Functional and Conceptual Design
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Lecture 01
Introduction

Welcome to the world of Engineering design, or creative engineering design. So, you would have attended a course on creative design in the first semester, it focuses more on the appearance, and other aspects of design. From here onwards you will be starting the engineering aspect of design. So, this course is titled as Functional and the Conceptual design.

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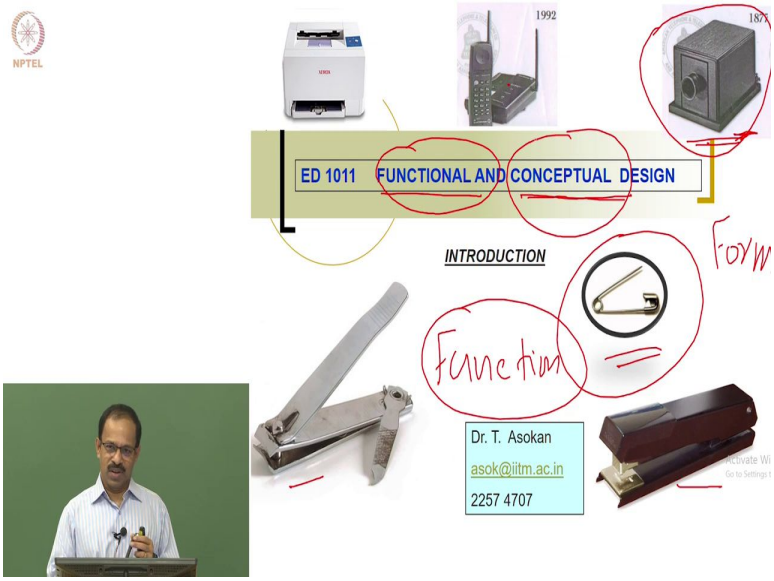

This ED 1011 functional and the conceptual design. So, what will be looked at in this course is how do you identify the functions used in the products and then how we developed a concept for satisfying this function. So, that is going to be the focus of this course, I will explain all these things as the progress, as we move forward. But as you can see here, you are seeing many products over here. So, how of you if you identify these products, what are these products? So, can you identify these products? What is this one? Please, louder,

Student: Printer

Professor: Next one, okay. So, you are saying this is a projector, we will see it later. What is this one? Stapler and?

Professor: Okay, so, the corner one, this one, can you have a close look at it and tell me what actually it is? Okay what is that? Cooking…

Professor: Oh safe, so for keeping valuables, 1877 can you get something from there? Camera 1877 anything to do with camera? Yes, what is it? That is not a camera that was the phone, that was the first phone or that was how a phone looked like long ago.

Now, look at these products, this one safety pin, how many of you used safety pin? How many of your parents use safety pin, how many of your grandparents use safety pin, once it is the same as this? Yes, So, your grandparents use the same kind of safety pin, your parents use the same kind of safety pin, you are using the same kind of safety pin, and probably the next generation also will be using the same kind of safety pin.

So, now look at this product, and this product, what is the difference here? The phone which was developed long ago has changed a lot. Now, the current phone has nothing to do with this shape, the shape or the structure or the form of the product has completely changed in the last 150 or 200 years. But the safety pin remains the same as what it was 100 years ago, or 150 years ago. What is the reason? Why the safety pin remains as the same and why other products keep changing its shape, size, many things. What is the reason for that?

Student: Simpler

Professor: Simpler yes, pardon, convenient to use yes.

Professor: Yes, So, that is one of the reasons, a better reason has not come to the markets, everything looks simple now, I mean phone also at that point of time that was the simplest that you can have. But then people started working on it, they came up with better design, better design, better functionality and many things. So, in the case of safety pin, what happened was that nobody could come up with a better, simpler design, which would meet the same purpose of use.

So, if you look at any products, any products in the market, you will be able to see these two important aspects of a product. So, one is the purpose of the products, or we call it as the function of the products, a function of the product is basically what the product we are supposed to do, what it is doing. So, that is basically known as the, the function of the products.

If you take the current printer and the printer 50 years ago, is doing the same thing, maybe you add a few things but basically it is providing the same kind of output, or the same output purpose it is being use, that means its function remain the same, there was no change in the function of the products. And what changed, what changed in the phone from this phone to this phone or the current mobile phone whatever it is, what was it changed?

Student: Design

Professor: Design, So, design has changed, so then how can we define design? So, what I actually changed is the form of the products. So, function and form, so these are the two important aspect of any products, whatever product you design, whatever product you see in the market, these two aspect will be always the core of that particular products, that is what it has to supposed to do, and how is it able to do that in what way it is being able to do that.

