Introduction to Flight
Department of Aerospace Engineering
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Course Layout and Brief Introduction of Course Instructor
Lecture 01.1

Welcome to the first class of introduction to flight AE705. Let us quickly see what is there in store for you.

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Now, this course is basically built of capsules. What is a capsule? Anyone? What is a capsule? Yes, okay, so according to you a capsule is a small container that contains some parts. Okay, anybody would like to add to this. Let us go here, somebody is here, in the front. What is meant by a capsule? Quickly. A dose, dose is of capsules.

So, let us see. So, there are going to be many many capsule in this course. I have shown you only the five capsules and I hope that there is no overdose because of these capsules.

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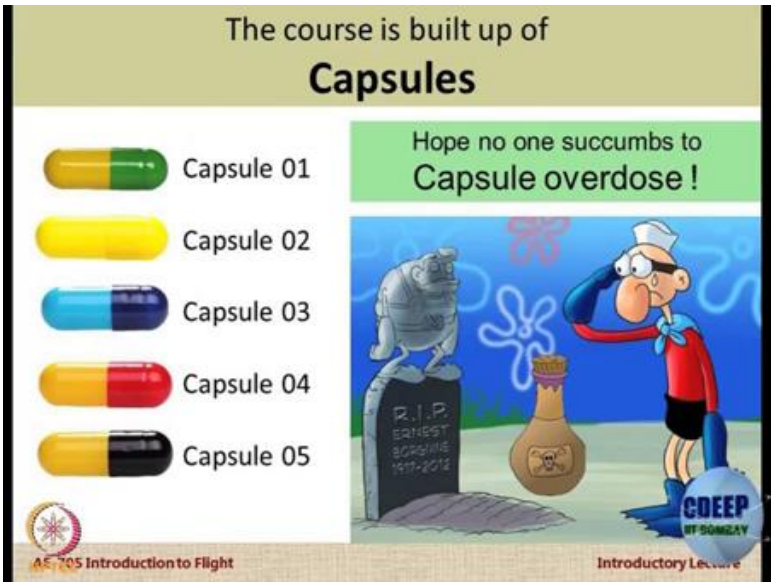

Because there are going to be 10 capsules. So as you take part in this course you are going to consume 10 capsules.

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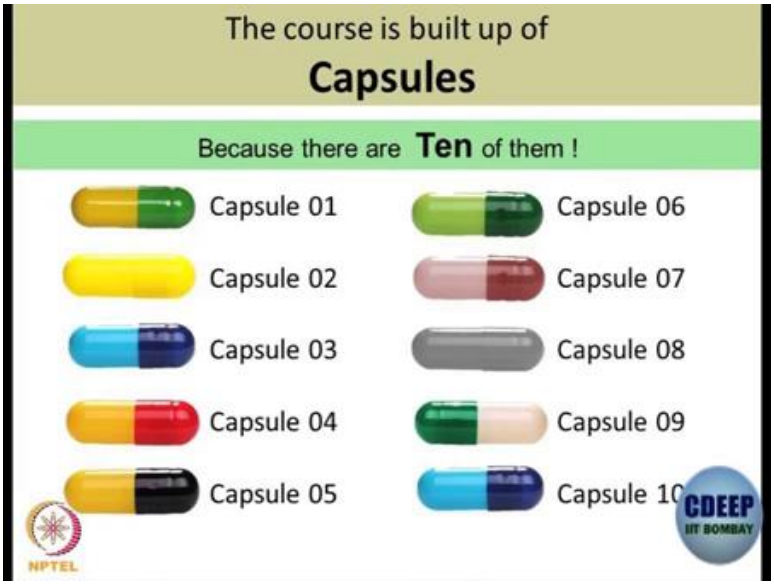

