STD Session 1

**Karthik C:** [00:00:00] Okay.

Yes.

Bro, go and get some live band! I had some more. I need water. Hey, hey, hey, hey, hey. Hey, hey, hey, hey, hey. What, bro? Go to hell with the fans! Okay. Go to hell with the fans! Okay. sir. I told him to leave it as it is. Yeah, I told him.

Okay.

12.[00:01:00]

Yeah, no. I love you. Now, get me right in the door. Shhh, shhh, shhh, shhh, shhh, shhh, shhh, shhh, shhh, shhh. Silence everybody. It's morning. Systems thinking for this. Oh, so we don't have to think. Systems will think for us. Oh, nice. So, good afternoon students. Good afternoon. Good afternoon, sir.

Can sir hear us? No. Then why did he tell good afternoon? He's a H1 5. He's a H1 5 nurse. He's teaching mechanical and SM. Really? Oh! Then he should have a screenshot of H1 5. Silence, please. He wants to tease them. Right? Let us quickly recap. What [00:02:00] we have learnt, I am going to speak a bit slowly because, uh, right, your friends are there listening, right.

If I go very fast, they may not be able to follow. So a quick recap of what we have learnt last week, right. So Dr. Raghuraman would have covered about a revisit to all the courses you have done, right. You did a in class assignment, right, of all the courses, what are the courses you did, right. And how those courses are actually useful for you.

Right, going forward, going forward with this course, right, yes or no, right. So those are some of the activities which you did, right. So starting with that, let us quickly recap last week's session, right.

So quick recap, we saw.

Triplet idiom and it's relevance. What is current state? 22. Right? Yes. That we saw. [00:03:00] So, we looked at Institutes like IITs and only one spectrum, right? Which are typically technology institutions. IITs, uh, you have your, uh, other, uh, I Is is right on one side of the spectrum. On the other side of the spectrum, what we have the Management Institute, right?

The iams, national Institute of Design, right? That focuses on entrepreneurship. That focuses on, right, more, most on the marketing side of things, right? Most on the economic side of data, right? These are the two ments of the spectrum. So that is located exactly at the middle, right? So what is the mandate of our institute?

Objective? Of our institute design centric centric engineering. So, you have engineering and then you have design, it is a culmination of these two, right. So, you have got disc and centric engineering, sir, right. That is what we saw last week here and, right, we looked at, right, the picture, right, between the gap between, we saw an image [00:04:00] where you have, right, people on one side of the valley, we saw a valley where, what are your core skills, right.

You have analytical skills, you have got, right, programming skills, lot of other skills as well. Right? But typically when you see, what are the expectations we saw, right, just to recap, delivery from day one. Right? Right? So students in H 1 5, right? So if you recall, right, I spoke about on Tuesday, right? What are the expectations, key expectations, right?

So which is delivery from day one. What are the other expectations? Ability to contribute to a new culture. Right? Right. Right. Right. Yes or no? And bringing about innovation, right? So we discussed three things. First thing is delivery from day one. I don't want you, I don't want to spend time in training you.

Yes or no? Right? I don't want to spend time training you. I want you to come to my office, whatever product development I am doing or if I am building a software, I want you to come there, [00:05:00] start delivering from day one. Right. Right. I do not want to spend any time trying to train you. Why? Right. It is costing me money.

I am paying you. Yes or no? If I am paying you, I want maximum benefit out of it. Yes or no? Right. So that is first thing. Second thing is, bring about the spirit of innovation. Right. Right. So, we looked at what is innovation, right? What are the ingredients for innovation? Right. Specifically if you see, what is innovation?

Right. So, some student might say. Uh, innovation is all about, right, uh, doing something new. Is doing something new innovation? Right? It is not just that, right, it is much more than that, right? So, right, so, where we speak about what is called necessary and sufficiency condition. Right, necessary and sufficiency condition.

What is a necessary condition? Right? Right. Right. I will give you an example, okay. [00:06:00] So I am a chess player. I want to go compete in a, some global tournament. What is the necessary condition? I need to know how to play chess, right? So that is a must. I need to know how to play chess. So that we term, term it as necessary condition.

What is sufficiency condition? It is much more than that. If I have to go compete, right, I need to have much more, much more than just knowing how to move coins, not just the rules of the game. Knowing the rules of the game is necessary. What is, what do you need much more to compete at an international arena?

I need to have a strategy, right. I need to know, you know, different techniques, right, different approaches, right, so that is a sufficiency condition. Please understand that, right. So if you have to innovate, right, there are certain basic ingredients that are required. What is that? You need a good environment, right?

You need a supportive environment. You should be given the option to experiment and you should be given the option to fail. When you try to do something for the first time, it is [00:07:00] highly likely that you will, you will fail, right? So failure is, it is very likely. Why? If I am doing something for the first time, right, it is very likely that I will fail, most likely, right?

If you use a trial and tested approach, right, then that guarantees some level of outcome. Yes or no? Right. If I am going to do something for the first time, right, it is like walking into a forest with a torch light. You do not know if there is a tiger inside, there is a bear inside, your life is under threat.

Yes or no? Right. So that, we should give you the, right, some option, right, give you the space for you to fail actually. You fall down, right, it will hurt a bit, right, then you get up, Right. Then you move on. Right. So, you need all this. Right. So, the second thing that we need when you get into industry. Right.

Industry requirement. What is the expectation of the industry? Right. First thing is delivery from day one. Second thing is you bring about some new form of innovation. Right. What is the [00:08:00] third thing? To contribute to a new culture. What do I, what do you, what do we mean by bring about a new culture? Right.

So, last Tuesday. Right. So, students in H 1 5. Right. So, we discussed about. Right. Doing things, things the exact same way. Yes sir. Right. So there is a saying by one Admiral Hopper, okay, he is a general. So he says, the most dangerous sentence in the English language is, we have always done it this way. We have always done it this way.

That is the most dangerous saying. Why is it dangerous? Because if I ask you, why are you doing it? Why are you doing it this way? Because I have always done it this way, sir. Because I have always done it this way. This way works. It is safer. It is proven. Okay. But in today's multipolar world, right, so it is not just the west, right, we looked at, right, the shift of engineering education from the western economies, [00:09:00] the well developed economies from nations like United States, western Europe, Germany, France, UK, right.

It is, it is slowly moving from, right, we looked at the MIT study. Right. That the leadership in engineering education is shifting from the west to emerging economies. What are the emerging economies? India. We are an emerging economy. India. China. China. Right. Brazil. Indonesia. Right. Southeast Asia. Indonesia.

Malaysia. Right. It is all simply shifting here. Right. Where is the bulk of the population located? India. China. It is in Asia. Right. So, last week, right, I asked students in H1 5 to buy a book, so the book is called Factfulness. Right? Please write it down, right? So, just to, right, recollect, so I asked some of your friends to buy Factfulness.

F A C T F U L N E S S. So, the book is [00:10:00] written by a doctor, okay, a Swedish doctor. His name is called, H. A. Ennis H. A. Ennis R. O. S L. A N. G. Hans Rosling. Right? So please take a look at the book, right? The book is actually not very big. It talks about the world in general. Okay. So right? And the another book I wanted to Students to actually buy, right?

It's called Lateral Thinking. A textbook of creativity, right? The book's name is now, it's split into multiple parts now. Lateral Thinking. It's written by an author called Edward, E D W A R D. Edward De Bono. D E B O N O. Edward De Bono. Right? So we looked at multiple kinds of thinking, right? What is the most common form of thinking you are used to?

You are used to analytical thinking, right, 1 plus 1 is 2, numbers you are very good, right, EE training basically [00:11:00] gives you lot of analytical thinking but there is also critical thinking, there is design thinking, there is lateral thinking, right, there are multiple, there is an whole array of thinking that you can, right, when you get into this, right, psychology or social, right, social engineering, right.

When you, when you get into the social sciences, right, when you get into these subjects, right, you will, you will see there is not just one type of thinking, there are a whole host of thinking that is involved. At the moment, for designers, right, for students like you, what is the most important thinking that is needed, right?

Analytical is like a necessary condition. I just spoke about, just now I spoke about necessary condition. What is that? Analytical thinking. Right? Critical thinking. To some level you do know. Now, I am talking about a new kind of thinking. What is it? Lateral thinking. What is lateral thinking? Thinking outside the box.

Right? I just said, we have always done this way. That is a very dangerous statement, that is a very dangerous belief system that [00:12:00] you have. Got it? So, you have to come out of the box. In other words, you have to come out of your conventional thinking. Risk failure. Right? The moment you come out of some established system, right, let me give you a quick example.

A lot of you have a phone. Just take, take out your phone. Right? Let everybody show your phone. Right? It is the same rectangle that everybody has. Yes or no? Yes or no? This form factor works. Right? What we call the embodiment. Right, the, the texture right, the color right, the finish, right. Everybody has got a form, right?

And it looks just the same. Is it a good thing or a bad thing? So again, it is about perspectives, right? What is perspective? It is good because we have what is called a standardized form factor. What is a standardized form factor, right? Something that works. Something that is [00:13:00] scalable. What is scalable, right?

I'll give you an example. I'm writing a piece of code, which beautifully runs on my computer, okay? Will it run? Run on a server form? I have to test it, right? Will it run on a global level? You understand? If I'm hosting a hosting site, right, may, I can do it work within reply t dm. If I connect it to the internet, if I, if I access this computer from, let us say, USA, will it work?

Right? Is the service scalable? That is the question we have to ask. Right? Often you can make one thing work. You can make a prototype work. But can you scale it? Can you make 100 of it? Can you make 1000 of it? Right? Can you increase the size? Can you decrease the size? Right? Scaling does not mean just making it big.

Will it work on a smaller scale also? Right? You have to ask all these questions. Right? So, the question is, right, having a standardized form factor gives you [00:14:00] cost reduction, because everybody is making the same phone, the processes are standardized, which means I can make the phone cheaper, I can give it to everybody.

If you go about building a new form factor, right, something that says, okay, now I have holographic projection, now I have this, that. Why does Apple, right, recently they, they built our, right, virtual reality, right? What is the device called? I forgot what it is called. Vision Pro, right? Your Apple Vision, right?

Why does it cost 3, 000, 4, 000 dollars to produce? Because not many companies build it, right? I still remember when the first cell phones came, right, back in, I am talking about 2002, 3. During that time, right? A phone. If you have to buy a phone with a color display, it's going to cost you upwards of 30,000 rupees for a, believe me or not, for a phone that is less than two 40 pixel.

A color display. That's square screen. That is a what? An inch in length and breadth. That's it. [00:15:00] One inch in length and breadth. Literally two to three centimeters in length and breath. That's it. That will run you upwards of 30,000 rupees. Why is it so expensive? Because somebody just invented the technology.

It is still not. Ammonia is the mass produced particle, got it, it is still not mass produced. So that form factor pretty much is new right, Nokia made one, Samsung made one extremely expensive. Now as more and more companies adopt that form factor what happens? There are few suppliers, these guys what they do?

They make them in not in hundreds not in thousands, but millions of them right when you build up that scale Now, a display that used to cost, right, maybe 3, 4, 000 rupees comes down to 100 rupees or 50 rupees. Right? So, that is why today, right, even if you buy a cell phone that is very cheap, let us say 7000, 8000, it has got 5G, it has got everything.

Right? It has got a full HD display. Pretty much. Right? You buy a phone for 10, 000, right? Pretty much it can do everything. Yes or [00:16:00] no? Right? Yeah. Now, the question I am going to, I am asking you is, this is one perspective, right? I have set a standard. I have set a standard. I have set Yeah, yeah. If you go to to a, a, a, a, A mechanical engineering article going on in the, in the, in the, in the, you know, in the, in the, I think it's the rockets, rockets, rockets, rockets of NASA.

So, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, so, Bye. This is one paradigm. Within this form factor, I can innovate only up to a certain level. Right? Just to reinforce my point, you think about phones. Let's take Apple. Apple 11, 12, 13, 14, 15 or 16 is going to come. What change have they done?

Maybe a slightly faster processor, slightly better camera, slightly better display. [00:17:00] Beyond that, they're actually saturated. We have designed, we have reached a point where, what is called peak design, the design is peaked because this paradigm, I've hit the limit of what it can do. Every, every phone looks the same, yes or no?

Yes or no. You have an issues, you have a whatever, right? You have got a Leno, you've got a right, you've got apple, Samsung. Doesn't matter. Every phone looks the same, feels the same. Why We have reached that point. We are always doing things this way. Now what we have to do? We have to step out, ask ourselves the question, what is a cell phone?

See, a cell phone. Ok. Now this is a complicated question. Is it a communication device? Yes. Is it a computer? Yes. Right. What else can it do? Right. What do you use your cell phone the most? Today you use it more as a computer, more than a communication device. Right. Often I, I do, right, I do banking on my phone, [00:18:00] right.

I am, right, I am, I am like, what, 15, 20 years older than you, right. Now I used to like go into icicibank. com online, right, log in. That, that was, that is how I have always used banking, internet banking, right. I was actually a little bit hours of doing net banking on my phone. But once I installed the app, once I saw the convenience.

What is that? Human brains can do anything. They can come up with questions, right? You can write an equation or you can do something How to So when you're looking at it, it says, you know, we don't know how to do everything. We just do bit by bit. So it is not that simple, right? So, let me show you something.

So this one. It is going to be I will show you. 2003. Sonu. All of you know, Sony right, the Japanese electronics giant. They came up with the phone. They had a partnership with Ericsson Sony Ericsson, right. They came up with a model. They challenged an another, they said. Back in a day, your cell phone was not, was just a communication device which you [00:19:00] use to which you use to make a phone call or send an SMS.

That's it. No internet nothing. So Sony asked the question. Okay why should cell phones have displays? Right. So what they did? Put a piece of You microphone, right. Pair of earphones, right. And the chota dabba, that's it. That's a phone. You put your sim in to the dabba, you charge the dabba, that's your phone.

So if you have to call somebody, you press couple of buttons, right, it will tell you calling so and so. If I am calling whatever, right. If I am calling Kumar, right, call a Kumar. It is a bit cumbersome to operate. Why? There is no display, that failed. That idea by Sony, right, to challenge the narrative. What is a narrative?

You

Yes, Sir. You are correct, Sir. But I am saying, [00:20:00] if you really want to say, if you really want to say like, you know, If you look at any disruptive innovation, right, I will repeat again. If you look at any disruptive innovation, it will be a controversial idea, right. For the friends in the H15, let me repeat, right, because you are not physically seeing me.

Any disruptive innovation requires that a company takes what is called a controversial idea. What is a controversial idea? Something that will make, if I just remove the, right. Display on my phone and then if I say, wear these glasses, now it will project, right? That, what is the first thing you will say?

Ah, that is absurd man. I do not think it will work. I do not like it. Google tried it. Google Glass failed. Right? Google Glass came like 15 years back. It failed. Right? At least 10, 12 years back. Idea was not new. Google [00:21:00] tried it. Did not work out. Apple was not the first one to do this Vision Pro. We had something called Oculus.

Yes. Right? Oculus. Right? The first device that I used was 20 years back. Okay? The idea of wearing a, wearing your, wearable, these are called wearable displays. It's not new. It, it goes back like 3, 4 decades back. Only thing, right, the, the ones which I remember using in the lab, right, they had what is called, uh, cyber glove.

Right? Read about it. Right? Make a note of it. Cyber. C Y B E R G L O V E. You can literally feel an object in your hand. You have a virtual model. I am talking technology that is 30 years old. Right? These are not new, new ideas. Right? You can literally wear the glass. It is a massive display. You have like a couple of boxes of computation.