So, this is the form of the product, so any product design is exactly concerned with only two aspects of the product : the function and form of the products. So, the function is basically, what the product is supposed to do and the form is how is it able to do that, or what is the where things change? So, the things can actually be changed in technology, it can change in appearance, it can be changed by color or whatever it is.

So, if design is basically looking at the function of a product and then finding a form to satisfy that function. If you can actually match these two things, then you are getting a new product. So, the whole concept, the whole course is basically designed to find out how we identify the functions needed in a product and then how we give a shape, or a structure to the product or how we identify the form of the product.

So, in this course, we will be looking at the functional aspects of the products and then the conceptual aspects, conceptual aspect is how we actually develop a concept or the form to satisfy the new. So, basically we will be looking at these two aspects, the functional aspects and the conceptual aspects, and then see how we actually understand for a new product or modifying in existing products, or coming up with the completely out of the box idea of having a new product.

We need to understand the functions of the products and how we provide these functions in the products and that is basically how we develop the concepts. We will be looking at these two

aspects of their product design i.e., the functional aspects and the conceptual aspect of designing a product. It can be a new product, it can be modifying an existing product, or it can be a complete reworking, or coming up with a totally new concept which is the whole idea of this course, how we identify the functions and form of a product.

Any questions please feel free to ask me questions if you are not sure, or you feel that something you guys feel more of on the it will beat on the philosophical aspect or which on the conceptual design. It is not really equations or hard core theory. But it is more of how we look at products and then develop products. So, in case you feel that some of the concepts seem to be incorrect, or you feel that something can be changed please feel free to discuss. So that we can make it more interesting.

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So, as I told you, the idea of this course is basically to introduce you to the design process. Engineering design is basically a structured process. So, people who have been designing products for a long time, they have been making products without the engineering design or

without any engineers. But when we talk about creative engineering design, we need to have a structured process to design the product.

We will be introducing this structured process and then telling you how we actually go step by step and come up with new concepts for product development. So, that is going to be the idea of this course. What are the learning outcomes of this course, first is basically to learn the importance of systematic design process.

We need to understand the systematic design process in product design, and identify various steps involved in the design process. We want to learn these various steps involved, and then learn and practice the contemporary theories of effective product design. So, there are a lot of theories that have been proposed.

We will look at some of these theories and then see how these theories can be used as various steps of the design process. And then as I told you learn the importance and function and form in the design process. So, function and form becomes the core of this design process. And then apply this process for product development. So, at the end of this course you should be confident enough to design or redesign a product from the engineering design prospective.

That is the whole idea and at the end of this course you should be able to come up with the design or you should be able to approach a problem, a design problem, apply these principles and come up with a design. That is the whole outcome, the learning outcome that we have been expecting from you in this course.

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Syllabus

Overview of the Design Process – Philosophy of Engineering Design. Steps involved in the Design Process. S curves. Communications during design process.

Understanding the Customer need – Steps involved in developing Engineering Design Specifications. The technique of Quality Function Deployment. Case studies in QFD.

Functional Design – Functions in engineering Design. Basics of Function Structure- Functional Basis, Functional decomposition and flow.

Product Architecture – Modularity. Module design and functional decomposition.

Generating Concept – Various methods of concept generation. The method of TRIZ.

Concept Selection and methods of evaluation.
An introduction to product metrics. Product Evaluation techniques.

References:

1. K. Otto and K. Wood, Product Design, Pearson Education, 2001.
2. D.G. Ullman, The Mechanical Design Process, McGraw- Hill, 1997
3. G. Pahl and W.Beitz, Engineering Design, Springer, 1996.

Grading:

10% Assignments (two assignments)
30% Laboratory work
25% Mid-term Examination
35% Final

So, the syllabus for this course is as here. We will be starting with an overview of the design process, and then we look at how we start from the customer, you have any product design start with the customer, or there should be a customer for any product. So, we will try to see how we identify the needs of a customer or other which we can identify the customer needs. And then we go to the functional design. We will see how we can convert the needs of the customer to functions in the products because if you want to satisfy the customer, there should be something in the product which will actually meet those needs of the customer.

And this is done by converting the needs into the functions, and it can be provided in the product. And then we look at the architecture, that is the, the form design parts, architecture of the product. And then how we generate concepts for the new products, that you have to be different from others, or you cannot have the same kind of design form for this product.

