there will be a power supply part, but there will be something that is actually doing mechanical transmission or there will be something which actually takes paper in a printer.

So, you will be able to identify these as different modules in a product. So, that also you try to identify how many modules there are. So, you will be able to create this kind of a diagram where you will be able to identify the modules in a product. And that is the structure that you will be making. And after this, you give your observation comments. What is so good about the product, why the product is so good, or what you feel that can be changed in the product to make it a better one?

Or is there a problem with the current design, whether it is difficult to assemble or difficult to operate, whatever it is, it need not be 100 percent correct at this stage.

Whatever you feel or observe please write that observation from your end and then your suggestion for improving the design.

Again, you are very new to design, and so you are not able to get a very detailed analysis of the design to suggest, but at least from your own understanding, what can be done in the product to make it a better product. That is what you need to add into the report.

Speaker 2: Good afternoon everyone. Today we will be dissecting and studying about a printer. It is an HP Deskjet D4168 printer. So, again so what is the printer first of all that we are discussing that question? What is a printer again?

Professor: Good so basically it prints like content on a sheet of paper that sheet of paper can be off any size depending on, it also depends on the specifications of the printer like how, what are the various sizes allowed to it? So, we have this HP Deskjet D4168 so before that, I want all of you to study and read about the evolution of a printer like in what year it was invented and what technology helps advancements for different printers.

So, coming to printing there are like 2 primary technology for printing. So, do you have any idea like? So, you said that there are 2 types: LaserJet and inkjet. Can you tell me some 2, 3 primary differences?

Professor: No, that is fine. I am talking about the functioning. Functioning or working of these 2 different types.

Student: Laser printer prints on a one shot.

Professor: On one shot.

Professor: That it is. So, I will explain what he said. So, he is saying the laser jet print there is only one motion only one direction that is from top of the and end of the that is laser jet and in ink jet there are like the movement of the nozzles, which sprays the ink on paper moves in two directions, one in the like horizontal let us called it horizontal that is called the vertical in both the directions moves. That is a really good point. And what else.

Professor: That is also correct LaserJet is faster than inkjet. And again, I think it can be also because it can be one of the reasons is again the same because the laserjet for every line the nozzle moves from the cortege moves from one end to another end and then comes down and does it. That is also point. What else?

Professor: Capacity. So, do you want to say that with a laserjet printer, you can print more copies at once?

Professor: Cost efficient, how cost efficient?

Professor: So, you want to say laser printers are cheaper than inkjet printers?

Professor: What is the difference between ink and laser jet printers?

Student: It is liquid

Professor: So, what is and which one is liquid?

Student: Ink jet.

Professor: Ink jet good, correct powder in that, that is cheap, fine but I will again say it is for you guys to study the difference like there are more differences and as he mentioned more cost efficiency and all. So, read about that also like LaserJet, like which one is cost efficient and which one is faster. So, I think what I suggest you guys do is pick 3, 4 printers from different companies of both types and then try to do a comparative study of both.

So, come on, to the same thing, LaserJet versus inkjet, do you guys know applications like where all you find LaserJet and where all you find Inkjet or why would someone prefer Laserjet over inkjet.

Professor: Yes, that is correct.

Professor: That is really, it is a really good point. So, you find LaserJet printers are mostly in office applications and corporate where you have bulk of able to print whereas ink jet is mostly popular for household applications or for custom users like

me and you. That is also good. So, fine you guys understood. Study about laser jet and ink jet and add that in your report of your differences.

So, let us just now talk about what we have in hand. We have an inkjet printer today. And we are studying about ink jets. So, I will just give you guys a brief working, I will demonstrate. I will not demonstrate; I will tell you how the inkjet printer works. So, as you can see, there is a paper tray here. It is not the first point.

So, let us take it this way. So, what is input so whenever there is a product, it has one input? Why is it one input and then there is something that happens , something magic happens in between and then there is an output. So, what are the inputs to a printer and what are the outputs of a printer?

Professor: Paper is one. Just write it down, keep on writing it down. So, paper is one output. What is the second output? I am talking inputs now. Paper. What?

Professor: What?