Right? That is where innovation has happened. Right? They are able to boil that down and put it in a Chota form factor on your, just as a wearable device. Right? Idea itself is actually pretty old. Right? So it is called a cyber glow. You can wear the [00:22:00] glow. Wear this. And then, you have the, you have the, the um, the, the, the, the, the, and then you have It looks weird.

What is this guy? Moe is hand in spades. Whereas, I who is experiencing, this is immersion, this is immersion, right? I can literally feel the object in my hand. Now, this is another paradigm. This is a controversial idea. Very expensive. In fact, back in the day, this cost something like 50 lakh rupees. Paradigm.

Right? The lab I went to, they said this costed us 50 lakh rupees. Very expensive. Right? So, that is trickling down. Now, we will have, what I call this haptic gloves. Right. So in our hands. Right. You understand? Right. So innovation, right, I hope I have given you, right, some thought process into, [00:23:00] right, what is innovation all about, right?

As somebody, right, who is an engineering student who is going to look for a job, right? You just need to have skills, that is a necessary skill. What is the sufficiency skill? It is much more than that. It is the ability to translate those skills into something that you can build, something that, that will address, right, again for our friends in H15, what is the phrase I taught you last week, right, India specific socially relevant problems, right, even for this class it is the same thing.

Right, I repeat. What is it I want you to? An representative of the youth groups is making, uh, a request from the youth groups in a way that's more effective. Okay. And we are, we are, we are doing that right. And also, we are, we are tweeting and texting. And in, in, in, In, in, in, in, in, in, in, in, in, in, in, in, in, in, in, in, [00:24:00] in, in, in, in, in.

Domain can be anything right within that domain You pick a problem statement. That problem statement has to address, right, a problem that is in my local context. An MMI problem, that is a Tamil Nadu problem, that is a South India problem, that is an India problem. You understand? But Ramani's problem, not United States problem.

Got it? That is the first thing. Why are we talking about picking a good socially, socially, socially relevant India specific problem? Reason being, only if you pick that. Right? You will be able to address the needs of the mandate of the institute and ultimately the needs of the nation. You understand that?

Clear? Right? So, so, what we have seen? We have seen AAAADM and its relevance and then we have seen gap between students competencies and industry requirements. And we also saw global state of the art in engineering. Right? So, generally, right, you are all third semester students, generally [00:25:00] with the same mind, right?

So, some of the students, they send me a mail, right, look at it, no subject and then I asked you to do, right, maybe this class, I do not know if it was stored, please go to a website called Gapminder, right, I will write it in the board for you, Gapminder,

right. So I asked students in H 1 5 to go to this website called Gapminder, again this website is run by. The book, right, the guy who wrote the book, Hans Rosling, right? So he wrote the book and he has a website called gapminder. org. Please take a test, right? And, I will go back, I will add you to our MS teams, right?

It will be a formal assignment you have to submit. So, some of the students a little bit unhappy, they did the assignment, they mailed me, but look at, look at the mail, right? This is what one student says, I have hidden the roll number, right? But if you see, it says, I have attached files to this [00:26:00] message.

What does it tell me? It tells me nothing. Right? There is no roll number, nothing. See, New Dog, 05 August, that's it. That's what it tells me. It tells me nothing. It doesn't tell me who sent me the message. I have to go back to the mail and say, oh, this, this student, okay. What is his assignment about? Every day I get 100 mails.

Right? So, I have to do some background search, I have to do some literally scavenging to find out what this mail is all about, right. So, please keep your recipient in your mind. It is what we called empathy, E M P A T H Y. What is empathy? If you see a beggar on the road, what do you feel? Oh, poor fellow, right.

That is not wrong. You, you develop some sort of, right, some sort of what is it? What is the other word for empathy, right? Some sort of, right? Emotion. Uh? Pity or, uh, uh? Sympathy. Sympathy, uh? He can't hear us. Some sort of [00:27:00] sympathy, right? He can't hear us. Okay, poor fellow, right? Now, empathy is, right, it is what is called six thinking hats, right?

Again, a concept proposed by Edward de Blom, right? So, he has also written book, written a book called Six Thinking Hats. So, in which he says, You have to play the role of a designer. What is the role of a designer? Now you put on your designer's cap and you think like a designer, ok. Take something as small as your writing instrument.

All of you are using a pen or pencil to write. Take a look at it, right. Designer cap. It has got a certain length, certain diameter, right. Pen length. Yes or no? Pretty much it is again standardized, right. I am holding a stylus right. So I am using a stylus to move the pointer. Right? A stylus pretty much looks like a pen.

It's got a nib. Right? So on and so forth. But the point is, right, pretty much everyone of you hold an instrument that more or less looks similar. When I put [00:28:00] on the hat of a designer, the question I have to ask is, right, who is my user, right? And how is this fellow going to use my, my instrument? Right. What are all the different scenarios in which he will use my instrument, yes or no, he or she will use my instrument, right and are they educated to use this instrument or should I tell them how to use this instrument, right, this is the role of a designer, right.

Now you remove that hat, you put on the hat of a different person, who is that person, marketing guy, ok. Now marketing guy is asking the same question in a different way, who is my customer, ok. This person is my customer. What can he afford? What can he pay for this? Now designer probably may not think, did not think about cost but the marketing guy is asking the question.

Ok. What is this? Who am I designing this for? Is the designer's question. Who am I going to sell it to is the question the marketing guy is asking. Got it? Now you remove the hat. You put on the guy who is [00:29:00] going to sell the pen to you, right? Ok. How do I sell this pen to you? That is the question he is going to ask.

Yes or no? Now, look at, change the hat, right. Next hat, what is this? Service person. Okay. Who is this guy? Okay. How will this product fail? If it fails, how do I fix it? Now you see, if six different people, marketing, there is a marketing guy, there is a design, there is a designer, there is a, uh, somebody who is doing, uh, the actual sales, who does the actual service.

If there are six different people, right, you will have a terrible product. Okay. You have to be a marketing guy. You have to be that marketing, right, that marketing person, whoever is selling that, whoever is advertising it, campaigning for it, who is going to service it and you yourself should be the user.

That is the important thing. I should become as a user. You understand? Right? So that is the question I am asking. Right? So, got it? So, that is [00:30:00] what we call six thinking hats. Right? So, you play the role of a designer, you play the role of a, take multiple things. Oh, oh, okay, okay, okay. Right? So, so we play multiple roles.

Right? So, the reason why I am saying this is, right, if there are six different people doing this, right, there will be a serious disjoint. Right. So, you have to become every single individual that is in question and then you have to play that role. Only then you can even build something as simple as a pen or a pencil, a writing instrument.

Got it? Right. So, where does it start? It starts with the economics. What is this my customer can pay? What is it that they can pay? Sir, 10 rupees. Sir, 10 rupees. So, I build a pen for 10 rupees. That is what we call demographic. Who is my customer? That is the first thing you ask. Ok. That is all they can pay.

My customer can only pay 10, 10 rupees. So, I, I build a pen. And what [00:31:00] are they going to use it for? My customers are students. So, they are students, right? They are being paid by their parents. So, I want the cheapest possible pen that will draw, that will write for like kilometers, write 2, 3 kilometers, write as much as possible, right?

In fact, if I can make a pen that will write for an entire semester, they are even more happy. Yes or no? Right? Got it? So, the point is, right? So, this is what, this Sixth thinking has the, the idea behind the book, right, what Edward de Bono preaches, right. So, please show empathy. When I, when I see mails like this, it just tells me, right, you have not given it any thought, nothing at all, right.

That is a key trait which I, which I would want you to develop over time, got it, right. Anybody can code, right. Again, I told this to students, right, our students, friends in H1 5. Anybody can code. ChatGPT can code. What difference are, have you got to make? We have algorithms that can do far better coding than any human alive today, right?

Then what role, what [00:32:00] significance, what relevancy do we have, right? The point is a computer algorithm does not understand, right? It does not understand context. There is no context, context for an algorithm. It is just a pattern matcher. It is a very sophisticated pattern matcher. Right. Often times, right? I even gave the example of using grammarly.

All of you use Grammarly, right? Proposition beautifully corrects. Sometimes I will be thinking, should I put on or should I put in, right, at, right? I get this confusion despite, right, learning English for a really long time. That it beautifully corrects, right? But the problem is once I started believing it too much, right, and then it, I made it, it gave a suggestion, I accepted the suggestion, fortunately I read it by mail, it just changed the meaning of the earlier sentence.

Right. It was grammatically correct, but it completely changed the meaning of the sentence. Right. Right. Then I had to go back, correct it. Right. Then again, from that point onwards, I [00:33:00] became, right, little bit more attentive. I don't blindly trust the tool. It is a tool that makes me very productive, but it is not a human.

A tool is not a human. Right. So, it does not understand context. Right. So, please understand context. Right. So, that is why I wanted to talk about this. Right. Right. So This we made, right, again, uh, so what did we do? I asked you to write basically using all these terms, right, in a single page, that is the constraint, right?

You did this exercise in class, right? Right. But most of you won, right? Many students, right, you started writing paragraphs, sentences, right? So what is the key message? What is the key message? Can somebody answer me? How do you consolidate in a very beautiful, elegant manner? How do you do that? Venn diagram.

Any volunteers? Venn diagram. You can put a flow chart or you Venn diagram, right? Idea is use figures, some sort of graphical representation, that is the message, right? Do not always resort to writing, [00:34:00] right? Writing is essential. So, the example I gave in last week, right, gave you last week is, look at a newspaper, any news article, what does it have?

A big headline, such as course 100, right? That tells you, okay? Then there is a graphic or let us say there is a, uh, information about, right, population of different states. What does it say? Right? It says population, right, stabilizing, replacement ratio of India stabilizing 2. 0, right, that is the headline.

And then it shows you a map of India with different states with percentages. This state is contributing this much. This used to be right. The replacement ratio used to be two, 2.1. Now it is a two. These states are below two, right? So what is the first thing you do? You don't start reading, right? So that is the important thing about right, designing DUIs, right?

Value. Want your user to go, right? You can literally dictate how somebody, I'll show you an example next week, right? So you can ba, I can control how [00:35:00] you read actually. So, it is what is called influence without authority. I am going to influence you without even you knowing I am, I am controlling you, right.

That is a very subtle art, right. So, in graphics, right, you put a very bright, very big bold letters, obviously that is the first thing your eyes will see, right. Then you reduce the font size, then you put all the information in the smallest possible font size, right. Often times you would not even read the thing, yes or no, you read the headline, look at the picture, carry on.

Got it? Right. So, use pictures, use graphics to illustrate as much as possible, use clustering. There are terms like make in India, start up India, skill India, all these are interconnected. What are these? How can I classify all these together in a, under a single umbrella? It is a, these are all government initiatives.

Yes or no? Government initiatives. Club all these three. Then market, customer, user, again I can club them into a single cluster. So, if I look at it, you might look at, there are 16 [00:36:00] elements. But then like, how am I going to put all this? Look at clustering and look at the interrelationship between different clusters, right?

You can actually boil this down into a very small figure that represents what we are trying to say in a very elegant fashion, right? Got it? Again, we looked at, right, what are the competencies you developed in year 1 and how, right? All the different subjects that you learnt, right? So let me just take a moment, right?

Let us look at calculus, right? You might have simply, you may have thought. How to differentiate? How to integrate? Right? How do you solve, uh, you know, first order, second order differential equation? How do you take a differential equation? Write the complementary function, particular integral. Yes or no?

This is your thought. But is it useful in real life? Is it useful in real life? All of you are feeling cold in this room? Yes, sir. Yeah? Right? So, what happened last semester? They were not turning on the air conditioner this time we asked. So, they put the air conditioner in full. So, next time I think they'll say.

When we go tell them it is too cold, [00:37:00] it is, it will get turned off, right, on a lighter note. I am of course joking, right. I will ask probably to slightly raise the temperature, right, it is 25, 26 I guess, pretty cold. Now look at this, right, look at the temperature distribution in this room, it is actually highly non uniform.

Somewhere there in one corner it is too cold, another corner it may not be that cold, it is probably comfortable, right, and somewhere in between. Right. And you look at the ducts. I want all the students, right, 5, I cannot see you, I hope you are looking up. Look at the placement of ducts, right, the AC ducts.

It is uniformly distributed. If you count, right, count the tiles on the ceiling, right, 1, 2, 3, 4, 5, right, there is one duct. 1, 2, 3, 4, 5, that is another duct. So it is like matrix grid. Yes or no? You can actually, if you see, it is like a 2 by 2 matrix. Right. Right. So, if I just look at it like a matrix problem.

It is a 2 by 2 matrix which is sitting right over your head, right. Now the problem is there [00:38:00] is one duct that connects to all these ducts, ok. Now the question is how do I ensure, right, it is like this, ok. If I connect it to the last duct, actually if you look behind, right, the door which you see at the back of the classroom, right, the AC unit is located there, right.

And that unit is connected to a big ductwork that connects to that very first duct there. If you actually go, the airflow there will be highest and if you come all the way to the front where I am standing, where the stage is, the last duct is here. So as the air is flowing, there is a pressure drop, there is a change in velocity, it slows down.

Now I have to design my ductwork such that, right, more or less, whichever, it does not matter where I sit, right. So, the first example is the R flow, right above my head is uniform. Second example, I am talking here, you can practically sit anywhere in the classroom and hear me with uniform volume. Yes or no?

The [00:39:00] guys, the last guy? Just wake him up, right? Are you listening man? Right? So, you can sit anywhere in the classroom. Right. And listen to me at the same volume. How is this possible? There are multiple speakers. Again look above you. Where are the speakers located? Right. There are couple of speakers that are located strategically.

Right. Again, this is a differential equation problem. Right. You learnt in calculus. Just dry theory. Right. For which you will say, why am I being asked to solve all these equations? Makes no sense to me. Right. I can model the flow of the air. I can model the propagation of the sound wave. So, let us take the simplest possible differential equation, all of you know, all of you know F equal to m a?

Yes sir. Right, F equal to m a, all of you know, force equal to mass into acceleration, Newton's second law. F equal to m a. Right, acceleration is the second derivative of what? Displacement. d square s by d t square, is that not a differential equation? Right, [00:40:00] so it can be as simple as your Newton's second law, If I have to get, how much I have travelled, if I apply a force over a certain period of time, where will I end up?

Right, of course, I have to look at, I have to model the system, I have to double integrate, yes or no? Right? Now you have a differential equation, you integrate it, right? You end up with the, right, what are called, right, your equations of motion, right? All your s equal to, right, v equal to u plus a t, right, all your three equations of motion, right?

You can use all that. Right, so what I am trying to tell you is, every subject you will learn, right, if you can look at, right, electromagnetics, right, again this is, generally I took, right, differential equations, right, graphics, right, again look at data structures, how is data structures useful, right. For CS students, yes, it makes sense, what about mechanical guys, what about electronics students, how is data structures useful sir, how is this useful?

That is why they did not study it. It [00:41:00] is everywhere. Exactly. Yes. Studied easy. See I work in medical devices space, which means you have to handle a lot of patients, okay. Right, right, right. Which means a patient comes, gets admitted, right. I have to know their name, their age, right. Uh, their medical, uh, records, where on all did they go, what all the treatments they have taken.

Now, that is a data set. When I have hundreds of such people, when I have thousands of such people, Okay, how do I handle the data efficiently. Now, how do I know a particular disease is spreading, COVID. Right, they did all this fancy maps, right, they said it is going to spread this way, right, it is modelling, right, all that is helpful with again, you have data structures in algorithms, right.

So, right, so I spent about 40 minutes recapping some of the principles that we covered in the last class, right. So, I am going to go headstrong. Into new principles Right. That we'll be seeing this week. Right. This week I'll be playing a video also. Right. Something which you've seen. Right. You've been shown the [00:42:00] lot of video and sociology of design.