We will look at how we actually design and generate concepts and then you have a large number of concepts. How do you do the concept selection and evaluation of these concepts? So, these are the parts that will be covering in this course. And design involves lot of other things also, because we need to do lot of analysis, functional analysis, its capabilities and all I mean in terms

of the forces movements and things like that, we will not be covering value this course because you will be learning these things in the courses that we coming up in the following semester.

So, this course will be focusing more on the functional and conceptual aspects of design courses. And the reference book is basically this book is what we have following K Otto and K Wood, it is a product design book, one product design and therefore the Indian edition. So, if you are interested, you can actually buy a one copy and keep it. It is a good book, which will be useful for you later also. And there are other reference books also like Ulman, the mechanical design process, and Pahi and W. Beitz, engineering design.

So, whenever I use these reference books for some chapters, I will mention that. So, that you can actually go through that book also, you can better have this first book for a personal copy of yours. So, that you will be able to refer to that whenever. Okay, alright, so, the grading will be like this you will be having assignments. So, I will be having two assignments, which is for 10 marks, or 10 percent.

And then you will have a laboratory component part of this course. So, every Wednesday 2:00 p.m. you have a laboratory course. This is more of practicing what you learn in the class. So, you will be learning some theory in the class and will try to practice this in the laboratory. So, this will be done in PD lab, ED 304.

So, the first Wednesday that is the day after tomorrow, there is no class, it is a holiday. The first session will be on 15th, 28th January in PD 304. So, let us talk a little bit on both some general aspects of the design process or may not be the actual engineering starting the actual engineering design process today we will slowly get on this process first of all I want to make you come to

the stage when you can think of new products development. Let us look at some of those existing things and then see how people work on his aspects.

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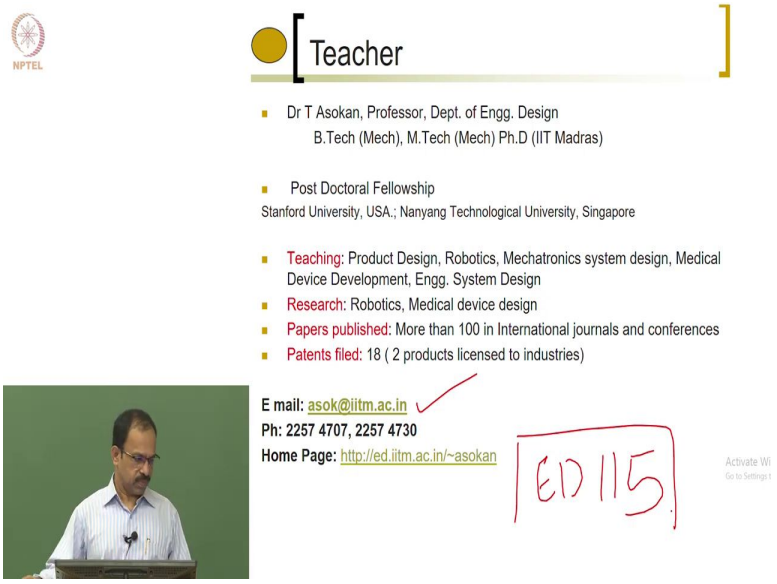

So, before that, let me introduce myself, so all of I hope you know my name. I am Asokan. I teach a few courses on product design, robotics and mechatronics system design. So basically, my research area is robotics, mechatronics system design and engineering system design. So, these are some of the basic things which I have patented. So whenever we develop products we file patents.

So, they are file on 18 patents for various design of products of licensed of technologies. So, you can contact me on this Email. This is my official Email asok@iitm.ac.in. So, make sure that you use the name asok do not use ashok you can go to someone else. So, make sure that use if you directly want to contact me please send email to me or you can call me, or incase you want to meet me you can always meet me in ED 115, this is my room, office room. So, if you have any questions you want to discuss something, you can always come and meet me in 115.

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So, let us go back and then think about what you need for designing and what the factors, which lead to new designs are. Few years ago or maybe 15, 20 years ago people were worried about how to make things, you know you have something to change, you want to automate something, or you want to increase the production. So, those questions were at that time how to make things, how to manufacture, what are the ways in which they can be manufactured and things like.

In the last few years things have changed a lot, people are more informed, they want more comforts, they want more amenities, they want more products which actually gives them much more capabilities and etcetera, etcetera. And that is why things changed to help people, how can we make new products to help people in their day today activities, or to improve the comfort of people.