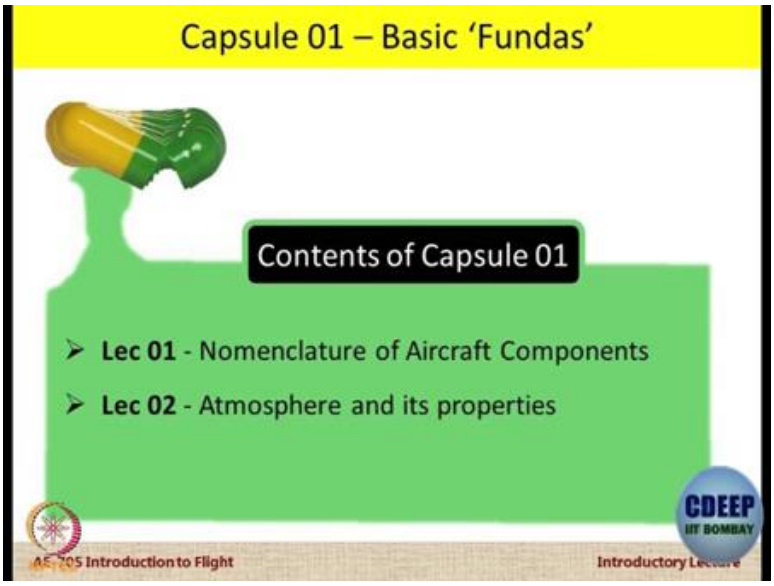

Okay, so let us see what are the constituents of each capsule? So for example, the first capsule consists of two lectures. The first one will introduce you to various components of an aircraft. The second one will talk about atmosphere and the properties of atmosphere.

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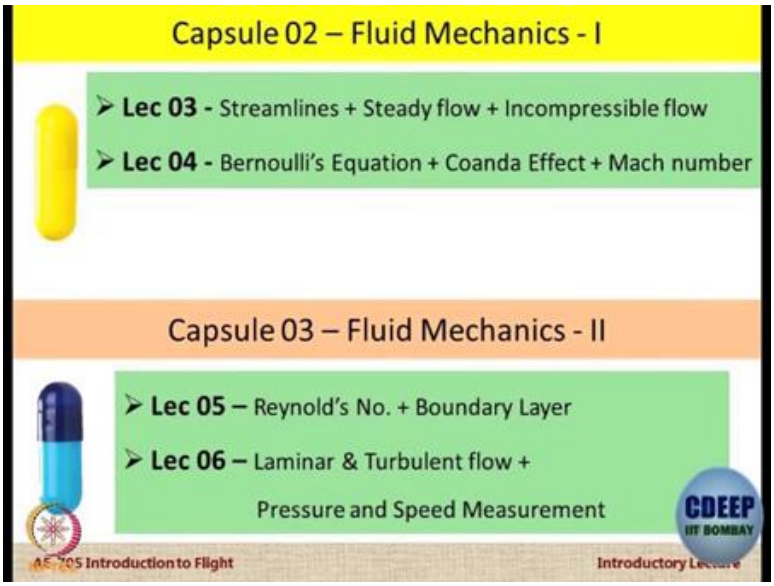

Similarly, capsule number two will be on the first part of fluid mechanics or introductory fluid mechanics. The contents are listed there. The third capsule will delve further in fluid mechanics. We will go to Reynold's No., Boundary Layer, and the types of flows, and how to measure pressure and speed.

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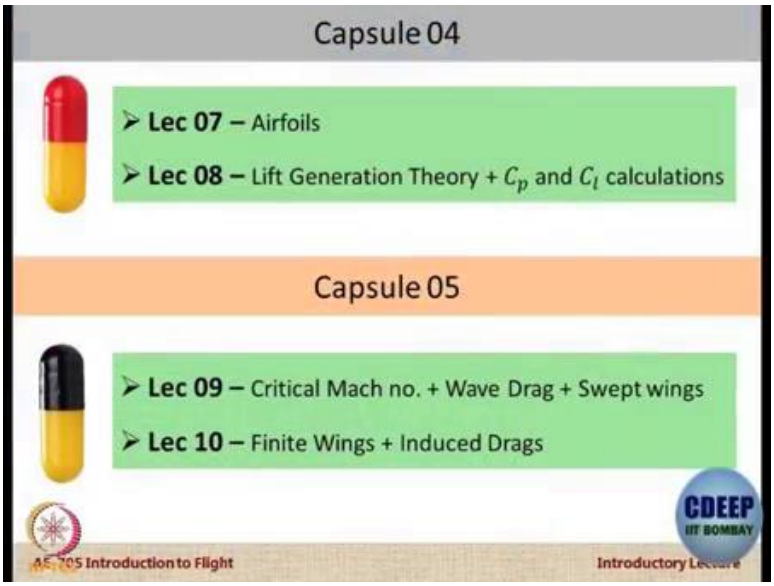

After that we will go to the fundamentals of aerospace engineering or flight - airfoils, and how lift is generated, how the pressure and lift coefficients are calculated and then the last capsule before mid-sem would be on what is called as the finite wings. Okay.