Professor: No, cord is like cord is the cord is your cord is a source through which an input is coming to the printer. It is not an input. Cord is not an input

Professor: So, the input is data not the cord or the system. So, the data is one, your sheet of paper is one and ink is one and what else?

Professor: Power. Good electrical energy is one you need some electrical energy. And there is one more than one more input.

Professor: There is one more input to it.

Professor: So, what is that, what does that mean, telling the printer the number of copies, what is that?

Professor: Not specifications.

Professor: Inputs, numerical inputs makes sense, but broadly what will you call that you giving numerical inputs. Command, command. So, the command given by the user is also an input to the printer. Understood. So, all these are my inputs to the

printer. So, let us talk about what are the outputs, what are the outputs? A printed page. What else? What else is an output?

Professor: Think in terms of energy, heat energy, heat energy is one output will get hot. What else is there that one more source of energy will have to come out?

Professor: Do you think any idea, sound, sound will also come out so when the printer runs we will hear a sound so, that is also output from the system, fine. So, now we know what are the inputs to a system and what are the outputs to a system.
So, what is the next step we will study? What is the system? What is happening in that black box that is taking in all the inputs and giving me all the outputs? Understood guys. So, let us talk about the black box in between. So, what does it do? So, let us take all the inputs one by one. So, how many do we have? We have 5 inputs. Can you repeat those inputs?

Professor: Paper is one, ink is one.

Professor: Data and commands, fine. So, let us take one, one input one by one. The first one is paper. So, what happens to paper? So, what we will do will just take each input one by one and will see what happens. What is happening to the input, how it is, what like, how, what are the functions which are happening independent on that paper and what are the functions which are like codependent on your other inputs, right. So, you take the paper inside the tray. So, what happens next?

Student: Suction cups and suction.

Professor: Suction, suction is not a correct word.

Student: Roller

Professor: Yes, so there is a roller inside, so when you put a paper inside, the roller will pull the paper in, pull the paper in. So, your paper is still a paper, your paper still is in the same condition till now. No other functions acted upon it like just it being pulled inside with the help of the roller. So, what happens next? What happens next?

Professor: No, you do not hit inkjet. You do not hit in ink jet

Professor: That is a laser jet.

Professor: So, it depends like, see paper turns when so where is an output. So, in this case I do not think paper will come from this side only? It turns. I just know before something else happens. It is the next step. No, it is creating but you print it. So, your roll goes inside then puts ink on it then it will turn and come out.

Professor: So, it is not like paper will come out as it is something printed on it, it went inside ink printed content, whatever content was there. So, this is the function of my paper. This is my input. Have you marked the attendance of all? So, this is what happens to a paper. What is the second input? Ink is the second input. So, I will show you there are two boxes so there is a printer that prints both black and white, as well as color.

So, there are two pink boxes inside that. ink like it is in already liquid form. Nothing happens. It just goes based on the content. It just goes to the nozzle and just prints. Nothing else happens to the ink. And then when some paper dries and it comes out, there is the only thing that happens to the ink. So, what is the next input?

Student: Data.

Professor: Data, data is the next input. So, what happens to data? So, this printer does not, I do not think this has internet or anything. So, it just needs you to connect USB to it. So, there are a lot of printers which work on the Internet so you do not need to, you do not need to connect it to a system. So, if it is a let us say is a lab or an office, you just connect to your Wi-Fi and you can give the command statement from any of that desktop in your lab.

But this one works on USB so you have to connect a USB to data in. So, how is data flowing here? So, the content in your computer travels through USB and comes to the printer and so what is. So, now your data will be there. So, what are the functions on data? So, what is acting on data here? So, what is happening to data inside the printer?

Professor: That is the, that is the end part you know what happens in between?

Professor: Fine I will tell you so you have data. So, yes, so data will tell you, what will be the movement of your cartridge? What will be the movement of your cartridge? So, and where to deposit ink and where to not deposit ink. So, how it works in inkjet printers is your starting point . It will go like this, it will go like this and come down like this it will go fine.

So, data the printer needs to know where to put ink or where to not print ink. So, this is what data tells the printer is a motherboard also inside which reads data and then converts into like the movement of your ink so that is data. What is the next input?

Student: Power.