That is what actually one has to make. So, what to make? Something which we need; what can I design for a particular application, or a particular thing? So, the current challenge is basically to look at, what to make and this is answered normally by something called innovation through creation, through design, that is innovative creation through design.

You need to create something which is an innovative product, and that can actually come through design. So, innovative creation through design is the core of any new product. You have to be very innovative, you have to look at how you can make a difference, or how you can make things different from existing and then at the same time meet the customer satisfaction or a satisfaction of the people. And that actually is a heat in the markets.

People make a lot of things but it may not really satisfy the customers and it may fail. So, the purpose is basically to meet the desires of contemporary society and, when you try to meet that desire of contemporary society then we call it a creative engineering design, that is there is a need for something in the market and people are looking for it. And if you can be satisfied through innovative methods then we call it creative engineering design.

The whole purpose of any design is to meet the customers' requirement. As long as you can meet the customer requirement, satisfy the customers then you are actually doing a creative engineering design. So, this design happened almost every time.

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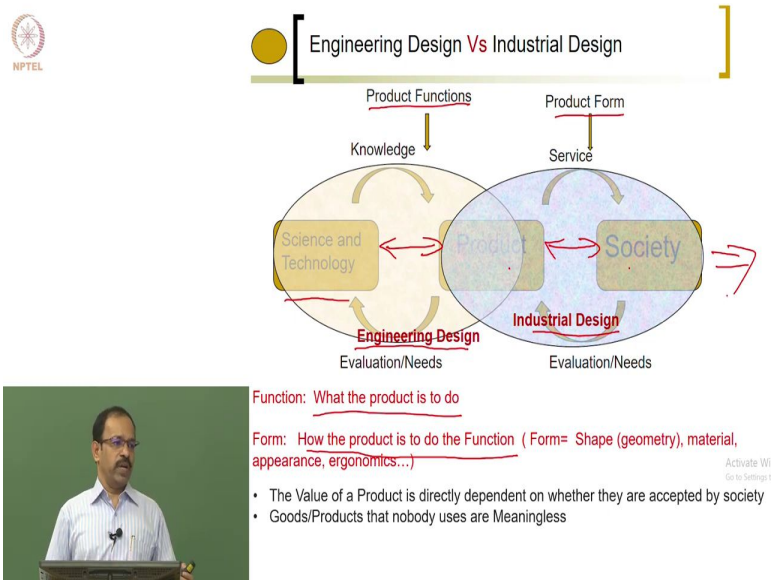

So, the designs keep on happening and in the creative engineering design, you can actually see there are two major aspects to creative engineering design. And these are basically known as engineering design and industrial design, i.e., you want to develop a product and this product has got two aspects; one is that, it has to meet the customers' requirement that is in terms of what it has to do, at the same time you need to attract the people also. The people should feel comfortable in using this.

So, these things actually come through two aspects of any design that is the engineering design and industrial design. Can anyone tell me what the difference between these two is? Or having heard industrial design? Yes or no? No, ok, engineering design you are heard because you are here. So, let us look at how the product cycle happens, see any products make any new product which comes.

So, it actually comes from technology, so there is a lot of research that has developed a lot of technologies in laboratories. For example people come up with a 2G, 3G, 4G, 5G, and etcetera. These are all technologies, you have a technology for communication, people come with

Bluetooth, USB and many other technologies, people come with micro processes, micro controls these are the technology, they are not really products.

If I have a 5G technology what can I do with this, how can I use this to help the people or how can I satisfy the needs of a customer using this technology. So, that is where the conversion of technology to products comes. So, you have the science and technology part, where people will be developing technologies, science and technology and then somebody will look at how can I convert this to a product and then when you develop a product you have a society which uses that product.

So, any product design has these three elements combined together, you have the society or the people, or the customer who will be using the products. And there will be somebody who will be designing the product and then somebody who will be developing the technology. So, these three work together to develop new product, that is why if you have getting better and better products, that is why you get iPad, iPhone, and many things because there are someone who develop technology, and there are someone who can convert that technology into product, and there are someone who make sure that this product will be accepted by the society.

The interlink activities of these three, actually leads to creating design. So, science and technology generate knowledge and the needs of the product also leads to research. Yes, you want some product to do something you do not have the technology for. Then somebody will start working on the technology, research and then develop technology. It is in a cycle, so you have the knowledge and the needs, and then the product will do some service to the people i.e., it will meet the requirements of the customer or the society and again it is in the cycle, because society is asking more then you have to develop a better products.