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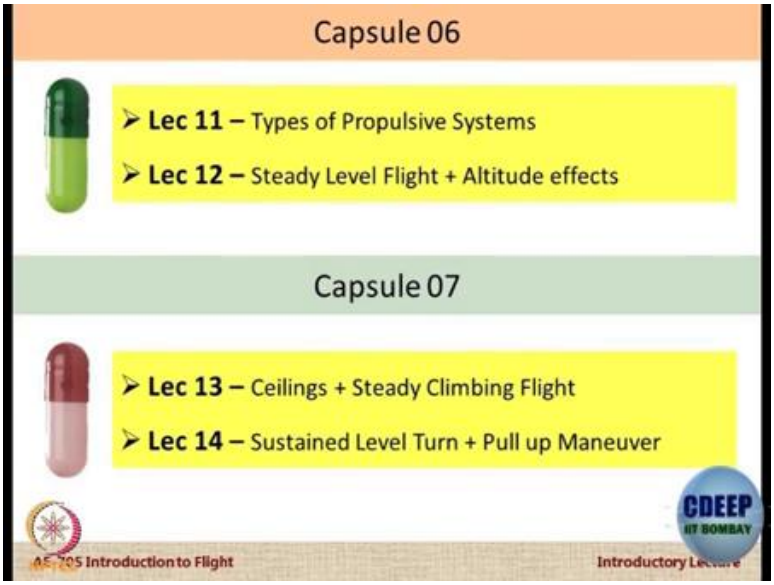

After mid-sem, we go to capsule 6, where we have a quick look at the types of propulsive systems because after this we will look at the effect of engine on various components or of various flight performance characteristics. We look at study flight, then we go to capsule 7, we look at ceilings, climbing, the turns, pull ups.

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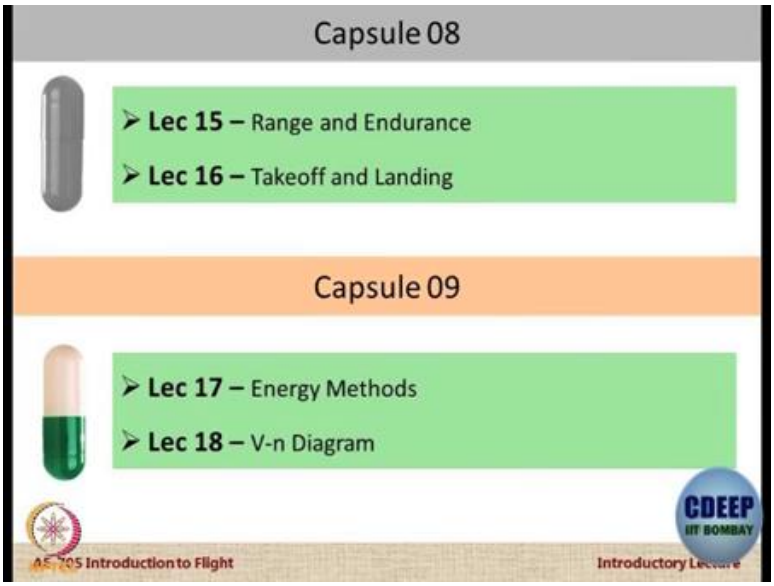

And then the two most important things for a transport aircraft, range, and endurance, and for any aircraft take-off and landing. Capsule 9 will consist of two interesting chapters or lectures, one on energy methods or energy manoeuvrability methods and then a V-n diagram. This V-n diagram is going to be a self-study kind of a capsule because we have already recorded a lecture on V-n diagram like this, many many years ago. So we will try to fish out that lecture and and make it available to you as self-study.