No. I'll play the video for you. Right. It's a 10 minute video. Right. Then we look at what is called fuzzy front end, right. I hope it was explained to you. FFE, fuzzy front end. What is fuzzy front end, right? Of NPD, what is NPD, right? For our friends in H1 5, right, what is NPD? NPD stands for, right, unfortunately I cannot write with this pen, I can only point for you guys, right?

NPD stands for New Product Development. I repeat, NPD stands for New Product Development, right? What is New Product Development? Right? Let me spend a couple of minutes trying to understand New Product Development, right? So I have got phone, classic example. Nokia became irrelevant, right? No. If I tell you back in 2008, right, right, everybody had a mobile phone and it was a Nokia.

Nokia, it is that simple. So, I repeat, back in 2007, 8, [00:43:00] everybody had a phone, it was Nokia. If you, if you said mobile phone, they will say Nokia, it was synonymous. It is like Google the problem, Google it. Google is what? Right? Google technically is 10 power 100, right? That is what Google is all about. So, 10 to the power 100 is Google, right?

So, right, these guys thought, okay, that is a fancy name. Let's name our service, our search engine as Google. Okay. It is actually a noun. Right? So, last week we looked at what is called noun and a verb. Looking at design as a noun and design as a verb. What is design as a noun? Right? So, I asked your friends, right, to basically look at the word for design in your own mother tongue.

Okay, I hope our friends in H 1 5, right, you looked up in Telugu, in Malayalam, right, in Hindi, whatever be your mother tongue, Kannada, right, does not matter, right, in your own mother tongue, look at the word, right, your mother tongue, in [00:44:00] your mother tongue, what is the word for design as an noun. Now, design can also be looked at as a verb.

What, what do I mean by looking at design as a verb? The process of designing, right, it is an activity, right. Okay. I am making something. It is like cooking, right? You are making food. The process of cooking, right? That is a verb, right? So you can also look at design as a verb, right? So in this case, right, we can look at anything, right?

As a noun and as a verb. So in case of Google, right, you can look at Google as, it was a noun to begin with, google. com, right? Right? Now, what it, what, what that, slowly it started turning into a verb. So it's a, Google it, which means the process of looking for an information came out to be Googling it. Over time, colloquially it became like that.

Yes or no? Oxford English added it. That's a verb, Google, [00:45:00] verb, to look for information on the internet. Now, Microsoft slowly, they also spent money, they said, Bing it. doesn't sound as good as googling it, right? Bing it, at least. Right? So, right? So, I digress, right? We were talking about new product development, right?

So specifically, right? I'll give you a 10 minute break, right? So, 5 minutes we'll talk about new product development, then we'll come back, we'll do an exercise in class, right? So, every week, as I said in last class, We expect you to have a bunch of paper, free papers, A4 sheets. Have them, You Right. We will give you exercises in class.

You please do the exercises. I will be there with you. Work with you. Right. So you will be filling in all the sheets. Right. And then you will be handing it over to the TAs. Understood? Right. Also the TAs are also parallelly. Right. So most of, most of the TAs are senior to you. Okay. They have already completed their degrees.

Right. They have got multiple backgrounds. Right. Now we have a mix of PhDs. Right. We have MDes students with us. Right. We have design students. Right. So they do integrated product [00:46:00] design. Right. So, they will be helping me in evaluating your assignments, so on and so forth, right. I come back to new product design.

So, new product design is actually very difficult. Why is it very difficult? If Apple makes, ok, let us look at iPhone 16, yet to be released, right, but you have seen all the rumors, right, all the, somebody has leaked the photograph, right, and then it looks exactly the same like 15. So, what is Apple, what has happened to Apple?

Right? So, if you look at what has happened means, they are a trillion dollar company, their revenues are pretty much streamlined. They have found a recipe that works. Why would I want to go and then destroy that recipe? That is earning revenue. I have trapped all of you in a ecosystem, in a recurring subscription model to my, right, iMac to my Apple ecosystem, right?

If you buy my iPhone, you have to buy my iMac, you have to buy everything from me. So, I [00:47:00] am going to do a quick version of this. So, you will see how to do a quick version of this. This is the instruction which you will see. So, this is what I am going to do. I am going to do a quick version of this. This is the instruction which you will see.

Now, they are also trying their own things, but it is not working. But, when somebody figures out, right, what will happen to the hegemony of Apple, they will be finished in no time. The same thing happened to Nokia, right, because I have seen it multiple times in my own eyes, right. I will give you historically another example.

All of you know about Kodak, right. Kodak was not a photographic company. Kodak made films for the world, ok. They made a camera called KB10, ok. It is like a legendary model. It is like your Nokia 0000, all of you. So, it is a phone that is made for [00:48:00] India, very cheap, very durable, you can put it in the dustbin, you can throw it, right, walk on it, put your, run your cycle over it, it will last, right.

It is like, built like a Shaktimaan, right. You cannot break it, ok, that is double one, double zero. So, KB10 was one such camera, you know, you know, you know, metaphorically speaking, right. So, KB10, take the camera. No electronics, just the flash. Other than the flash, everything you have to do manually. Put in the film, right, load the film, start clicking pictures.

So there is a total viewfinder, you look through it. Whatever you saw, click a picture, you got a photograph. That's it. Anybody can take a photograph with the KB10. Before that, you have all these DSLRs, you have to twist a couple of knobs, right. All the fancy things You have to really understand exposure, you have to understand exposure triangle, you have to know Okay.

What is illumination? What should be my ISO? Blah, blah, blah. What should be my aperture? All the, right? It is so much. For an average person, it was too much. KB10, nothing. It has got a fixed aperture. Right? Those of you who are interested in [00:49:00] photography, I mean, I hope you can follow me, right? Fixed aperture.

Fixed focal length. Right? And then it is focused at infinity, which means if I take a photograph, it will photograph everything. You cannot have all these, you know, lens blur, none of that fancy stuff. But it took nice photographs. Right? So, KB10. Kodak sold this evidence like anything, and then they sold the films.

They were initially a chemical company. Kodak expertise was in making films chemical. So the problem was the management kept that mindset, right? They never looked at theirselves as a purely photographic company. They said, we are a chemical company and we make films and cameras. This was their thinking.

You understand? Now this recipe worked for decades, seventies, eighties, nineties. right, Fuji came, right other, uh, manufacturers starts, right, they started, uh, making, right, even, uh, companies like Leica, okay, uh, I forget, right, there is a Swedish company, what is it called, [00:50:00] man? Uh, wait, I forget the name, uh?

Hasselblad, yeah, that is the one I was looking for, right. Hasselblad, you have all these fantastic manufacturers, camera manufacturers, right. They come and challenge Kodak slowly. But Kodak was the king, right, for decades. Slowly what happens, somebody in Kodak, right, this is the irony, okay, I am giving you some history, right, bear with me another for 5 minutes, I will let you go for a break, right.

So right, 5 please, I hope you are listening, right. So historically speaking, Kodak was a chemical company, they were also making cameras and films, okay. Okay. So, we took this equation. We got this equation R d say, we had R d say. This is the next equation. So, R d divisor is going to be R d plus 1. Can you see this one?

Was that R d? So, let us take this equation, so that we have this expression in the matrix. And this is going to be, I am going to write this equation here, x dot x dot. [00:51:00] And I am going to take the numerator here. So, we have to erase this and we have to write this equation. So, this is, this is going to be the fraction.

Let us go digital, they build a proof of concept digital camera, Kodak builds it. They prove it and then what does the management do, they say, no, no, no, we are a film company, we are a chemical company, right, if we make this, it will cannibalize our own market because what happens if you sell a digital camera, done, you sell a camera, that's it, done.

Nobody could foresee the role of, uh, phones, right, the camera phones, nobody. See, unfortunately I come from an age where cell phones used to be this big with an antenna. The first cell phone I used did not have a camera. The next cell phone I used had a VGA camera, which, which can only take still photographs.

My Sony Ericsson, right, could only store 8 images, 8 pictures. Those are precious 8 images, okay, which means I have to think 10 times before I took a photograph. Why? Space is limited. I only could store 8 images, which means I [00:52:00] have to be absolutely sure. Should I record this moment? Yes. Then I took the photograph.

You understand? Right, so I come from those days, 240 pixels I can have told you. Will you even bother looking at a photo at 240p? I still have those images that I took that, right, I can maybe share with you in next class, right. There is a famous bridge, right, and then I took it, right. Now literally you will see pixels, right, something that will resemble a bridge, right, I digress anyway, right.

So that was the case. Blue color, right. So, when I say, what is a transcript? Transcript is a number of word. No. Transcript is a number of word. Transcript is a number of word. Ok, one more thing. Ok. Transcript is a number of word. Correct. In fact, I can hold it. right, with our film cameras. Right? Nikon saw the trend, the changing shift in [00:53:00] the market, they start pivoting.

What is pivoting? They say, world is going to go digital, let's start building digital cameras. Canon did the same thing. All the big, everyone except Kodak started getting into digital market. Slowly, slowly, slowly, over, between 1990 and 2000, slowly, Kodak is losing market share. Digital cameras picking up, point and shoot cameras come into being.

Right? Now you have your DSLR. First DSLR, DSLR is coming. Right? Which an average, uh, right? Guy can buy. About thousand dollars. Thousand five hundred dollars. I can buy a DSLR. Slowly, when people started seeing the benefits, within three, four years, entire world goes digital. It's all point and shoot. Point and shoot cameras.

And slowly, cell phone cameras are also evolving. Kodak wakes up. They are like, dude, we have to do something. Right? They start releasing a couple of digital cameras. By this time, Nikon has established, right, your Hasselblad, other manufacturers, they are much more advanced models. What happens? Fugee, which is also a film company, Fugee has very good digital cameras, [00:54:00] right?

Kodak loses its market share all the way from 90. I still remember seeing their, they went bankruptcy. I witnessed Kodak's bankruptcy. I am seeing the thing, it goes to 1. BBC, what they are saying, Kodak becomes bankrupt, 1, right? In, it's a decade of, right, downfall for Kodak. Why?

Aspire to change, right? Even when their own team said, right, we have to change, they were reluctant to change, they become obsolete. There is another case, Indian company called Hindustan Motors, all of you know Ambassador, right? Same problem, never innovated, stuck to the same, same model year on year, reliable car it runs for, right?

I still have my, uh, if I go to my village, right, uh, my neighbor has a car which is 35 years old. Same car, right? Of course, rusted, right? But it runs. It runs. But. No safety. If you got into a crash, you die. No airbags, no seatbelt, nothing. Right? So the point I'm trying to do, which I'm trying to make, is [00:55:00] right.

New product development is vital, especially in today's interconnected world. If I don't do it, Chinese are going to do it. If I don't do it, the Koreans are going to do it right? So I have to be, make sure I'm top of my game. You understand? So NPD, new product development, you have to do it right If you are for software guys, right?

If some software works, let's go at MS. Office. Microsoft Office, right? Okay, it has been there since, right? Early 85, 90s, right? Word processing. It's not a new idea, right? But then you can slowly see what is happening there. Right? Now you have, right? Earlier PowerPoint, right? It used to come with, uh, lot of templates and you can download these, uh, what are called, uh, I'm forgetting.

These animations, you know, what do you call them? Huh? Microsoft Right, I forget. Right, so slowly you, you see it evolving. Now it has become more of a cloud service. I can run Microsoft on my phone. I never thought, I never thought I [00:56:00] could actually write a text document with my phone. I never thought I could do, I could do Excel on my phone.

Nowhere. If you 10 years back, I would have said, no, you are blabbering. Impossible. Because the processing power was pathetic. Right? So, right, we'll continue with new product development. I'll give you 10 minutes, right? Time on my watch is 2. 55. Let's come back here at 3. 05. Right? So, please order. Please be on time.

Good morning.

Good morning.

You want to come back and meet me? Sir, sir, how many minutes [00:57:00] break, sir? Ten minutes. Ten minutes. Take care of my tab, Aditya. Take care of it. Aditya, take care of my tab.[00:58:00]

It's okay, we're still there. It's okay, we'll be there.

I'll go five minutes late. I told him rest room only, you know, he'll take that by Hey, here's attendance gate, you know. Yeah, but then it's over.

Share it,

share it, share it. [00:59:00] Same tactics you also know? Yeah, we both are in the same class. How is Karthik's team? Perfect. Enjoyed it. Why sir did come for you today? He wants some, yeah. He came once in a while. Because he is busy something. Oh. Hey, bro, my I. D. card is lost. What? Without I. D. card.[01:00:00]

I think.

You can just take my ID card and go, okay. Then I'm, you can go. No, let this be, [01:01:00] they can go together.

To nine in the morning. Number, uh, sir. Yeah. Morning , uh, CS 23, A 1 0 1 4 Badminton and gym only nine to 10. Um, CS 23, A one zero.

How much enough? [01:02:00] 6 25.

Batching

have to,

I don't think it have D Did not get that mail. I got that mail. I think Google form. Yeah. Yeah. You know, no, no, no. Go, uh, did you fill them up? submit them? Yeah.

This family? No. Uh,

right.[01:03:00]

Send it to yourself in WhatsApp. And then, uh, No, no, where is all the What are you guys? Photos is there. Let's upload to Photokill. Do one thing, send to your WhatsApp. Send to your WhatsApp and take it from there. Send to you WhatsApp. I'll save it in WhatsApp. Yeah. Let's save it. Press on save. Yeah, like, exactly.

Wait there, now. Same? Up to a value? 1 Venkatan, badminton. [01:04:00] 0

Badminton. 2 slots. 2 slots. 2 slots. I think I did not submit that form. What is the, 3 o'clock break started no? 3 o'clock break started no? 3 o'clock break started no?

How does it start? I don't know the answer. Go on, you have the answer. You must know that you don't [01:05:00] know the answer. I, uh, I came up with the answer. Somebody did not give me an answer. Good morning, dear old comrade. I've

got this. Can you tell me who cares about smarts? No one cares. It's for formality, bro. See. Even they know that they are smart. If you know what they are telling in Tamil, you know what service you are getting. If no one comes, you can play. Yeah, obviously. If no one comes, you can play. If no one comes, you can play, yeah, exactly.

You take mornings, not evenings. Which is obviously the case. Yeah, obviously. I was literally the last semester. Last semester, no, no. Last semester, I took morning only. I came and played evening every day. Yeah. So, the rain thing is going to happen. See, this thing, obviously. See, pressures, they'll all be taken in the morning itself.[01:06:00]

Pressure's on and I have 8 o'clock news. They put them everywhere. Date of payment, badminton, CS club. Today there is, uh, Summit. Summit is there. What? This thing is also there. What? Technoduction. Fuck. But I won't go for it. Are you attending CS club? No. Suit B. I have AU event, I have object oriented programming, so I'm not doing it.

I know object oriented programming with matrixing. Yeah, yeah, yeah. Pro determinant is very interesting. It's a super interesting problem. Adjoint, adjoint. You just find an adjoint matrix and it's easy. See, for adjoint you need cofactor, for cofactor you need determinant. So, if you do determinant, but determinant also [01:07:00] you need, I, I, I, no, what is it called?

iJoin My What's Co factors thing? You know? No. Yeah. See it's a repercussion. That's inverse audio delay. It's repercussion. Decsion only four. You take the first calculation three. Yes. I like that. That's only like that we have to going. Yeah, exactly. So that's very easy to say. Do you want to use the restroom again?

You are D. O. Hi. Oh, you don't want to use it. There's no soap upstairs. I'm going to show you. I only use water. Water is really efficient. You start it.