And when you have to develop a product you would have better technology. So, it keeps on working in this cycle. So, this is how researchers design is and the society far into a single loop and then keep developing products for meeting the requirements of the customer. So, this part is basically what actually discusses with the product functions i.e., the functions needed in the products can be developed through technology.

You can develop a new technology to meet the product functions and the product form is basically how you make sure that exactly meets the customers requirement. You have the function and the form. The function is what the product is to do and form is how the product is to do the function. The technology helps you to develop these functions and then somebody converts that into the requirements of the customer or a proper shape, size, ergonomics, everything is beside the point. And then got into this society.

So, you have a function and form in the design process, and where an engineering design comes here. So, this part is basically known as engineering design, that is how do you convert technologies to products to meet some requirements. And the industrial design comes about how we actually make sure that the society accepts it.

Society has specific requirements, they want a particular color, they want a particular shape, they want a particular ergonomics, I mean where they can use how to make it user-friendly, all these things are coming under the industrial design aspects, where the focus is more on appearance, shape, size, ergonomics, user-friendliness all these are basically the industrial design aspect.

The engineering design aspect is more on how do you convert technology to products and how do you identify the functions needed, how to develop the concept for that function and develop the product. So, this product when you do not have this link, it will be a proto type which will be available in the laboratory, which nobody can use, and people would not be able to use it

directly. But when it is connected like this, then you have a product which can actually go to the markets.

So, when engineering designers and industrial designers work together you have a fully useful product coming out of the market. This is how we can actually differentiate the role of engineering design and the industrial designs. So, industrial designers are more of what do you call the soft side of the design and the engineering designs are on the hard side of design where they look at the engineering aspect of the products, make sure that it will meet all the other requirements, for example if you take the design of a car, what will be the role of engineering design is in the design of a car, what will be there role? Yes?

Professor: Yea so, they make sure that it can actually achieve a particular speed and it can actually be comfortable that will not be any accident safety will be considered, the failure will be considered, that it will not fail under different conditions. So, all those engineering aspects will be considered by the design or engineering designs. And industrial designs are that we will look at the shape of the car, the color combination, how we actually organize the dash boards, how you keep your speedometer, or your engine speed and all those things.

And where you provide the air conditioning vans, other things are basically considered by the industrial designs, because there is more user-friendliness and acceptance of the customer. So, this is how combined acts of engineering designers and the industrial designs, comes into play, okay, any questions?

Now the value of a product is directly dependent on whether they are accepted by society. So, any product that is not accepted by society is of no value, however innovative your design is however good your design is. You can be very creative with the products and very innovative,

but sometimes people do not accept it. There can be various reasons but generally the society is not accepting a product when we say that it is not good for use, or it is not a good design.

Good products that nobody uses are considered to be meaningless, there is no value for such products and therefore the fundamental idea of any product development product design is to make sure that it is accepted by the society or somebody is there to buy your product, if that is not there, then there is no point in developing the products. And that is why we need to have a creative design process which will ensure that there is a need for it.

And there is a way to make sure that it is accepted by the society, and whatever you do, there are many cases where actually products will fail. But then at least we can ensure that we follow a process to make sure that the product is accepted by the society.

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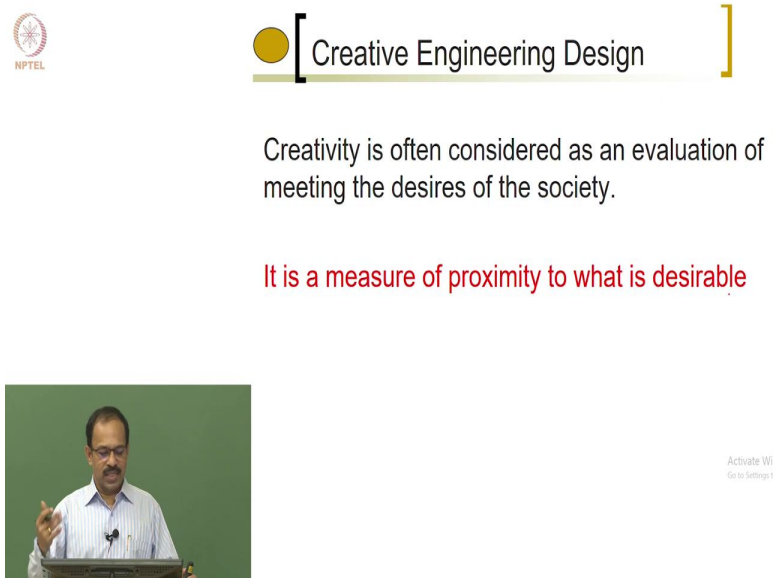

As I already explained, this creativity is often considered as an evaluation of meeting the desires of the society. So, how creative you are is basically decided by how much it is accepted by

society. It is applicable to many things also. So, how good you are a teacher is decided by how the students value your classes, the same thing.