Professor: Power so power is an electrical energy running everything. So, you will see that electrical energy gets converted into mechanical energy to move the rollers. It is all converted into electrical energy because there is a motherboard inside the already, we saying there is motherboard inside and then it is counting and coming out as a hitter sound. And it also does some work on all the papers, fine.

What is the next input command? Command, so command is given by the user, which tells the printer, like how many copies to print and all that like whether you can destroy it or stop in between and all that. So, we will see what are possible commands used to print. So, this is the overall understanding of the printer.

So, now what we will do, so we will just start dissecting it. And once you have all the components out then I will have one more out of demonstration, I will tell you guys

what is the function of each component and how, how, what, why? Why is it important, why is it even there in the printer?

So, guys let us start. So, you have to use these. So, you have to write down everything, like what was the first component you took out from the product? And you have to put the stickers on, you can number those components also this is component number 1, component number 2, 3, 4.

Keep a track so that basically this is very easy to dissect so you want good exercise to keep a track of, everything like how many screws you unscrewed and what was the tool you used. And keep on taking pictures. So, this is taking one picture now and then when you want to remove one part take a picture. So, now start doing it and then we will see how it goes.

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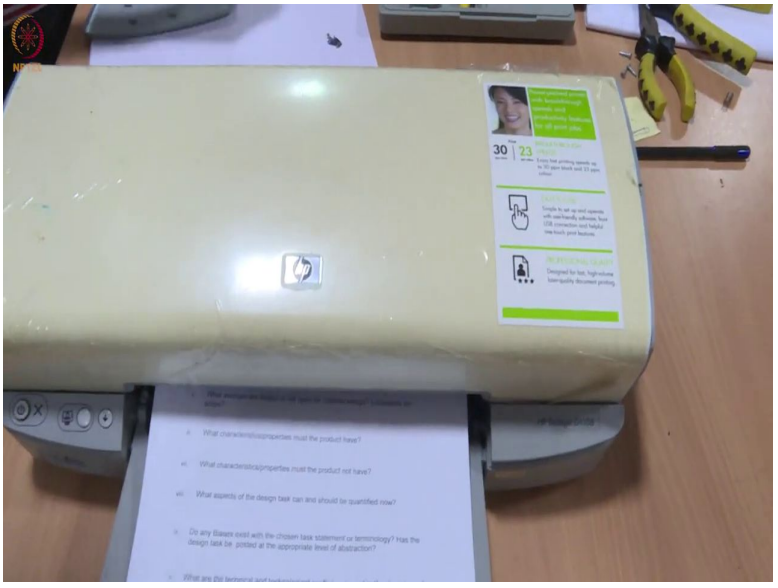

Professor: What is this? So, this is our fine, yes continue to keep on putting stickers and noting everything.

Student: All right, because this is all you need to know, this is not something that would be hard, like when you removed everything and it is this massive, you know, partisan.

Student: So, this is a printing unit and this cartridge, so it is every line with a mechanical chain out here, it moves line by line and prints. So, this is the motor which runs this mechanical belt and then this cartridge moves around. So, let us first dismantle this, then we can proceed on the main. So, this is the color cartridge and it is black and white cartridge. It is enough for both of them.

Student: Springs.

Student: This rod helps in a moment cartridge from the direction and then this was connected by springs and one wall kind of thing so we remove this.

Student: This keeps products in order. So, right now, we are trying to figure out the next layer, if you want to remove. What you say? And then comes over closer to sometimes just pretending like. So, after every moment, the cart just swipes with this part of the film and then they want to for some.

Student: Very convenient. So, one taking out of this one by one, slowly. That is the roller which is like paper which makes the move from the tray to the printing. Paper moves ahead, the outer roller proceeds ahead and paper goes out. It is going to take, you know, all of this together. This is the whole chain of access, this works together. This is the last part we removed. This is a unit which holds the cartridge after every print. So, the cartridge just comes into this as a spring which helps in closing the air gap through the cartridge with.

Student: So, we get help with these three gaps simultaneously on this motor. So, that is why the paper at the moment of the paper occurs due to this roller. So, these are the three motors. Which works with the help of these three gaps with the help of this motor and looks at the moment the paper occurs. So, go in this and come out in this. No, it is already fixed.

Student: So, the fixing is over. So, like we can start printing with this.