Yes, sir. That's the question you're asking. Can I start on an empty slate? [01:08:00] Can I ask the question, if you are talking about a car, okay, Hyundai makes cars, right. Let us take a classic example, okay. Santro was their success model. They came into India with Santro. Then they put Santro Zing, right. Then they started selling Verna, Elantra, multiple models.

Now they are selling i10. What happened to Santro? Multiple different iterations. For some reason, the car model that brought, that introduced Hyundai to India, is not selling. People look at it as a old car. Yes or no? It is an old design, man. Do not buy a Sandro. Only poor people buy Sandro. Do not buy that.

Right? Nobody wants to be associated with, right? Being poor or being, uh, without influence, right? So, Sandro went out of the way. Right? You have your items. Guys, please come back on time, right? If you keep coming, right? It is a lot of disturbance. So RO was replaced by item. Item. [01:09:00] Is there item? What is the next model?

Right item. Let's talk to one model, right? You have grand item grant. Then this guy had a Neos, right? And is updated. Now if you look at the 10 lifecycle, right, it's all 20 year period. Yes or no? Yeah. It's a 20 year journey. In this period, if you look at item grand and item 10, not much difference. That is not new product development, that is incremental improvement, not even innovation.

I would not even call it innovation, right. If a company gets in and let us say, right, entire world is moving towards electric vehicles, yes or no? Everybody is going into electric, right. Toyota is a bit on the fence. Toyota is the world's largest manufacturer in terms of volume. They sell the most number of cars anywhere on the planet, right.

And then what are they doing? They do not. They do not have that many electric cars, right. You do not see. They have their Prius. They have a hybrid. They have a, what is called, plug in hybrid. Right. THEV. Plug in hybrid [01:10:00] electric vehicles. That they do. They do not do a, they do have only one model in US, right.

Only one model. Why is that? Because Toyota is still not convinced of the EV. Only time can answer. I do not know. I do not know. BMW, every other manufacturer. Now, this is what you have to understand about placing beds. What did I start the lecture with? If you want to innovate, you have to bet on a controversial idea.

Now the problem with the controversial idea is, it is most often will be a failure. Because the reason controversial ideas are controversial, because they have not that good a chance of succeeding, right. Now, I don't know what will happen to Toyota, right, they are playing the long game, probably they will wait, see how the market responds for another 5 years.

I have friends in Volvo, I have friends in, uh, Caterpillar, they are saying, hey, probably this is a failure, man. Electric cars are not selling well in US, right. They are piling up. India, right, Tata some level, Nexon [01:11:00] they sold, right, Tiago, they put, right, they are selling, right. But the adoption is not there.

Why? Again, somebody can always say infrastructure is not there, sir. Charging infrastructure is lacking. Let us put that and see, right. But there are other inconveniences, right. I can go to a petrol bunk. Fill better in two minutes. Even with the fastest battery charger. It's our right. Yesterday I saw a video in China.

Somebody's demonstrating five minute charging, right? Possible, right? It'll be a demo. I will be convinced only if I see a mass market car that can do that, right? That technology is several years away, right? So Toyota is on the fence, right? Toyota is betting on hydrogen, right? Multiple other technologies, right?

So what is that the company should do? Answer is. Of course, he has I think two more. I have the third one. He has the, he has the third one. I have the third one. And I have the [01:12:00] second one. What's your name? Well, I am sorry. What's your name? Siddhant. What is your name? Siddhant. My the last one. What is your name?

My name is Siddhant. You Oh, people like this man because if A series fails Samsung doesn't lose anything, it's a cheaper model, right. It's a cheaper phone, right. People who want, right, maybe uh Xiaomi, maybe oneplus, they'll go for a A series or M series, right. If I'm buying a, a, a series, I want performance.

You guarantee me. I'm paying a lakh for a phone. It better work properly. I don't want any glitches. I am a discerning customer. So you better not irritate for joining. Right. So, they will play it safe. They will not really try anything with their S series. You will always find it with their cheaper models, right, even Samsung does it.

That is why Apple, one of the reasons why they don't take any massive risk, right. They made an Apple car, 10 billion dollars. How much money is that? 1 billion is 100 crore dollars, which is like what, [01:13:00] 8000 crores, 1 billion, 8000 into 100, how much is that? How much is that? Huh? Huh? 8, 8, 0 lakh. Right? Look at the quantum of money.

Apple scrapped the project. 8 billion dollars, they built a car, they said this is not working, let us scrap. Ok. There are multiple concepts, right? I mean this is not a management course, but I am giving you some flavor from these things. Because you have to, you have to think like a marketing guy also.

Finances are involved. One of the reasons I asked you to read that book Factful is, if you only, if you are concerned with technical things, right, which is a small slice, once you go to industry, it is just a small slice, probably 15, 20 percent of the entire pie that you see. You understand? There are finances, there are, you have to understand, uh, customer demographics, what sells, please keep your phone in silent mode, right, what sells in one country will not sell.

I will give you an example. In Indian culture, right, if somebody breaks a glass, [01:14:00] what does your, uh, grandmother will say? Oh my God, this fellow broke a glass, man. Right? They look at it as a woman, right, as a bad thing if you break a glass. Yes or no? Your grandmother will be scolding you for the next five days, right?

Why did you break it? It is going to bring in bad luck. Yes or no? Right? Historically. But, if you look at, right, only recently I came to know about this. In Jewish wedding. After they will stamp on and then they will, they will break the glass. Like what, what one culture perceives as a bad luck is what another culture starts their life with, a new journey.

Who is right? It is just a customary thing, it is a cultural thing. Right, what, society has a whole beliefs, you are right, you will have your own way to defend it, I am not going there. All I am saying is as an outsider, right, I am saying, ok, one class of people behave this way, another class of people behave exactly the opposite and then what?

It is accepted and it is [01:15:00] frowned upon in another society. So when you build something, right, it will sell really well in one place, but in another place it will be a miserable failure because culturally it will be different, right. If you are not sensitive to this, in a global work space, right, I will tell you the problems.

Sometimes, right, we work with lot of clients, ok. Ok. European clients are there own thing. Okay. They are chill. French people are laid back. They will work 3 to 4 hours a day. They will do beautiful work. Okay. A French guy will work 3 to 4 hours a day. Not more than that. He will be chill. But when he works, he will deliver.

Okay. Typically Indians, Philippines, right, Chinese, Koreans, they will work like 10 to 12 hours. Right? We won't even know. They will be working. I am busy man. I am doing some work. Don't disturb me. Whether I am doing the productive work I am going to, I don't know, but I am working all the time, right.

Americans are a bit, right, they will work hard, right, but they have a very strict timeline, they will stick to that. Similarly, Japanese are also overworked, right. When you work with different peoples, right, Europeans, [01:16:00] they are puzzling. Dutch people, they are puzzling. How come, I will give you an example, right.

PhD in India takes on an average 5 years, 5 years of time, 4 to 5 years, a degree equal to any IITs anywhere. Five years. You don't want to do a good job five years in Europe it is three years. How can it be three years? I ask a lot of promises. How are you able to give a doctoral degree in three years? I know you guys work five days a week, you don't even work on the weekends.

How is it you able to do that? Because their approach is very different, right? They work 40 hours, 40 less than 40 hours, right? But yet you are able to do, create value in that limited time. How is it possible? Right? Because their system is different. Here if I go, right, maybe the light doesn't work, internet doesn't work, right, water doesn't come in the tap, something is delayed, right, there is a chain of events that have to work for you to deliver, right, that will be pucca, picture perfect, right?

In a western system, you go there, [01:17:00] right, there is no attendance in classroom. Right, these I said. Last week itself I said. There are no attorneys. Nobody will take attorneys. Especially in a postgraduate course. This is an undergraduate course. Postgraduate courses, no attorneys. Students will come, sit, that's it.

They will listen to the lecture, take notes and go. Why? Because the system trust you will behave well. It will trust you. It is a faith based system. I can go to a shop, right, there are shops I have seen, you can buy the grocery, you have to do a self checkout and then go. Faith based, driven, they'll believe, okay, you'll do the job.

Is that not a better system? Instead of policing? Often when I ask you, right, how do we enforce traffic laws? More police, sir, bring in more police. We have solved the problem. No. Somebody who's trained in systems thinking will not do that. They will ask the question, no, I will build a society where I don't need police.

Where people behave, self behave. What do I do to get there? That's the question I have ask. I'll ask the question, what does it take? To [01:18:00] incentivize. Let me repeat. What does it take to incentivize good behavior? This is a fundamental tenant of a good design, right? A good design. If you build something, if I put a traffic signal right, the moment I see it, I should be incentivized to stop.

How do you do that? Okay, I'll give you another example, right? All of you, right? When you want to take a vacation, you go somewhere, you travel to a different place. You go to a hotel, sometimes you go to a very expensive hotel, right, it is the same food he is giving you. Wake her up. She is a deep gyaan.

Students, please do not sleep. If you want, go, wash your face and come. I understand not the best of times, right, sometimes you drift without even knowing. Good for me, I am standing, so there is no way I can sleep, right, although I have a friend who can stand and sleep, right, okay, as I was saying, right, you go to a nice hotel, You go to Taj [01:19:00] Coromandel.

There is a hotel in Kandigai. Let us, let us, uh, take, uh, some famous, uh, food. Can you tell me something? Your favorite food, ma'am? Let me ask her. What is your favorite food? Biryani. Okay. Let us go in the safe, safe room. Everybody agrees with biryani? Okay. Some pulao, something. Okay. You go to Kandigai, some hotel in Kandigai.

Guys, listen. I am not joking about this. Right? So, I hope our friends in H 1 Let us go to Kandigai. Find the most expensive restaurant. How much it will be? 200 rupees, 300 rupees? Let us call it 300 rupees. I go to the center of the city. I go to Thenabad. I go to Taj Coromandel, 5 star hotel. Biryani cost me 1200 rupees.

I can find the best place where I have acceptable quality. Ok. I pay 300 rupees. I go to Taj Coromandel. I pay something like 4 x more. Why? Why would I pay that much? Yes, somebody [01:20:00] said setting, setting, what, what is, uh, yes, yeah, uh, yeah, you can answer. Brand value, do I pay for the brand value, it is food right, if it is a phone I agree with you.

Somebody said ambience, somebody said ambience, who said ambience, raise your hand. That is exactly. What is the first thing you do? Somebody opens the door. That fellow is nicely dressed, right, pakka, very formally dressed. He opens the door. Welcome, sir. Oh, he is telling welcome to me. Okay, nice. Please be seated, sir.

Okay. And what about the room? Will you be going and chattering like this? Guys, right, I do not want to throw you out. Please behave yourself. Right, you go there. What happens? Please be seated. He pulls the chair for you. So, you sit and then he gives you, right. All the, it is, there is a fragrance in the air, nice sound playing.

What about the illumination? Very dull, right? So you would mind your [01:21:00] tone, right? You will not be shouting. You go to Saravana Bhawan, Pa, idli yeh thruva? Right? But you come here, what do you do? Sir, can I please have the menu? Right? That changes, so that is influence without authority. You understand? I am influencing you without even telling you.

Right, you understand? Right? I am influencing you without even explicitly controlling you. I am actually controlling you by the way of setting all this. Everybody is well behaved. I have my, uh, right, friend, New York airport fellow is well behaved. Both of us are going nicely, well, right, right. Unfortunately, our, uh, friends in H 1 5 cannot see me.

Right? Imagine, right, properly, right, dressed man, right, formal suit, right, tie, shoe, everything. Right. New York, John F. Kennedy airport. Man is well behaved. Right. Both of us are taking the plane. We are climbing. Right. Well behaved. Right. Stands in queue. Right. Behaves beautifully. The most well dressed, well [01:22:00] mannered man you can come across.

Comes to Indira Gandhi terminal, Delhi. What happens? First thing he does? Puts his shoe on the table. Right. We are in the lounge sitting. This fellow, first thing he puts his foot on the table. And loosens his tie. Right. Same guy. Exact same guy. Drives like a maniac here. Right. If I make him sit, right, I have to hold on to my dear life.

Like, why are you driving like this? Because no, traffic laws does not exist here. I am free. This is the word he uses. I am actually free. Then why, why do you want to settle in the U. S.? You have a home in Texas, right? So deep down, his Indianness is still very, it is still there. It is just he has suppressed it, right?

Once he comes out, the monster comes out, right? He is the worst man you can come across, right? Right? Puts his foot on the table. Right? Behaves like anything. Now the point I am trying to emphasize is, right, I am telling you a huge long winded story, right. Some of it may seem, seemingly unrelated, right. The point is, right, design is all [01:23:00] about this.

You understand? It is not just a simple term. There is a reason they put it as part of our college's title, design and manufacturing. IT, we have an IT institute, first and foremost, then design, then comes manufacturing, right. So, what is your name? Just Roop Katam. Roop, okay, that's easier. R O O P. R U P, right?

So, Roop, you're a classmate, right? So, so she asked me a question during the break. She, she asked me, Sir, woman safety is a huge issue. So, I have an idea. I want to solve it, right? So, I'm going to spend the next five minutes. How do we address this problem? Right? The first thing, first thing is, how do we address this problem?

Movement safety. Very, very relevant, right? You know what is going on nationwide. Now, let us take that point. Okay? Now, our idea is, [01:24:00] or rather her friend s idea is, we will put a drone, why not, right? Everything has to be a drone these days, right? We will put a drone. And I will put, and I will put all the fancy sensors, it has got a wide angle view lens, it has got a IR, thermal imaging camera, it is connected to the IOT, right, because it has to be interconnected, because it is a drone, and it is a subscription based service, I have to pay monthly, right, that way I keep paying the company, right.

So, right, this is the idea. Now let us see, what did she do, first question we should ask is, if you are talking about drone and safety, right. Okay, you are looking at everybody as a threat, first thing. Now I have a watchful eye, right, that's looking and protecting me, right? This is exactly what I started my preface with.

If you start policing, the more police and laws you bring in, yes, you can keep people in control. Singapore is one such example, [01:25:00] right? It's, it's so strictly policed, right? Japan also, for that matter, it's, it's, I mean, you, I mean, I, I mean. I mean, for, for an Indian like me, it is too much, right? I took my mother.

She was like, randomly she was about to cross the road. I said, they will fine you thousand dollars. I don't have that kind of money. Right? I have just enough to take you home. Right? And then I made her walk two kilometers this way, took her over bridge, two kilometers that way. She said, to cross the road, we have to walk this much.

What is this? This is this country. This is the system. And that is why you see everything is nice. And the trade off is, you have to make that walk. As an Indian, what you will do? Ok. Chalo. You just walk. Right? So, the point is, right, that is a very deeper issue culturally. You talk of women's safety, again it depends on the context, state, right, which place they are, right.

In a college, do you feel, no, you have a gate, it's gated, it's like a gated community. When you go out, yes. Right? So, now you, you will extrapolate the same thing [01:26:00] outside. Right? You say, put more police. How many police can we put? Now. Tamil Nadu, I'll tell you, I have the numbers. There are 1 lakh policemen and women.

For a population of 8 crores, 7. 5 crores. What is that? 1 lakh, policing, 7. 5 crore people. And out of those 1 lakh, most of the people, right? Usually it's the S. I. s and the constables, right? They are on the road. They are down doing their dirty work. Tough, tough work. So that's like 70 80 thousand. So in essence, Tamil Nadu.

You have something like 70, 80, 000 policemen and women, policing 7. 5 crore people. How is this? You have any idea the workload they have? 10 million. Right, mentally. They are also human beings, right? So, the point is, if I am building such a device, right, then you have to ask the question, okay, sir, I cannot change the society at large.