If you want to be a creative designer then it will be made sure that this design is accepted by society, which is not accepted. That means it is not creative, despite you making a lot of work and a lot of effort. But to make sure that it is acceptable we need to work on the aspects of customer satisfaction. And creativity is basically a measure of proximity to what is desirable, that is there is something which is decided by the society, and you have to make sure that it is accepted and that it is a proximity to the desires.

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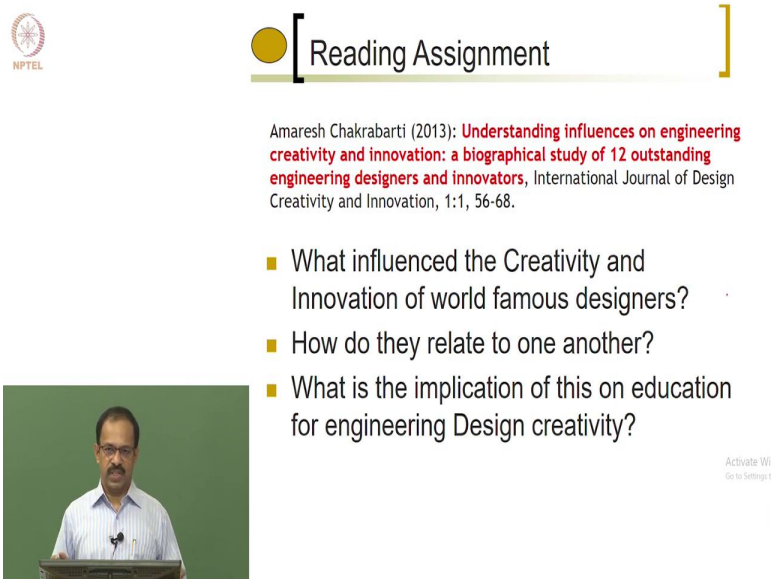

Let us do a first reading assignment for you, this is a you do not need to submit it, but I want you to read this paper which talks about understanding influences on engineering creativity and innovation, a biographical study of 12 outstanding engineering designers and innovators. This was published in 2013, and talks about a designer or 12 outstanding designers from history. And then see how they influenced the society through their creative and innovative designs. All these slides will be available on moodle, I hope all of you got access to models.

We can actually go through the slides later also you are going to really copy everything, but if you want to note down something you are always welcome. Now, what influenced the creativity and innovation of world-famous designers? How do they relate to one another? And what is the implication of this on education for engineering design creativity? Yes, for you to read and understand, you do not need to submit it at this stage as I will tell you what is to be submitted later, and there are assignments, I will tell you how to submit.

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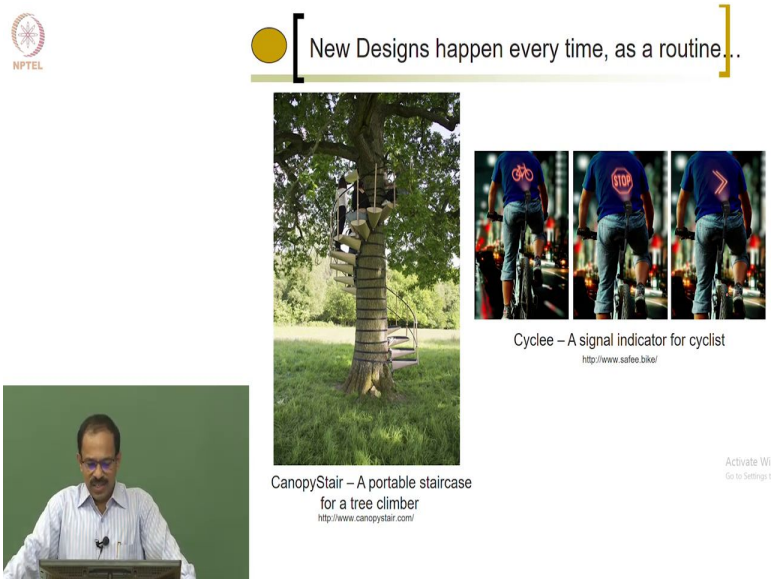

Let us look at the creativity of people and how these things actually happened. So, you will see that lot of creative things happen in the world. Every day you will see that something is happening in the world. So, for example this Canopy stair, a portable staircase for a tree climber. Cyclee, a signal indicator for cyclists and like this there are a lot of other things also where you see this kind of a toothpaste squeezer, then modern knives set, laser projection virtual keyboards, wearable nail polish holder, cookie mug with biscuit holder.