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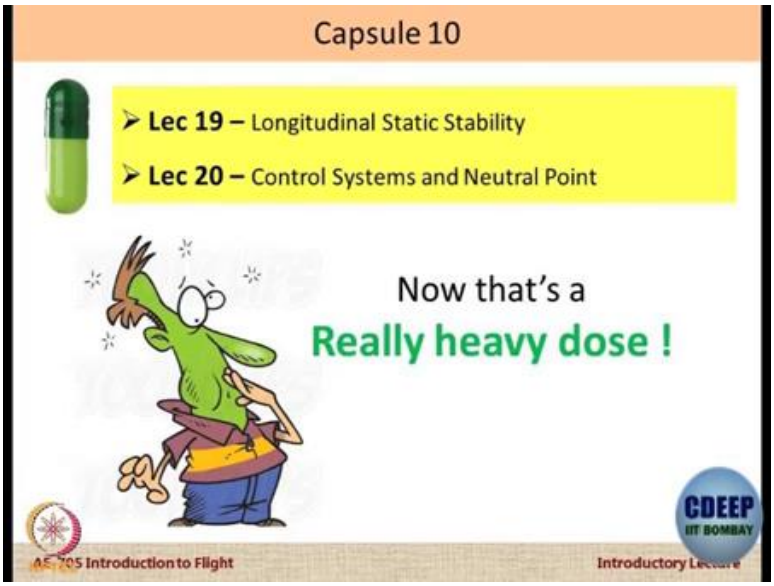

And then the last capsule is introduction to static stability only the longitudinal part, and then control systems, and neutral point. Okay, so yes, ten capsules is really heavy dose.

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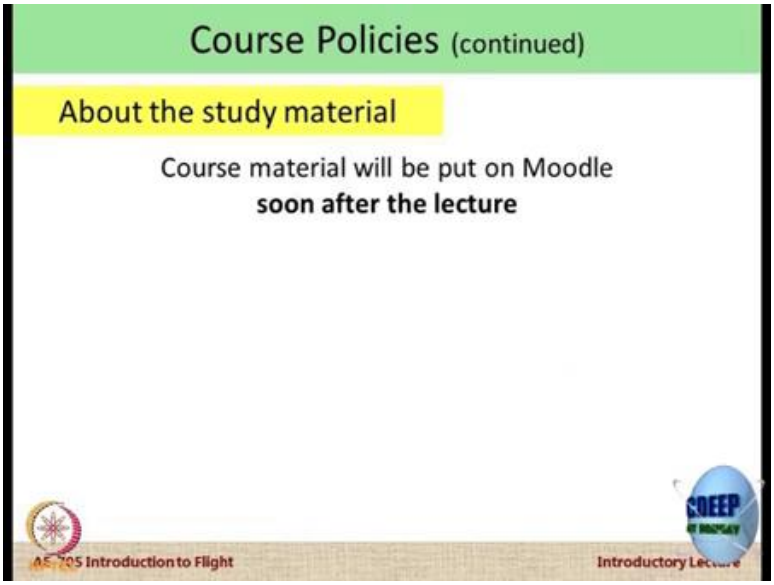