It might take 10, 15 years, educating, all that, fine. What should I do? Okay. Now, you have to ask the question, okay, what is that you want, right? Okay. [01:27:00] Can I not? Instead of a drone flying you, you are already carrying a computer. Take the phone. Right? So for the French in H one five, right? So I, let me just spin that idea, right?

I'm going to pivot that area. This called pivoting, right? So group gave me the idea of using a drone with a right over that camera that looks forward and then scans the area. Can I do the same thing with my phone or a forward looking thing? Pull it down my pocket right now this camera is pointing out.

the area. I am walking. Same thing this is doing. I have not spent one rupee extra. Now this simply becomes an app development instead of going to a drone. Drone if you see actually, what is the first thing? The stupid thing makes noise. A second thing, it is a danger. Propellers can get caught. It is a danger to yourself.

In trying to protect you, it actually can hurt you and others also. What is the third thing? If you have worked with drone, guys listen, the first thing you will know is, Drone cannot fly for long. Best drone can fly for an [01:28:00] hour. That's it. You'll only get one hour of protection. And what about you all say cell phone signal.

You know how under level it is often, where do you need protection the most? Where there is a secluded area, right? Which means if there are a lot of people around, there's will. A lot of cell phone towers. Let's logically think this through where you need protection the most, this device will actually fail.

So the question I'll ask is, I'm not giving you a solution, right? You can actually pivot. And then look at the phone, leveraging your phone which has pretty much everything, all the sensors, whatever you spoke about, putting it here, the processing power is there, connectedness is there. Why do you want to duplicate it?

You understand? Why do you want to duplicate it? The question I should ask is, I don't have a solution, right? What I can tell you is, solution has to be, right, democratized. What is democratization? It has to be democratized. What is democracy? Everybody participates. A phone is 10, 000 rupees, everybody can buy.

Can everybody buy a 10, 000, a 1 lakh rupee phone? No. No. That is why [01:29:00] Apple, Apple only, he will only compare, that fellow will only compare with Apple. He will not say I am better than Samsung. I am better than iPhone 14. I am better than iPhone 15. That is all. You look at their marketing. They will only compare it with themselves.

Because they know, if they are going to compare with Samsung or others, they cannot do that. Right? So the first thing is when you build a product, make sure. accessibility, the access to the product is there. You cannot put a massive paywall, right? Say, I have to pay this much to get there, right? That way it becomes inaccessible, right?

You have to improve the accessibility. One way you do that is make it extremely cheap, dirt cheap. Right, you understand? Right? So, to answer your question, It needs a multi pronged approach. If I ask me, I will say, there is no one solution. There are multiple things we have to do at a societal level, cultural level.

Of course, policing is also part of that. Devices like this also will play a role, right? That will be a multi pronged approach. There is no one solution. I say, do this, all women are safe. I will not agree with that approach. It will not work. [01:30:00] Right. Especially for a considerate, diverse nation like ours, it will not work, right.

It should be contextual. What works in Bihar will not work in Tamil Nadu. What works here will not work in our own neighboring state, right. It is, even within Tamil Nadu, you travel, right, 1000 kilometers, go to south, very different. Very different, right. You understand, right. Look at statistics, right, and then different places needs, maybe some places need a lot of policing.

There is no other way. Some places need a lot of focused right model. I mean, you have to have policing. Some places may need maybe a softer approach, right? So, right. That's a very sensitive subject. That's why, right? I'm not following law law into it. But since you brought it up, right, this is how you know from a systemic perspective, what's happening, man.

Hm. Go wash your face and come gave the cap. See Derek, slowly, they are big sinking. I don't know about our, uh, friends in H 1 5, I don't know what is going on. I have no [01:31:00] visibility of them, they don't know, they, they can't see me, right. Slowly, start of the class he was like this, slowly he is sinking, right, unfortunately, right.

The reason why we do these three hour sessions is the ideas I am telling you, sharing, they are very, it might look easy on surface, you have to slowly internalize them, right. I can't do it over, if I put three separate classes. It will not work. We have tried that. Right? This recipe again we have tried and then this is what works better.

I am not saying this is the best way. This is what works most of the time. Right? This time we are slightly going to twist this idea. If I tell you don't stick to norms, if I stick to norms, I am not setting a good example. Right? So what we do? Maybe 3 4 classes, we will do it here. In the coming weeks, we have 6 Right?

Two large classrooms. I give you these lectures, right, since this is, these are initial phases, right, I am giving you a lot of, I am doing the talking and you are not doing much work. [01:32:00] Slowly as you pick the problem statement, right, your domain and problem statements, I will come, other professors will come, TAs are there, they will review your work, right, they will review your work, we will give feedback, we will fine tune your problem statement, right, slowly we go from there, you understand.

So it will be that way, right, there is participation, it is not just a classroom where one way I deliver a lecture, you listen and go, understood, right. So, you understand some sense of what new product development means, right? First thing you have to ask is, I have to start with a clean slate, right? Indian companies, right, typically do not do new product development, right, because it is risky.

And we don't have a lot of capital. If it fails, my company will sink, right? So, and we have what are called challenges. We will look at fuzzy front end, right, and we will look at need for interdisciplinary concepts and approaches. What is this interdisciplinary? In a college, right, like ours, this is naturally present.

This is naturally present. Everything is interdisciplinary. [01:33:00] You want to make a pen, you want to make a phone, I need software engineers, I need hardware engineers, I need mechanical engineers, I need people who can make it, you understand, I need designers who can actually design the phone, right, what do you mean by designing the phone?

I am talking about the form. There are two things, ok. Let me write it down on the board for you. I want you to learn two important things, very simple words, right. One is called form, another is called function. Ok, form and function. What is form and what is function? All of you again look at your phone.

Functionally, what does it do? Make phone calls, send emails, browse the internet. That is its function. What is the form? It is in the shape of a cuboid. It is black in color. It has got a slightly slippery texture or it has got a rubberized grip, right? That is the form, the physical embodiment of the form.

You understand? Now the question is which should take [01:34:00] precedence? When I say precedence, which should take importance? Should I give more importance to the form or should I give more importance to the function? So somebody is saying both, right? Right. Now, it really depends on the kind of product you are making, ok.

Let us say, I have got a ornament, right, some decorative element at my home. Now, this is tricky. What is its function? To look nice. But, for it to look nice, form matters. You understand, right? Functionally, right, functionally, if you look at it, what is its function? To give a, to add to the ambience, right, to add value to the ambience.

Right. The local atmosphere where I have placed it. Other than that, it is not, it is not doing, it does not need electricity or maybe, maybe there is, there is couple of lights glowing, right, maybe there is, there is something to it. It is, maybe it is an animated sculpture. It is a kinetic art. Right. So, right, there is some animation to it.

But other than that, for something like that, right, [01:35:00] form is more important because that is its function. You understand? But for a phone, should it look more beautiful? It is a formal form. There are several ways of writing, uh, a grammar formula, uh, short form, and complex form. And this one is also a kind of a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a.

Right. Somebody buy, buy an Apple phone, for them form is important. They value form over function, right, right. Again, uh, there are many examples I gave, right, which is way beyond this lecture. Look at the failure of a Apple cable. It will always fail, right, exactly at the, where the braid ends, right, where you have the, what is called the strain relief.

It will fail there, right. It is by design. Apple's products will [01:36:00] fail within two years. It is by design, because it looks nice. But if you look at proper engineering design, it will actually disobey the principles of good design. It will say no sharp corners. Look at, look at your typical apple plug, right, it will have a very sharp this thing.

The strain relief will be horrible. That is not how you do it, right. You cannot actually grasp. It will be slippery. Have you ever tried pulling it out? It is smooth, right. There is nothing to grip on to. Right. Now these days they have started putting a dimple. In their mind, right, anything that is minimalistic, right, Apple follows this minimalistic design philosophy, right, anything that is minimalistic, right, so takes precedence, right, takes more importance compared to its function.

Got it? So, for them the dial on the form is a bit higher, maybe 60 percent, 70 percent, function is 30, 40 percent. For a functional form, let us say, Right. What is your value for money? VFM we say. Value for money. Let us take a [01:37:00] Samsung. What I have? Right. I bought this primarily for the value for money. Right.

May be 25, 25, 000 rupees. Slightly stripped down. You have the fan edition. Right. FE. Right. S21 FE, S22 FE. I cannot afford like 70, 000 rupees phone. Right. So I see what is called point of diminishing return. Economics, it is a very important principle. I will write it down here for you.

So, this is very true in economics if you write code, whatever domain you work in, this principle is widely applicable, point of diminishing. What does this mean? I buy a phone for 10, 000 rupees, I get some value. I buy a phone for 20, 000 rupees, I get some value, so on and so forth. I buy a phone for one lakh rupees, my phone cost about 30, 000 rupees.

Ok? It is a fan edition. You take S20 and S20 FE. Okay. It shares the same camera, software is slightly stripped down, right? But for me, right, maybe it's got a QHD display. Maybe it's got an [01:38:00] AMOLED display. Mine doesn't have that. It's okay. Right? Like this, there are a lot of other gimmicks for which I'm paying how much additional?

70, 000 rupees. So, for me, the point of diminishing return is around 25, 000 rupees in today's world. Most of you, right, if you want. You don't want to spend more than 25, 000 rupees for a phone. If you build a phone more than that, for that price point, what you are, what you are paying for is form. You are paying for the form, keep that in mind, more than function, right.

Function breaks there at, at that point, right, at that threshold, right, got it? So I, I am going to talk about a few things, right. So please let us all do an exercise in class, we still have 1 hour 20 minutes, right. All of you take an A4 sheet. Okay. I want you to do this individually, later on I will ask you to submit, I will give this as a group assignment.

I will ask you to form groups. All of you please take a piece of paper. Let us stick to 10 minutes, right? Right, please, I have put 20 [01:39:00] minutes there. Let us stick to 10 minutes, right? Time on my watch is, right, 3. 40. Let us work till 3. 50. Okay. So, identify, right, look at the first thing, right. Identify a few areas of interest individually.

Your areas of interest, what I meant area is domain. What is the domain in which you want to work on, right? It can be health care, okay. It can be health care, it can be waste management, right. So, it can be transportation, it can be anything, okay, right. Everybody I'm writing, right? So it can be anything, right?

Your domain, right? Pick your domain individually. Why am I asking you to pick individually? When you form a group, you'll have conflict. You'll say, let's work in healthcare. Somebody will say, let's work on renewable energy. Let's work on transportation. Let's work on consumer product design, right? You have some disagreement.

I want you to have the disagreement, right? There is no need for you to talk to your friends, [01:40:00] right? It's an individual access I'm giving you, asking you to do it in class, right? Students in H one five. Also, please take.

Right. The Go back to the diagram. Right. So, you see, the, the, the, we have this, we have this, and then this. So, this, and this. So, the, and this, and this, and this. So, you see, the, the, I was not trying to explain to you, what are these, what are these So, you see, there is a, a 2 step program to be followed. So, if you have a 2 step program, you can have any game, any game that you want to play, it has a 2 step program.

You just need to draw a short, short diagram of the game. And so, if you have a 3 step program, you just need to draw a short diagram of the game. Okay. Can be education. Education also can be a domain. You are free to pick. Only constraint is that domain has to be relevant, socially relevant, India specific.

That is the only thing I want. You can pick anything you want. Right? I hope all of you have put down a domain if you want, if you are still undecided, put down maybe one or two or one or two, one, two, three, [01:41:00] then you make a pick. Okay. No need to talk to our friends. And list out a couple of dimensions of each area, ok, let us say you put three, ok.

Now let us start with health care, ok. What do I mean by dimensions, ok? One dimension of health care is cost, ok. Cost is one dimension. What is another dimension? Accessibility, ok. What is the third thing, right? Accessible we have put, cost we have put, third thing? Safety. I am giving healthcare. It has to be safe.

Right? What is the fourth thing? What is in terms of dimension? You understand what I meant by dimension? Given a domain, right? What are the various facets of it? Right? For me, right? Think about, okay, I have got fever. Okay? Fine. You can talk about self diagnosis. Right? You can have, I am at home. Can I do a diagnosis?

Can my watch tell me I have got a fever? [01:42:00] Right. That is one, one thing, self diagnosis. Right. Second thing can be what are called point of care devices. Right. For instance, right, you have these insulin syringes. Right. That you can. So, self administration. Right. Self care on a broad level. Right. Diagnosis and care.

It is, I can do it myself. I do not need a trained physician or a trained clinician to administer. Right. So, there are multiple dimensions to this. I don't have to go to any hospital but I do have to go to the hospital to get a sample because I have to go to the hospital in order to get it. dimensions, right.

Let us take another area, renewable energy, okay. Okay, what about renewable energy? Okay, typically, right, we are limited, solar, wind, right, you have geothermal, right, blah blah blah. Let us take wind. All of you understand wind energy, ok. What is [01:43:00] one dimension? Ecological impact. Students, listen. So, if I pick renewables.

Renewables has not without its problem. It has its own problem. If I put a massive turbine in the middle of a field, what happens? It affects the local climate actually. There have been studies, right? Air is flowing and if I put something and slow it down, what happens? It affects the local climate. It affects the local ecology.

There are birds that fly, get caught. That's well, well documented. Birds die. Birds of prey die. Eagles, vultures, they get caught in them and they die. That causes an imbalance in the local biodiversity. It creates noise. If you live near a wind farm, you'll know. Vvv, vvv, vvv. Right? That's irritating. What is called adoption cost, right?

If I put a windmill, 2 crore, 3 crore rupees I have to sink it for one. When will I get the return, return on investment? So typically when you look at any dimension, you can ask the question, ecological impact, right? Economics, right? Accessibility, broadly, right? When I say dimensions, this [01:44:00] is what I mean, right?

You can look at all this, right? Then summarize top 10 factors, aspects of the problem you identified, right? Even if you are unable to complete it, now it is fine. You just put down, give it to me, whatever you can write down, right? You understand? Right? So, someone has talked in aspects of the problem, you identified.

Right? Again, if you explore the diversions, naturally you will get this. Work together as a team on the idea, you do it later, not, not here. Right? Add the relevant to Google Drive. So, not, not Google Drive. Right? I will ask you to put it in Teams. Right? MS Teams instructions I will send you. And maintain it for the rest of your stay at, why am I asking you to do this?

You'll have to stick to it at least till your sixth semester I'll come back. Right. So this, I'm handling systems thinking for this batch. Right. Again, I might do smart product or prototyping and testing. So you'll again, you know, I'll be handing you in your sixth semester, this is your third semester.

After one year I'll come back. Right. So I will ask you to continue working [01:45:00] on the problem that you're selecting now. Understood. Fine. Please work on it. Let us take the next five minutes quickly. Put down, jot down your ideas. Do not worry about correctness, right. This is just as an exercise to train your brain, right, get you more comfortable, right.

Just put down,

right. Let us do it quickly. Is there any questions you can ask me?

Yeah, [01:46:00] food.

Aspects he said. I don't think, I [01:47:00] mean I don't know. It's the couple of dimensions of each area. Yeah. What is it, unit 10? Unit 3,[01:48:00]

sir. I don't understand. If [01:49:00] you are wrong, it's okay. Right? I'm not looking for a perfect answer. I'm not looking for a perfect answer. Right? You can stop this. All I'm saying is, I'm not able to transcribe. You're able to follow me, right? It's not difficult, right? I'm only looking for this information.

It's okay. I'm just randomly putting out stuff. I know it's impossible to solve. If you're given the opportunity, why not? Now, what are the dimensions, bro? Education. Education. I mean, I'm educated.[01:50:00]

Technology

addiction. That is a different topic. That is, uh, Anything you think about that?

I don't know, sir.