Sometimes you will see that people go for meetings, they are holding a cup of coffee and then they cannot, they will be having something else in their hands. So, they cannot hold their biscuit. So, it is a way to satisfy the customer, so if you look at all these designs, you will see there is some creativity in this product, every product has got some creativity. But how much it is accepted by society depends on so many other factors, you do not see many cups with a biscuit holder in the markets. Because it is not really accepted by society as a need.

So, but that does not mean that it is not creative in this way, but it is a very innovative design, unfortunately acceptance is very low. I am not sure you have seen this video. So, there is a new cycle design some of you might have seen this, where there is no a chain for transmission is

basically a leg motion which actually converts to rotary motion. So, basically there is no rotary motion by the leg, it is only an up and down motion and that is converted to a rotary motion in the cycle. So, you get a new cycle design.

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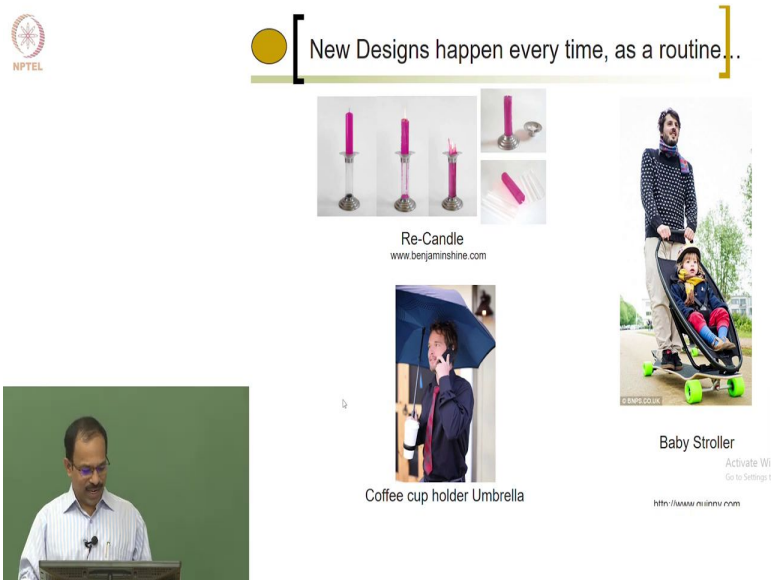

And these are some of the other creative designs. You can see here, coffee cup holder with umbrella. And so what is this? What Vada it is? Medu Vada, how many of you have medu vada?

How many of you heard medu vada? No, you are not. So, what is the difference between a medu vada and a paruppu vada, paruppu vada that is a dal vada, what is a difference?

Students: Hole.

Professor: Hole yea, hole in the middle. So, one of the challenges in making medu vada is making the hole. So, that is why people find it very difficult to make medu vada because of the hole in the middle of the vada. So, why do we need that hole there? What is a reason? Anybody? Pardon, so, basically it will get the center portion properly boiled or properly cooked, because you have a larger area for oil contact.

So, making this medu vada is a skilled work, we need to have some skill to do that. So, there is a company, which actually was working on this kind of product basically the products which are basically for the dosa, idli, and they make the dough. So, for to get the make dosa, so this company was trying to make a product which can actually provide you vada without any efforts, or you can make a medu vada without any efforts, that is you do not need to have a skilled person to make this, you just use this and their product you can actually automatically make this vada.

So, there are some needs for some customers that do deskill the activity that is the product may not be made by the I do not need a skilled person to make this product. And that is when a company in Bangalore, you might have heard about iD. This company iD is the one which actually makes a lot of these kinds of products for dosa, idli, and now you can go and get a readymade ingredient then make it.

So, this company came up with the products as you can see there on the right side this product is like a package and it is what has a cap at the bottom of this is the top side of it, there is a particular design. So, the moment you squeeze this in this tube, you will actually get a shape with a central hole. So, without having any particular effort you will be able to make medu vada. So, that is a product which he came up with. He actually did a lot of research and he did a lot of trials and a lot of efforts.