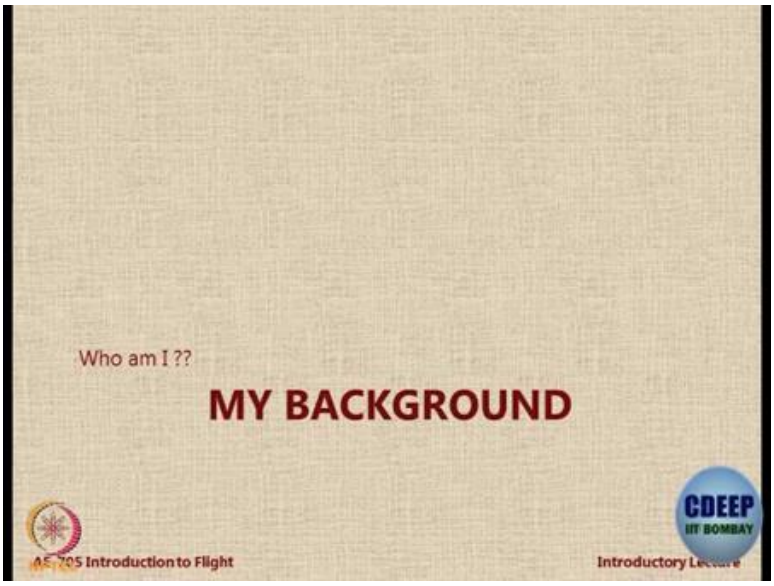

All right! Now, one question that some students ask me. I must share with you very interesting anecdote. I was once asked to teach a course on aircraft design, not here, it was a university in Singapore, called NTU. I was there for a year as a visiting professor.

So, I heard some murmurs among the students and one murmur I hear was, why have we got this guy from India to come and teach aircraft design. So I thought it is important for me to tell you about my background. The purpose is not to glorify myself in front of you. I do not need to do that actually, okay, because I am not selling something to you. Anyway it is a core course, you have to be here. Whether it is me or any Professor or Professor Prabhu Ramchandaran, someone will teach this course.

Okay, and you have to be here. So, I'm, I gain nothing selling myself to you, but I just want to reassure you that guys, I am suitably qualified to teach this course. So for that purposes I think you have a right to know who is this guy? Why should we listen to him? And more important why should we believe him? What is his background? How much does he know? What is his training? Correct? So it is important.

So, I start with academic qualifications. The first point which will reassure you is, that this guy is a core aerospace engineer. He is not an electrical engineer converted to aero or mechanical engineer converted to aero.

He is a diseased aerospace engineer because not one, one could be by mistake or because of rank or because of you know could not get any other branch. Okay. Not two, because that could be a mistake. Third degree also he has done aeronautical engineering, that means he is mad. Definitely crazy in aeronautical engineering. So, what are my degrees? My degrees are, a Bachelor's degree from Punjab engineering college, now called as PEC, University of Technology.

I am very happy that there is one student from the current PEC, aero. Udit, can you introduce, just stand up. You will see about him, little bit more. He is a student of my college. He is there and he is as an intern, he is working here. So, this is my Bachelor's degree.

It was way back before many of you were even born probably, so that tells you how old I am.

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Then I went and did a Master's degree from IIT, Madras, and this Masters was actually sponsored by HAL. Because after my graduate degree, I had one job in HAL as a graduate Engineering Trainee, and I also had an admission in IISC, Bangalore for M.Tech in aero. So, both my hands were full, but I wanted both.

I wanted not only M.Tech, but also a job because as you know after M.Tech also there is sometimes a question mark about, what job will you get? So, I was keen on the core job. I had an M.Tech

degree in hand, not in hand of course, an admission only and also a job, I wanted both. So, then I was fortunate that there was another scheme called as the design trainee stroke management trainee's scheme of HAL, in which if selected, you would be sent to IIT, Madras for M.Tech.

Now you should become a management trainee. You go for a special degree called as aircraft production engineering. If you do a design trainee which I chose, then you get to do M.Tech in your own department. So I chose to be a design trainee, and I did master's from IIT, Madras. But because I was sponsored by HAL, I had to do a three year master's. That means the Master's took three years, because some people are looking for 84 to 86, and they are saying "maybe he was failed one year". He must have, he must have flunked in something or I did not flunk in anything.

I had a descent CPI, but after coursework there was a break, we were sent to HAL, and then we did our M.Tech project in the in the factory. I was in HAL , Kanpur, when I was doing my project. The third degree was after many many years and that was a PhD which I did from College of Aeronautics. This is without any doubt the best place in the world to do a PhD especially in aircraft design.

So, all of my specializations including Bachelor's also, I was interested in aircraft design, Master's also and PhD is in aircraft design, and this PhD was fully funded by a scholarship called as the commonwealth scholarship commission in the UK. Even now this is available. Every year they send typically one M.Tech, and one PhD student to UK for Aerospace Engineering, fully funded.