Same. What problem is there in Boston? I. G. What? After the 10 minutes, you can finalize it. Your IGN spelling, I [01:51:00] forgot. H Y G I E What? H Y G I E N E G I E N E I G I E N E Correct only. No, you know, this is, you know what this is? This is this. Because E. Oh my God. Oh, there will be. What will this be?

Hi. Hi. Hi.

I'm saying double bond. Double bond. Uh.

You thought about this joke in 9th standard? No, just now, just now. Sorry. Chemistry is not dead, Omar. Do not bring it up again. What's [01:52:00] the point of giving a break and giving an assignment to him? Exactly.[01:53:00] [01:54:00]

I can.[01:55:00]

You're thinking in your mother tongue. I'm trying my best. I'm a soft boy. I'm a good soft boy. I'm a good soft boy. I'm going to eat. Tell me one second.

Mass food is bad. They can't read mass food here. Why not? Food is also about something right?[01:56:00]

Um, solution top 10 aspects of the problem. What does that mean? Isn't the same. What did you say?

I don't know, man.

What is that?

I heard rumor.

No.[01:57:00]

Not towards work. Not towards work. Not towards marathon. What is significance of that? What is the origin of that? I'm very good at following people. But the people say they're thinking of doing a marathon, but not of a trip. We already have a marathon plan. Three.[01:58:00]

Children. Children don't go to school because it's not in the central system. Teachers. Just for the sake of[01:59:00]

So, in all these, in all these technologies, today it's, oh, I want to be a medic. Sir, five lakhs a month, sir. Five lakhs a month. Five thousand five? I cannot. Today it's costing me five lakhs. Right? The constraints on it. There are, factors can be anything. What's the meaning of the word? Right? Affordance or not?

What? [02:00:00] Can I afford it? Hey, you're writing these on the dimensions, aren't you? What is called, uh, these people wrote it under ASCII. It's still fast forwarded. I'll give you a phone number. Okay. Right? If I give you a phone, can you start? You see, it's right away without any frame. Right? So, these are the questions, uh, you've got to answer.

Students, listen! Students, listen! Students, if I hear somebody, see somebody, I will, I will have to leave, right? So, I hope, uh, our friends in H 5 have also returned, right? So TES, please make sure students are back, back in their classroom, today I have no control, okay? So, let us talk about choosing a problem, right?

Good thing I gave a break, right? Got a quick feedback from a lot of you, right? Many of you are picking. Solutions are looking for a problem. Okay, let me repeat. You are picking a solution and looking for a problem. So my guru used to tell me this, Karthik, don't look [02:01:00] at every , don't look at every problem as a nail.

Why? If I'm carrying a hammer, what will I do? I will treat every problem as an hell. What can a hammer do? It can only hammer if I have a screw. I need a screwdriver. If I have a bolt, I need a bench. So you pick the tool accordingly. Don't pick the tool and select the problem. That is a bad way to go about it.

We have to have a top down approach, right? You can have bottom up approach, okay? So somebody said, Sir, I want to work on global warming. And somebody said, I want to work on macroeconomic policy, right? When you pick a problem, make sure you There is some engineering solution can be provided to it, that is important.

Do not have, right, let me write it down for you, policy prescription, this is something we do not want. We do not want [02:02:00] policy prescription. What is policy prescription? Sir, there is corruption, sir, lot of corruption. Let us put strict laws. That is not a problem I want you to pick. Right? Sir, there is road, there is holes on the road.

There are lot of potholes. Let us change the law, that is a government policy, you cannot do anything about it, at this stage. Right? Guys, I hear somebody talking, right, do not get into policy prescription, I do not want you to get into policy prescription, understood, right? I want you to pick a problem, right, where you can apply your skills with some stretch.

Let me repeat that again. I want you to pick a problem, right? In which you can work on for the next 3 to 4 semesters, right, with some slightly stepping out of your comfort zone. That is what I mean. You cannot just say, sit and say, okay, somebody said, uh, uh, macroeconomic policy, that's an economic [02:03:00] policy, name itself is there, it's a policy, you can't do anything.

Somebody said, uh, infrastructure, I said infrastructure is fine, you have to boil down a bit. Right? Sir, India has got bad infrastructure. . Okay. Don't go to that level. Okay, let's, let's see how I can slowly, right. Zoom into this infrastructure problem. Okay? What, why is infrastructure a problem? Cost is very high, sir.

Okay. Why is cost high? Ask why five times Ask why Five times. Why is infrastructure a problem? It is very expensive, sir. Why is it expensive? Because materials and construction methods are expensive. Why are materials and construction expensive? You keep asking, right? Then you can. If you are a mechanical engineer, right, you can look at the problem in a different perspective.

Let me start problems for mechanical engineers, right, here, then I will come to CS engineers, right. Both of you can work on this problem from several different perspectives, right. So if it is a problem of infrastructure for a mechanical guy, for a mechanical engineer, what is [02:04:00] it he or she can do? Ask that question.

There are so many reasons why infrastructure is expensive. Let me look at building materials. Parameter. And let me look at doors. Ok, let me take a door. Ok, it is very expensive sir. Wood is expensive. Can I look at an alternative material? No, do not go there. That is phenomenal sciences. Sir, I know there are doors that are polymer based.

Ok. And they have got good acoustic and thermal performance. Can I just look at some change in design parameter? it, you have to acquire the, uh, the language. Language is a basic idea about, uh, the, uh, the, the, the, the, the language. And, uh, and the language is a basic idea about, uh, the, the, the, the, the, the, [02:05:00] the, the nature of language.

Please don't Right. So I have a problem, I have to go over it. So the first thing is, first thing is, first thing is, when you have a problem, make sure the problem has a, that can be leveraged with engineering, right. I can bring in some engineering knowledge, some engineering solution can be given. Don't worry about the solution, right.

Somebody said I will use cyanobacteria sir. I am worried about global warming. Let me use cyanobacteria, do something, right. This is something fundamental sciences, don't go there, don't go there, right. Look at something that's fairly simple, right. So I am going to, right, I am going to write something very important, right.

So you have science and then from science you have technology, right. You have science, tech, from technology you have a product, so from product, product goes into society. [02:06:00] Okay. So, comparable institution, IISc, works on science, tech, AAATDM. Product, tech to product again, let me put some manufacturer and society is the market, right.

If you start this way, right, that is bad, let us not do this. You have to go ulta, this way. Look at the society and ask the question, what does, what is your problem, okay? What is your problem? India specific problem you are saying. So problems can be from any dimension, any domain, right? What is your most pressing problem?

You can ask that question, right? Then look at what product will suit this. Don't worry about the details. What, what battery I will put, right? What microprocessor I will put, don't look at it that way. Then from the product. You go back to [02:07:00] technology. From technology, you should go to science, right? So like the student said, Sino bacteria, cyanobacteria is science.

You should end up with sino bacteria as you follow this path from society, product technology. Then all the way to sino bacteria, you understand? So let me rephrase, repeat. When you pick a problem statement, don't pick problem statements that. require policy prescription, government intervention. That is not the point of this course that is not the point of why you're here.

You are here to learn Engineering, apply engineering, translate engineering, ok, translation, we want translation. If you simply you can solve a differential equation it is of no use to me. I want you to take that knowledge of you using how to use a differential equation to construct a duct, to model a financial system, right.

To model flow of traffic, right. Use that Can I use that, can I translate that knowledge, that is the key emphasis here, understood? So it has to be society, product, tech and only then science, [02:08:00] right? For our computer friends, I said I can use the same infrastructure problem in a different way, right? Let us look at logistics.

So for a CS guy, it is all about data, ok, ok. You can ask the question, you can do. Like a parent analysis, right? What are the different costs? Cement is costing this much, right? And then, uh, somewhere, uh, you mine sand, right? Blah, blah, blah. In so many places, now it becomes a supply chain problem, right? So purely you can now see, look at Amazon, how are we able to give you at such a cheap cost, much cheaper than your local Cara shop, right?

How is it he able to do that? His supply chain is so well optimized, right? As soon as I order, sometimes, right, it is crazy. I will order from Chennai, right, what was the recent order I made, right. I think I bought a, uh, uh, right, 0. 3 mm lead, I could not find it, ok, local shop it is not there. So, I [02:09:00] ordered it from Amazon.

This lead came from Uttar Pradesh, why, why would you send me from all the way? Is the, is this not available in anywhere else? Why are you shipping it from 2000, 3000 kilometers away? In his supply chain, right? He does aggregation right in for him, that is cheaper. You understand? Even though for me, obviously, right?

Why would you send a product all the way from up to here maybe, right? They got an algorithm, right? Supply chain algorithm that decides, right, what is the cheapest option for them, right? What is the cheapest option for them? You understand? Is this not infrastructure problem, right? If you look at it for a CS engineer, right?

This is how you can look at it. You can look at data in different ways, fine. So if you have to do cost reduction, if you have to build what is called low cost housing, right, in terms of infrastructure, right, I can look at it as a purely mechanical problem or I can look at it as a data problem also, you understand, [02:10:00] right.

So there is room for everybody, there is room for everybody, right. Everybody can get in, right, contribute and work on it. So, if you have a good number of, of, of, of, of, of, of, of, of, of, of, of, of, of, I repeat, no policy prescription. I don't want you to give me policy prescription. Problems of that sort, I don't want.

What I want is, don't worry about the details. Worry about the broad thing. It is like what I was telling you, right? I said, okay, if you want a woman's safety, let me put a drone. Don't even go there. Don't even go there. It's okay. You may think of putting a drone. That's okay. Stop there. Right? On a [02:11:00] broad level, you have an idea.

So, I am going to play a video, this is a very very old video, okay,

it is a 10 minute video, let us listen to this. Students, please listen, please

play, pay close attention to, he's going to talk a lot of terminology, right? Let's watch it. Of all the objects we have seen and admired during our visit to India, the motor, that simple vessel of everyday use, stands out as perhaps the greatest. Most beautiful.[02:12:00]

The village women have a process which, with the use of tamarind and ash, each day turns this brass into gold.

But how could one go about designing a lota? First, one would have to shut out all preconceived ideas on the subject, and then begin to consider factor after factor. The optimum amount of liquid to be fetched, carried and poured and stored in a prescribed set of circumstances. The size and strength and gender of the hands, if hands, that would manipulate it.

The way it is to be transported, head, hip, hand, basket or cart.

The [02:13:00] balance, the center of gravity. When empty, when full, it's balance when rotated for pouring. The fluid dynamics of the problem, not only when pouring, but when filling and cleaning, and under the complicated motions of head carrying, slow and fast. It's sculpture, as it fits the palm of the hand. The curve of the hip, its sculpture as complement to the rhythmic motion of walking or a static pose at the well.

The relation of opening to volume in terms of storage uses and objects other than liquid.

The size of the opening and inner contour in terms of cleaning. The texture, [02:14:00] inside and out. These are the different dimensions, right? What he's talking. Heat transfer. Can it be grasped if the liquid is hot? How pleasant does it feel? Eyes closed. Eyes open.

How pleasant is its sound when it strikes another vessel, is set down on ground or stone, empty or full, or being poured into?

What is the possible material? What is its cost in terms of working?

What is its cost in terms of ultimate service?

What kind of an investment does the material provide, as product, as salvage? How will the material affect the contents? [02:15:00] How will it look as the sun reflects off its surface? How does it feel to possess it, to sell it, to give it? Of course, no one man could have possibly designed the locations of factors to be considered, gets to be astronomical.

But many men,

individuals represented in their own way, through something they may have added, or may have removed, or through some quality of which they were particularly aware. The hope for and the reason for [02:16:00] such an institute as we describe, is that it will hasten the production of the lotas of our time. By this we mean a hope, that an attitude be generated, That will appraise and solve the problems of our coming times with the same tremendous service, dignity, and love that will make us serve its time.

Right? Video was made, right? Close to 40, 50 years back. Right? Profound message, right? What are the different dimensions, right? How does it feel to possess it? How does it feel to sell it? What is it used for, right? Are you storing liquid? Are you storing something solid, semi solid, right? How does it feel when you [02:17:00] strike it?

These are things we don't even think, right? Finally what is the core message, right? The presenter was talking about, right? What he is saying is, it is not designed by one human being. Right. No one man designed it. It is over generations. Right. Slow and steady improvement. It is what is called as kaizen in Japanese.

Right. There is a term for it. It is called kaizen. I will write it down for you. Right. Slow and small incremental improvement. This is the Japanese philosophy. Right. Kaizen. Do it in small steps every day. Kaizen. Right. That is how it works for us also, right? Suddenly, if I say I want to build a, become a bodybuilder, we go, can I lift a hundred kilograms?

No, I can probably do 20. Let's make it 21 for a week. Let's make it 25 next week. Right? Slowly, incrementally, I improve, right? That that is the core message, right? So when you're looking at a problem, you [02:18:00] have to talk about different dimensions. I've given the YouTube link, right? I'll share the presentation with you.

We can go watch the video again. Right. It is very important. It is a five minute video, takes in a multiple watches, slowly you have to pause it, take notes, absorb all the principles he is talking about. Right. That guy James is not a small guy, right. He is considered one of the biggest in the design world.

He is placed in a big mantle, you can read about Charles, James, right, Charles and James. Right. So, these two guys, right, you can read about these people. Right. Right. Now. Another important aspect I want you to consider, think about is what is called the hidden cost. What is the hidden cost? There is a phrase in English literature.

What is it called? Tip of the iceberg. Yes or no? Headlight, headlight. What is this tip of the iceberg? Means what? If you see a Chota tip of the iceberg, there is a massive iceberg that is actually below the water level. Right? Same thing here. Right? So the question I am asking you is, what do you think, right?[02:19:00]

How much do you think the headlight, right, which is this part here, right, cost? Any idea? Give me a rough, rough, rough figure. 5000. Uh? 10, 000. Uh? 1000 rupees, uh? 1000. Let us go with law of averages. Uh? Wisdom of the crowds, they say. Last guy, tell me a number, man. What is your name? Yeah? Kamal. Okay. Kamal, what's your guess?

What's the price? Thousand rupees. Thousand rupees, okay. Let me pick that, uh, green shirt. What, what, what is your, uh, estimate? Eight hundred. Eight hundred. He said thousand, eight hundred. Okay. How, how the man? Huh? Seven hundred rupees, sir. Okay. Minimum five thousand. Okay, he's going on the lower end. Find, I think nobody, nobody knows the price.

Yes. Of the crowd is proving me wrong. Actually.

2000. Who said 2000? Okay. Somebody saying [02:20:00] 2000. Now we have prices raising from students. Listen. Listen guys, listen. So we have estimates all the way from 500 to 2000, right? If I average it, I'm going to end up like much at the lower end of the spectrum, right? So. Um, yes. What is the way this treat if it is just you tell me how it works?

1st question is Woo. 10 Lakh dollars basically. Woo, yes. Right It is just a piece of plastic, transparent polycarbonate, right? It is costing, why should it cost so much? There is something called a dye, D I E, ok. D I E. So, C. S. Penn's do, please, I will keep, mechanical terms, not dye as in that dye. This is a noun, [02:21:00] ok.

Dye means, it is a mold, M O U L D, mold, ok, it is also known as a mold. Ok. Thank you. So, you do, in this case you do injection molding. Right? So, you have a cavity. Okay? Have you all played with coconut? Right? Right? You have the coconut shell, right? Have you played with all the sand? All of you know? You make this nice hemispherical things, right?

How do you make them? Take a coconut shell and scoop, right? So, that coconut shell is your tie, understand, now you can follow, right. So for our CS friends again, if you take a coconut shell, split coconut, you get two halves and then if you scoop sand and if you keep, put it what, you will get a hemisphere.