And finally, he got this product out and then this product is selling in the market and this company is actually having a lot of business in the market. So, that is an example for a creative design. So, you are actually looking at the requirements of a customer and then trying to meet the requirements of the customers. And trying to come up with a design which makes the customer requirement. So, this is what is actually needed in the market where we need to identify the needs of the customer and then come up with designs.

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So, now let us have a few minutes. We will just look at how good you are as a designer? Can you please take your notebook? All of you have your notebook, before that can you identify these

two people here? Who are they? Chef. So, both of them are chefs. What is a common thing in these two? What is the common factor in these two pictures?

Students: Fat

Professor: They both are very fat. Why are they fat?

Professor: They eat well, they enjoy their foods and that is why they are good chefs. So, they are passionate about food. So, they are passionate about food so they cook food and make sure that cooked food is tasty, they eat and they enjoy it. So, any profession if you look like you have to be passionate about what you are doing.

So, one of the most critical aspects of success in life is that you have to be passionate about what you are doing. And if you are passionate about what you are doing, you will enjoy doing that and that will lead to better results. These two people they like food, they are passionate about food. So, they cook food, they cook good food and they become good chefs.

This is applicable to designers also, if you want to be a good designer, you have to be passionate about designs, you should be able to appreciate good designs. You should be able to look for that good design, you will see things and you will try to appreciate all that is a good design.

So, to become a good designer, you have to be passionate about good design, you should be looking for good design whenever you use a product you should try to find out what is good about that. How people are actually made that product and then what are the good things about it, why this is accepted by people and this thing, this analysis will allow you to be a good designer.

One of the most important aspects is to be a good designer in depth you have to be passionate about your designs or passionate about design. Then you will be able to come up with better design, if you are not appreciating good design or you do not care about design, you cannot be a

good designer. All of you need to keep this in mind and then look for good designs in the markets. Whenever you use a product you look at what is good about that product, how do they actually meet some of the requirements extra, extra.

Let me ask you a few questions, please write down what your most or least favorite car is? If you do not like cars you can write bikes also or something else. So, please write down what is the most or least favorite car? And you write why also? Done? So, any volunteers who can tell me what is the most favorite car for you? Somebody? Behind? Lamborghini, okay. Why?

Student: Speed.

Professor: Speed and its look, yeah good. Anyone else? Yeah.

Student: Tesla.

Professor: Tesla model S, why?

Student: Good looking.

Professor: Good looking, good acceleration, yeah, autonomous operation, okay, good. So, you have one from the industrial design aspect, good looking, the performance is coming from the functional design of the product that is the Engineering Design. Anyone, one more? Anybody? You do not like cars? Ok, next we will go to the next one.

What is the last product you bought for you or someone else? What was the last product you bought for you or for someone else? And why did you pick those products? Please write down. The third question is what was the product that fascinated you the most for its innovative design or function? What was the product that fascinated you the most for its innovative design or its function?

Ok, so what is the last product you bought for you or someone else? Yes, what was the product you bought?

Student: Don't remember.

Professor: You do not remember, ok.

Student: Water bottle.

Professor: Water bottle, good for you?

Student: Yes.

Professor: Yeah, why did you choose that one?

Professor: So, it makes your size requirements and color requirements, right? And somebody? Yes, you. Yeah.

Student: Pen.

Professor: Pen, so normal pen or special pen?

Student: Normal pen.

Professor: Normal pen, ok. Why did you choose that, any particular reason? You just wanted it to meet your requirement, function, that is all. Anyone else, any other interesting product you bought? Nobody bought anything, interesting, for you or someone else? For your friends? No. What was the product that fascinated you the most for its innovative design or function? Anybody? Yes.

Student: ABS.

Professor: Automotive braking system, sorry antilock braking system, ABS. Why?

Student: Good product.

Professor: So you found that it is a very good product. Yeah, anyone else? Yeah.

Professor: Galaxy phone.

Student: Galaxy fold

Professor: Fold, Galaxy fold and you found it very interesting, it folds because of that you like it. Yeah.

Professor: Moto Razr, phone.

Professor: So, that is the reason why you like that design. Anyone else like that? So, this is basically for you to now think about whenever you see a product, whenever you buy a product, or whenever you decide to make a product, you need to think about these things and see what is that which actually makes it innovative.

Whenever you see a product, please look it at from the design point of the or design perspective and then try to find out what makes the products an innovative one or why the product is interesting to you or what actually makes the product successful in the markets. So, we will continue the discussion, we have a few more points to discuss before we get into the design process. Probably in the next class we will discuss some of these points. So, probably next class if you have any interesting products to answer these questions, we will discuss that in the next class