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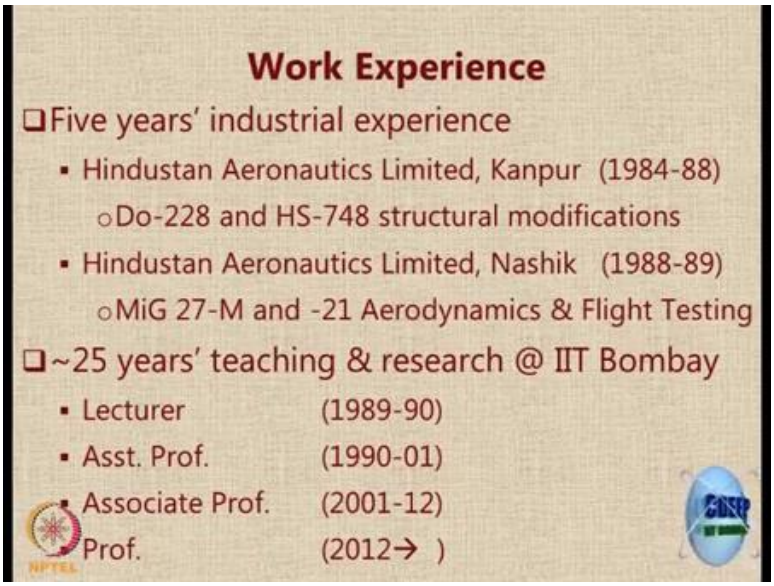

Right! Then work experience, so before coming to IIT Bombay I have actually worked in HAL for five years. This is because, any guesses? Why did I work for five years in HAL. Therefore, therefore there is a bond, correct. So, because HAL sponsored my M.Tech there was a five year bond, and I enjoyed those five years because after three and a half year I got a promotion from HAL, Kanpur, shifted to Nashik.

As you can see in HAL, Kanpur I worked on structures, structural modifications, structural support and when I came to Nashik, I became an aerodynamicist flight test engineer. I had the great honour of working with Wing Commander Rakesh Sharma. He was the test, deputy test pilot and I was the flight test engineer, and the airodynamicist. At that time, HAL was doing the overall of MiG 21 and manufacturing MiG 27. So I have an experience on both of them.

So, after completing five years in HAL, then I shifted to IIT, Bombay, first as a lecturer because I did not have a PhD. I came in from HAL with experience of five years, and therefore I was offered the position of a lecturer and then while being in IIT, Bombay I got this scholarship, and I went for PhD to UK. And around five years ago I was promoted as a professor. So that is my work experience.

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All right! I want to share with you some information about aircraft on which I have worked during my stint in HAL. So, can anybody identify this aircraft? Just raise your hands if you know what they are? Only one, two people in the class. Anybody here? Yes, speak out. Dornier, that is the company, which model. That is not a, that is not a model of the aircraft. I mean Dornier, Dornier is a company. Dornier GMBH which is no more now. But yes, that is just the basic model.

Okay, this is Dornier 228-201, which is a dedicated model for India, that is right. This is the Dornier 228-201, as you can see it is a twin turboprop, with high wing. Which one is this? How can you say MiG 27? One minute, because of the shape. How about MiG 23?

No, I think it is very difficult for someone to identify between MiG 21 and 23. Radome is very similar to both. I will tell you where is the difference is. The difference is in the intake. Somewhere here do you notice there is something called as the splitter plate. We will read about this in our course. This particular plate, this particular plate, there is a slight difference between MiG 23 and MiG 27. Okay, so by looking at the splitter plate I can say, yes, this is MiG 27 M. So I worked on this aircraft in Nashik.

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Then there are other aircrafts, I worked on. Which is this one? Hindustan Piston Trainer 32, HPT 32. This aircraft was used in recently by the Indian Air Force for Ab Initio pilot training. Not Ab Initio, sorry, for a pilot trainings. And then we worked on a modified version of that one. Which one is that?

Which is the modification of HPT? Many of you may not know this. See this will be known only to service officers or people who have worked. So, I do not expect you to know. Do you know sir ,what is the modification? This is the HTT 34, which is a conversion, okay, from a piston to a turbo conversion. So, HPT is Hindustan Piston Trainer, this is the piston prop Engine. HTT 34 is Hindustan Turbo Trainer, that is a turbo prop engine.