How do you get that hemisphere? You can make it by hand also, but this is easy, right, like an ice cream scoop, when you scoop ice cream, you get a nice [02:22:00] hemispherical surface. So that, in technical terms, we call that coconut shell, that form. Right. We call it a mold or a dye. So the mold or a D do now. Now you know Right?

You, you can see the shape. It's a complex shape. Right now, the dye will be a negative image. You understand? It'll be . It'll be the opposite of it. Right? If it is, if you are product you're making is concave, it'll be convex. You understand? Right. Alright. This is convex. That will be con . Okay? Always. It is a negative.

It'll be the opposite of that. Now, this diet, do you have any idea how much it'll cost?

Okay. Let us start with again Kamal. 25 lakhs. Kamal, what is your guess? You are a mech guy, right? We have smart manufacturing and mechanical engineers here, right? Yeah. 25, 000. Okay. Yes. He is saying 1. [02:23:00] 5 lakhs. Okay. Permanent guy. He is talking about hard tooling. Okay, we are running short of time. I'll give you the answer.

It'll cost you anywhere from 50 likes to a crow rupees 25. Wow. See, the plastic itself is cheap. Poly ate is cheap. Okay. Probably 200, 300 rupees. That's it. Students, listen. So if the die is costing me a cro, and if I make a hundred of this, what is the price? Every headache will be one piece. Wow. You understand more than a lag, including the price of the material.

If I make 1000 of that, right, so 10, 000, 5, 000, you understand. So if I make a die and if I, I have to make numbers, now you understand why standardization is important, why every company makes phone in this shape, right? So for this, the hidden cost is, technically speaking, it's called tooling, okay. The cost, this is called tooling cost.[02:24:00]

For CS graduates, right? I buy an operating system. It's expensive, right? Windows 11 license if I want, right? Anywhere from, depending on where I buy, I might get it for 3000, some stolen key. If you want the home or pro license, it may go all the way to 25, 000, right? But even 25, 000, what is the hidden cost of an operating system?

Look at the resources that go into making it. There are thousands of engineers. Not only in Microsoft, please understand. Windows is not only built by Microsoft. Microsoft licenses products of others. You understand? For instance. Right? The BIOS. Right? You have a BIOS in your computer. Right? Made by American Megatrends.

That company special As soon as you turn on the computer, you say American Megatrends. That guy That company specializes in making the BIOS chip. Right? So, it means even Dell You If that fellow is building, he has to buy from so many other people, which means he has to pay [02:25:00] royalty to all these people. You understand?

That is the hidden cost. Always, whenever you are looking at a product, think about the hidden cost. It is not apparent. Right? It will not be obvious. Whether you are right, it is a piece of code or if it is something else. Right? Now, again, this is a very old data, four year old data I am showing, right? Now data.

If you look, if you look at, uh, today, it's much different, right? Data, data is actually even into, uh, Hyundai Days market even more. Okay? So I'm showing 3-year-old data. Look at this,

how to identify what is called late 10th. What is late 10th, or what is called unstated need? I can go ask this guy, right? What is it you want? Okay, let me demonstrate with an example. Okay? So, for students in H1 5, right, physically I cannot question you. I am going to question your friends. I am going to tell you what they say.

Tell me. You are going to buy a phone. What do you see, what do you want in a phone? Yeah, green shirt. What do you [02:26:00] want? You are buying a phone. How would you go about buying a phone? What is it you want in a phone? What is your need? I would say storage and RAM. Minimum storage. Okay. He means, okay, bare minimum.

I need 128 GB of storage. There.

Two or more apps, okay. Good display. Yes. Good camera. Good camera, right? So if I go on asking, right, I'm all too familiar with the answers. So students, right? Students in H15 also, right? So, think about this. I'm asking a question, right? You're looking for a phone. first answer he gives me, gives me a very precise answer.

I need minimum 128 Gb of storage. I am happy with that answer. Next thing I ask him, minimum it should run 2 to 3 apps? That is a very ambiguous answer, [02:27:00] why I can 2 or 3, right? You have to, when you are an engineer you have to be very precise, right? There is a good camera. You are saying what is good? I come from 240p, I come from 840p.

Back in the day, if you have given me a four 80 p, that would've been not good. It'd be a godly image, right? I can see your eyes, right? If you, if you took photographs of that camera, it'd be like a blob. My face would be like a blo, like two dots nose. It'd be like a cartoon character. My face would look like that.

So if you go, go back, talk to that Karthik, right? Who's not used to your ultra 4K, eight K, right? That fellow will tell you. Any camera that can recognize my phone my own face is a good camera. It is subjective. It is relative. So, you cannot talk like that. Right? Next Battery Life. Excellent battery life.

Define excellent. Right you understand where I am going with this. At least, right, this is something you are stating. You are stating. Explicitly mentioned. There is something called [02:28:00] unstated. The customer is not going to tell you that. What is that unstated? Nobody told me. I want a phone that does not explode.

I want a phone that does not give me cancer. Did any of you look for SAR value? Right? Some of you, because of the fear mongering, right? You started looking at it, right? Right? So, how many of you look at this? I look at the SAR value. Whenever I buy the phone, I go, I list down 4 5 models. Invariably, it will come down to that number.

Right. I will go for the lowest one. Even then, right, I have my own apprehensions about it, right, we will talk about it some other time. Right. So, what is unstated? As a customer, I want a phone that is reliable. It is unstated, right. Now over time, what unstated is? So, I will just give you a few examples. So, let us say, [02:29:00] I have a cell phone.

I have a cell phone. I have a cell phone. I have a cell phone. I have a cell phone. Bye. Somebody put a camera on a phone, nobody asked for a camera on a phone, yes or no? Now you expect it, it is stated today, today you cannot sell a phone without a camera. In fact, a large part of you selling a phone hinges on its camera, yes or no?

No man, this is trash, I don't want it, right? That earlier used to be unstated, now has become stated. You understand? Tomorrow, right? I'll give you another example, right? Again for our friends, already I gave this example. Esus. They made a phone with a projector. Esus. Right? 10 years back they made a phone with a projector, portable projector.

Although the projector ran for 15 20 minutes, that's it. Your phone will die after that. Why? Such a motor thing, [02:30:00] right? So, Esus made that. That product failed. No customer wanted it. Why? It didn't work. So, I will, I did not do that. And I will, I will not do that. Okay, so there is no need to do that. So, now, the problem is there.

There is a crazy guy. The problem is let's say you have a\_\_ K k, K k, K k, K k, K k. So, that is what happened. What happened, you have a\_\_ K K. Yeah. K k, K k. K k, K k. So, now when I do this, I will write down the public key. Do that. pulse oximeter on your phone. You can just monitor your heart rate. Look at your SpO2.

Right. I really loved it. Right. I do not have to carry a separate pulse oximeter. It is like this big. Right. It is part of my phone. Right. I do not know why after S10 Samsung stopped doing that. I do not know why they stopped doing that. That is a beautiful addition where you can do health tracking. If somebody has a heart condition you can always check.

Right. Is my SpO2 fine? [02:31:00] Somebody with a heart condition can check. If there is a, if they have got a valve problem, leakage, right, they can always put their hand and check their cardiac health. Right. That is an unstated need. Very cheap. SpO2 sensor is very cheap. Not that expensive. 100 rupees, 50 rupees. Put that.

Certain phones came with sensors to measure humidity. It will tell you what is the humidity of the room. Samsung S4 had it.

So, I am going to talk about a story of Tata, right? Tata, right, until 5 6 years back nobody bought a Tata, right? Indica, you take Indica, it is all, only taxi vallas will be using Indica. Yes or no? Right? Otherwise, it is not a car most people will buy. But today, you see Nexon, everybody is buying Nexon.

Everybody is buying, uh, what is that, uh, crossover SUV, what is that vehicle like for punch. Everybody is buying punch. Everybody is buying, uh, Tiago. Why? Tata is not the most reliable brand. Right? I am not [02:32:00] speaking ill of Tata from experience because I used to own one, I can tell you. Right? Not the most, not the best customer service.

The moment you, they sell you the car, you go to their service, you'll understand their service. Extremely painful even today. But how come they turned, turned around the market today? They are number two actually. They, they've displaced a human. How come? How did they do that?

All beautiful. That is the thing I'm gonna talk about, right? So, so what the strategy Tata took was different, right? Data new. You can go to A, B, C. You can go to B, C, D, E, F, G, H, I, J, K, L, M, [02:33:00] N, O, P, L, Volkswagen has got a reputation for quantities. Quota has got a reputation for quantity. You will pay extra if it is a Volkswagen, if it's pricing tool at extra, you will pay.

A designing customer will be paying will pay. If Tata is commanding the price, will you buy, right? So Foxcon build for Apple and he bills it for sir, if Azure is buying a phone for what? FedEx? Will any of you buy it? But he can give you the quality of apple. He can do that. That's the point. Nobody will buy that.

They don't have the reputation. That's the point. Right? So, then what Tata saw was, ok, let me take an approach. Unstated date. What is the customer not asking, right? Some brilliant, they did a brilliant marketing strategy actually. A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, L, M, N, O, P. What is the plete diagram for this?

So, let us go back to the previous topic. So, let us [02:34:00] say for this, let us say, let me, let me, let me give you an example. Second term, third term, just like that we call it a complete algebra. Okay, what happens? Right? Slowly They are the ones who brought in this mindset of what is the end cap number? Star four starra, five Starra.

That's when they, I didn't ask him. I understand. Right. So you, a customer is not gonna ask. Right. Three star carra. I don't want what item is two star? No, I'm sta Right. Still they sell it anyway. Right? Right. So I bought a two star car. Why would I do that? I knew, okay, because my requirements are different.

Right. So, the point is, right, you look at what the market wants and you look at what the market doesn't ask you explicitly and give that. You understand? This is like, before Uber started this idea, right, it is called [02:35:00] just in time, JIT, right. Again, that's a Japanese concept. Just in time, JIT. Earlier, there was fast track, right.

I am talking about Chennai. Right, you want a taxi? I want a car now. Can it be done? Fast track is doing its best. He has his own network. He knows, okay, there is a car in Tambaram sir. Now, the half an hour it will reach. What Uber did, right? And it took CS guys, electronic guys, right, mechanical guys, lot of people.

you Again, enter discipline. There is one no particular discipline that can fulfill this problem. Yeah, they ask the question, it's taking you lot of time. Let's put cars everywhere. Let them all move and you have to make sure the average occupancy rate is there. Other, too much driving. He's polluting, he's too much boring petrol.

It's doing nothing. You, you'll run out of business. You cannot sustain the business model. They or no. [02:36:00] Right? So they said, again, data analytics, right? You bring in all this data. And then you pick and choose, oh this guy is, this is his geolocation, he wants a car, where does he want to go, here, where is this car heading, where does, this is the driver wants to go, right, so you have to do a lot of planning, right.

You have all these algorithms and plans in the background, right, that fulfills. This is again an example of unstated D, nobody asked for Uber or Ola but it is there, right. So, now let us look at what is called, A fuzzy front end of design. Very, very important principle, right? I want you to spend some time with this.

Right, NPTEI already given the expression here. Why, what is this? What is this phase? Right? Don't worry about this phase. I have put the Dabba here, right? This dabba is all you have to worry about in this course. In systems thinking, worry about phase 1 and worry about phase 2. This we will handle in smart product design.

You will anyway, you have a class called smart [02:37:00] product design and you will have prototyping and testing, PTT. When you get to the course, we will worry about detailed design and prototype. You will not do manufacture. You will not do, this is not your job. Okay, let me clear the slide, right. You will not do any, these two phases.

So new product development starts with what is called the concept design. What is a concept? What is a concept? Okay. Now let me take something really simple, right. I am using lot of technology here, right. We got a projector. I am holding, right, for our friends in H1 5, right. I am holding a stylus, an electronic stylus, right.

And I am, I am having a digitizer, right, I digitizer, it is connected to the computer. That is how I am able to write. So, the idea is, right, if I have to, now see, there are people in the classroom who cannot see me. But yet I have to point out things in the slide, right, I am able to point out, but you can, so, you, you precisely know which is the point I am [02:38:00] talking about, right, right.

People in HR 5 can actually appreciate it more. They are not physically seeing me. I am not seeing them, right. Now, the point is. I have to come up with something that will help me highlight things on a slide remotely. That is a concept. I know how I am going to do that, what technology I will use, right, whether I will use RJ45 cable, whether I will use passive stylus, active stylus, I do not know.

I will use EMR technology, I do not know, right. At this stage, I have an idea. I have a problem. What is the problem? I have to highlight things when teaching. When you get down to this level, right, it is beautiful. If you can get out to this level, right, that is what I said, even education can be a domain. In that, you can talk about teaching aids, right, can I build a teaching aid that will help me deliver my lecture better and faster, that is the importance, right.

So that is your concept. Next is system level design. What is system level design, sir? Okay. [02:39:00] Now, I want to highlight. Okay, what are the forms I can explore? I can just use my laser pointer. That, or a point, it'll hide. That is one, right? That is one idea. What is the other idea? Now I have a pen kind of a thing.

I will write I for that pen. It needs some sort of electronics, some sort of mechanical arrangement, some sort of software that will track my thing. So there are three, four subsystems that said Stop there. Stop there. What should be the battery I should put, what microcontroller should I put inside, what, whether it will write Python, C I don't know.

Don't worry about it. Right? You understand? So we are picking a problem that everybody has. It can be a stated problem or it can be an unstated problem. Right? Something the customer is openly stating, something that the customer is not openly stating. Right? And then addressing that problem with a conceptual idea, just a concept, right.

In fact it can be multiple [02:40:00] concepts, not one concept. In fact I want you to try multiple concepts. What is multiple? Come up with as many. Quantity, quality does not matter. Come up with quantity. Okay, when we ideate, right, when we, what is called brainstorm, there is a procedure, right, procedurally if you want to do, it is called brainstorming.

You have your brain. It is called brainstorming. Ok. You can sit with your friends, discuss, can we do this, can we do that, right, let it run free without any constraint, without thinking about the economics, right, without talking, ok, what technology we will use, will the customer accept it, do not worry about anything, just let the ideas flow freely, discuss, jot down all the ideas.

Right point is to create as many ideas as possible without worrying about anything. No constraint. Let it go freely. Next. Now you look at factors and say, oh, this will not work matter. Okay, [02:41:00] this is too expensive, right? Like that you can start filtering, okay? Once you do that, then you have the concept. You work at the system level, right?

This course, you stop there. Once you get to smart product design, prototyping, then you ask that question, So I have the sub system ready. I know I have to have a pen. I don't know what to put inside, whether I should have put a battery, whether a copper coil, that will interactively talk to that, right? I am still figuring out, or should I put a optical sensor here, as it moves, or maybe a capacitive stylus, right?

I explore these are the options in which you can track a point in space. Or put the external camera track, the X-ray coordinates that way right there. There are many possibilities, right? So that is the important thing. When you do that, we call it fuzzy, right? And look at this. It's all over the place. It is.

There is no linear progression, right? You don't say, let me start here, let me go there. It's not that, [02:42:00] right? I'll give you an example. So one of, one of your seniors, right? Is a final, A student. He's working with me. Right. If time permits, I will actually bring the physical prototype and show you. Ok. So the problem that I gave him was, look at human hand.

Ok. I want you to exactly build something, I don't know what it is, come up with something that will work like a human hand. Also it should work like an elephant's trunk. What does an elephant's trunk do? If it hits you, what will happen? It can kill you. Right? It can lift a tree trunk. Right? It is pretty hefty.