So, HAL internally, they converted the aircraft from piston prop to turbo prop, so that is the one on the, on your right, that is one also I worked on. This one, it is a very old aircraft. This is the HS 748, HS is Hawker Siddeley, also called as Avro. HS 748, now it is obsolete.

This is very difficult to guess. I do not know whether anybody can guess, anybody, do you have any idea? This is the Ardhra Glider. It is a wooden glider. Mostly made up of wood, very few metallic parts used for teaching pilots how to fly on gliders. It is used to be used by flying clubs earlier. This was something that was fabricated in HAL, Nashik, HAL, Kanpur, on license but now

it is obsolete. So I am very fortunate to have worked on wooden gliders, metallic aircraft, Turbo Props, piston props, jets, military. So, I have a very nice wide exposure.

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Okay, I have also flown aircraft in the cockpit. So this one anybody knows? It is a very old aircraft called Pushpak. This is a aircraft which, I had flown this thing in Chennai Flying Club in Meenambakkam in Chennai, and the reason was very interesting. As a mark of, you can say, respect to IIT, Madras, the Chennai Flying Club had given eight hours to the aerospace department for the students to experience flying.

So eight hours were here marked for the department. My good luck that no student volunteered to take those. So I cancelled my return train ticket and I took all the eight hours and I flew for eight hours in this aircraft. Six flights total duration will be eight flying hours, that was during my M.Tech.

May 1984 is when I flew on this aircraft eight hours, and then when I went for PhD to Cranfield, there again I was told that every student, Master's or PhD, Cranfield does not have an undergraduate course. So, they have only Master's courses. So, every student from the aerospace department, especially college of aeronautics gets two hours free on this aircraft called as the Beagle Pup.

So I have flown two hours two flights one hour each on a Beagle Pup aircraft, and this is my flying experience, right.

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These are my contact details. If anybody wants to note down the email address, the phone number. Okay let us look at the list of books which are recommended for this course. These are available to you.

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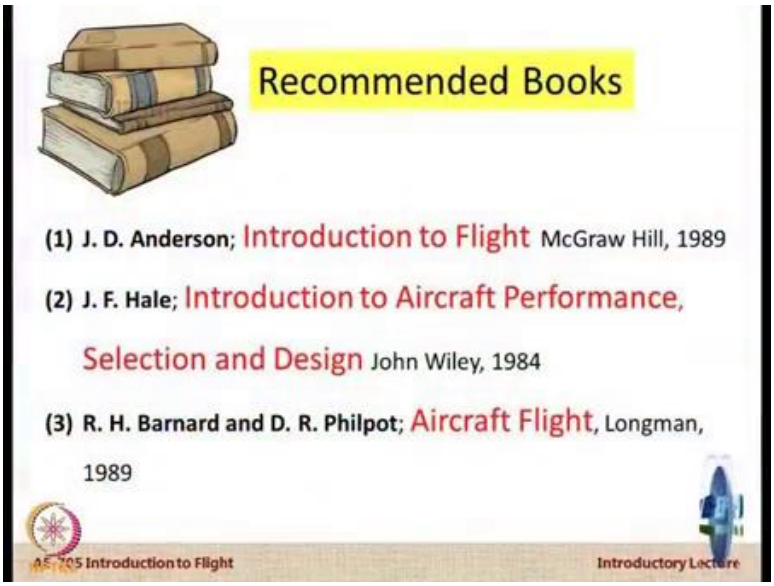

You do not have to really copy them down, because the list of books is available in the courses of study bulletin, which is available online. The most popular book is the book by J.D Anderson Introduction to flight, that is where the title comes from. So soft copies are available. We will follow the seventh (version) seventh edition, not this one. This is a old edition. So, if you give an internet search on the author's name, you will get the soft copy of the seventh edition free. Therefore nothing, there is no need for you to worry, it is easily available.

There is a book by Francis J. Hale on performance, selection, and design which is also an interesting book. We have one copy of that in our departmental library. We also have copies in the main library and then Barnard and Philpot, another interesting book on aircraft flight. But actually you may not really need to go for any specific thing, except the first book which will contain specific contents which I will encourage you to read.

I don't think you need to really make any effort to acquire these books. If you want we can make it available to you. But do not worry too much. Do not go and buy them and all that too, they are not needed that much.

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