Yes or no? You want to see an example? Right? It is actually a work in progress. Let me actually show you that. I think I should have a,

yeah. I think I should have a, yeah. Okay. This is [02:43:00] a work in progress, okay. Just to emphasize the point, I am going to show you something that I am working on so you get an idea. Okay. This is a discussion I had with the company, right? Look at this, okay. This is what I am talking about, right? So I hope our friends in HR 5 can see this.

See an elephant trunk, right? You can carry a trunk. Okay. It can carry a petal. It can go nicely pick a flower petal. Not easy to do. You can have two separate things that can either pick a flower petal or it can go pick a, it can carry a trunk. Can I have one thing that can do both? Not easy to do. Right? So, there is something I am working on.

Right? So, you look at this. Now, you see, this is what is called bio inspiration. Right? Literally, we are copying. Right? You see, looking like a tree trunk. Right? So, we put three of it. So I can actually go grab, grab something. You can see the different movements it is doing.[02:44:00]

Right? So pretty much, pretty much I am doing, copying mother nature. Right? I will show you another example. Right? Okay. This has got lot of my personal work. Right? I will show you the interesting bits. Okay. Unfortunately there is no control. Okay. Let it play through.

Right, so, okay, so you get the idea? Right? Got the idea? So, what is the idea? The problem I gave that fellow was, figure out something that can? Okay. You are going to have to do some workshop's on this. Okay. I, I think we're done here. Have you got [02:45:00] anything else? More than anything else, that's all. I think we're done here.

I have no more questions. Any questions? That's that's. Okay. So then, next, this is a little bit more difficult than the other lab work, but it takes a lot of time and a lot of ideas. Right. When you have a reference, easy, you can just copy paste it. But you are the first one to do it, right. I will give you a classic example in coding, ok.

There is this guy, Danish guy, ok. He wrote an algorithm called A star algorithm, right. Read about it. What is this A star algorithm, sir, right? Even today, even with AIMR, ok, this algorithm I think he wrote, uh, 15, 20 years back, right. This fellow is having a cup of coffee. I do not know. Starbucks somewhere.

Right? And then he has got a piece of napkin. And the napkin, what is he doing? He is thinking about this problem. What is the problem? Path planning. What is path planning? I want to go from one, one place to another. There are lot of obstacles. [02:46:00] How do I navigate this obstacles? It is a robotics, it is an autonomous navigation.

This is a classic problem. I have to, I have to go from a start point to a goal. Right? Think about a maze. Right? You have got a starting point, a goal. Right, this is your starting point, this is your ending point, this is your goal, right, this is your starting point and there are lot of boxes, right. Should I go this way, should I go this way, should I go this way, you understand?

There are lot of possibilities, right? How do I solve it? It is not, humans, we, we, we, what we do instinctively for robots is not that straightforward. People over decades have tried to solve this problem. This guy wrote down, or a cup of coffee, he wrote down the algorithm, right? On a piece of tissue paper.

Even today, it is a benchmark algorithm, right? So I making it sound easier, right? If you actually talk to him, he'll tell you he has solving this problem for years, right? Maybe that [02:47:00] manifested in five minutes, right? But the work that he put in, right, it took him that long to get there. You understand? So, when you talk about this fuzzy front end, right, it's a very, very complicated, you don't even know where to start, right.

I am talking about tracking my hand, right, my pen, how do you start? I don't know. I don't know. Yes or no? So, I would, I just told you that, uh, grasper I showed you, right, that elephant car, right, that grasper. Took me two and a half years. I am still not finished. Might take me another year to properly do it.

Right. I am still at the detail design stage. I am at the detail design stage. Concepts I am not showing you. Right. If I show you the concept, right, I have so many failed ideas. About 15, 20 concepts we explored and finally we said, okay, this will work. You understand? Right. So, that is the whole point of FFE.

You start with something, you do not know where to start. Problem is just keep doing. If you ask me also, I will also not know. You just have to keep doing it. But once you get an idea, right, Okay, now I have some [02:48:00] convergence, right? You have divergent thinking, right? You explore all the ideas, then you have convergent thinking, right?

Then all the things will come together. Then you can, once you get down at the system level, then you can get into, right, detailed design, right? Why, why, why are we talking about FFE? What, why is it so important, right? Look at this, right? Think about Hidden cost I was talking about, right? The market. 800 and the Windows, right?

Building windows, right? So look at the cost. It says 60% of the product, project, product cost is committed. When the concept design is selected, wrong choices can destroy the advantage. Why, for instance, right? My styling team will tell me, let's design the headlight like this. I told you, what is the cost of a life for headlight?

One crow rupees, one headlight. You have a left and a right. Two tails that four crows, there are multiple ties. So die alone is going to cost me 50 to a hundred cores of investment, fixer [02:49:00] tuning. You understand? Suddenly if the marketing department said Nobody will like this head like a hundred crows down the drain.

You understand? So about 60% of the product cost is committed when the concept design is selected, wrong choices will be a disaster. You understand? You have to spend a lot of time there. Here. This is where you have to spend a lot of time. That is why we are spending an entire semester here. Because if you commit to a wrong idea, right, this is cost committed.

What is committing? Right? Okay. I have to build a house. Right? I have not poured the concrete. I have not invested anything. Right? For instance, let us talk about code development. Okay. I need to invest in a platform. We are going to build this using Java. I have committed. I am going to write it in Java. Or I am going to write it in C Half way through the project I will say, Sir, this does not integrate well with my hardware.

You are doomed. I can't just translate the codes. Often times, right, if you go to embedded [02:50:00] systems, it doesn't work, it cannot simply port the codes. Often gamers, all of you know, right, games written for PS4, Steam will, they will do a port to Steam, PC. It will run, they will be like PS4 version is well optimized.

Here it is not running well. In fact, the hardware for PS4 is terrible, right. But PC is one of the stronger hardware, but it runs poorly. Why? It is not optimized for this. The code was not written for PC. For games that are developed for PC will run well. You understand? Right? So that is what, right? When you commit, you have to commit to the platform.

You have to commit to the day, right? About 60%, right? But what cost incurred is actually following a different trajectory. See, it goes this way, but cost committed is this way, right? So any opportunity, so opportunity to shape up, market, create new sources of competitive advantage, right? Competition can come from anywhere.

This is why you have to do new product development, right? You understand? Regulatory issue. What is regulatory issue, sir? What is regulatory body? ISI. [02:51:00] I build a phone, right? And the phone has to follow CE. So CE says, phone should not randomly catch fires. And I build a phone, it doesn't follow regulation. It doesn't pass regulatory inspection.

It fails. It fails CE marking. It fails UL certification. You understand? Right. So, it fails ASTM standards. Right. There are good practices of writing code. Right. Even codes, cyber security does not pass the test that we put it through. Right. So, that is very important. Right. So, key challenges. Right. So, this way gives a summary of the key challenges in fuzzy front end.

Why? What are the challenges? A large number of factors are involved. Very large number of factors. What are they? Underlying pattern may not be obvious. Right. You have lot of interdisciplinary things coming in. Right. So, you have a lot of interdisciplinary things coming in. So, Which technology should I use?

And very important thing, we are designing it today. If I'm building a phone today, that when will I finish it? I'll tell you. The average lifecycle of a car, it's about two years. Suzuki takes about two [02:52:00] years to design a car. So if I start today a new car, when will I release it? 27. So going to sell it on 27.

What would be the market perception in 27? I don't know. It's a guess. If the public doesn't like it, I'll put in 2,003,000 crops in tooling alone. So overall, 10,000, 20 thousands, Marty might have spent, and if the model flops right in two, three model flops, Marty has to top up their distance. You understand how painful it is?

Very difficult to see changes over time. I have to design it for the future. Intel is making a chip today. They're committing to architecture, right? They're committing to an architecture for. Four years down the lane. What you see today is 4-year-old technology. Most of you don't realize it. The phone, which I have snapdragon, sir, second gen probably it's four years old, man.

What? What these people are doing. You only have it in your hands after four years, right? You please look at the lifecycle. Don't forget the lifecycle. You can't instantly build a [02:53:00] product and then it's in the market tomorrow. It takes time, right? So you may get lost in detail right when you start probing.

You may, you'll get lost in detail. Cross-functional, multidisciplinary communication. I was telling. Today, product design is done globally, right? Martin will make a design a dye here. It'll go to Europe to get fabricated, right? Somebody from wash sitting in, uh, Germany will tune the a BS controller, right?

You've got something like 60, 70 microcontrollers in an automobile, right? You've got, for the EC, you have, you have got what is called, uh, can controlled area networks, right? For CSK is very important. Easy. Also, it's called can control area network. Right. Your brake system. As soon as you turn on, you see a lot of lights light up on your dashboard, right.

What are they? It is self diagnostics. Just like your BIOS. How your computer run through a BIOS, ok, you have what is called a start up diagnostics on a car, in every car, start up diagnostics, right. [02:54:00] It will check, is my ABS working? Is my, uh, emission control system working? Ok. But, I am doing a simple math and you won't even notice.

You will be like, ping, ping and that ping is doing the testing. It is doing a self test. It is called a self test. Right, that is the startup diagnostics. Something is wrong, it will say ABS sensor failed. It will tell you right there. It will say something wrong with the engine. Oil pressure is gone. Right, cooling system failure.

You Brake system failure, right? It tells you that there is a function in your thing. All this, right? It has to do in a macro seconds. There is lot of sensors talking to, so this is like cross-functional team. What is a cross-functional team? I'll tell you from my own experience, right? So what happens is, right, normally, guys, listen, so I've been in research and development, right?

So when you build a product, right, I have to literally have [02:55:00] practiced the thinking. That's what I'm telling you. I. So, I will just put it into practice. I was fortunate to be involved in the new product development process. So you start with what is called VOC, Voice of the Customer, right? You get that, you translate it into product specification, right?

You take that and work on the subsystem, right? Which means I have to talk to the service engineer, right? If I build a car, somebody has to put his wrench and then turn a spanner inside, right? So I will ask him, what sort of spanner will you use? Right. Somebody will go into the diagnostics. He will plug in what is called an OBD port, right, for diagnosis.

So much software is sitting in your car, right. OBD 2, today OBD 2 is the standard. He will plug in, right, that is a massive tapa. That is like 5 lakh to pay for that tapa. It is called, it is own operating system. It will talk to the car, right. So, if you are going to do a, a, a, a, a, a, [02:56:00] a, a, a, a, a, a, a, a, a, a, a, a, a, a, You have components coming from all around the globe, right.

So that is called CFT, cross functional teams, multidisciplinary in nature. Effects over time are difficult to predict. We just spoke about it. Multiple scenarios are possible. Requirements can be ambiguous. Just as, just as how this guy said, good camera, good battery, right. So this is what makes FFE extremely difficult, right.

So a variety of factors are involved, right. Look at embodiment, right. So I am going to slightly overshoot, bear with me, 2 3 minutes I will wrap up, right. So embodiment, what is embodiment? The physical thing, right? Okay, sir, I have built a turbine. Turbine, if you have been to a turbine, has any of you seen a wind turbine up close?

The blade will be like from here like to the next building, right? So you need a special thing to transport. So if I build the entire turbine, how do [02:57:00] I move that thing? What about the safety, right? How do I move the turbine? Which means I have to design it to be dismantlable, right? I can take it. What about the cost?

How do I maintain it, right? How do I transport it, you see? Right. If I am simple, I can build a product that works, but I should also think about how is somebody going to climb on this thing, how is somebody going to service this thing. Suddenly, if the turbine, one blade breaks off, goes off, what, it will kill somebody.

Right. It can break a house in half. That is how big these, right. You understand? Can you read this? Little I have read. Can you read this? Full of spelling mistakes, right? Only 55 100 can. I could not believe that I could actually understand I was reading. How come you are able to read this? Right? No, this is not a test if you can read.

I know you can read. For students in H, H 1 5. I know you guys can read it. Please stop reading. The point is not that. The point is what I have given in red at the bottom. The power of seeing the whole, right? Without seeing all of the parts. [02:58:00] What does it tell you? You are looking for the first and last letter.

Look at that can. C A N U Y O U Right? Read. R A E D It's spelled as R A E D. You are looking at the first letter, last letter. So, in your mind, you are actually not reading the spelling. You are looking at the pattern. I repeat, when you read fast, you are actually not reading the word itself. You are looking for a pattern.

First letter, last letter. You Read. Right? Sometimes, this will lead to problems, right? We will talk about it in the upcoming classes. Right? You understand? So the point is, you have to see, see the complete thing without the knowledge of all the parts. Right? You understand? That is the point of this course.

Right? This is the important point of this course. Look at the picture. There are three dots here, right, which I'm going to point. Right here, right, which I've pointed here, I'm going to delete it. Focus on those dots. Okay, [02:59:00] for some reason, my eraser is not working.

Okay. It's not working. Okay. Right. Focus on this. Dot three dots.

Okay. What do you see? Look at the three dot and close your eyes. What do you see?

What do you see? Look at the picture for a couple of seconds and close your eyes. What do you see closely focus on the three dots. I've circled it actually. Take a long hard look and close your eyes and tell me what you see. Some Dali Valava. No, no. That is actually a very famous picture.[03:00:00]

Look at it, man. I am actually surprised. Last year, some of the students picked out in like, in a jiffy. If I tell you, you will be surprised. You all know this. Yes. Yes, it is a negative image. What I have given is a negative image. Yes. Yes. It is the negative

Yes? I don't know what students in H1 5 are saying, yes? Uh, Somebody said it. Uh, It's Christ, yeah, not Mona Lisa man. It's, it's, it's Christ, it's Jesus Christ actually if you see. Right, now can you see? Now can you see? No, huh? Anyway, I'll give you the slide, you try it out later. Right. So the problem requirement can be ambiguous.

Guys listen. Two more minutes and half of the class. Look at the set of elements. Guys listen. Right. Look at the [03:01:00] elements. Right. I give you this. Words, if I ask you to construct, right, you can construct different sentences, right. Look at the first, first sentence, right. Look, let's look at this. Let's look at this sentence, right.

With a computer I can handle, I handle a problem in my office. Means what? I am using a computer to handle business problem, right. If I rephrase it, with my office I handle a problem in my computer. It means what? I am providing hardware service, right? The meaning completely changes. Let us look at the last one, right?

In my office I handle a problem with my computer. Again, in this case with computers, I am solving client problems. So each pattern suggests different requirements, right? So depending on how you put it, right? It will change. So similarly, right? So this is a case where a nuclear reactor blow, blew up because of a piece of coal.

Again, for our friends in H one five, very important. What happened here, right? There is a problem in the gearbox, right? Normally it'll put in catalyst into the reactor, and it'll also pop in cooling water. Okay? If you put too much catalyst, the reactor will speed up. If you put too much cooling water [03:02:00] on that, it'll slow up.

Now, because of a problem in the code, right, the gearbox failed. It started dumping catalyst, and there is a sensor that picked up, yes, there is a mistake, and you have to put in cooling water. That signal came. Feedback came a bit later. Bit late. And finally what happened? Cooling water was deprived, right?

So it was cut off and by the time the system really still have to jump in cooling water. We got too hot, gotta meltdown and the thing went problematic. This problem is only getting worse with iot, right? Understand? Right. So you can, you can look at right. Changes over time will be difficult to predict.

There's a right, so the point is this, I'll post this, right? Your answer, you should be able to see the. Right? That and elephant, right? The point is, right? When I say elephant, I mean metaphorically. The overall outline, right? That is what I mean by elephant, right? The overview of your problem, right? Can you see that, right?

That is the question they are asking, right? So, anyway, all these principles, right, we will [03:03:00] cover in the upcoming, uh, classes, right? FBD. All this will cover in upcoming, right? I stop here and.